

[DESCRIPTION]

[Invention Title]

CHEMICAL SAMPLING DEVICE

[Technical Field]

5 Embodiments relate to a chemical sampling device.

[Background Art]

Companies that handle chemicals harmful to the human body, e.g., companies that manufacture chemicals, such as paint companies and companies that manufacture semiconductors, liquid crystal displays (LCDs), organic light emitting
10 diodes (OLEDs), or pharmaceuticals, use various types of chemicals in one or more unit processes.

Generally, chemicals are supplied to a main storage tank through a tank lorry or the like, and some of the chemicals stored in the main storage tank are divided and stored in a plurality of sub-storage tanks, thus being able to be sequentially supplied
15 to a single unit process or individually supplied to a plurality of unit processes.

As another example, in a case where the amount of chemical is small or the tank lorry cannot be used due to the nature of the chemical itself, the chemical may also be directly supplied to the sub-storage tank through a drum, a bottle, or the like.

Meanwhile, when a chemical is contaminated in a tank lorry, a drum, a bottle,
20 a storage tank, a pipe, or the like, defects are caused in a unit process that receives the chemical. Therefore, chemical contamination should be managed at an appropriate level for each major location such as a tank lorry, a drum, a bottle, a storage tank, and a pipe.

Accordingly, in recent years, a sampling device for sampling a chemical at major locations such as a tank lorry, a drum, a bottle, a storage tank, and a pipe has been developed.

However, conventionally, a worker has to directly open a cap of a sampling
5 bottle and put the sampling bottle into a sampling booth, operate a valve of a sampling line connected to a major location where sampling is desired to be performed and fill the sampling bottle with a chemical, and collect the sampling bottle filled with the chemical from the sampling booth and then directly close the cap of the sampling bottle and transport the sampling bottle to a chemical
10 contamination analysis site. Accordingly, there is a problem in that the worker is exposed to the chemical during the chemical sampling process, and there is a problem in that the reliability and accuracy of the chemical contamination analysis work may be lowered due to the chemical being contaminated due to the carelessness of the worker.

15 Also, conventionally, a separate sealing means for selectively sealing an outlet end of the sampling line is not provided. Accordingly, there is a problem in that the outlet end of the sampling line exposed to the outside after the chemical sampling process is completed (or before the chemical sampling process) may be contaminated and damaged due to contact with contaminants contained in the outside
20 air or contact with surrounding equipment.

Further, conventionally, it is not possible to seal the outlet end of the sampling line. Accordingly, there is a problem in that, when the chemical unintentionally leaks from the sampling line (e.g., when a chemical remaining at the outlet end of the sampling line falls or a chemical spills due to a valve failure or the

like) after the chemical sampling process is completed, the internal environment of the sampling booth and the worker are exposed unprotected to the chemical.

Accordingly, in recent years, various studies have been conducted on ways to prevent contamination of sampling lines and minimize chemical leakage, but the studies are still insufficient, and there is an urgent need for development thereon.

[Disclosure]

[Technical Problem]

Embodiments are directed to providing a chemical sampling device capable of improving safety and reliability.

10 Embodiments are also directed to suppressing chemical leakage from a sampling line and minimizing contamination of the sampling line.

Embodiments are also directed to minimizing external spilling and scattering of chemicals during a process of draining chemicals remaining in a sampling line.

15 Embodiments are also directed to allowing a chemical to be sampled in a sealed space that is completely sealed and minimizing external leakage of chemical fumes during the chemical sampling process.

Embodiments are also directed to preventing damage to a sampling bottle.

Embodiments are also directed to, in a case where a container is exposed to chemicals, detecting the exposure.

20 Embodiments are also directed to improving the accuracy of chemical contamination analysis work.

Embodiments are also directed to simplifying a structure and improving space utilization.

The objectives of the embodiments are not limited thereto, and purposes or effects that may be grasped from the means for achieving the objectives or the embodiments described below also belong to the objectives of the embodiments.

[Technical Solution]

5 One preferred embodiment of the present disclosure provides a chemical spill preventing device including: an end cap member provided to be able to seal an outlet end of a sampling line through which a chemical is discharged; and a moving unit configured to selectively move the end cap member so that the end cap member is located at a first position for sealing the outlet end or a second position for opening
10 the outlet end.

This is to suppress the leakage of the chemical through the sampling line and minimize the contamination of the sampling line and damage thereto.

That is, conventionally, there is a problem in that, as a chemical unintentionally leaks from a sampling line (e.g., a chemical remaining at the outlet
15 end of the sampling line falls or a chemical spills due to a valve failure or the like) despite the supply of the chemical being stopped, an internal environment of a sampling booth and the worker are exposed unprotected to the chemical.

Also, conventionally, there is a problem in that the outlet end of the sampling line exposed to the outside after the chemical sampling process is completed is
20 contaminated and damaged due to contact with contaminants contained in the outside air or contact with surrounding equipment.

However, by the outlet end of the sampling line being sealed by the end cap member after the chemical sampling process is completed (or before the chemical sampling process), it is possible to obtain advantageous effects of suppressing

chemical leakage and suppressing direct exposure of the sampling booth to the chemical fallen or spilled from the sampling line.

Also, since the outlet end of the sampling line may be accommodated in a sealed manner in the end cap member, it is possible to obtain an advantageous effect of minimizing contamination of the sampling line and damage thereto caused by
5 contact with contaminants contained in the outside air or contact with surrounding equipment.

According to a preferred embodiment of the present disclosure, the moving unit may be configured to rotate the end cap member from the first position to the
10 second position (or from the second position to the first position).

For example, the moving unit includes a driving portion configured to provide a driving force and a rotating member configured to support the end cap member, rotate due to the driving portion, and move the end cap member from the first position to the second position.

15 Preferably, the rotating member is configured to horizontally rotate about an axis in the vertical direction and move the end cap member from the first position to the second position. In this way, by the rotating member horizontally rotating about the axis in the vertical direction and moving the end cap member from the first position to the second position, a space necessary for the arrangement and operation
20 of the rotating member may be minimized, and thus it is possible to obtain an advantageous effect of improving space utilization and design freedom.

According to a preferred embodiment of the present disclosure, the sampling line is supported by a holder member, the outlet end of the sampling line passes through the holder member and is exposed to a lower portion of the holder member,

and at the first position, the end cap member is disposed to come in close contact with the lower portion of the holder member to wrap around the outlet end.

For example, an accommodation groove is formed to be recessed in an upper surface of the end cap member, and at the first position, the outlet end of the sampling line is accommodated in the accommodation groove to be spaced apart
5 from an inner wall surface of the accommodation groove.

In this way, by the end cap member coming in close contact with the lower portion of the holder member and sealing the outlet end of the sampling line without coming in direct contact with the sampling line, it is possible to obtain an
10 advantageous effect of more stably maintaining the arrangement state of the end cap member with respect to the sampling line and the sealed state of the outlet end.

Also, a protruding portion may be formed to protrude from the upper surface of the end cap member that faces the lower portion of the holder member, and a recessed portion that corresponds to the protruding portion may be formed in the
15 holder member.

In this way, by the protruding portion formed on the upper surface of the end cap member being accommodated in the recessed portion formed in a bottom surface of the holder member, a double sealing structure may be formed along with the accommodation groove. Thus, it is possible to obtain an advantageous effect of
20 more effectively suppressing a chemical leaking to the accommodation groove from leaking to the outside through a portion between the holder member and the end cap member.

Also, according to a preferred embodiment of the present disclosure, a detection sensor configured to detect a chemical spilling from the outlet end of the
25 sampling line is provided in the accommodation groove.

According to a preferred embodiment of the present disclosure, the chemical spill preventing device includes a first lifting/lowering unit configured to selectively lift/lower the holder member, which supports the sampling line, with respect to the end cap member.

5 More specifically, the first lifting/lowering unit is configured to move the holder member so that the holder member moves from a lowering position at which the outlet end of the sampling line is disposed in the accommodation groove to a lifting position at which the outlet end is disposed outside the accommodation groove, and the moving unit is configured to move the end cap member in a state in which
10 the outlet end is disposed at the lifting position.

For example, the first lifting/lowering unit includes a fixing block fixed to a case and a lifting/lowering member connected to the holder member and configured to move in the up-down direction with respect to the fixing block.

Preferably, a support block may be connected to the lifting/lowering member,
15 and a plurality of holder members may be supported by the support block. In this way, by the plurality of holder members being supported by the support block, it is possible to obtain advantageous effects of controlling the lifting/lowering height of the plurality of holder members to be uniform and minimizing vibration and unnecessary movement of the holder members.

20 According to another preferred embodiment of the present disclosure, the chemical spill preventing device may include a second lifting/lowering unit configured to selectively lift/lower the moving unit with respect to the holder member supporting the sampling line.

According to a preferred embodiment of the present disclosure, a sealing
25 member is provided between the holder member and the end cap member.

Preferably, when the holder member moves to the lowering position, the sealing member is pressed between the holder member and the end cap member.

In this way, by allowing the sealing member to be pressed (compressed) by the holder member when the holder member is lowered (reaches the lowering position), a gap between the holder member and the end cap member may be more effectively sealed, and thus it is possible to obtain an advantageous effect of minimizing the leakage of the chemical to the outside of the end cap member.

According to another preferred aspect of the present disclosure, a chemical sampling device includes a case in which a container having a cap fastened thereto is accommodated, a cap attaching/detaching unit configured to selectively separate or fasten the container and the cap inside the case, a sampling line configured to supply a chemical to the container separated from the cap inside the case, an end cap member provided to be able to seal an outlet end of the sampling line, and a moving unit configured to selectively move the end cap member so that the end cap member is located at a first position for sealing the outlet end or a second position for opening the outlet end.

Preferably, when the end cap member moves from the first position to the second location, the container is transferred to a lower portion of the outlet end, and the chemical is supplied to the container through the outlet end.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes a partition configured to divide an inner space of the case into a standby space and a work space that are independently sealed, wherein the cap attaching/detaching unit and the sampling line are provided in the work space, and the container moves from the standby space to the work space along a single linear movement path.

The chemical sampling device according to a preferred embodiment of the present disclosure includes a sampling line configured to supply a chemical, a drain module which has an inlet through which an outlet end of the sampling line enters formed therein and which is configured to collect the chemical discharged from the outlet end, and a holder member configured to support the sampling line and selectively seal the inlet.

This is to minimize external spilling and scattering of the chemical during a process of draining the chemical remaining in the sampling line.

That is, conventionally, a separate drain facility for discharging the chemical remaining in the sampling line is not provided, and the chemical has to be discharged without change to a lower portion of a sampling booth. Accordingly, there are problems in that a concentration of chemical fumes in the sampling booth increases and the chemical discharged to the bottom of the sampling booth scatters in all directions, causing the sampling booth to be contaminated.

However, according to the embodiment, by allowing the chemical remaining in the sampling line to be drained by the drain module in a state in which the inlet of the drain module is sealed, it is possible to obtain an advantageous effect of minimizing external spilling and scattering of the chemical during the chemical draining process.

Above all, according to the embodiment, by allowing the inlet of the drain module to be sealed by the holder member during the chemical draining process, the chemical discharged into the drain module may be suppressed from scattering and spilling to the outside of the drain module through the inlet even when a strong discharge pressure acts on the outlet end of the sampling line, spacing is present between the outlet end of the sampling line and the drain module, or the chemical

contains air bubbles. Therefore, it is possible to obtain an advantageous effect of improving safety and reliability.

According to a preferred embodiment of the present disclosure, the drain module includes a drain box which is configured to communicate with the inlet and
5 has an accommodation space in which the chemical is accommodated and a discharge line which is configured to discharge the chemical from the accommodation space to the outside of the drain box.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes a first moving unit configured to selectively move the
10 holder member so that the holder member moves to a first position for sealing the inlet or a second position for opening the inlet.

For example, the first moving unit includes a first driving portion and a first moving member configured to support the holder member, linearly move in the up-down direction by the first driving portion, and move the holder member to the first
15 position or the second position.

Preferably, the outlet end of the sampling line passes through the holder member and is exposed to a lower portion of the holder member, and when the holder member moves to the first position due to the first moving unit, the outlet end of the sampling line exposed to the lower portion of the holder member is
20 accommodated in the inlet (the outlet end of the sampling line is disposed at a height lower than the height of the uppermost end of the inlet).

In this way, by the outlet end of the sampling line being accommodated in the inlet when the holder member moves to the first position, a falling distance of the chemical discharged from the outlet end of the sampling line may be minimized, and
25 thus it is possible to obtain advantageous effects of minimizing scattering of the

chemical to the outside of the inlet and further improving the chemical collection efficiency.

Also, a support block may be connected to the first moving member, and a plurality of holder members that correspond to a plurality of sampling lines are supported by the support block in the case.

In this way, by the plurality of holder members being supported by the support block, it is possible to obtain advantageous effects of controlling the lifting/lowering height of the plurality of holder members to be uniform and minimizing vibration and unnecessary movement of the holder members.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes a guide block disposed above the holder member to be spaced apart therefrom and connected to the first moving member, wherein a guide hole configured to guide the upward/downward movement of the sampling line is formed in the guide block.

In this way, by the guide block having the guide hole formed therein being provided above the holder member and guiding the upward/downward movement of the sampling line, it is possible to obtain advantageous effects of minimizing twisting and tangling of the sampling line when the holder member is lifted/lowered and more stably maintaining the arrangement state of the sampling line.

According to a preferred embodiment of the present disclosure, a sealing member is provided between the holder member and the drain module.

Preferably, when the holder member moves to the first position (lowering position), the sealing member is pressed between the holder member and the drain module (drain box). In this way, by the sealing member being pressed by the holder member when the holder member is lowered (reaches the lowering position), a gap

between the holder member and the drain module may be more effectively sealed, and thus, it is possible to obtain an advantageous effect of minimizing leakage of the chemical to the outside of the drain module.

According to a preferred embodiment of the present disclosure, the chemical
5 sampling device includes a second moving unit configured to selectively move the drain module so that the drain module moves to a third position at which the inlet is aligned with the outlet end or a fourth position at which the inlet is spaced apart from the outlet end.

For example, the second moving unit includes a second driving portion and a
10 second moving member connected to the drain module and configured to linearly move in the horizontal direction by the second driving portion and move the drain module to the third position or the fourth position.

Preferably, the second moving unit is controlled to operate in conjunction with the first moving unit. According to a preferred embodiment of the present
15 disclosure, when the drain module moves to the third position due to the second moving unit in a state in which the holder member is at the second position, the first moving unit moves the holder member from the second position to the first position.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes an end cap member provided to be able to seal the outlet
20 end of the sampling line and a third moving unit configured to selectively move the end cap member so that the end cap member is located at a fifth position for sealing the outlet end or a sixth position for opening the outlet end.

The end cap member and the third moving unit are provided to constitute the chemical sampling device for suppressing chemical leakage through the sampling
25 line and minimizing contamination of the sampling line and damage thereto.

That is, in the chemical sampling device, there is a problem in that a chemical unintentionally leaks from the sampling line despite the supply of the chemical being stopped. More specifically, after the chemical sampling process is completed, a small amount of chemical remains at the outlet end of the sampling line, and there is
5 a problem in that, as the chemical remaining at the outlet end of the sampling line falls drop by drop, the entire work space is directly exposed to the chemical.

Also, even in a case where a failure occurs in a valve controlling the supply of the chemical using the sampling line, there is a problem in that a chemical is unintentionally discharged from the sampling line and thus the work space is
10 exposed to the chemical.

However, according to the embodiment, by the outlet end of the sampling line being sealed by the end cap member after the chemical sampling process is completed (or before the chemical sampling process), it is possible to obtain advantageous effects of suppressing chemical leakage and suppressing direct
15 exposure of the work space to the chemical fallen or spilled from the sampling line.

Further, since the outlet end of the sampling line may be accommodated in a sealed manner in the end cap member, it is possible to obtain an advantageous effect of minimizing contamination of the sampling line and damage thereto caused by contact with contaminants contained in the outside air or contact with surrounding
20 equipment.

For example, the third moving unit includes a third driving portion and a third moving member configured to support the end cap member, horizontally rotate about an axis in the up-down direction by the third driving portion, and move the end cap member to the fifth position or the sixth position.

Preferably, the third moving unit is controlled to operate in conjunction with the first moving unit and the second moving unit. According to a preferred embodiment of the present disclosure, when the drain module moves to the fourth position in a state in which the holder member is at the second position, the end cap member is moved to the fifth position by the third moving unit, and when the holder member moves from the second position to the first position due to the first moving unit, the outlet end is sealed by the end cap member.

According to a preferred embodiment of the present disclosure, the outlet end of the sampling line passes through the holder member and is exposed to a lower portion of the holder member, and at the fifth position, the end cap member is disposed to come in close contact with the lower portion of the holder member to wrap around the outlet end.

For example, an accommodation groove is formed to be recessed in an upper surface of the end cap member, and at the fifth position, the outlet end of the sampling line is accommodated in the accommodation groove to be spaced apart from an inner wall surface of the accommodation groove.

In this way, by the outlet end of the sampling line being accommodated in the accommodation groove to be spaced apart from the inner wall surface of the accommodation groove, it is possible to obtain an advantageous effect of preventing contamination of the outlet end of the sampling line caused by the outlet end coming in contact with the end cap member (or coming in contact with the worker).

Further, by the end cap member coming in close contact with the lower portion of the holder member and sealing the outlet end of the sampling line without coming in direct contact with the sampling line, it is possible to obtain an

advantageous effect of more stably maintaining the arrangement state of the end cap member with respect to the sampling line and the sealed state of the outlet end.

According to a preferred embodiment of the present disclosure, a protruding portion may be formed to protrude from the upper surface of the end cap member that faces the lower portion of the holder member, and a recessed portion that corresponds to the protruding portion may be formed in a bottom surface of the holder member.

In this way, by the protruding portion formed on the upper surface of the end cap member being accommodated in the recessed portion formed in the bottom surface of the holder member, a double sealing structure may be formed along with the accommodation groove. Thus, it is possible to obtain an advantageous effect of more effectively suppressing a chemical leaking to the accommodation groove from leaking to the outside through a portion between the holder member and the end cap member.

A chemical sampling device according to a preferred embodiment of the present disclosure includes a case, a partition portion configured to divide an inner space of the case into a first space and a second space that are independently sealed, a holder module provided to be movable along a predetermined movement path inside the first space and having a container stored therein, a sampling line configured to supply a chemical to the container in the first space, a first magnetic body disposed in the holder module, a second magnetic body provided in the second space so that an attractive force acts between the first magnetic body and the second magnetic body while the partition portion is disposed therebetween, and a transfer unit provided in the second space and configured to transfer the second magnetic body.

This is to minimize external leakage of the chemical during the chemical sampling process.

Above all, according to the embodiment, by the holder module disposed in the first space and the transfer unit disposed in the second space being bound to be
5 able to interlock with each other by the attractive force between the first magnetic body and the second magnetic body disposed with the partition portion placed therebetween, a hole (or a slot) for structurally connecting the holder module and the transfer unit is not necessary to be formed through the partition portion, and thus it is possible to completely prevent chemical fumes of the first space from leaking to the
10 second space during the chemical sampling process.

Therefore, it is possible to obtain advantageous effects of suppressing corrosion of the transfer unit and damage thereto caused by exposure to the chemical and preventing the chemical of the first space from leaking to the outside of the case via the second space.

15 Further, according to the embodiment, since the first space in which a moving unit is disposed and the second space in which the container is disposed are spatially completely separated, it is possible to obtain advantageous effects of completely preventing foreign matter, such as dust generated during the operation of the transfer unit, from entering the first space and preventing foreign matter, which enters the
20 first space from the second space during the chemical sampling process, from entering the inside of the container.

The transfer unit may be formed of various structures capable of transferring the holder module. For example, the transfer unit includes a transfer driving portion provided in the second space, and a transfer member configured to support the
25 second magnetic body in the second space, linearly move by the transfer driving

portion, and transfer the second magnetic body. According to another embodiment of the present disclosure, the holder module and the transfer member may be configured to move along a curved movement path or a bent movement path.

According to a preferred embodiment of the present disclosure, a slider which
5 is linearly movable along the predetermined movement path is provided in the first space, and the holder module is supported by the slider.

Preferably, a guide rail configured to guide the linear movement of the slider is provided in the first space.

In this way, by the linear movement of the holder module being guided by the
10 slider and the guide rail in the first space, it is possible to obtain advantageous effects of ensuring smooth movement of the holder module and improving movement stability and reliability.

The guide rail may be formed of various structures capable of guiding the linear movement of the slider. For example, the guide rail includes a lower wall
15 portion, an upper wall portion disposed above the lower wall portion to be spaced apart therefrom, and a sidewall portion configured to connect the lower wall portion and the upper wall portion, and the lower wall portion, the upper wall portion, and the sidewall portion together form a rail groove in which the slider is accommodated to be linearly movable.

20 Preferably, a guide slot is formed through the partition portion along the movement path of the holder module, wherein the guide slot is sealed by the sidewall portion, and one end of the transfer member is movably accommodated in the guide slot.

In this way, by the one end of the transfer member moving along the guide
25 slot formed in the partition portion, it is possible to obtain advantageous effects of

maintaining the posture of the transfer member to be constant during the movement of the transfer member and improving the movement stability of the transfer member. Further, since the one end of the transfer member may be accommodated in the guide slot, it is possible to obtain an advantageous effect of minimizing the space necessary
5 for the arrangement and movement of the transfer member.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes a bearing portion rotatably provided at the slider and configured to come in rolling contact with the guide rail.

The bearing portion may be formed of various structures capable of rollably
10 supporting the slider with respect to the guide rail.

For example, the bearing portion includes a first rolling member rotatably provided at a lower end of the slider and configured to come in rolling contact with the lower wall portion, a second rolling member rotatably provided at an upper end of the slider and configured to come in rolling contact with the upper wall portion,
15 and a third rolling member rotatably provided at a rear end of the slider and configured to come in rolling contact with the sidewall portion.

In this way, by the slider rolling with respect to the guide rail, it is possible to minimize wear and dust generation caused by contact between the slider and the guide rail. Therefore, it is possible to obtain an advantageous effect of minimizing
20 the flow of foreign matter into the container with the cap open in the first space.

According to a preferred embodiment of the present disclosure, the first magnetic body is coupled to the slider, and the second magnetic body is coupled to the transfer member to face the first magnetic body while the sidewall portion is disposed therebetween.

Preferably, the second magnetic body is mounted on an end portion of the transfer member that faces the first magnetic body while the sidewall portion is disposed therebetween.

5 In this way, by the second magnetic body being mounted on the end portion of the transfer member that faces the first magnetic body while the sidewall portion is disposed therebetween, spacing between the first magnetic body and the second magnetic body may be minimized (the first magnetic body and the second magnetic body may be disposed to be as closest as possible), and thus it is possible to obtain an advantageous effect of stably ensuring the formation of the attractive force between
10 the first magnetic body and the second magnetic body even without increasing the size of the first magnetic body and the second magnetic body.

According to a preferred embodiment of the present disclosure, the chemical sampling device includes a detecting portion configured to detect the position of the second magnetic body relative to the position of the first magnetic body.

15 As the detecting portion, various detection means capable of detecting the position of the second magnetic body relative to the position of the first magnetic body may be used.

More specifically, the detecting portion includes a portion to be detected that is provided at the slider, and a sensing portion provided at the transfer member and
20 configured to sense the portion to be detected. For example, a transparent window is provided at the sidewall portion, and a light sensor configured to transmit and receive a light signal transmitted through the transparent window is used as the sensing portion.

According to a preferred embodiment of the present disclosure, the structure
25 and form of the first space and the second space divided by the partition portion may

be changed in various ways according to required conditions and design specifications.

For example, the partition portion includes a first partition configured to horizontally divide the inner space of the case and a second partition connected to an end portion of the first partition and configured to vertically divide the inner space of the case.

Preferably, the first space is divided by a third partition into the standby space and work space that are independently sealed, and the holder module moves from the standby space to the work space along a single linear movement path.

A cap opening/closing device according to one feature of the present disclosure includes a holder module configured to fix a container and an attaching/detaching module configured to separate a cap from the container or fasten the cap to the container, wherein the container includes a first screw thread, the cap includes a second screw thread coupled to the first screw thread, and the attaching/detaching module includes a grip portion coupled to the cap, a rotating portion configured to rotate the grip portion, a lifting/lowering portion configured to move the grip portion in the up-down direction, and a buffer portion configured to, when the second screw thread is separated from the first screw thread and the cap is lifted, cause the grip portion to be lifted along with the cap.

[Advantageous Effects]

According to an embodiment of the present disclosure, an advantageous effect of improving the safety and reliability of a sampling device can be obtained.

Also, advantageous effects of suppressing chemical leakage from a sampling line and minimizing contamination of the sampling line can be obtained.

Also, an advantageous effect of minimizing external spilling and scattering of chemicals during a process of draining chemicals remaining in a sampling line can be obtained.

Also, advantageous effects of allowing a chemical to be sampled in a sealed
5 space that is completely sealed and minimizing external leakage of chemical fumes during the chemical sampling process can be obtained.

Also, by having a means for rotating a cap grip portion and transferring the cap grip portion upward/downward, damage to a container can be prevented when separating a cap from the container or re-coupling the cap to the container.

10 Also, in a case where the container is exposed to chemicals, the exposure can be detected and the worker can be warned of the exposure, and thus an accident in which the worker is exposed to the chemicals can be prevented.

Also, according to an embodiment of the present disclosure, an advantageous effect of improving the accuracy of chemical contamination analysis work can be
15 obtained.

Also, according to an embodiment of the present disclosure, advantageous effects of simplifying a structure and improving space utilization can be obtained.

Various useful advantages and effects of the present disclosure are not limited to those described above and may be more easily understood from the process in
20 which specific embodiments of the present disclosure are described.

[Description of Drawings]

FIG. 1 is a view for describing a chemical storage facility according to a first embodiment of the present disclosure.

FIG. 2 is a view for describing a chemical sampling device according to the
25 first embodiment of the present disclosure.

FIGS. 3 to 5 are views for describing a chemical spill preventing device applied to the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 6 is a view for describing another embodiment of the chemical spill preventing device applied to the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 7 is a view for describing a cap attaching/detaching unit of the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 8 is a view for describing a movement path of a container of the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 9 is a view for describing a cap separation process by the cap attaching/detaching unit of the chemical sampling device according to the first embodiment of the present disclosure.

FIGS. 10 and 11 are views for describing an operation structure of an end cap member of the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 12 is a view for describing a chemical supply process through a sampling line of the chemical sampling device according to the first embodiment of the present disclosure.

FIG. 13 is a view for describing a chemical sampling device according to a second embodiment of the present disclosure.

FIGS. 14 to 16 are views for describing a drain module of the chemical sampling device according to the second embodiment of the present disclosure.

FIGS. 17 and 18 are views for describing an end cap member of the chemical sampling device according to the second embodiment of the present disclosure.

FIG. 19 is a view for describing a movement path of a container of the chemical sampling device according to the second embodiment of the present disclosure.

FIG. 20 is a view for describing a cap separation process by a cap
5 attaching/detaching unit of the chemical sampling device according to the second embodiment of the present disclosure.

FIGS. 21 and 27 are views for describing an operation structure of the drain module and the end cap member of the chemical sampling device according to the second embodiment of the present disclosure.

10 FIG. 28 is a view for describing a chemical supply process through a sampling line of the chemical sampling device according to the second embodiment of the present disclosure.

FIG. 29 is a view for describing a chemical sampling device according to a third embodiment of the present disclosure.

15 FIGS. 30 and 31 are views for describing a connection structure of a transfer unit and a holder module of the chemical sampling device according to the third embodiment of the present disclosure.

FIG. 32 is an enlarged view of portion “A” of FIG. 31.

FIG. 33 is a view for describing a drain module and an end cap member of
20 the chemical sampling device according to the third embodiment of the present disclosure.

FIG. 34 is a view for describing a movement path of a container of the chemical sampling device according to the third embodiment of the present disclosure.

FIGS. 35 and 36 are views for describing a cap separation process by a cap attaching/detaching unit of the chemical sampling device according to the third embodiment of the present disclosure.

FIGS. 37 and 38 are views for describing a chemical supply process through a sampling line of the chemical sampling device according to the third embodiment of the present disclosure.

FIG. 39 is a conceptual diagram of a chemical sampling device according to a fourth embodiment of the present disclosure.

FIG. 40 is a view showing a state in which a cap opening/closing device is coupled to a cap.

FIG. 41 is a view showing a state in which the cap is lifted from a container by the cap opening/closing device.

FIG. 42 is a view showing a state in which the cap is separated from the container by the cap opening/closing device.

FIG. 43 is a view showing a state in which the cap opening/closing device is lifted.

FIG. 44 is a view showing a process of putting a chemical into the container.

FIG. 45 is a view showing a state in which the cap is coupled to the container.

FIG. 46 is a view showing a state in which the container is moved to a standby area.

FIG. 47 is a cross-sectional view of an attaching/detaching module.

FIG. 48 is an enlarged view of a buffer portion.

FIG. 49 is a view showing a height at which the attaching/detaching module is lifted and lowered along with the cap by the buffer portion.

FIG. 50 is a view showing a height at which the attaching/detaching module in a deformed state is lifted and lowered along with the cap.

FIG. 51 is a conceptual diagram of a holder module.

FIG. 52 is a view showing a second detection sensor disposed in the holder
5 module.

FIG. 53 is a conceptual diagram of the second detection sensor.

FIG. 54 is a flowchart showing a sampling method according to an embodiment of the present disclosure.

[Modes of the Invention]

10 Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

However, the technical spirit of the present disclosure is not limited to some embodiments described herein and may be implemented in various different forms. One or more elements may be selectively combined or substituted between the
15 embodiments within the scope of the technical spirit of the present disclosure.

Also, unless explicitly defined otherwise, all terms including technical or scientific terms used in the embodiments of the present disclosure should be construed as having a meaning that is generally understandable by those of ordinary skill in the art to which the present disclosure pertains, and commonly used terms,
20 such as those defined in dictionaries, should be construed as having a meaning that is consistent with their meaning in the context of the relevant art.

Also, the terms used in the embodiments of the present disclosure are for describing the embodiments and are not intended to limit the present disclosure.

In this specification, a singular expression may include a plural expression unless the context clearly indicates otherwise, and “at least one (or one or more) of A, B, and C” may include one or more of all possible combinations of A, B, and C.

Also, in describing the elements of the embodiments of the present disclosure,
5 terms such as first, second, A, B, (a), and (b) may be used.

Such terms are only for distinguishing one element from another element, and the essence, order, or sequence of the corresponding elements is not limited by the terms.

Also, when a certain element is described as being “connected,” “coupled,”
10 or “linked” to another element, this may not only include a case where the element is directly connected, coupled, or linked to the other element, but also include a case where the element is “connected,” “coupled,” or “linked” to the other element via another element present therebetween.

In addition, when described as being formed or disposed “above (on) or
15 below (under)” each element, the “above (on) or below (under)” not only includes a case where two elements come in direct contact with each other, but also includes a case where one or more other elements are formed or disposed between the two elements. Also, when expressed as being “above (on) or below (under),” this may not only include an upward direction from one element but also include a downward
20 direction therefrom.

<First embodiment>

A chemical spill preventing device according to an embodiment of the present disclosure includes an end cap member 1400 provided to be able to seal an outlet end of sampling lines L1, L2, and L3 through which chemicals are discharged,
25 and a moving unit 1500 configured to selectively move the end cap member 1400 so

that the end cap member 1400 is located at a first position for sealing the outlet end or a second position for opening the outlet end.

For reference, the chemical spill preventing device according to an embodiment of the present disclosure is provided to block the chemicals leaking
5 from the sampling lines L1, L2, and L3. For example, the chemical spill preventing device may be mounted on a chemical storage facility 1 to constitute a chemical sampling device 110 for sampling the chemicals at major locations such as a tank lorry, a drum, a bottle, a storage tank, and a pipe.

Referring to FIG. 1, the chemical storage facility 1 may include an automatic
10 clean quick coupler (ACQC) unit 2, a first chemical storage tank 3, a chemical distribution device 4, and a plurality of second chemical storage tanks 5 and 6.

The ACQC unit 2 delivers chemicals received from a tank lorry to the first chemical storage tank 3, and the chemical distribution device 4 divides and supplies some of the chemicals stored in the first chemical storage tank 3 to the plurality of
15 second chemical storage tanks 5 and 6.

For example, the chemical sampling device 110 may be connected to each of the chemical storage tanks 3, 5, and 6 through the plurality of sampling lines L1, L2, and L3, and an opening/closing valve V and a pump P for controlling the transfer of chemicals may be provided in each of the sampling lines L1, L2, and L3.

20 According to another embodiment of the present disclosure, chemicals of a chemical supply source may be configured to be transferred through a sampling line by supplying a gas (e.g., nitrogen or air) to the chemical supply source.

In an embodiment of the present disclosure, a case where the sampling lines L1, L2, and L3 are connected to a chemical storage tank is described as an example,
25 but according to another embodiment of the present disclosure, a sampling line may

be connected to any other types of chemical supply sources, such as a tank lorry, a drum, a bottle, a storage tank, and a pipe, that supply, store, or transfer chemicals, and the present disclosure is not limited or restricted by an object or position to which a sampling line is connected.

5 Also, in an embodiment of the present disclosure, a case where the three sampling lines L1, L2, and L3 are connected to the chemical sampling device is described as an example, but according to another embodiment of the present disclosure, two or less or four or more sampling lines may be connected to the chemical sampling device, and the present disclosure is not limited or restricted by
10 the number of sampling lines.

 According to a preferred embodiment of the present disclosure, the chemical sampling device 110 includes a case 1100 in which a container 20 having a cap 22 fastened thereto is accommodated and a cap attaching/detaching unit 1300 configured to selectively separate or fasten the container 20 and the cap 22 inside the
15 case 1100, and the sampling lines L1, L2, and L3 are configured to supply chemicals to the container 20 separated from the cap 22 inside the case 1100.

 Various storage means capable of accommodating chemicals and having the selectively separable cap 22 may be used as the container 20, and the present disclosure is not limited or restricted by the structure and form of the container 20.

20 For example, a sampling bottle capable of accommodating chemicals may be used as the container 20, and the cap 22 may be fastened or separated by rotating along a screw thread formed on an inlet of the container 20.

 The case 1100 is formed to have a linear (e.g., straight) inner space 1102, and the inner space 1102 of the case 1100 is divided into a standby space 1102a and a
25 work space 1102b that are independently sealed by a partition 1101.

Here, the standby space 1102a is defined as a space in which the container 20 temporarily stands by when a worker puts the container 20 into the case 1100 from outside the case 1100 or takes the container 20 (e.g., a container filled with chemicals) accommodated in the case 1100 out of the case 1100.

5 Also, in the embodiment of the present disclosure, the work space 1102b may be defined as a space in which the cap 22 is separated from or coupled to the container 20 and chemicals are supplied into the container 20.

Preferably, the container 20 is configured to move back and forth between the standby space 1102a and the work space 1102b along a single linear path (e.g., a
10 linear movement path in the left-right direction) inside the case 1100.

Here, the container 20 moving along the single linear path means that the movement path of the container 20 is formed in a single linear shape.

In this way, by setting the movement path of the container 20 to have a single linear shape inside the case 1100, it is possible to obtain advantageous effects of
15 simplifying a movement structure of the container 20 and shortening the movement path and movement time of the container 20.

According to another embodiment of the present disclosure, the container may be configured to move along an L-shaped movement path inside the case. For example, the container entering the standby space may be configured to, after
20 moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit and a lower portion of the sampling lines along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path.

Otherwise, the container may be configured to move along a right-angled C-
25 shaped movement path inside the case. For example, the container entering the

standby space may be configured to, after moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path and then move to a lower portion of the sampling lines along a third linear movement path that crosses (e.g., is perpendicular to) the second linear movement path.

A first entry/exit that communicates with the standby space 1102a is formed in the case 1100, and the first entry/exit is selectively opened/closed by a first door 1104 (see FIG. 8). For example, the first door 1104 may be rotatably coupled to the case 1100 to open/close the first entry/exit by a hinged manner. According to another embodiment of the present disclosure, the first door may be configured to open/close the first entry/exit by a sliding manner.

A second entry/exit through which the container 20 is able to enter and exit is formed in the partition 1101, and the second entry/exit is selectively opened/closed by a second door 1106. The second door 1106 may open/close the second entry/exit by a hinged or sliding manner, and the present disclosure is not limited or restricted by the opening/closing method and structure of the second door 1106.

The second door 1106 is configured to open the second entry/exit when the container 20 accommodated in the standby space 1102a is transferred to the work space 1102b (or transferred from the work space to the standby space) and configured to close the second entry/exit when the cap 22 is separated from or coupled to the container 20 or chemicals are supplied into the container 20.

In this way, according to the embodiment, by allowing the separation and coupling of the cap 22 from and to the container 20 and the chemical sampling process (injecting chemicals into the container) to be performed in the work space 1102b independently sealed from the standby space 1102a, it is possible to obtain an

advantageous effect of minimizing external discharge of chemical fumes, which are generated during the sampling process, through the standby space 1102a.

Also, an exhaust device (not illustrated) capable of discharging the chemical fumes to the outside may be provided in the work space 1102b.

5 For reference, in an embodiment of the present disclosure, a case where the separation and coupling of the cap 22 from and to the container 20 and the supply of chemicals are all performed in the work space 1102b is described as an example, but according to another embodiment of the present disclosure, the work space of the case may be divided into a first work space and a second work space that are
10 independently sealed, the process of separating or coupling the cap from or to the container may be performed in the first work space, and the process of supplying chemicals into the container may be performed in the second work space.

A holder module 1110 configured to store and support the container 20 is provided inside the case 1100.

15 The holder module 1110 may be formed of various structures capable of gripping and supporting the container 20 inside the case 1100, and the present disclosure is not limited or restricted by the structure of the holder module 1110.

For example, the holder module 1110 may include a bottom portion 1112 configured to support a bottom surface of the container 20, a first side surface support portion 1114 configured to extend upward from one side of the bottom
20 portion 1112 to support a side surface of the container 20, and a second side surface support portion 1116 configured to extend upward from another one side of the bottom portion 1112 to face the first side surface support portion 1114 to support another side surface of the container 20, and the first side surface support portion

1114 and the second side surface support portion 1116 together form a storage space in which the container 20 is stored.

Preferably, the second side surface support portion 1116 is formed to have a height (height in the up-down direction) relatively shorter than the height of the first side surface support portion 1114. In this way, by forming the height of the second side surface support portion 1116 to be shorter than the height of the first side surface support portion 1114, a free space that the container 20 is able to enter may be formed at an upper portion of the second side surface support portion 1116, and thus the container 20 may be obliquely tilted through the free space and stored in the storage space. Also, the worker may easily grip a circumferential surface of the container 20 that is exposed through the free space.

According to a preferred embodiment of the present disclosure, the chemical sampling device 110 includes a transfer unit (not illustrated) configured to transfer the holder module 1110 inside the case 1100.

For example, the transfer unit may be configured to transfer the holder module 1110 so that the holder module 1110 linearly moves back and forth between the standby space 1102a and the work space 1102b in the horizontal direction (the left-right direction based on FIG. 2).

More specifically, the transfer unit transfers the holder module 1110 (the holder module in which the container is accommodated) disposed in the standby space 1102a to a lower portion of the sampling lines L1, L2, and L3 via a lower portion of the cap attaching/detaching unit 1300 provided in the work space 1102b, and after the container 20 is filled with chemicals, the transfer unit transfers the holder module 1110 disposed in the work space 1102b back to the standby space 1102a via the lower portion of the cap attaching/detaching unit 1300.

The transfer unit (not illustrated) may be formed of various structures capable of transferring the holder module 1110, and the present disclosure is not limited or restricted by the structure and operation method of the transfer unit.

For example, the transfer unit may be configured to linearly move the holder
5 module 1110 using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems.

Preferably, the transfer unit may be mounted outside the case 1100 and configured to transfer the holder module 1110 using a magnetic force (or an electromagnetic force) while being structurally separated from the holder module
10 1110. In this way, by the transfer unit and the holder module 1110 being structurally separated from each other, a slot for structurally connecting the holder module 1110 disposed inside the case 1100 and the transfer unit provided outside the case 1100 is not necessary to be formed through a wall surface of the case 1100, and thus it is possible to obtain an advantageous effect of suppressing external exposure
15 of fumes, which are generated during the chemical sampling process, through the slot.

The cap attaching/detaching unit 1300 is provided on the work space 1102b and configured to separate the cap from the container 20 transferred to the work space 1102b or fasten the cap to the container 20.

The cap attaching/detaching unit 1300 may be formed of various structures
20 capable of selectively separating or fastening the cap 22 from or to the container 20, and the structure and operation method of the cap attaching/detaching unit 1300 may be changed in various ways according to required conditions and design specifications.

For example, referring to FIG. 7, the cap attaching/detaching unit 1300 may include a grip portion 1310, a rotating portion 1320, and a lifting/lowering portion 1330.

More specifically, the grip portion 1310 may include a plurality of grippers 1311 configured to support a side surface of the cap 22 of the container 20, a fixing frame 1312 to which the grippers 1311 are rotatably coupled, a first lifting/lowering frame 1313, a connection link 1314 having one end rotatably connected to the grippers 1311 and the other end rotatably connected to the first lifting/lowering frame 1313, and a frame lifting/lowering portion 1315 configured to transfer the first lifting/lowering frame 1313 in the up-down direction.

For example, when the plurality of grippers 1311 rotate clockwise (based on FIG. 7) with respect to the connection link, a grip surface (a portion gripping a side surface of the cap) of each gripper 1311 may move in a direction moving away from a grip surface of another gripper 1311, and thus each gripper 1311 may be separated from the cap 22 (the grip state of each gripper 1311 may be released). On the other hand, when the plurality of grippers 1311 rotate counterclockwise (based on FIG. 7) with respect to the connection link, a grip surface (a portion gripping a side surface of the cap) of each gripper 1311 may move in a direction approaching a grip surface of another gripper 1311, and thus the grippers 1311 may together grip a side surface of the cap 22.

The frame lifting/lowering portion 1315 may be lifted/lowered by a pneumatic cylinder but is not necessarily limited thereto and may be lifted/lowered using other lifting/lowering means such as a hydraulic cylinder.

The rotating portion 1320 is provided to rotate the frame lifting/lowering portion 1315 about a vertical line (an axis of rotation in the up-down direction), and

the lifting/lowering portion 1330 is provided to transfer a second lifting/lowering frame, which is connected to the rotating portion, in the up-down direction.

Due to such a structure, the grip portion 1310 may be lowered by the lifting/lowering portion 1330 and then grip the cap 22, and the cap 22 may be
5 separated from the container 20 by rotation (rotation in a first direction) caused by the rotating portion 1320 and upward movement caused by the lifting/lowering portion 1330. Conversely, the process of fastening the cap 22 to the container 20 may be performed by rotation (rotation in a second direction) caused by the rotating portion 1320 and downward movement caused by the lifting/lowering portion.

10 For example, the rotating portion 1320 may include a servomotor. In some cases, the rotating portion may include other driving means.

The lifting/lowering portion 1330 may include a pneumatic cylinder but is not necessarily limited thereto.

The lifting/lowering portion 1330 may be coupled to an upper surface of the
15 case 1100, the frame lifting/lowering portion 1315, the rotating portion 1320, and the lifting/lowering portion 1330 may be disposed outside the case 1100, and the frame lifting/lowering portion 1315 may extend toward the inside of the work space 1102b through a through-hole (not illustrated) formed in an upper wall of the case 1100. Accordingly, exposure of driving devices, such as the rotating portion 1320 and the
20 lifting/lowering portion 1330, to chemicals and corrosion caused thereby may be minimized.

In addition, the entry/exit of chemical fumes through the through-hole (not illustrated) formed in the case 1100 may be blocked by a first cover member 1340 (see FIG. 2). For example, the first cover member 1340 may be formed as an
25 expandable/contractible corrugated tube, both ends of the first cover member 1340

may be coupled to a lifting/lowering frame 1331 configured to rotatably support the upper surface of the case 1100 and the frame lifting/lowering portion 1315, and the frame lifting/lowering portion 1315 may extend through the first cover member 1340. Accordingly, it is possible to suppress the entry/exit of chemicals or chemical fumes through the through-hole of the case 1100.

According to a preferred embodiment of the present disclosure, binding members 1210 and 1220 for selectively binding rotation (rotation about the vertical axis) of the container 20 with respect to the cap attaching/detaching unit 1300 are provided at the lower portion of the cap attaching/detaching unit 1300.

For example, the binding members 1210 and 1220 may be provided as a plurality of binding members 1210 and 1220 that are linearly movable in directions approaching and moving away from the circumference of the container 20. Here, the number of binding members 1210 and 1220 and intervals at which the binding members 1210 and 1220 are disposed may be changed in various ways according to required conditions and design specifications.

When the container 20 stored in the holder module 1110 is located at the lower portion of the cap attaching/detaching unit 1300 (a cap attaching/detaching position), the plurality of binding members 1210 and 1220 move in the direction approaching the circumference of the container 20 and together press the circumference of the container 20 to bind the rotation of the container 20. On the other hand, after the separation or fastening of the cap 22 is completed, the binding members 1210 and 1220 move in the direction moving away from the circumference of the container 20, and thus binding by the binding members 1210 and 1220 is released.

According to a preferred embodiment of the present disclosure, the chemical sampling device 110 may include a drain module (not illustrated) for collecting chemicals remaining in the sampling lines L1, L2, and L3 before chemicals are supplied into the container 20.

5 The drain module is provided to discharge contaminated chemicals remaining in the sampling lines L1, L2, and L3 before chemicals are supplied from the sampling lines L1, L2, and L3 into the container 20.

That is, chemicals filled in the sampling lines L1, L2, and L3 may stagnate after a certain period of time, causing precipitates to be generated or the chemicals to
10 be contaminated through an open outlet.

However, according to the embodiment, by allowing the chemicals remaining in the sampling lines L1, L2, and L3 to be collected by the drain module before chemicals are supplied into the container 20, uncontaminated high-purity chemicals may be supplied into the container 20, and thus it is possible to obtain an
15 advantageous effect of improving the reliability of chemical contamination analysis.

The end cap member 1400 and the moving unit 1500 are provided to constitute the chemical spill preventing device for suppressing leakage of chemicals through the sampling lines L1, L2, and L3 and minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto.

20 That is, in the chemical sampling device, there is a problem in that chemicals unintentionally leak from the sampling line despite the supply of chemicals being stopped. More specifically, after the chemical sampling process is completed, a small amount of chemicals remains at the outlet end of the sampling line, and there is a problem in that, as the chemicals remaining at the outlet end of the sampling line
25 fall drop by drop, the entire work space is directly exposed to the chemicals.

Also, even in a case where a failure occurs in a valve controlling the supply of chemicals using the sampling line, there is a problem in that chemicals are unintentionally discharged from the sampling line and thus the work space is exposed to the chemicals.

5 However, according to the embodiment, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 1400 after the chemical sampling process is completed (or before the chemical sampling process), it is possible to obtain advantageous effects of suppressing chemical leakage and suppressing direct exposure of the work space 1102b to the chemicals fallen or
10 spilled from the sampling lines L1, L2, and L3.

 Further, since the outlet end of the sampling lines L1, L2, and L3 may be accommodated in a sealed manner in the end cap member 1400, it is possible to obtain an advantageous effect of minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto caused by contact with contaminants contained in the
15 outside air or contact with surrounding equipment.

 The end cap member 1400 may be formed of various structures capable of sealing the outlet end of the sampling lines L1, L2, and L3 through which chemicals are discharged, and the shape and structure of the end cap member 1400 may be changed in various ways according to required conditions and design specifications.

20 Here, the end cap member 1400 sealing the outlet end of the sampling lines L1, L2, and L3 means that the outlet end of the sampling lines L1, L2, and L3 is blocked by the end cap member 1400 without being exposed to the outside (e.g., the work space).

 For example, the end cap member 1400 may be provided as three end cap
25 members 1400 to correspond to each of the three sampling lines L1, L2, and L3, and

the number and arrangement structure of the end cap members 1400 may be appropriately changed according to the number and arrangement form of the sampling lines L1, L2, and L3.

The moving unit 1500 is provided to selectively move the end cap member 1400 so that the end cap member 1400 is located at the first position for sealing the outlet end or the second position for opening the outlet end.

Here, the end cap member 1400 being located at the first position means that the end cap member 1400 is located to block (seal) the outlet end of the sampling lines L1, L2, and L3 as illustrated in FIG. 4, and the end cap member 1400 being located at the second position means that the end cap member 1400 is located to expose (open) the outlet end of the sampling lines L1, L2, and L3 as illustrated in FIG. 11.

The end cap member 1400 may be configured to move from the first position to the second position in various ways according to required conditions and design specifications.

For example, the moving unit 1500 is configured to rotate the end cap member 1400 from the first position to the second position (or from the second position to the first position).

More specifically, the moving unit 1500 includes a driving portion 1510 configured to provide a driving force, and a rotating member 1520 configured to support the end cap member 1400, rotate due to the driving portion 1510, and move the end cap member 1400 from the first position to the second position.

A cylinder (e.g., a pneumatic cylinder or a hydraulic cylinder), a motor, and the like capable of providing a driving force may be used as the driving portion 1510,

and the present disclosure is not limited or restricted by the type and structure of the driving portion 1510.

The rotating member 1520 is formed in a substantially L-shape and has one end (upper end) connected to the driving portion 1510 and the other end configured
5 to support the end cap member 1400.

Preferably, the rotating member 1520 is configured to horizontally rotate about an axis in the vertical direction and move the end cap member 1400 from the first position to the second position. In this way, by the rotating member 1520 horizontally rotating about the axis in the vertical direction and moving the end cap
10 member 1400 from the first position to the second position, a space necessary for the arrangement and operation of the rotating member 1520 may be minimized, and thus it is possible to obtain an advantageous effect of improving space utilization and design freedom.

According to another embodiment of the present disclosure, the rotating
15 member may be configured to rotate about the axis in the vertical direction or an axis in another direction and move the end cap member from the first position to the second position. According to still another embodiment of the present disclosure, the end cap member may be configured to linearly move (horizontally move) from the first position to the second position.

20 According to a preferred embodiment of the present disclosure, the sampling lines L1, L2, and L3 are supported by a holder member 1420.

For example, the sampling lines L1, L2, and L3 are supported by the holder member 1420 fixed to the case 1100.

A cover member (not illustrated), which is formed as an
25 expandable/contractible corrugated tube, may be provided between an upper portion

of the holder member 1420 and an inner surface (upper inner surface) of the case 1100, and the sampling lines L1, L2, and L3 are disposed to pass through the inside of the cover member. Accordingly, it is possible to obtain an advantageous effect of minimizing exposure of fumes through a through-hole (not illustrated) formed in the case 1100 to allow passage of the sampling lines L1, L2, and L3.

Preferably, the outlet end of the sampling lines L1, L2, and L3 passes through the holder member 1420 and is exposed to a lower portion of the holder member 1420, and at the first position, the end cap member 1400 is disposed to come in close contact with the lower portion of the holder member 1420 to wrap around the outlet end.

For example, an accommodation groove 1402 is formed to be recessed in an upper surface of the end cap member 1400, and at the first position, the outlet end of the sampling lines L1, L2, and L3 is accommodated in the accommodation groove 1402 to be spaced apart from an inner wall surface of the accommodation groove 1402.

In this way, by the outlet end of the sampling lines L1, L2, and L3 being accommodated in the accommodation groove 1402 to be spaced apart from the inner wall surface of the accommodation groove 1402, it is possible to obtain an advantageous effect of preventing contamination of the outlet end of the sampling lines L1, L2, and L3 caused by the outlet end coming in contact with the end cap member 1400.

Also, in a case where a task of sealing the outlet end of the sampling line is manually performed by the worker, there is a problem in that the worker is directly exposed to chemicals spilling to a sealing member sealing the outlet end. However, according to the embodiment, since the task of sealing the outlet end of the sampling

lines L1, L2, and L3 using the end cap member 1400 may be automatically performed in the work space 1102b without the worker coming in direct contact with the end cap member 1400, it is possible to obtain an advantageous effect of preventing the worker from being exposed to chemicals spilling to the end cap member 1400.

Further, by the end cap member 1400 coming in close contact with the lower portion of the holder member 1420 and sealing the outlet end of the sampling lines L1, L2, and L3 without coming in direct contact with the sampling lines L1, L2, and L3, it is possible to obtain an advantageous effect of more stably maintaining the arrangement state of the end cap member 1400 with respect to the sampling lines L1, L2, and L3 and the sealed state of the outlet end.

Also, a protruding portion 1404 may be formed to protrude from the upper surface of the end cap member 1400 that faces the lower portion of the holder member 1420, and a recessed portion 1424 that corresponds to the protruding portion 1404 may be formed in a bottom surface of the holder member 1420.

In this way, by the protruding portion 1404 formed on the upper surface of the end cap member 1400 being accommodated in the recessed portion 1424 formed in the bottom surface of the holder member 1420, a double sealing structure may be formed along with the accommodation groove 1402. Thus, it is possible to obtain an advantageous effect of more effectively suppressing chemicals leaking to the accommodation groove 1402 from leaking to the outside through a portion between the holder member 1420 and the end cap member 1400.

Also, according to a preferred embodiment of the present disclosure, a detection sensor 1430 configured to detect chemicals spilling from the outlet end of

the sampling lines L1, L2, and L3 may be provided in the accommodation groove 1402.

As the detection sensor 1430, common sensors (e.g., a light sensor, an infrared sensor, a capacitance sensor) capable of detecting chemicals may be used, and the present disclosure is not limited or restricted by the type and sensing method of the detection sensor 1430.

Also, when chemical spill is detected by the detection sensor 1430, a controller (not illustrated) may generate an alarm signal that may inform the worker of the chemical spill situation.

Here, the alarm signal may include at least one of an aural alarm signal by a common acoustic means and a visual alarm signal by a common warning light, and in addition, various other alarm signals that may inform the worker of the chemical spill situation may be used.

According to a preferred embodiment of the present disclosure, the chemical sampling device 110 includes a first lifting/lowering unit 1600 configured to selectively lift/lower the holder member 1420, which supports the sampling lines L1, L2, and L3, with respect to the end cap member 1400.

More specifically, the first lifting/lowering unit 1600 is configured to move the holder member 1420 so that the holder member 1420 moves from a lowering position at which the outlet end of the sampling lines L1, L2, and L3 is disposed in the accommodation groove 1402 to a lifting position at which the outlet end is disposed outside the accommodation groove 1402, and the moving unit 1500 is configured to move the end cap member 1400 in a state in which the outlet end is disposed at the lifting position.

On the other hand, when the supply of chemicals by the sampling lines L1, L2, and L3 is completed, the end cap member 1400 moves back to the first position (position at the lower portion of the sampling lines), and the outlet end of the sampling lines L1, L2, and L3 moves to the lowering position by the first
5 lifting/lowering unit 1600 and is sealed by the end cap member 1400.

The first lifting/lowering unit 1600 may be formed of various structures capable of lifting/lowering the holder member 1420, and the present disclosure is not limited or restricted by the structure and lifting/lowering method of the first lifting/lowering unit 1600.

10 For example, the first lifting/lowering unit 1600 includes a fixing block 1610 fixed to the case 1100 and a lifting/lowering member 1620 connected to the holder member 1420 and configured to move in the up-down direction with respect to the fixing block 1610.

The lifting/lowering member 1620 may be configured to be lifted/lowered
15 with respect to the fixing block 1610 by a cylinder (e.g., a pneumatic cylinder or a hydraulic cylinder), a motor, or the like.

The lifting/lowering member 1620 may be formed of a single member capable of being lifted/lowered with respect to the fixing block 1610 mounted on an outer surface of the case 1100 or may be formed of a plurality of members assembled
20 together, and the present disclosure is not limited or restricted by the structure and form of the lifting/lowering member 1620.

Preferably, a support block 1630 may be connected to the lifting/lowering member 1620, and a plurality of holder members 1420 may be supported by the support block 1630. In this way, by the plurality of holder members 1420 being
25 supported by the support block 1630, it is possible to obtain advantageous effects of

controlling the lifting/lowering height of the plurality of holder members 1420 to be uniform and minimizing vibration and unnecessary movement of the holder members 1420.

According to another embodiment of the present disclosure, instead of
5 lifting/lowering the holder member 1420 with respect to the end cap member 1400, the end cap member 1400 may be configured to be lifted/lowered with respect to the holder member 1420.

That is, referring to FIG. 6, the chemical sampling device 110 may include a second lifting/lowering unit 1600' configured to selectively lift/lower the moving unit
10 1500 with respect to the holder member 1420 supporting the sampling lines L1, L2, and L3.

The second lifting/lowering unit 1600' may be formed of various structures capable of selectively lifting/lowering the end cap member 1400, and the present disclosure is not limited or restricted by the structure and lifting/lowering method of
15 the second lifting/lowering unit 1600'.

For example, by the moving unit 1500 being lifted/lowered in the up-down direction by the second lifting/lowering unit 1600', the end cap member 1400 connected to the moving unit 1500 may be lifted/lowered. Otherwise, the rotating member may be configured to be lifted/lowered with respect to the driving portion.

20 According to a preferred embodiment of the present disclosure, a sealing member 1440 is provided between the holder member 1420 and the end cap member 1400.

For example, the sealing member 1440 may be formed in a ring shape and disposed to wrap around the circumference of the accommodation groove 1402.

25 The sealing member 1440 may be formed of an elastic material such as rubber or

silicone, and the present disclosure is not limited or restricted by the material and cross-sectional shape of the sealing member 1440.

Preferably, when the holder member 1420 moves to the lowering position, the sealing member 1440 is pressed between the holder member 1420 and the end cap member 1400.

Here, the sealing member 1440 being pressed between the holder member 1420 and the end cap member 1400 is understood as the sealing member 1440 being compressed between the holder member 1420 and the end cap member 1400 due to a pressing force caused by the holder member 1420 being lowered.

In this way, by allowing the sealing member 1440 to be pressed by the holder member 1420 when the holder member 1420 is lowered (reaches the lowering position), a gap between the holder member 1420 and the end cap member 1400 may be more effectively sealed, and thus it is possible to obtain an advantageous effect of minimizing the leakage of chemicals to the outside of the end cap member 1400.

Hereinafter, the chemical sampling process by the chemical sampling device according to an embodiment of the present disclosure will be described.

Referring to FIG. 2 and FIGS. 8 to 12, when the worker inputs a command to unlock the first door 1104 through an input portion (not illustrated), a state in which the first door 1104 is locked by a door locking device (not illustrated) is released.

When the locked state of the first door 1104 is released, the worker opens the first door 1104 and stores an empty container 20 (container having the cap coupled thereto) in the holder module 1110 disposed in the standby space 1102a.

Preferably, the standby space 1102a may be set as an initial position of the holder module 1110 during an initial operation of the chemical sampling device 110.

In some cases, the work space may be set as the initial position of the holder module.

When the first door 1104 is closed, the second door 1106 is opened, and the container 20 stored in the holder module 1110 is transferred to the lower portion of the cap attaching/detaching unit 1300 provided in the work space 1102b.

When the second door 1106 is closed, as illustrated in FIG. 9, the cap 22 coupled to the container 20 is separated by the cap attaching/detaching unit 1300. Here, the cap attaching/detaching unit 1300 may separate the cap 22 by rotating the cap 22, but the present disclosure is not necessarily limited thereto, and the container 20 may rotate in a state in which the cap is held and fixed by the cap attaching/detaching unit 1300.

Next, the container 20 from which the cap 22 is separated is transferred to a lower portion of the outlet end of the sampling lines L1, L2, and L3, and as illustrated in FIG. 12, the inside of the container 20 is filled with chemicals discharged from the outlet end of the sampling lines L1, L2, and L3.

For reference, chemicals remaining in the sampling lines L1, L2, and L3 may be discharged in advance through the drain module before chemicals are supplied into the container 20.

Also, in a case where some of the chemicals overflow while chemicals are being supplied into the container 20, a sensor provided in the container 20 or provided near the container 20 (e.g., provided in the holder module) may detect the overflow, and the controller may stop the sampling process according to a value sensed by the sensor and generate an alarm.

Then, the container 20 filled with chemicals is transferred back to the lower portion of the cap attaching/detaching unit 1300, and the cap 22 is coupled to the container 20 by the cap attaching/detaching unit 1300.

Next, the second door 1106 is opened, and the container 20 to which the cap 22 is coupled is transferred to the standby space 1102a.

When the second door 1106 is closed, the worker opens the first door 1104 and takes the container 20 disposed in the standby space 1102a out of the case 1100
5 to perform a chemical contamination analysis process.

Meanwhile, the end cap member 1400 is configured to be disposed at the position (first position) for sealing the outlet end of the sampling lines L1, L2, and L3 and then, before chemicals are supplied into the container 20, move to the position (second position) for opening the outlet end of the sampling lines L1, L2,
10 and L3.

Here, a point in time at which the end cap member 1400 moves from the first position to the second position may be changed in various ways according to required conditions and design specifications.

For example, the point in time at which the end cap member 1400 moves
15 from the first position to the second position may be a point in time at which the second door 1106 is closed after the container 20 is transferred to the lower portion of the cap attaching/detaching unit 1300 provided in the work space 1102b. According to another embodiment of the present disclosure, the point in time at which the end cap member moves from the first position to the second position may
20 be a point in time at which the cap coupled to the container is separated by the cap attaching/detaching unit or a point in time at which the first door is closed after the container initially enters the standby space.

On the other hand, preferably, a point in time at which the end cap member 1400 moves from the position (second position) for opening the outlet end of the
25 sampling lines L1, L2, and L3 to the position (first position) for sealing the outlet end

of the sampling lines L1, L2, and L3 may be right after the cap 22 is fastened to the container 20 filled with chemicals. In this way, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 1400 right after the cap 22 is fastened to the container 20 filled with chemicals, it is possible to obtain an advantageous effect of minimizing the flow of foreign matter, which may be generated during operation of the moving unit 1500 and the first lifting/lowering unit 1600, into the container 20 filled with chemicals.

<Second embodiment>

Referring to FIG. 13, a chemical sampling device 210 according to an embodiment of the present disclosure includes sampling lines L1, L2, and L3 configured to supply chemicals, a drain module 2120 which has an inlet 2123 formed to allow entry of an outlet end of the sampling lines L1, L2, and L3 and which is configured to collect chemicals discharged from the outlet end, and a holder member 2420 configured to support the sampling lines L1, L2, and L3 and selectively seal the inlet 2123.

For reference, the chemical sampling device 210 according to an embodiment of the present disclosure may be mounted on a chemical storage facility 1 and used for sampling chemicals at major locations such as a tank lorry, a drum, a bottle, a storage tank, and a pipe, and the present disclosure is not limited or restricted by the type and location of a subject on which the chemical sampling device 210 is mounted.

The chemical sampling device 210 includes a case 2100 in which a container 20 having a cap 22 fastened thereto is accommodated and a cap attaching/detaching unit 2300 configured to selectively separate or fasten the container 20 and the cap 22 inside the case 2100, and the sampling lines L1, L2, and L3 are configured to supply chemicals to the container 20 separated from the cap 22 inside the case 2100.

Various storage means capable of accommodating chemicals and having the selectively separable cap 22 may be used as the container 20, and the present disclosure is not limited or restricted by the structure and form of the container 20.

For example, a sampling bottle capable of accommodating chemicals may be used as the container 20, and the cap 22 may be fastened or separated by rotating
5 along a screw thread formed on an inlet of the container 20.

The case 2100 is formed to have a linear (e.g., straight) inner space 2102, and the inner space 2102 of the case 2100 is divided into a standby space 2102a and a work space 2102b that are independently sealed by a partition 2101.

10 Here, the standby space 2102a is defined as a space in which the container 20 temporarily stands by when a worker puts the container 20 into the case 2100 from outside the case 2100 or takes the container 20 (e.g., a container filled with chemicals) accommodated in the case 2100 out of the case 2100.

Also, in the embodiment of the present disclosure, the work space 2102b may
15 be defined as a space in which the cap 22 is separated from or coupled to the container 20 and chemicals are supplied into the container 20.

Preferably, the container 20 is configured to move back and forth between the standby space 2102a and the work space 2102b along a single linear path (e.g., a linear movement path in the left-right direction) inside the case 2100.

20 Here, the container 20 moving along the single linear path means that the movement path of the container 20 is formed in a single linear shape.

In this way, by setting the movement path of the container 20 to have a single linear shape inside the case 2100, it is possible to obtain advantageous effects of simplifying a movement structure of the container 20 and shortening the movement
25 path and movement time of the container 20.

According to another embodiment of the present disclosure, the container may be configured to move along an L-shaped movement path inside the case. For example, the container entering the standby space may be configured to, after moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit and a lower portion of the sampling lines along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path.

Otherwise, the container may be configured to move along a right-angled C-shaped movement path inside the case. For example, the container entering the standby space may be configured to, after moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path and then move to a lower portion of the sampling lines along a third linear movement path that crosses (e.g., is perpendicular to) the second linear movement path.

A first entry/exit that communicates with the standby space 2102a is formed in the case 2100, and the first entry/exit is selectively opened/closed by a first door 2104 (see FIG. 19). For example, the first door 2104 may be rotatably coupled to the case 2100 to open/close the first entry/exit by a hinged manner. According to another embodiment of the present disclosure, the first door may be configured to open/close the first entry/exit by a sliding manner.

A second entry/exit through which the container 20 is able to enter and exit is formed in the partition 2101, and the second entry/exit is selectively opened/closed by a second door 2106. The second door 2106 may open/close the second entry/exit by a hinged or sliding manner, and the present disclosure is not limited or restricted by the opening/closing method and structure of the second door 2106.

The second door 2106 is configured to open the second entry/exit when the container 20 accommodated in the standby space 2102a is transferred to the work space 2102b (or transferred from the work space to the standby space) and configured to close the second entry/exit when the cap 22 is separated from or
5 coupled to the container 20 or chemicals are supplied into the container 20.

In this way, according to the embodiment, by allowing the separation and coupling of the cap 22 from and to the container 20 and the chemical sampling process (injecting chemicals into the container) to be performed in the work space 2102b independently sealed from the standby space 2102a, it is possible to obtain an
10 advantageous effect of minimizing external discharge of chemical fumes, which are generated during the sampling process, through the standby space 2102a.

Also, an exhaust device (not illustrated) capable of discharging the chemical fumes to the outside may be provided in the work space 2102b.

For reference, in an embodiment of the present disclosure, a case where the
15 separation and coupling of the cap 22 from and to the container 20 and the supply of chemicals are all performed in the work space 2102b is described as an example, but according to another embodiment of the present disclosure, the work space of the case may be divided into a first work space and a second work space that are independently sealed, the process of separating or coupling the cap from or to the
20 container may be performed in the first work space, and the process of supplying chemicals into the container may be performed in the second work space.

A holder module 2110 configured to store and support the container 20 is provided inside the case 2100.

The holder module 2110 may be formed of various structures capable of gripping and supporting the container 20 inside the case 2100, and the present disclosure is not limited or restricted by the structure of the holder module 2110.

For example, the holder module 2110 may include a bottom portion 2112
5 configured to support a bottom surface of the container 20, a first side surface support portion 2114 configured to extend upward from one side of the bottom portion 2112 to support a side surface of the container 20, and a second side surface support portion 2116 configured to extend upward from another one side of the bottom portion 2112 to face the first side surface support portion 2114 to support
10 another side surface of the container 20, and the first side surface support portion 2114 and the second side surface support portion 2116 together form a storage space in which the container 20 is stored.

Preferably, the second side surface support portion 2116 is formed to have a height (height in the up-down direction) relatively shorter than the height of the first
15 side surface support portion 2114. In this way, by forming the height of the second side surface support portion 2116 to be shorter than the height of the first side surface support portion 2114, a free space that the container 20 is able to enter may be formed at an upper portion of the second side surface support portion 2116, and thus the container 20 may be obliquely tilted through the free space and stored in the
20 storage space. Also, the worker may easily grip a circumferential surface of the container 20 that is exposed through the free space.

According to a preferred embodiment of the present disclosure, the chemical sampling device 210 includes a transfer unit (not illustrated) configured to transfer the holder module 2110 inside the case 2100.

For example, the transfer unit may be configured to transfer the holder module 2110 so that the holder module 2110 linearly moves back and forth between the standby space 2102a and the work space 2102b in the horizontal direction (the left-right direction based on FIG. 13).

5 More specifically, the transfer unit transfers the holder module 2110 (the holder module in which the container is accommodated) disposed in the standby space 2102a to a lower portion of the sampling lines L1, L2, and L3 via a lower portion of the cap attaching/detaching unit 2300 provided in the work space 2102b, and after the container 20 is filled with chemicals, the transfer unit transfers the
10 holder module 2110 disposed in the work space 2102b back to the standby space 2102a via the lower portion of the cap attaching/detaching unit 2300.

The transfer unit (not illustrated) may be formed of various structures capable of transferring the holder module 2110, and the present disclosure is not limited or restricted by the structure and operation method of the transfer unit.

15 For example, the transfer unit may be configured to linearly move the holder module 2110 using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems.

Preferably, the transfer unit may be mounted outside the case 2100 and configured to transfer the holder module 2110 using a magnetic force (or an
20 electromagnetic force) while being structurally separated from the holder module 2110. In this way, by the transfer unit and the holder module being structurally separated from each other, a slot for structurally connecting the holder module disposed inside the case and the transfer unit provided outside the case is not necessary to be formed through a wall surface of the case, and thus it is possible to

obtain an advantageous effect of suppressing external exposure of fumes, which are generated during the chemical sampling process, through the slot.

The cap attaching/detaching unit 2300 is provided on the work space 2102b and configured to separate the cap from the container 20 transferred to the work
5 space 2102b or fasten the cap to the container 20.

The cap attaching/detaching unit 2300 may be formed of various structures capable of selectively separating or fastening the cap 22 from or to the container 20, and the structure and operation method of the cap attaching/detaching unit 2300 may be changed in various ways according to required conditions and design
10 specifications. The configuration described above with reference to FIG. 7 may be applied without change to the configuration of the cap attaching/detaching unit 2300.

The entry/exit of chemical fumes through a through-hole (not illustrated) formed in the case 2100 may be blocked by a first cover member 2340 (see FIG. 13). For example, the first cover member 2340 may be formed as an
15 expandable/contractible corrugated tube, both ends of the first cover member 2340 may be coupled to a lifting/lowering frame 2331 configured to rotatably support an upper surface of the case 2100 and a frame lifting/lowering portion 2315, and the frame lifting/lowering portion 2315 may extend through the first cover member 2340. Accordingly, it is possible to suppress the entry/exit of chemicals or chemical fumes
20 through the through-hole of the case 2100.

According to a preferred embodiment of the present disclosure, binding members 2210 and 2220 for selectively binding rotation (rotation about the vertical axis) of the container 20 with respect to the cap attaching/detaching unit 2300 are provided at the lower portion of the cap attaching/detaching unit 2300.

For example, the binding members 2210 and 2220 may be provided as a plurality of binding members 2210 and 2220 that are linearly movable in directions approaching and moving away from the circumference of the container 20. Here, the number of binding members 2210 and 2220 and intervals at which the binding members 2210 and 2220 are disposed may be changed in various ways according to required conditions and design specifications.

When the container 20 stored in the holder module 2110 is located at the lower portion of the cap attaching/detaching unit 2300 (a cap attaching/detaching position), the plurality of binding members 2210 and 2220 move in the direction approaching the circumference of the container 20 and together press the circumference of the container 20 to bind the rotation of the container 20. On the other hand, after the separation or fastening of the cap 22 is completed, the binding members 2210 and 2220 move in the direction moving away from the circumference of the container 20, and thus binding by the binding members 2210 and 2220 is released.

The drain module 2120 is provided to collect chemicals remaining in the sampling lines L1, L2, and L3 before chemicals are supplied into the container 20.

That is, chemicals filled in the sampling lines L1, L2, and L3 may stagnate after a certain period of time, causing precipitates to be generated or the chemicals to be contaminated through an open outlet.

However, according to the embodiment, by allowing the chemicals remaining in the sampling lines L1, L2, and L3 to be collected by the drain module 2120 before chemicals are supplied into the container 20, uncontaminated high-purity chemicals may be supplied into the container 20, and thus it is possible to obtain an advantageous effect of improving the reliability of chemical contamination analysis.

The drain module 2120 may be formed of various structures having the inlet 2123 through which the outlet end of the sampling lines L1, L2, and L3 enters, and the present disclosure is not limited or restricted by the structure of the drain module 2120.

5 For example, the drain module 2120 includes a drain box 2122 which is configured to communicate with the inlet 2123 and has an accommodation space 2122a in which chemicals are accommodated and a discharge line 2126 which is configured to discharge the chemicals from the accommodation space 2122a to the outside of the drain box 2122.

10 More specifically, the drain box 2122 may be formed in the shape of a quadrangular barrel that has the accommodation space 2122a formed therein, and the inlet 2123 communicating with the accommodation space 2122a is formed in an upper surface of the drain box 2122. For example, three inlets 2123 that correspond to the three sampling lines L1, L2, and L3 may be formed to be spaced apart from
15 each other in the upper surface of the drain box 2122.

The discharge line 2126 is provided to discharge the chemicals stored in the accommodation space 2122a to the outside of the drain box 2122, and the chemicals discharged through the discharge line 2126 may be purified through a chemical purification facility (not illustrated) provided outside the drain box 2122.

20 Preferably, a diluent supply line 2124 configured to supply a diluent (e.g., deionized water (DIW)) to the accommodation space 2122a is connected to the drain box 2122, and chemicals collected in the accommodation space 2122a are discharged in a state in which the chemicals are diluted by the diluent (mixed with the diluent).

In this way, by allowing the chemicals collected in the drain box 2122 to be
25 discharged in a state in which the chemicals are diluted by the diluent, it is possible

to obtain advantageous effects of reducing the use of a neutralizing agent for neutralizing chemicals in a post-treatment facility (e.g., a wastewater treatment plant) and simplifying a post-treatment process.

On the other hand, in a case where the chemical is sulfuric acid, when
5 sulfuric acid is mixed with a diluent (e.g., DIW), an excessive heat generation phenomenon may occur and adversely affect the facility. Thus, preferably, sulfuric acid may be discharged as it is without being mixed with a separate diluent.

The holder member 2420 is provided to support the sampling lines L1, L2, and L3 and selectively seal the inlet 2123.

10 Here, the holder member 2420 sealing the inlet 2123 means that an upper portion of the inlet 2123 is blocked by the holder member 2420.

The holder member 2420 may be formed of various structures capable of sealing the inlet 2123 while supporting the sampling lines L1, L2, and L3, and the shape and structure of the holder member 2420 may be changed in various ways
15 according to required conditions and design specifications.

For example, the holder member 2420 may be formed to have a substantially cylindrical cross-section, and the outlet end of the sampling lines L1, L2, and L3 passes through the holder member 2420 and is exposed to a lower portion of the holder member 2420.

20 Also, a cover member (not illustrated), which is formed as an expandable/contractible corrugated tube, may be provided between an upper portion of the holder member 2420 and an inner surface (upper inner surface) of the case 2100, and the sampling lines L1, L2, and L3 are disposed to pass through the inside of the cover member. Accordingly, it is possible to obtain an advantageous effect

of minimizing exposure of fumes through a through-hole (not illustrated) formed in the case to allow passage of the sampling lines L1, L2, and L3.

Preferably, the chemical sampling device 210 includes a first moving unit 2600 configured to selectively move the holder member 2420 so that the holder member 2420 moves to a first position for sealing the inlet 2123 or a second position for opening the inlet 2123.

Here, the holder member 2420 being located at the first position means that the holder member 2420 is located (e.g., lowered) to block (seal) the inlet 2123 as illustrated in FIG. 16, and the holder member 2420 being located at the second position means that the holder member 2420 is located (e.g., lifted) above the inlet 2123 to be spaced apart from the inlet 2123 in order to expose (open) the inlet 2123 as illustrated in FIG. 25.

The first moving unit 2600 may be formed of various structures capable of selectively lifting/lowering the holder member 2420.

For example, the first moving unit 2600 includes a first driving portion 2610, and a first moving member 2620 configured to support the holder member 2420, linearly move in the up-down direction by the first driving portion 2610, and move the holder member 2420 to the first position or second position.

The first moving member 2620 is provided to be linearly movable in the up-down direction, and the first driving portion 2610 is provided to provide a driving force for linearly moving the first moving member 2620.

Various driving means capable of providing a driving force necessary for the linear movement of the first moving member 2620 may be used as the first driving portion 2610. For example, as the first driving portion 2610, a common pneumatic (or hydraulic) cylinder or a motor may be used. According to another embodiment

of the present disclosure, the first moving member 2620 may be configured to linearly move using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems.

The first moving member 2620 may be formed of a single member capable of lifting/lowering by the first driving portion 2610 mounted on an outer surface of the case or may be formed of a plurality of members assembled together, and the present disclosure is not limited or restricted by the structure and form of the first moving member 2620.

Preferably, when the holder member 2420 moves to the first position by the first moving unit 2600, the outlet end of the sampling lines L1, L2, and L3 exposed to the lower portion of the holder member 2420 is accommodated in the inlet 2123 (the outlet end of the sampling lines is disposed at a height lower than the height of the uppermost end of the inlet).

In this way, by the outlet end of the sampling lines L1, L2, and L3 being accommodated in the inlet 2123 when the holder member 2420 moves to the first position, a falling distance of chemicals discharged from the outlet end of the sampling lines L1, L2, and L3 may be minimized, and thus it is possible to obtain advantageous effects of minimizing scattering of the chemicals to the outside of the inlet 2123 and further improving the chemical collection efficiency.

Also, a support block 2630 may be connected to the first moving member 2620, and a plurality of holder members 2420 that correspond to the plurality of sampling lines L1, L2, and L3 are supported by the support block 2630 in the case.

In this way, by the plurality of holder members 2420 being supported by the support block 2630, it is possible to obtain advantageous effects of controlling the

lifting/lowering height of the plurality of holder members 2420 to be uniform and minimizing vibration and unnecessary movement of the holder members 2420.

According to a preferred embodiment of the present disclosure, the chemical sampling device 210 includes a guide block 2640 disposed above the holder member 2420 to be spaced apart therefrom and connected to the first moving member 2620, wherein a guide hole 2642 configured to guide the upward/downward movement of the sampling lines L1, L2, and L3 is formed in the guide block 2640.

The guide block 2640 is connected to the first moving member 2620 so as to be disposed above the holder member 2420 to be spaced apart therefrom and is configured to be lifted/lowered along with the first moving member 2620. The guide hole 2642 through which the sampling lines L1, L2, and L3 pass is formed in the guide block 2640.

In this way, by the guide block 2640 having the guide hole 2642 formed therein being provided above the holder member 2420 and guiding the upward/downward movement of the sampling lines L1, L2, and L3, it is possible to obtain advantageous effects of minimizing twisting and tangling of the sampling lines L1, L2, and L3 when the holder member 2420 is lifted/lowered and more stably maintaining the arrangement state of the sampling lines L1, L2, and L3.

According to a preferred embodiment of the present disclosure, a sealing member 2440 is provided between the holder member 2420 and the drain module 2120.

For example, the sealing member 2440 may be formed in a ring shape and disposed to wrap around the circumference of the inlet 2123. The sealing member 2440 may be formed of an elastic material such as rubber or silicone, and the present

disclosure is not limited or restricted by the material and cross-sectional shape of the sealing member 2440.

Preferably, when the holder member 2420 moves to the first position (lowering position), the sealing member 2440 is pressed between the holder member
5 2420 and the drain module 2120 (drain box).

Here, the sealing member 2440 being pressed between the holder member 2420 and the drain module 2120 is understood as the sealing member 2440 being compressed between the holder member 2420 and the drain module 2120 due to a pressing force caused by the holder member 2420 being lowered.

10 In this way, by allowing the sealing member 2440 to be pressed by the holder member 2420 when the holder member 2420 is lowered (reaches the lowering position), a gap between the holder member 2420 and the drain module 2120 may be more effectively sealed, and thus it is possible to obtain an advantageous effect of minimizing the leakage of chemicals to the outside of the drain module 2120.

15 According to a preferred embodiment of the present disclosure, the chemical sampling device 210 includes a second moving unit 2700 configured to selectively move the drain module 2120 so that the drain module 2120 moves to a third position at which the inlet 2123 is aligned with the outlet end or a fourth position at which the inlet 2123 is spaced apart from the outlet end.

20 Here, the drain module 2120 moving to the third position means that the drain module 2120 moves to a position (drain position) at which the inlet 2123 of the drain module 2120 is aligned with the outlet end of the sampling lines L1, L2, and L3 in the up-down direction, and the drain module 2120 moving to the fourth position means that the drain module 2120 moves to a position (standby position) at which

the inlet 2123 of the drain module 2120 is spaced apart from the outlet end of the sampling lines L1, L2, and L3.

The second moving unit 2700 may be formed of various structures capable of moving the drain module 2120 from the third position to the fourth position.

5 For example, the second moving unit 2700 includes a second driving portion 2710 and a second moving member 2720 connected to the drain module 2120 and configured to linearly move in the horizontal direction by the second driving portion 2710 and move the drain module 2120 to the third position or the fourth position.

10 The second moving member 2720 is provided to be linearly movable in the horizontal direction, and the second driving portion 2710 is provided to provide a driving force for linearly moving the second moving member 2720.

15 Various driving means capable of providing a driving force necessary for the linear movement of the second moving member 2720 may be used as the second driving portion 2710. For example, as the second driving portion 2710, a common pneumatic (or hydraulic) cylinder or a motor may be used. According to another embodiment of the present disclosure, the second moving member may be configured to linearly move using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems. According to still another embodiment of the present disclosure, the second moving unit may be configured to rotate the drain module (e.g., rotate the drain module about a direction
20 along the vertical axis) from the third position to the fourth position.

The second moving member 2720 may be formed of a single member capable of linearly moving by the second driving portion 2710 mounted on an outer side of the work space or may be formed of a plurality of members assembled together, and

the present disclosure is not limited or restricted by the structure and form of the second moving member 2720.

The second moving unit 2700 is controlled to operate in conjunction with the first moving unit 2600. More specifically, when the drain module 2120 moves to the third position due to the second moving unit 2700 in a state in which the holder member 2420 is at the second position, the first moving unit 2600 moves the holder member 2420 from the second position to the first position. When the holder member 2420 moves to the first position in a state in which the drain module 2120 is at the third position, the inlet 2123 is sealed by the holder member 2420.

According to a preferred embodiment of the present disclosure, the chemical sampling device 210 includes an end cap member 2400 provided to be able to seal the outlet end of the sampling lines L1, L2, and L3 and a third moving unit 2500 configured to selectively move the end cap member 2400 so that the end cap member 2400 is located at a fifth position for sealing the outlet end or a sixth position for opening the outlet end.

The end cap member 2400 and the third moving unit 2500 are provided to constitute the chemical sampling device 210 for suppressing chemical leakage through the sampling lines L1, L2, and L3 and minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto.

That is, in the chemical sampling device 210, there is a problem in that chemicals unintentionally leak from the sampling lines L1, L2, and L3 despite the supply of chemicals being stopped. More specifically, after the chemical sampling process is completed, a small amount of chemicals remains at the outlet end of the sampling lines L1, L2, and L3, and there is a problem in that, as the chemicals

remaining at the outlet end of the sampling lines L1, L2, and L3 fall drop by drop, the entire work space is directly exposed to the chemicals.

Also, even in a case where a failure occurs in a valve controlling the supply of chemicals using the sampling lines L1, L2, and L3, there is a problem in that
5 chemicals are unintentionally discharged from the sampling lines L1, L2, and L3 and thus the work space is exposed to the chemicals.

However, according to the embodiment, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 2400 after the chemical sampling process is completed (or before the chemical sampling process), it is
10 possible to obtain advantageous effects of suppressing chemical leakage and suppressing direct exposure of the work space 2102b to the chemicals fallen or spilled from the sampling lines L1, L2, and L3.

Further, since the outlet end of the sampling lines L1, L2, and L3 may be accommodated in a sealed manner in the end cap member 2400, it is possible to
15 obtain an advantageous effect of minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto caused by contact with contaminants contained in the outside air or contact with surrounding equipment.

The end cap member 2400 may be formed of various structures capable of sealing the outlet end of the sampling lines L1, L2, and L3 through which chemicals
20 are discharged, and the shape and structure of the end cap member 2400 may be changed in various ways according to required conditions and design specifications.

Here, the end cap member 2400 sealing the outlet end of the sampling lines L1, L2, and L3 means that the outlet end of the sampling lines L1, L2, and L3 is blocked by the end cap member 2400 without being exposed to the outside (e.g., the
25 work space).

For example, the end cap member 2400 may be provided as three end cap members 2400 to correspond to each of the three sampling lines L1, L2, and L3, and the number and arrangement structure of the end cap members 2400 may be appropriately changed according to the number and arrangement form of the sampling lines L1, L2, and L3.

The third moving unit 2500 is provided to selectively move the end cap member 2400 so that the end cap member 2400 is located at the fifth position for sealing the outlet end or the sixth position for opening the outlet end.

Here, the end cap member 2400 being located at the fifth position means that the end cap member 2400 is located to block (seal) the outlet end of the sampling lines L1, L2, and L3 as illustrated in FIG. 18, and the end cap member 2400 being located at the sixth position means that the end cap member 2400 is located to expose (open) the outlet end of the sampling lines L1, L2, and L3 as illustrated in FIG. 22.

The end cap member 2400 may be configured to move from the fifth position to the sixth position in various ways according to required conditions and design specifications.

For example, the third moving unit 2500 is configured to rotate the end cap member 2400 from the fifth position to the sixth position (or from the sixth position to the fifth position).

More specifically, the third moving unit 2500 includes a third driving portion 2510 and a third moving member 2520 configured to support the end cap member 2400, horizontally rotate about an axis in the up-down direction by the third driving portion, and move the end cap member 2400 to the fifth position or the sixth position.

Various driving means capable of providing a driving force necessary for the rotation of the third moving member 2520 may be used as the third driving portion

2510. For example, as the third driving portion 2510, a common pneumatic (or hydraulic) cylinder or a motor may be used, and the present disclosure is not limited or restricted by the type and structure of the third driving portion 2510.

The third moving member 2520 is formed in a substantially L-shape and has
5 one end (upper end) connected to the third driving portion 2510 and the other end configured to support the end cap member 2400.

Preferably, the third moving member 2520 is configured to horizontally rotate about an axis in the vertical direction and move the end cap member 2400 from the fifth position to the sixth position. In this way, by the third moving member 2520
10 horizontally rotating about the axis in the vertical direction and moving the end cap member 2400 from the fifth position to the sixth position, a space necessary for the arrangement and operation of the third moving member 2520 may be minimized, and thus it is possible to obtain an advantageous effect of improving space utilization and design freedom.

15 According to another embodiment of the present disclosure, the third moving member may be configured to rotate about the axis in the horizontal direction or an axis in another direction and move the end cap member from the fifth position to the sixth position. According to still another embodiment of the present disclosure, the end cap member may be configured to linearly move (horizontally move) from the
20 fifth position to the sixth position.

The third moving unit 2500 is controlled to operate in conjunction with the first moving unit 2600 and the second moving unit 2700. More specifically, when the drain module 2120 moves to the fourth position in a state in which the holder member 2420 is at the second position, the end cap member 2400 is moved to the
25 fifth position by the third moving unit 2500, and when the holder member 2420

moves from the second position to the first position due to the first moving unit 2600, the outlet end of the sampling lines L1, L2, and L3 is sealed by the end cap member 2400.

Preferably, the outlet end of the sampling lines L1, L2, and L3 passes through
5 the holder member 2420 and is exposed to a lower portion of the holder member 2420, and at the fifth position, the end cap member 2400 is disposed to come in close contact with the lower portion of the holder member 2420 to wrap around the outlet end.

For example, an accommodation groove 2402 is formed to be recessed in an
10 upper surface of the end cap member 2400, and at the fifth position, the outlet end of the sampling lines L1, L2, and L3 is accommodated in the accommodation groove 2402 to be spaced apart from an inner wall surface of the accommodation groove 2402.

In this way, by the outlet end of the sampling lines L1, L2, and L3 being
15 accommodated in the accommodation groove 2402 to be spaced apart from the inner wall surface of the accommodation groove 2402, it is possible to obtain an advantageous effect of preventing contamination of the outlet end of the sampling lines L1, L2, and L3 caused by the outlet end coming in contact with the end cap member 2400.

20 Also, in a case where a task of sealing the outlet end of the sampling lines L1, L2, and L3 is manually performed by the worker, there is a problem in that the worker is exposed to chemicals spilling to a sealing member sealing the outlet end. However, according to the embodiment, since the task of sealing the outlet end of the sampling lines L1, L2, and L3 using the end cap member 2400 may be automatically
25 performed in the work space 2102b without the worker coming in direct contact with

the end cap member 2400, it is possible to obtain an advantageous effect of preventing the worker from being exposed to chemicals spilling to the end cap member 2400.

Further, by the end cap member 2400 coming in close contact with the lower
5 portion of the holder member 2420 and sealing the outlet end of the sampling lines L1, L2, and L3 without coming in direct contact with the sampling lines L1, L2, and L3, it is possible to obtain an advantageous effect of more stably maintaining the arrangement state of the end cap member 2400 with respect to the sampling lines L1, L2, and L3 and the sealed state of the outlet end.

10 Also, a protruding portion 2404 may be formed to protrude from the upper surface of the end cap member 2400 that faces the lower portion of the holder member 2420, and a recessed portion 2424 that corresponds to the protruding portion 2404 may be formed in a bottom surface of the holder member 2420.

In this way, by the protruding portion 2404 formed on the upper surface of
15 the end cap member 2400 being accommodated in the recessed portion 2424 formed in the bottom surface of the holder member 2420, a double sealing structure may be formed along with the accommodation groove 2402. Thus, it is possible to obtain an advantageous effect of more effectively suppressing chemicals leaking to the accommodation groove 2402 from leaking to the outside through a portion between
20 the holder member 2420 and the end cap member 2400.

Also, according to a preferred embodiment of the present disclosure, a detection sensor 2430 configured to detect chemicals spilling from the outlet end of the sampling lines L1, L2, and L3 may be provided in the accommodation groove 2402.

As the detection sensor 2430, common sensors (e.g., a light sensor, an infrared sensor, a capacitance sensor) capable of detecting chemicals may be used, and the present disclosure is not limited or restricted by the type and sensing method of the detection sensor 2430.

5 Also, when chemical spill is detected by the detection sensor 2430, a controller (not illustrated) may generate an alarm signal that may inform the worker of the chemical spill situation.

Here, the alarm signal may include at least one of an aural alarm signal by a common acoustic means and a visual alarm signal by a common warning light, and
10 in addition, various other alarm signals that may inform the worker of the chemical spill situation may be used.

Also, according to a preferred embodiment of the present disclosure, a sealing member 2440 may also be disposed between the holder member 2420 and the end cap member 2400.

15 Preferably, the sealing member 2440 may be provided below the holder member 2420 and used to press either the end cap member 2400 or the drain module 2120 from above as the holder member 2420 is lowered (moves to the first position).

Preferably, when the holder member 2420 moves to the first position, the sealing member 2440 is pressed between the holder member 2420 and the end cap
20 member 2400.

In this way, by the sealing member 2440 being pressed by the holder member 2420 when the holder member 2420 is lowered (reaches the lowering position), a gap between the holder member 2420 and the end cap member 2400 may be more effectively sealed, and thus, it is possible to obtain an advantageous effect of
25 minimizing leakage of chemicals to the outside of the end cap member 2400.

Hereinafter, the chemical sampling process by the chemical sampling device 210 according to an embodiment of the present disclosure will be described.

Referring to FIG. 13 and FIGS. 19 to 28, when the worker inputs a command to unlock the first door 2104 through an input portion (not illustrated), a state in which the first door 2104 is locked by a door locking device (not illustrated) is released.

When the locked state of the first door 2104 is released, the worker opens the first door 2104 and stores an empty container 20 (container having the cap coupled thereto) in the holder module 2110 disposed in the standby space 2102a.

10 Preferably, the standby space 2102a may be set as an initial position of the holder module 2110 during an initial operation of the chemical sampling device 210. In some cases, the work space may be set as the initial position of the holder module.

When the first door 2104 is closed, the second door 2106 is opened, and the container 20 stored in the holder module 2110 is transferred to the lower portion of the cap attaching/detaching unit 2300 provided in the work space 2102b.

15 When the second door 2106 is closed, as illustrated in FIG. 20, the cap 22 coupled to the container 20 is separated by the cap attaching/detaching unit 2300.

For reference, chemicals remaining in the sampling lines L1, L2, and L3 are discharged in advance through the drain module 2120 before chemicals are supplied into the container 20.

20 Referring to FIG. 21, before chemicals are sampled in the sampling lines L1, L2, and L3, the end cap member 2400 is disposed at the position (fifth position) at which the end cap member 2400 seals the outlet end of the sampling lines L1, L2, and L3, and the drain module 2120 is disposed at the fourth position (standby

position) at which the drain module 2120 is spaced apart from the outlet end of the sampling lines L1, L2, and L3.

Next, as illustrated in FIG. 22, when the holder member 2420 moves to the second position, the end cap member 2400 disposed at the position (fifth position)
5 for sealing the outlet end of the sampling lines L1, L2, and L3 moves to the position (sixth position) for opening the outlet end of the sampling lines L1, L2, and L3 before chemicals are supplied into the container 20.

Here, a point in time at which the end cap member 2400 moves from the fifth position to the sixth position may be changed in various ways according to required
10 conditions and design specifications.

For example, the point in time at which the end cap member 2400 moves from the fifth position to the sixth position may be a point in time at which the second door 2106 is closed after the container 20 is transferred to the lower portion of the cap attaching/detaching unit 2300 provided in the work space 2102b.
15 According to another embodiment of the present disclosure, the point in time at which the end cap member moves from the fifth position to the sixth position may be a point in time before (or after) the cap coupled to the container is separated by the cap attaching/detaching unit or a point in time at which the first door is closed after the container initially enters the standby space.

20 Next, as illustrated in FIG. 23, by the second moving unit 2700, the drain module 2120 moves forward toward the sampling lines L1, L2, and L3 and is disposed at the third position at which the inlet 2123 is aligned with the outlet end of the sampling lines L1, L2, and L3.

Next, as illustrated in FIG. 24, by the holder member 2420 being lowered to
25 the first position, the inlet 2123 is sealed by the holder member 2420.

In the state in which the inlet 2123 is sealed by the holder member 2420, chemicals remaining in the sampling lines L1, L2, and L3 are discharged into the drain module 2120. Further, while the chemicals remaining in the sampling lines L1, L2, and L3 are discharged into the drain module 2120, a diluent may also be supplied into the drain module 2120.

Next, when the chemical drain process is completed (for example, a preset time is reached), the holder member 2420 is lifted back to the second position (see FIG. 25), and the drain module 2120 moves rearward by the second moving unit 2700 and is disposed at the fourth position (see FIG. 26).

Next, referring to FIG. 27, the container 20 from which the cap 22 is separated is transferred to the lower portion of the outlet end of the sampling lines L1, L2, and L3, and as illustrated in FIG. 28, the container 20 is filled with the chemicals discharged from the outlet end of the sampling lines L1, L2, and L3.

Meanwhile, in a case where some of the chemicals overflow while chemicals are being supplied into the container 20, a sensor provided in the container 20 or provided near the container 20 (e.g., provided in the holder module) may detect the overflow, and the controller may stop the sampling process according to a value sensed by the sensor and generate an alarm.

Then, the container 20 filled with the chemicals is transferred back to the lower portion of the cap attaching/detaching unit 2300, and the cap 22 is coupled to the container 20 by the cap attaching/detaching unit 2300.

Next, the second door 2106 is opened, and the container 20 to which the cap 22 is coupled is transferred to the standby space 2102a.

When the second door 2106 is closed, the worker opens the first door 2104 and takes the container 20 disposed in the standby space 2102a out of the case 2100 to perform a chemical contamination analysis process.

Meanwhile, preferably, a point in time at which the end cap member 2400
5 moves from the position (sixth position) for opening the outlet end of the sampling lines L1, L2, and L3 to the position (fifth position) for sealing the outlet end of the sampling lines L1, L2, and L3 may be right after the cap 22 is fastened to the container 20 filled with the chemicals. In this way, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 2400 right after
10 the cap 22 is fastened to the container 20 filled with the chemicals, it is possible to obtain an advantageous effect of minimizing the flow of foreign matter, which may be generated during operation of the first moving unit 2600 and the third moving unit 2500, into the container 20 filled with the chemicals.

<Third embodiment>

15 Referring to FIG. 29, a chemical sampling device 310 according to an embodiment of the present disclosure includes a case, a partition portion 3101 configured to divide an inner space of the case into a first space 3102 and a second space 3103 that are independently sealed, a holder module 3110 provided to be movable along a predetermined movement path inside the first space 3102 and
20 having a container 20 stored therein, sampling lines L1, L2, and L3 configured to supply chemicals to the container 20 in the first space 3102, a first magnetic body 3910 disposed in the holder module 3110, a second magnetic body 3920 provided in the second space 3103 so that an attractive force acts between the first magnetic body 3910 and the second magnetic body 3920 while the partition portion 3101 is disposed

therebetween, and a transfer unit 3800 provided in the second space 3103 and configured to transfer the second magnetic body 3920.

For reference, the chemical sampling device 310 according to an embodiment of the present disclosure may be mounted on a chemical storage facility 31 and used
5 for sampling chemicals at major locations such as a tank lorry, a drum, a bottle, a storage tank, and a pipe, and the present disclosure is not limited or restricted by the type and location of a subject on which the chemical sampling device 310 is mounted.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes a cap attaching/detaching unit 3300 configured to
10 selectively separate or fasten the container 20 and a cap 22 inside the case 3100 (for example, a work space of the first space 3102), and the sampling lines L1, L2, and L3 are configured to supply chemicals to the container 20 separated from the cap 22 inside the case 3100.

Various storage means capable of accommodating chemicals and having the
15 selectively separable cap 22 may be used as the container 20, and the present disclosure is not limited or restricted by the structure and form of the container 20.

For example, a sampling bottle capable of accommodating chemicals may be used as the container 20, and the cap 22 may be fastened or separated by rotating along a screw thread formed on an inlet of the container 20.

20 The case 3100 is formed to have a linear (e.g., straight) inner space, and the inner space of the case 3100 is divided into the first space 3102 and the second space 3103 that are independently sealed by the partition portion 3101.

Here, the first space 3102 and the second space 3103 being independently sealed means that the first space 3102 and the second space 3103 are spatially

separated and an air flow between the first space 3102 and the second space 3103 is blocked.

The structure and form of the first space 3102 and the second space 3103 divided by the partition portion 3101 may be changed in various ways according to
5 required conditions and design specifications, and the present disclosure is not limited or restricted by the structure and form of the first space 3102 and the second space 3103.

For example, the partition portion 3101 includes a first partition 3101a configured to horizontally divide the inner space of the case 3100 and a second
10 partition 3101b connected to an end portion of the first partition 3101a and configured to vertically divide the inner space of the case 3100. The first space 3102 divided by the first partition 3101a and the second partition 3101b may be formed to have a substantially quadrangular cross-section, and the second space 3103 may be formed to have a substantially L-shape cross-section.

15 According to another embodiment of the present disclosure, the partition portion may include a plurality of first partitions and a plurality of second partitions or include various other partitions, and the present disclosure is not limited or restricted by the number and structure of partitions constituting the partition portion.

Also, the first space 3102 is divided by a third partition 3101c into a standby
20 space 3102a and a work space 3102b that are independently sealed.

Here, the standby space 3102a is defined as a space in which the container 20 temporarily stands by when a worker puts the container 20 into the case 3100 from outside the case 3100 or takes the container 20 (e.g., a container filled with chemicals) accommodated in the case 3100 out of the case 3100.

Also, in the embodiment of the present disclosure, the work space 3102b may be defined as a space in which the cap 22 is separated from or coupled to the container 20 and chemicals are supplied into the container 20.

Preferably, the container 20 is configured to move back and forth between the
5 standby space 3102a and the work space 3102b along a single linear path (e.g., a linear movement path in the left-right direction of FIG. 29) inside the case 3100.

Here, the container 20 moving along the single linear path means that the movement path of the container 20 is formed in a single linear shape.

In this way, by setting the movement path of the container 20 to have a single
10 linear shape inside the case 3100, it is possible to obtain advantageous effects of simplifying a movement structure of the container 20 and shortening the movement path and movement time of the container 20.

According to another embodiment of the present disclosure, the container may be configured to move along an L-shaped movement path inside the case. For
15 example, the container entering the standby space may be configured to, after moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit and a lower portion of the sampling lines along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path.

20 Otherwise, the container may be configured to move along a right-angled C-shaped movement path inside the case. For example, the container entering the standby space may be configured to, after moving along a first linear movement path, move to a lower portion of the cap attaching/detaching unit along a second linear movement path that crosses (e.g., is perpendicular to) the first linear movement path

and then move to a lower portion of the sampling lines along a third linear movement path that crosses (e.g., is perpendicular to) the second linear movement path.

A first entry/exit that communicates with the standby space 3102a is formed in the case 3100, and the first entry/exit is selectively opened/closed by a first door 3104 (see FIG. 34). For example, the first door 3104 may be rotatably coupled to the case 3100 to open/close the first entry/exit by a hinged manner. According to another embodiment of the present disclosure, the first door may be configured to open/close the first entry/exit by a sliding manner.

A second entry/exit through which the container 20 is able to enter and exit is formed in the partition portion 3101 (the second partition), and the second entry/exit is selectively opened/closed by a second door 3106. The second door 3106 may open/close the second entry/exit by a hinged or sliding manner, and the present disclosure is not limited or restricted by the opening/closing method and structure of the second door 3106.

The second door 3106 is configured to open the second entry/exit when the container 20 accommodated in the standby space 3102a is transferred to the work space 3102b (or transferred from the work space to the standby space) and configured to close the second entry/exit when the cap 22 is separated from or coupled to the container 20 or chemicals are supplied into the container 20.

In this way, according to the embodiment, by allowing the separation and coupling of the cap 22 from and to the container 20 and the chemical sampling process (injecting chemicals into the container) to be performed in the work space 3102b independently sealed from the standby space 3102a, it is possible to obtain an advantageous effect of minimizing external discharge of chemical fumes, which are generated during the sampling process, through the standby space 3102a.

Also, an exhaust device (not illustrated) capable of discharging the chemical fumes to the outside may be provided in the work space 3102b.

For reference, in an embodiment of the present disclosure, a case where the separation and coupling of the cap 22 from and to the container 20 and the supply of chemicals are all performed in the work space 3102b is described as an example, but
5 chemicals are all performed in the work space 3102b is described as an example, but according to another embodiment of the present disclosure, the work space of the case may be divided into a first work space and a second work space that are independently sealed, the process of separating or coupling the cap from or to the container may be performed in the first work space, and the process of supplying
10 chemicals into the container may be performed in the second work space.

The holder module 3110 configured to store and support the container 20 is provided inside the first space 3102, and the holder module 3110 is configured to move along a predetermined movement path inside the first space 3102.

The holder module 3110 may be formed of various structures capable of
15 gripping and supporting the container 20 inside the case 3100, and the present disclosure is not limited or restricted by the structure of the holder module 3110.

For example, the holder module 3110 may include a bottom portion 3112 configured to support a bottom surface of the container 20, a first side surface support portion 3114 configured to extend upward from one side of the bottom
20 portion 3112 to support a side surface of the container 20, and a second side surface support portion 3116 configured to extend upward from another one side of the bottom portion 3112 to face the first side surface support portion 3114 to support another side surface of the container 20, and the first side surface support portion 3114 and the second side surface support portion 3116 together form a storage space
25 in which the container 20 is stored.

Preferably, the second side surface support portion 3116 is formed to have a height (height in the up-down direction) relatively shorter than the height of the first side surface support portion 3114. In this way, by forming the height of the second side surface support portion 3116 to be shorter than the height of the first side surface support portion 3114, a free space that the container 20 is able to enter may be formed at an upper portion of the second side surface support portion 3116, and thus the container 20 may be obliquely tilted through the free space and stored in the storage space. Also, the worker may easily grip a circumferential surface of the container 20 that is exposed through the free space.

Referring to FIGS. 30 to 32, the transfer unit 3800 is provided in the second space 3103 and is provided to transfer the holder module 3110 disposed in the first space 3102 by being connected in a non-contact manner to the holder module 3110 via the first magnetic body 3910 and the second magnetic body 3920 while the partition portion 3101 (e.g., the second partition) is disposed between the transfer unit 3800 and the holder module 3110.

That is, the transfer unit 3800 is configured to transfer the holder module 3110 in the second space 3103 separated from the first space 3102 in which the holder module 3110 is disposed.

For example, the transfer unit 3800 may be configured to transfer the holder module 3110 so that the holder module 3110 linearly moves back and forth between the standby space 3102a and the work space 3102b in the horizontal direction (the left-right direction based on FIG. 29).

More specifically, the transfer unit 3800 transfers the holder module 3110 (the holder module in which the container is accommodated) disposed in the standby space 3102a of the first space 3102 to a lower portion of the sampling lines L1, L2,

and L3 via a lower portion of the cap attaching/detaching unit 3300 provided in the work space 3102b of the first space 3102, and after the container 20 is filled with chemicals, the transfer unit 3800 transfers the holder module 3110 disposed in the work space 3102b back to the standby space 3102a via the lower portion of the cap attaching/detaching unit 3300.

The first magnetic body 3910 is coupled to the holder module 3110, and the second magnetic body 3920 is coupled to the transfer unit 3800 so that an attractive force acts between the first magnetic body 3910 and the second magnetic body 3920 while the second partition 3101b is disposed therebetween. According to another embodiment of the present disclosure, the second magnetic body may be disposed in the second space so that an attractive force acts between the first magnetic body and the second magnetic body while the first partition is disposed therebetween.

For example, the first magnetic body 3910 and the second magnetic body 3920 may be formed as permanent magnets of opposite polarities. According to another embodiment of the present disclosure, any one or more of the first magnetic body and the second magnetic body may be formed as an electromagnet that is magnetized when current flows.

The transfer unit 3800 may be formed of various structures capable of transferring the holder module 3110, and the present disclosure is not limited or restricted by the structure and operation method of the transfer unit 3800.

For example, the transfer unit 3800 includes a transfer driving portion 3810 provided in the second space 3103, and a transfer member 3820 configured to support the second magnetic body 3920 in the second space 3103, linearly move by the transfer driving portion 3810, and transfer the second magnetic body 3920.

Various driving means capable of providing a driving force necessary for the linear movement of the transfer member 3820 may be used as the transfer driving portion 3810. For example, as the transfer driving portion 3810, a common motor or a pneumatic (or hydraulic) cylinder may be used. According to another
5 embodiment of the present disclosure, the transfer member may be configured to linearly move using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems.

The transfer member 3820 may be formed of a single member capable of linearly moving by the transfer driving portion 3810 mounted on the second space
10 3103 or may be formed of a plurality of members assembled together, and the present disclosure is not limited or restricted by the structure and form of the transfer member 3820.

For reference, in an embodiment of the present disclosure, a case where the holder module 3110 and the transfer member 3820 linearly move along a linear
15 movement path by the transfer unit 3800 is described as an example, but according to another embodiment of the present disclosure, the holder module and the transfer member may be configured to move along a curved movement path or a bent movement path.

In this way, by the holder module 3110 disposed in the first space 3102 and
20 the transfer unit 3800 disposed in the second space 3103 being bound to be able to interlock with each other by the attractive force (magnetic force) between the first magnetic body 3910 and the second magnetic body 3920 disposed with the partition portion 3101 placed therebetween, a hole (or a slot) for structurally connecting the holder module 3110 and the transfer unit 3800 is not necessary to be formed through
25 the partition portion 3101, and thus it is possible to completely prevent chemical

fumes of the first space 3102 from leaking to the second space 3103 during the chemical sampling process. Therefore, it is possible to obtain advantageous effects of suppressing corrosion of the transfer unit 3800 and damage thereto caused by exposure to chemicals and preventing chemicals of the first space 3102 from leaking
5 to the outside of the case via the second space 3103.

Further, according to an embodiment of the present disclosure, since the first space 3102 in which a moving unit is disposed and the second space 3103 in which the container is disposed are spatially completely separated, it is possible to obtain advantageous effects of completely preventing foreign matter, such as dust generated
10 during the operation of the transfer unit 3800, from entering the first space 3102 and preventing foreign matter, which enters the first space 3102 from the second space 3103 during the chemical sampling process, from entering the inside of the container.

According to a preferred embodiment of the present disclosure, a slider 3830 which is linearly movable along the predetermined movement path is provided in the
15 first space 3102, and the holder module 3110 is supported by the slider 3830.

Preferably, a guide rail 3840 configured to guide the linear movement of the slider 3830 is provided in the first space 3102.

In this way, by the linear movement of the holder module 3110 being guided by the slider 3830 and the guide rail 3840 in the first space 3102, it is possible to
20 obtain advantageous effects of ensuring smooth movement of the holder module 3110 and improving movement stability and reliability.

The guide rail 3840 may be formed of various structures capable of guiding the linear movement of the slider 3830, and the structure and form of the guide rail 3840 may be changed in various ways according to required conditions and design
25 specifications.

For example, the guide rail 3840 may include a lower wall portion 3842, an upper wall portion 3844 disposed above the lower wall portion 3842 to be spaced apart therefrom, and a sidewall portion 3846 configured to connect the lower wall portion 3842 and the upper wall portion 3844 and may have a substantially right-angled C-shaped cross-section, and the lower wall portion 3842, the upper wall portion 3844, and the sidewall portion 3846 together form a rail groove in which the slider 3830 is accommodated to be linearly movable.

Preferably, a guide slot 3108 is formed through the partition portion 3101 along the movement path of the holder module 3110 (in the longitudinal direction of the guide rail 3840), wherein the guide slot 3108 is sealed by the sidewall portion 3846, and one end (upper end) of the transfer member 3820 is movably accommodated in the guide slot 3108.

In this way, by the one end of the transfer member 3820 moving along the guide slot 3108 formed in the partition portion 3101, it is possible to obtain advantageous effects of maintaining the posture of the transfer member 3820 to be constant during the movement of the transfer member 3820 and improving the movement stability of the transfer member 3820. Further, since the one end of the transfer member 3820 may be accommodated in the guide slot 3108, it is possible to obtain an advantageous effect of minimizing the space necessary for the arrangement and movement of the transfer member 3820.

For reference, since the guide slot 3108 formed in the partition portion 3101 is covered by the sidewall portion 3846 and thus entirely blocked, the spill of chemicals and the inflow of foreign matter through the guide slot 3108 may be completely prevented.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes a bearing portion 3850 rotatably provided at the slider 3830 and configured to come in rolling contact with the guide rail 3840.

5 The bearing portion 3850 may be formed of various structures capable of rollably supporting the slider 3830 with respect to the guide rail 3840, and the structure of the bearing portion may be changed in various ways according to required conditions and design specifications.

For example, the bearing portion 3850 includes a first rolling member 3852 rotatably provided at a lower end of the slider 3830 and configured to come in rolling
10 contact with the lower wall portion 3842, a second rolling member 3854 rotatably provided at an upper end of the slider 3830 and configured to come in rolling contact with the upper wall portion 3844, and a third rolling member 3856 rotatably provided at a rear end of the slider 3830 and configured to come in rolling contact with the sidewall portion 3846.

15 Common rollers or balls may be used as the first rolling member 3852, the second rolling member 3854, and the third rolling member 3856, and various other members that are able to come in rolling contact with the guide rail 3840 may be used according to required conditions and design specifications.

In this way, by the slider 3830 rolling with respect to the guide rail 3840, it is
20 possible to minimize wear and dust generation caused by contact between the slider 3830 and the guide rail 3840. Therefore, it is possible to obtain an advantageous effect of minimizing the flow of foreign matter into the container with the cap open in the first space 3102.

Meanwhile, mounting positions of the first magnetic body 3910 and the second magnetic body 3920 may be changed in various ways according to required conditions and design specifications.

For example, the first magnetic body 3910 is coupled to the slider 3830
5 supporting the holder module 3110, and the second magnetic body 3920 is coupled to the transfer member 3820 to face the first magnetic body 3910 while the sidewall portion 3846 is disposed therebetween.

Preferably, the second magnetic body 3920 is mounted on an end portion of the transfer member 3820 that faces the first magnetic body 3910 while the sidewall
10 portion 3846 is disposed therebetween.

In this way, by the second magnetic body 3920 being mounted on the end portion of the transfer member 3820 that faces the first magnetic body 3910 while the sidewall portion 3846 is disposed therebetween, spacing between the first magnetic body 3910 and the second magnetic body 3920 may be minimized (the first
15 magnetic body and the second magnetic body may be disposed to be as closest as possible), and thus it is possible to obtain an advantageous effect of stably ensuring the formation of the attractive force between the first magnetic body 3910 and the second magnetic body 3920 even without increasing the size of the first magnetic body 3910 and the second magnetic body 3920.

20 According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes a detecting portion 3940 configured to detect the position of the second magnetic body 3920 relative to the position of the first magnetic body 3910.

Here, detecting the position of the second magnetic body 3920 relative to the
25 position of the first magnetic body 3910 may be understood as detecting whether the

first magnetic body 3910 and the second magnetic body 3920 are aligned with each other, which is a condition for sufficient formation of an attractive force between the first magnetic body 3910 and the second magnetic body 3920.

5 In this way, by detecting the position of the second magnetic body 3920 relative to the position of the first magnetic body 3910, it is possible to detect whether movement of the holder module 3110 is normal, corresponding to the movement of the transfer member 3820.

For example, when deviation of the second magnetic body 3920 with respect to the first magnetic body 3910 (a misaligned state in which an attractive force is not generated) is detected by the detecting portion 3940, a controller (not illustrated) may stop the operation of the transfer member 3820 and the chemical sampling device 310 and generate an alarm signal (e.g., an aural alarm signal or a visual alarm signal) that may inform the worker of the occurrence of the abnormal situation (deviation of the second magnetic body with respect to the first magnetic body).

15 As the detecting portion 3940, various detection means capable of detecting the position of the second magnetic body 3920 relative to the position of the first magnetic body 3910 may be used, and the present disclosure is not limited or restricted by the type and detection method of the detecting portion 3940.

For example, the detecting portion 3940 includes a portion to be detected 20 3942 that is provided at the slider 3830, and a sensing portion 3944 provided at the transfer member 3820 and configured to sense the portion to be detected 3942.

Various sensors capable of detecting the portion to be detected 3942 may be used as the sensing portion 3944, and the type and characteristics of the sensing portion 3944 may be changed in various ways according to required conditions and 25 design specifications.

For example, a transparent window 3846a may be provided at the sidewall portion 3846, and a light sensor configured to transmit and receive a light signal transmitted through the transparent window 3846a may be used as the sensing portion 3944. The light sensor may detect light that passes through the transparent window 3846a and is reflected by the portion to be detected 3942.

For example, the transparent window 3846a provided at the sidewall portion 3846 may be formed to entirely cover (block) the guide slot 3108 formed in the partition portion 3101, and the spill of chemicals and the inflow of foreign matter through the guide slot 3108 may be completely prevented by the transparent window 3846a.

The transparent window 3846a may be formed of glass, plastic, or a synthetic resin film capable of transmitting light, and the present disclosure is not limited or restricted by the material of the transparent window 3846a.

According to another embodiment of the present disclosure, the detecting portion may be configured using a proximity sensor or various other sensors, in place of the light sensor. Also, according to another embodiment of the present disclosure, the sensing portion may be provided at the slider, and the portion to be detected may be provided at the transfer member.

Meanwhile, the cap attaching/detaching unit 3300 is provided on the work space 3102b and configured to separate the cap from the container 20 transferred to the work space 3102b or fasten the cap to the container 20.

The cap attaching/detaching unit 3300 may be formed of various structures capable of selectively separating or fastening the cap 22 from or to the container 20, and the structure and operation method of the cap attaching/detaching unit 3300 may

be changed in various ways according to required conditions and design specifications (refer to the configuration of FIG. 7).

According to a preferred embodiment of the present disclosure, binding members 3210 and 2220 for selectively binding rotation (rotation about the vertical axis) of the container 20 with respect to the cap attaching/detaching unit 3300 are provided at the lower portion of the cap attaching/detaching unit 3300.

For example, the binding members 3210 and 2220 may be provided as a plurality of binding members 3210 and 2220 that are linearly movable in directions approaching and moving away from the circumference of the container 20. Here, the number of binding members 3210 and 2220 and intervals at which the binding members 3210 and 2220 are disposed may be changed in various ways according to required conditions and design specifications.

When the container 20 stored in the holder module 3110 is located at the lower portion of the cap attaching/detaching unit 3300 (a cap attaching/detaching position), the plurality of binding members 3210 and 2220 move in the direction approaching the circumference of the container 20 and together press the circumference of the container 20 to bind the rotation of the container 20. On the other hand, after the separation or fastening of the cap 22 is completed, the binding members 3210 and 2220 move in the direction moving away from the circumference of the container 20, and thus binding by the binding members 3210 and 2220 is released.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 may include a drain module 3120 configured to collect chemicals remaining in the sampling lines L1, L2, and L3 before chemicals are supplied into the container 20.

That is, chemicals filled in the sampling lines L1, L2, and L3 may stagnate after a certain period of time, causing precipitates to be generated or the chemicals to be contaminated through an open outlet.

However, according to the embodiment, by allowing the chemicals remaining
5 in the sampling lines L1, L2, and L3 to be collected by the drain module 3120 before chemicals are supplied into the container 20, uncontaminated high-purity chemicals may be supplied into the container 20, and thus it is possible to obtain an advantageous effect of improving the reliability of chemical contamination analysis.

The drain module 3120 may be formed of various structures having an inlet
10 3123 through which the outlet end of the sampling lines L1, L2, and L3 enters, and the present disclosure is not limited or restricted by the structure of the drain module 3120.

For example, the drain module 3120 includes a drain box 3122 which is configured to communicate with the inlet 3123 and has an accommodation space in
15 which chemicals are accommodated and a discharge line 3126 which is configured to discharge the chemicals from the accommodation space to the outside of the drain box 3122.

More specifically, the drain box 3122 may be formed in the shape of a quadrangular barrel that has the accommodation space formed therein, and the inlet
20 3123 communicating with the accommodation space is formed in an upper surface of the drain box 3122. For example, three inlets 3123 that correspond to the three sampling lines L1, L2, and L3 may be formed to be spaced apart from each other in the upper surface of the drain box 3122.

The discharge line 3126 is provided to discharge the chemicals stored in the
25 accommodation space to the outside of the drain box 3122, and the chemicals

discharged through the discharge line 3126 may be purified through a chemical purification facility (not illustrated) provided outside the drain box 3122.

Preferably, a diluent supply line 3124 configured to supply a diluent (e.g., DIW) to the accommodation space is connected to the drain box 3122, and chemicals
5 collected in the accommodation space are discharged in a state in which the chemicals are diluted by the diluent (mixed with the diluent).

In this way, by allowing the chemicals collected in the drain box 3122 to be discharged in a state in which the chemicals are diluted by the diluent, it is possible to obtain advantageous effects of reducing the use of a neutralizing agent for
10 neutralizing chemicals in a post-treatment facility (e.g., a wastewater treatment plant) and simplifying a post-treatment process.

On the other hand, in a case where the chemical is sulfuric acid, when sulfuric acid is mixed with a diluent (e.g., DIW), an excessive heat generation phenomenon may occur and adversely affect the facility. Thus, preferably, sulfuric
15 acid may be discharged as it is without being mixed with a separate diluent.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 may include a holder member 3420 configured to support the sampling lines L1, L2, and L3 and selectively seal the inlet 3123.

Here, the holder member 3420 sealing the inlet 3123 means that an upper
20 portion of the inlet 3123 is blocked (covered) by the holder member 3420.

The holder member 3420 may be formed of various structures capable of sealing the inlet 3123 while supporting the sampling lines L1, L2, and L3, and the shape and structure of the holder member 3420 may be changed in various ways according to required conditions and design specifications.

For example, the holder member 3420 may be formed to have a substantially cylindrical cross-section, and the outlet end of the sampling lines L1, L2, and L3 passes through the holder member 3420 and is exposed to a lower portion of the holder member 3420.

5 Also, a cover member (not illustrated), which is formed as an expandable/contractible corrugated tube, may be provided between an upper portion of the holder member 3420 and an inner surface (upper inner surface) of the case 3100, and the sampling lines L1, L2, and L3 are disposed to pass through the inside of the cover member. Accordingly, it is possible to obtain an advantageous effect
10 of minimizing exposure of fumes through a through-hole (not illustrated) formed in the case to allow passage of the sampling lines L1, L2, and L3.

Preferably, the chemical sampling device 310 includes a first moving unit 3600 configured to selectively move the holder member 3420 so that the holder member 3420 moves to a first position for sealing the inlet 3123 or a second position
15 for opening the inlet 3123.

Here, the holder member 3420 being located at the first position means that the holder member 3420 is located (e.g., lowered) to block (seal) the inlet 3123, and the holder member 3420 being located at the second position means that the holder member 3420 is located (e.g., lifted) above the inlet 3123 to be spaced apart from the
20 inlet 3123 in order to expose (open) the inlet 3123.

The first moving unit 3600 may be formed of various structures capable of selectively lifting/lowering the holder member 3420.

For example, the first moving unit 3600 includes a first driving portion 3610, and a first moving member 3620 configured to support the holder member 3420,

linearly move in the up-down direction by the first driving portion 3610, and move the holder member 3420 to the first position or second position.

The first moving member 3620 is provided to be linearly movable in the up-down direction, and the first driving portion 3610 is provided to provide a driving
5 force for linearly moving the first moving member 3620.

Various driving means capable of providing a driving force necessary for the linear movement of the first moving member 3620 may be used as the first driving portion 3610. For example, as the first driving portion 3610, a common pneumatic (or hydraulic) cylinder or a motor may be used. According to another embodiment
10 of the present disclosure, the first moving member may be configured to linearly move using a lead screw, which rotates due to a driving force of a driving motor, or other common linear motion systems.

The first moving member 3620 may be formed of a single member capable of lifting/lowering by the first driving portion 3610 mounted on an outer surface of the
15 case or may be formed of a plurality of members assembled together, and the present disclosure is not limited or restricted by the structure and form of the first moving member 3620.

Preferably, when the holder member 3420 moves to the first position by the first moving unit 3600, the outlet end of the sampling lines L1, L2, and L3 exposed
20 to the lower portion of the holder member 3420 is accommodated in the inlet 3123 (the outlet end of the sampling lines is disposed at a height lower than the height of the uppermost end of the inlet).

In this way, by the outlet end of the sampling lines L1, L2, and L3 being accommodated in the inlet 3123 when the holder member 3420 moves to the first
25 position, a falling distance of chemicals discharged from the outlet end of the

sampling lines L1, L2, and L3 may be minimized, and thus it is possible to obtain advantageous effects of minimizing scattering of the chemicals to the outside of the inlet 3123 and further improving the chemical collection efficiency.

Also, a support block 3630 may be connected to the first moving member
5 3620, and a plurality of holder members 3420 that correspond to the plurality of sampling lines L1, L2, and L3 are supported by the support block 3630 in the case.

In this way, by the plurality of holder members 3420 being supported by the support block 3630, it is possible to obtain advantageous effects of controlling the lifting/lowering height of the plurality of holder members 3420 to be uniform and
10 minimizing vibration and unnecessary movement of the holder members 3420.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes a guide block 3640 disposed above the holder member 3420 to be spaced apart therefrom and connected to the first moving member 3620, wherein a guide hole 3642 configured to guide the upward/downward movement of
15 the sampling lines L1, L2, and L3 is formed in the guide block 3640.

The guide block 3640 is connected to the first moving member 3620 so as to be disposed above the holder member 3420 to be spaced apart therefrom and is configured to be lifted/lowered along with the first moving member 3620. The guide hole 3642 through which the sampling lines L1, L2, and L3 pass is formed in
20 the guide block 3640.

In this way, by the guide block 3640 having the guide hole 3642 formed therein being provided above the holder member 3420 and guiding the upward/downward movement of the sampling lines L1, L2, and L3, it is possible to obtain advantageous effects of minimizing twisting and tangling of the sampling

lines L1, L2, and L3 when the holder member 3420 is lifted/lowered and more stably maintaining the arrangement state of the sampling lines L1, L2, and L3.

According to a preferred embodiment of the present disclosure, a sealing member (not illustrated) may be provided between the holder member 3420 and the
5 drain module 3120.

For example, the sealing member may be formed in a ring shape and disposed to wrap around the circumference of the inlet 3123. The sealing member may be formed of an elastic material such as rubber or silicone, and the present disclosure is not limited or restricted by the material and cross-sectional shape of the sealing
10 member.

Preferably, when the holder member 3420 moves to the first position (lowering position), the sealing member is pressed between the holder member 3420 and the drain module 3120 (or an end cap member).

Here, the sealing member being pressed between the holder member 3420
15 and the drain module 3120 is understood as the sealing member being compressed between the holder member 3420 and the drain module 3120 due to a pressing force caused by the holder member 3420 being lowered.

In this way, by allowing the sealing member to be pressed by the holder member 3420 when the holder member 3420 is lowered (reaches the lowering
20 position), a gap between the holder member 3420 and the drain module 3120 may be more effectively sealed, and thus it is possible to obtain an advantageous effect of minimizing the leakage of chemicals to the outside of the drain module 3120.

According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes a second moving unit 3700 configured to selectively
25 move the drain module 3120 so that the drain module 3120 moves to a third position

at which the inlet 3123 is aligned with the outlet end or a fourth position at which the inlet 3123 is spaced apart from the outlet end.

Here, the drain module 3120 moving to the third position means that the drain module 3120 moves to a position (drain position) at which the inlet 3123 of the drain module 3120 is aligned with the outlet end of the sampling lines L1, L2, and L3 in the up-down direction, and the drain module 3120 moving to the fourth position means that the drain module 3120 moves to a position (standby position) at which the inlet 3123 of the drain module 3120 is spaced apart from the outlet end of the sampling lines L1, L2, and L3.

10 The second moving unit 3700 may be formed of various structures capable of moving the drain module 3120 from the third position to the fourth position.

For example, the second moving unit 3700 includes a second driving portion (not illustrated) and a second moving member (not illustrated) connected to the drain module 3120 and configured to linearly move in the horizontal direction by the second driving portion and move the drain module 3120 to the third position or the fourth position.

The second moving member is provided to be linearly movable in the horizontal direction, and the second driving portion is provided to provide a driving force for linearly moving the second moving member.

20 Various driving means capable of providing a driving force necessary for the linear movement of the second moving member may be used as the second driving portion. For example, as the second driving portion, a common pneumatic (or hydraulic) cylinder or a motor may be used. According to another embodiment of the present disclosure, the second moving member may be configured to linearly move using a lead screw, which rotates due to a driving force of a driving motor, or

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other common linear motion systems. According to still another embodiment of the present disclosure, the second moving unit may be configured to rotate the drain module (e.g., rotate the drain module about a direction along the vertical axis) from the third position to the fourth position.

5 The second moving member may be formed of a single member capable of linearly moving by the second driving portion mounted on an outer side of the work space or may be formed of a plurality of members assembled together, and the present disclosure is not limited or restricted by the structure and form of the second moving member.

10 The second moving unit 3700 is controlled to operate in conjunction with the first moving unit 3600. More specifically, when the drain module 3120 moves to the third position due to the second moving unit 3700 in a state in which the holder member 3420 is at the second position, the first moving unit 3600 moves the holder member 3420 from the second position to the first position. When the holder member 3420 moves to the first position in a state in which the drain module 3120 is at the third position, the inlet 3123 is sealed by the holder member 3420.

 According to a preferred embodiment of the present disclosure, the chemical sampling device 310 includes an end cap member 3400 provided to be able to seal the outlet end of the sampling lines L1, L2, and L3 and a third moving unit 3500
20 configured to selectively move the end cap member 3400 so that the end cap member 3400 is located at a fifth position for sealing the outlet end or a sixth position for opening the outlet end.

 The end cap member 3400 and the third moving unit 3500 are provided to constitute the chemical sampling device 310 for suppressing chemical leakage

through the sampling lines L1, L2, and L3 and minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto.

That is, in the chemical sampling device 310, there is a problem in that chemicals unintentionally leak from the sampling lines L1, L2, and L3 despite the supply of chemicals being stopped. More specifically, after the chemical sampling process is completed, a small amount of chemicals remains at the outlet end of the sampling lines L1, L2, and L3, and there is a problem in that, as the chemicals remaining at the outlet end of the sampling lines L1, L2, and L3 fall drop by drop, the entire work space is directly exposed to the chemicals.

Also, even in a case where a failure occurs in a valve controlling the supply of chemicals using the sampling lines L1, L2, and L3, there is a problem in that chemicals are unintentionally discharged from the sampling lines L1, L2, and L3 and thus the work space is exposed to the chemicals.

However, according to the embodiment, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 3400 after the chemical sampling process is completed (or before the chemical sampling process), it is possible to obtain advantageous effects of suppressing chemical leakage and suppressing direct exposure of the work space 3102b to the chemicals fallen or spilled from the sampling lines L1, L2, and L3.

Further, since the outlet end of the sampling lines L1, L2, and L3 may be accommodated in a sealed manner in the end cap member 3400, it is possible to obtain an advantageous effect of minimizing contamination of the sampling lines L1, L2, and L3 and damage thereto caused by contact with contaminants contained in the outside air or contact with surrounding equipment.

The end cap member 3400 may be formed of various structures capable of sealing the outlet end of the sampling lines L1, L2, and L3 through which chemicals are discharged, and the shape and structure of the end cap member 3400 may be changed in various ways according to required conditions and design specifications.

5 Here, the end cap member 3400 sealing the outlet end of the sampling lines L1, L2, and L3 means that the outlet end of the sampling lines L1, L2, and L3 is blocked by the end cap member 3400 without being exposed to the outside (e.g., the work space).

For example, the end cap member 3400 may be provided as three end cap
10 members 3400 to correspond to each of the three sampling lines L1, L2, and L3, and the number and arrangement structure of the end cap members 3400 may be appropriately changed according to the number and arrangement form of the sampling lines L1, L2, and L3.

The third moving unit 3500 is provided to selectively move the end cap
15 member 3400 so that the end cap member 3400 is located at the fifth position for sealing the outlet end or the sixth position for opening the outlet end.

Here, the end cap member 3400 being located at the fifth position means that the end cap member 3400 is located to block (seal) the outlet end of the sampling lines L1, L2, and L3, and the end cap member 3400 being located at the sixth
20 position means that the end cap member 3400 is located to expose (open) the outlet end of the sampling lines L1, L2, and L3.

The end cap member 3400 may be configured to move from the fifth position to the sixth position in various ways according to required conditions and design specifications.

For example, the third moving unit 3500 is configured to rotate the end cap member 3400 from the fifth position to the sixth position (or from the sixth position to the fifth position).

More specifically, the third moving unit 3500 includes a third driving portion
5 3510 and a third moving member 3520 configured to support the end cap member 3400, horizontally rotate about an axis in the up-down direction by the third driving portion, and move the end cap member 3400 to the fifth position or the sixth position.

Various driving means capable of providing a driving force necessary for the rotation of the third moving member 3520 may be used as the third driving portion
10 3510. For example, as the third driving portion 3510, a common pneumatic (or hydraulic) cylinder or a motor may be used, and the present disclosure is not limited or restricted by the type and structure of the third driving portion 3510.

The third moving member 3520 is formed in a substantially L-shape and has one end (upper end) connected to the third driving portion 3510 and the other end
15 configured to support the end cap member 3400.

Preferably, the third moving member 3520 is configured to horizontally rotate about an axis in the vertical direction and move the end cap member 3400 from the fifth position to the sixth position. In this way, by the third moving member 3520 horizontally rotating about the axis in the vertical direction and moving the end cap
20 member 3400 from the fifth position to the sixth position, a space necessary for the arrangement and operation of the third moving member 3520 may be minimized, and thus it is possible to obtain an advantageous effect of improving space utilization and design freedom.

According to another embodiment of the present disclosure, the third moving
25 member may be configured to rotate about the axis in the horizontal direction or an

axis in another direction and move the end cap member from the fifth position to the sixth position. According to still another embodiment of the present disclosure, the end cap member may be configured to linearly move (horizontally move) from the fifth position to the sixth position.

5 The third moving unit 3500 is controlled to operate in conjunction with the first moving unit 3600 and the second moving unit 3700. More specifically, when the drain module 3120 moves to the fourth position in a state in which the holder member 3420 is at the second position, the end cap member 3400 is moved to the fifth position by the third moving unit 3500, and when the holder member 3420
10 moves from the second position to the first position due to the first moving unit 3600, the outlet end of the sampling lines L1, L2, and L3 is sealed by the end cap member 3400.

 Preferably, the outlet end of the sampling lines L1, L2, and L3 passes through the holder member 3420 and is exposed to a lower portion of the holder member
15 3420, and at the fifth position, the end cap member 3400 is disposed to come in close contact with the lower portion of the holder member 3420 to wrap around the outlet end.

 For example, an accommodation groove 3402 is formed to be recessed in an upper surface of the end cap member 3400, and at the fifth position, the outlet end of
20 the sampling lines L1, L2, and L3 is accommodated in the accommodation groove 3402 to be spaced apart from an inner wall surface of the accommodation groove 3402.

 In this way, by the outlet end of the sampling lines L1, L2, and L3 being accommodated in the accommodation groove 3402 to be spaced apart from the inner
25 wall surface of the accommodation groove 3402, it is possible to obtain an

advantageous effect of preventing contamination of the outlet end of the sampling lines L1, L2, and L3 caused by the outlet end coming in contact with the end cap member 3400.

Also, in a case where a task of sealing the outlet end of the sampling lines L1, L2, and L3 is manually performed by the worker, there is a problem in that the worker is exposed to chemicals spilling to a sealing member sealing the outlet end. However, according to the embodiment, since the task of sealing the outlet end of the sampling lines L1, L2, and L3 using the end cap member 3400 may be automatically performed in the work space 3102b without the worker coming in direct contact with the end cap member 3400, it is possible to obtain an advantageous effect of preventing the worker from being exposed to chemicals spilling to the end cap member 3400.

Further, by the end cap member 3400 coming in close contact with the lower portion of the holder member 3420 and sealing the outlet end of the sampling lines L1, L2, and L3 without coming in direct contact with the sampling lines L1, L2, and L3, it is possible to obtain an advantageous effect of more stably maintaining the arrangement state of the end cap member 3400 with respect to the sampling lines L1, L2, and L3 and the sealed state of the outlet end.

Also, according to a preferred embodiment of the present disclosure, a detection sensor (not illustrated) configured to detect chemicals spilling from the outlet end of the sampling lines L1, L2, and L3 may be provided in the accommodation groove 3402.

As the detection sensor, common sensors (e.g., a light sensor, an infrared sensor, a capacitance sensor) capable of detecting chemicals may be used, and the

present disclosure is not limited or restricted by the type and sensing method of the detection sensor.

Also, when chemical spill is detected by the detection sensor, a controller (not illustrated) may generate an alarm signal that may inform the worker of the chemical spill situation.

Here, the alarm signal may include at least one of an aural alarm signal by a common acoustic means and a visual alarm signal by a common warning light, and in addition, various other alarm signals that may inform the worker of the chemical spill situation may be used.

Hereinafter, the chemical sampling process by the chemical sampling device 310 according to an embodiment of the present disclosure will be described.

When the worker inputs a command to unlock the first door 3104 through an input portion (not illustrated), a state in which the first door 3104 is locked by a door locking device (not illustrated) is released.

When the locked state of the first door 3104 is released, the worker opens the first door 3104 and stores an empty container 20 (container having the cap coupled thereto) in the holder module 3110 disposed in the standby space 3102a.

Preferably, the standby space 3102a may be set as an initial position of the holder module 3110 during an initial operation of the chemical sampling device 310.

In some cases, the work space may be set as the initial position of the holder module 3110.

When the first door 3104 is closed, the second door 3106 is opened, and the container 20 stored in the holder module 3110 is transferred to the lower portion of the cap attaching/detaching unit 3300 provided in the work space 3102b by the transfer unit.

When the second door 3106 is closed, the cap 22 coupled to the container 20 is separated by the cap attaching/detaching unit 3300.

For reference, chemicals remaining in the sampling lines L1, L2, and L3 are discharged in advance through the drain module 3120 before chemicals are supplied
5 into the container 20.

Before chemicals are sampled in the sampling lines L1, L2, and L3, the end cap member 3400 is disposed at the position (fifth position) at which the end cap member 3400 seals the outlet end of the sampling lines L1, L2, and L3, and the drain module 3120 is disposed at the fourth position (standby position) at which the drain
10 module 3120 is spaced apart from the outlet end of the sampling lines L1, L2, and L3.

Next, when the holder member 3420 moves to the second position, the end cap member 3400 disposed at the position (fifth position) for sealing the outlet end of the sampling lines L1, L2, and L3 moves to the position (sixth position) for opening the outlet end of the sampling lines L1, L2, and L3 before chemicals are supplied
15 into the container 20.

Here, a point in time at which the end cap member 3400 moves from the fifth position to the sixth position may be changed in various ways according to required conditions and design specifications.

For example, the point in time at which the end cap member 3400 moves
20 from the fifth position to the sixth position may be a point in time at which the second door 3106 is closed after the container 20 is transferred to the lower portion of the cap attaching/detaching unit 3300 provided in the work space 3102b. According to another embodiment of the present disclosure, the point in time at which the end cap member moves from the fifth position to the sixth position may be
25 a point in time before (or after) the cap coupled to the container is separated by the

cap attaching/detaching unit or a point in time at which the first door is closed after the container initially enters the standby space.

Next, by the second moving unit 3700, the drain module 3120 moves forward toward the sampling lines L1, L2, and L3 and is disposed at the third position at
5 which the inlet 3123 is aligned with the outlet end of the sampling lines L1, L2, and L3.

Next, by the holder member 3420 being lowered to the first position, the inlet 3123 is sealed by the holder member 3420.

In the state in which the inlet 3123 is sealed by the holder member 3420,
10 chemicals remaining in the sampling lines L1, L2, and L3 are discharged into the drain module 3120. Further, while the chemicals remaining in the sampling lines L1, L2, and L3 are discharged into the drain module 3120, a diluent may also be supplied into the drain module 3120.

Next, when the chemical drain process is completed (for example, a preset
15 time is reached), the holder member 3420 is lifted back to the second position, and the drain module 3120 moves rearward by the second moving unit 3700 and is disposed at the fourth position.

Next, the container 20 from which the cap 22 is separated is transferred to the lower portion of the outlet end of the sampling lines L1, L2, and L3 by the transfer
20 unit, and the container 20 is filled with the chemicals discharged from the outlet end of the sampling lines L1, L2, and L3.

Meanwhile, in a case where some of the chemicals overflow while chemicals are being supplied into the container 20, a sensor provided in the container 20 or provided near the container 20 (e.g., provided in the holder module) may detect the

overflow, and the controller may stop the sampling process according to a value sensed by the sensor and generate an alarm.

Then, the container 20 filled with the chemicals is transferred back to the lower portion of the cap attaching/detaching unit 3300 by the transfer unit, and the
5 cap 22 is coupled to the container 20 by the cap attaching/detaching unit 3300.

Next, the second door 3106 is opened, and the container 20 to which the cap 22 is coupled is transferred to the standby space 3102a by the transfer unit.

When the second door 3106 is closed, the worker opens the first door 3104 and takes the container 20 disposed in the standby space 3102a out of the case 3100
10 to perform a chemical contamination analysis process.

Meanwhile, preferably, a point in time at which the end cap member 3400 moves from the position (sixth position) for opening the outlet end of the sampling lines L1, L2, and L3 to the position (fifth position) for sealing the outlet end of the sampling lines L1, L2, and L3 may be right after (or while) the container 20 filled
15 with the chemicals is transferred to the lower portion of the cap attaching/detaching unit 3300. In this way, by the outlet end of the sampling lines L1, L2, and L3 being sealed by the end cap member 3400 right after the chemicals are discharged from the outlet end of the sampling lines L1, L2, and L3, it is possible to obtain an advantageous effect of minimizing falling of the chemicals remaining in the outlet
20 end of the sampling lines L1, L2, and L3.

Meanwhile, preferably, a point in time at which the end cap member 3400 moves from the position (sixth position) for opening the outlet end of the sampling lines L1, L2, and L3 to the position (fifth position) for sealing the outlet end of the sampling lines L1, L2, and L3 may be right after the cap 22 is fastened to the
25 container 20 filled with the chemicals. In this way, by the outlet end of the

sampling lines L1, L2, and L3 being sealed by the end cap member 3400 right after the cap 22 is fastened to the container 20 filled with the chemicals, it is possible to obtain an advantageous effect of minimizing the flow of foreign matter, which may be generated during operation of the first moving unit 3600 and the third moving unit 3500, into the container 20 filled with the chemicals.

<Fourth embodiment>

FIG. 39 is a conceptual diagram of a chemical sampling device according to an embodiment of the present disclosure.

Referring to FIG. 39, the chemical sampling device according to the embodiment may include a case 4100 in which a container 21 having a cap 22 fastened thereto is stored, cap opening/closing modules 4300 and 4220 configured to separate or fasten the container 21 and the cap 22, and sampling lines L1, L2, and L3 configured to fill the container 21 separated from the cap 22 with chemicals.

The container 21 may be a sampling bottle from which some of the chemicals can be extracted, but is not necessarily limited thereto. For example, the container may be a drum in which a large amount of chemicals is stored. Hereinafter, description will be given assuming that the container 21 is the sampling bottle.

The case 4100 may be divided into a standby space 4100a and a work space 4100b by a blocking door 4102. The standby space 4100a may be a space in which a worker stores the sampling bottle 21. Also, the work space 4100b may be a space in which the cap 22 of the sampling bottle 21 is opened to fill the sampling bottle 21 with chemicals.

According to the embodiment, since the standby space 4100a and the work space 4100b are partitioned by the blocking door 4102, it is possible to suppress external discharge of chemical fumes generated during the sampling task.

However, the present disclosure is not necessarily limited thereto, and the work space 4100b may be subdivided into a plurality of spaces. For example, a blocking door may be additionally installed between an area in which a cap opening/closing device is disposed and an area in which the plurality of sampling
5 lines L1, L2, and L3 are disposed. In this case, it is possible to more effectively suppress the external discharge of the chemical fumes.

When the worker opens a door 4103, places an empty sampling bottle 21 in the standby space 4100a, and operates the device, a holder module 4220 may transfer the sampling bottle 21 to a lower portion of a grip portion 4310. The holder module
10 4220 may move in a transverse direction along a movement line 4104, but is not necessarily limited thereto.

During an initial operation, the holder module 4220 may be disposed in the standby space 4100a. Accordingly, the worker may insert the sampling bottle 21 into a holder of the holder module 4220 and cause the sampling task to be performed.
15 However, an initial position of the holder module is not limited thereto.

An attaching/detaching module 4300 (cap attaching/detaching unit) may include the grip portion 4310 coupled to the cap 22, a rotating portion 4320 configured to rotate the grip portion 4310, and a lifting/lowering portion 4330 configured to lift/lower the grip portion 4310. According to the embodiment, the
20 rotating portion 4320 and the lifting/lowering portion 4330 may be disposed outside the case 4100 and prevent penetration of chemical fumes generated during the sampling task.

A cover 4381 may be coupled to an upper portion of the case 4100 and may be formed in the shape of an expandable/contractible tube and wrap around a
25 through-hole formed in the case 4100. For example, the cover 4381 may be a

corrugated tube. Accordingly, it is possible to suppress entry/exit of chemical fumes through the through-hole of the case 4100.

FIG. 40 is a view showing a state in which a cap opening/closing device is coupled to the cap, and FIG. 41 is a view showing a state in which the cap is lifted
5 from the container by the cap opening/closing device.

Referring to FIG. 40, when the sampling bottle 21 is disposed at a lower side of the attaching/detaching module 4300, the grip portion 4310 may be lowered and coupled to the cap 22. A configuration in which a gripper 4312 of the grip portion 4310 unfolds is not particularly limited. For example, various robot arm gripper
10 structures may be applied without limitations.

Here, a plate member 4318 disposed at the grip portion 4310 may come in contact with an upper surface of the cap 22, and thus the grip portion 4310 may be prevented from being lowered past the cap 22. Also, since the plate member 4318 presses the cap 22, it is possible to address a problem in that the cap 22 is not
15 properly closed due to a slip phenomenon of the gripper 4312 when the grip portion 4310 is lowered while rotating.

The plate member 4318 may press the cap 22 using an elastic member such as a spring, but is not necessarily limited thereto. For example, the plate member 4318 may have an elastic force using a magnetic force.

20 The rotating portion 4320 may transmit a rotational force to the grip portion 4310 and separate the cap 22 from the sampling bottle 21. The rotating portion 4320 may include a motor but is not necessarily limited thereto. For example, the rotating portion 4320 may transmit a rotational force using a cylinder. That is, the configuration of the rotating portion 4320 is not particularly limited as long as the
25 configuration is able to transmit a rotational force to the grip portion 4310.

Referring to FIG. 41, a first screw thread 21a may be formed on an inlet 21-1 of the sampling bottle 21 and coupled to a second screw thread 22a of the cap 22. When the gripper 4312 of the grip portion 4310 holds and rotates the cap 22, the first screw thread 21a and the second screw thread 22a are separated, and in this process, the second screw thread 22a is pushed by the first screw thread 21a and lifted. Therefore, the cap 22 is gradually lifted from the sampling bottle 21.

When the cap 22 is lifted from the sampling bottle 21 by rotation, if the weight of the attaching/detaching module 4300 is transmitted as it is to the cap 22, the cap 22 may not be lifted further and press the sampling bottle 21 having the first screw thread 21a formed thereon. Accordingly, the shape of the sampling bottle 21 may be deformed.

The material, shape, and the like of the sampling bottle 21 may be standardized for the sampling bottle 21 to accommodate chemicals, and the strength of the sampling bottle 21 may not be relatively high. In particular, the strength may be weaker at the inlet 21-1 of the sampling bottle 21. Accordingly, when the weight of the attaching/detaching module 4300 is transmitted as it is to the sampling bottle 21 through the cap 22, the inlet 21-1 may be crushed.

When the inlet 21-1 is deformed, chemicals may be exposed to the outside instead of normally being filled in the sampling bottle 21 through the inlet 21-1. Accordingly, a configuration for separating the cap 22 without changing the shape of the sampling bottle 21 may be very important.

FIG. 42 is a view showing a state in which the cap is separated from the container by the cap opening/closing device, and FIG. 43 is a view showing a state in which the cap opening/closing device is lifted.

Referring to FIG. 42, a buffer portion 4350 may prevent the attaching/detaching module 4300 from excessively pressing the cap 22 and control the grip portion 4310 to be pushed and lifted when the cap 22 is lifted. As a result, an adjustment distance d2 of the buffer portion 4350 may be reduced as much as a
5 distance at which the cap 22 is lifted.

The buffer portion 4350 may serve to reduce the weight of the grip portion 4310. For example, by being fixed to the rotating portion 4320 and providing an elastic force to an upper side, the buffer portion 4350 may reduce the weight at which the grip portion 4310 presses the cap 22. The configuration of the buffer
10 portion 4350 is not particularly limited.

For example, the buffer portion 4350 may have an elastic structure like a spring or a pneumatic structure like a cylinder or may include a motor. That is, the configuration of the buffer portion 4350 is not particularly limited as long as the configuration allows the grip portion 4310 to be lifted when the cap 22 is separated
15 from the sampling bottle 21 and lifted.

A detection sensor 4371 may, according to the grip portion 4310 being lifted, detect that the cap 22 is completely separated from the sampling bottle 21. The configuration in which the detection sensor 4371 detects that the cap 22 is completely separated from the sampling bottle 21 is not particularly limited.

20 For example, the detection sensor 4371 may include a light transmitter and a light receiver and may cause a signal transmitted from the light transmitter to not be received by the light receiver when the grip portion 4310 is lifted above a set height. Accordingly, when a light signal is not received, the cap 22 may be determined as having been separated from the sampling bottle 21. However, the detection sensor

4371 is not necessarily limited thereto and may have an electric or mechanical detection structure.

Referring to FIG. 43, when the cap 22 is determined as having been completely separated from the sampling bottle 21, the grip portion 4310 may be lifted. The lifting/lowering portion 4330 may drive a cylinder to lift the grip portion 4310. Here, a connection frame 4332 may be connected to the grip portion 4310, connected to the buffer portion 4350, or connected to the rotating portion 4320. That is, the connection frame 4332 may be connected to an appropriate position for lifting/lowering the attaching/detaching module 4300.

By the lifting/lowering portion 4330, the attaching/detaching module 4300 may be lifted upward from the sampling bottle 21. Here, in the lifting process, the adjustment distance d2 of the buffer portion 4350 may extend in the vertical direction again due to gravity.

FIG. 44 is a view showing a process of putting a chemical into the container.

When the attaching/detaching module 4300 is lifted after separating the cap 22, a controller 4110 may move the holder module 4220 to sample a chemical selected by the worker among the plurality of sampling lines L1, L2, and L3.

Various chemicals necessary for a semiconductor process or the like may be stored as chemicals. Accordingly, when the sampling bottle 21 is disposed at the sampling lines L1, L2, and L3 from which chemicals that need testing are discharged, a supply device (not illustrated) may be driven to fill the sampling bottle 21 with the chemicals.

Here, a drain module (not illustrated) for discharging chemicals remaining in the sampling lines L1, L2, and L3 may be further disposed. The chemicals filled in the sampling lines L1, L2, and L3 may stagnate after a certain period of time, which

is highly likely to cause precipitates to be generated or the chemicals to be contaminated through an open outlet. Accordingly, by discharging the chemicals remaining in the sampling lines L1, L2, and L3 before sampling is performed, it is possible to improve the reliability of chemical contamination analysis.

5 FIG. 45 is a view showing a state in which the cap is coupled to the container, and FIG. 46 is a view showing a state in which the container is moved to a standby area.

Referring to FIG. 45, when the sampling bottle 21 is filled with chemicals, the holder module 4220 may place the sampling bottle 21 below the
10 attaching/detaching module 4300 again.

The grip portion 4310 may lower and rotate to couple the cap 22 to the sampling bottle 21. Here, when the grip portion 4310 couples the cap 22 to the sampling bottle 21, the buffer portion 4350 may be contracted again to prevent the grip portion 4310 from excessively pressing the sampling bottle 21.

15 Although the cap 22 presses the sampling bottle 21 due to lowering of the grip portion 4310, since the weight of the grip portion 4310 is sufficiently reduced by the buffer portion 4350, the grip portion 4310 may be pushed and lifted by the sampling bottle 21.

Then, by rotation, the cap 22 is coupled to the sampling bottle 21 and lowered,
20 and the grip portion 4310 may also be lowered as much as a height at which the cap 22 is lowered. As much as the grip portion is lowered, the buffer portion 4350 may extend in the vertical direction again.

The detection sensor 4371 may measure the lowering height of the grip portion 4310 and detect that the cap 22 is completely coupled to the sampling bottle
25 21. For example, the detection sensor 4371 may include a light transmitter and a

light receiver and may cause a signal transmitted from the light transmitter to not be received by the light receiver when the grip portion 4310 is lowered below a set height. Accordingly, when a light signal is not received, the cap 22 may be determined as having been completely coupled to the sampling bottle 21.

5 According to an embodiment, the chemical sampling device may include a torque measuring portion (not illustrated) configured to measure a torque value of the rotating portion 4320. The controller 4110 may compare the torque value of the rotating portion 4320 with a predetermined torque value.

10 In the case where the torque value of the rotating portion 4320 is within a predetermined torque range, the controller 4110 may determine that the cap 22 is coupled to the sampling bottle 21. When the torque value does not reach the predetermined torque range, the controller 4110 may determine that the cap 22 is running idle without being coupled to the sampling bottle 21.

15 In the case where a cap closing signal is detected by the detection sensor 4371 and the measured torque value is within the predetermined range, the controller 4110 may determine that the cap 22 is coupled to the sampling bottle 21.

20 Accordingly, in the case where the cap closing signal is detected but the torque value does not reach the predetermined range, the controller 4110 may determine that the cap 22 is running idle without being coupled to the sampling bottle 21.

25 Also, in the case where the torque value reaches the predetermined range but the cap closing signal is not detected, the controller 4110 may determine that the cap 22 is erroneously fastened to the sampling bottle 21. In this case, the controller 4110 may output an error signal to the outside, and thus accidents due to poor fastening of the cap 22 may be prevented.

In the case where the cap closing signal is detected and the torque value reaches the predetermined range, the controller 4110 may separate the grip portion 4310 from the cap 22 and lift the attaching/detaching module 4300.

Referring to FIG. 46, the controller 4110 may lift the blocking door 4102 and
5 transfer the sampling bottle 21 to the standby space 4100a. Accordingly, the worker may open the door 4103 and collect the sampling bottle 21.

FIG. 47 is a cross-sectional view of the attaching/detaching module, FIG. 48 is an enlarged view of the buffer portion, and FIG. 49 is a view showing a height at which the attaching/detaching module is lifted and lowered along with the cap by the
10 buffer portion.

Referring to FIGS. 47 to 49, the attaching/detaching module 4300 may include the grip portion 4310 configured to be coupled to the cap, the rotating portion 4320 configured to rotate the grip portion 4310, and the lifting/lowering portion 4330 configured to lift/lower the grip portion 4310.

15 The grip portion 4310 may grip the cap. To this end, the grip portion 4310 may further include a plurality of grippers 4312, a frame 4313, and the plate member 4318.

The plurality of grippers 4312 may be rotatably coupled to the frame 4313 to support a side surface of the cap 22.

20 The frame 4313 may be connected to a piston 4317 and move in the up-down direction, that is, the Z-axis direction. The frame 4313 and the plurality of grippers 4312 may be connected by a connection link (not illustrated). By the connection link (not illustrated), upward/downward linear movement of the frame 4313 may be converted into rotation of the grippers 4312.

Accordingly, when the frame 4313 moves upward, the plurality of grippers 4312 may be spaced apart from each other and be separated from the cap 22, and when the frame 4313 moves downward, the plurality of grippers 4312 may become close to each other and grip the cap 22. However, the present disclosure is not necessarily limited thereto, and the plurality of grippers 4312 may be designed to become close to each other when the frame 4313 moves downward and be spaced apart from each other when the frame 4313 moves upward.

The plate member 4318 may be disposed below the frame 4313 and coupled to be movable upward/downward. The plate member 4318 may include an elastic member. For example, the elastic member may be a spring but is not necessarily limited thereto, and a magnet may be used.

A lower surface of the plate member 4318 may be disposed to face an upper surface of the cap gripped by the plurality of grippers 4312. Accordingly, not only is it possible to suppress damage to the grip portion 4310 due to collision with the sampling bottle 21 or the cap 22 when the grip portion 4310 is lifted/lowered, but also it is possible to change the posture of the sampling bottle 21 to an upright state even when the sampling bottle 21 is partially tilted.

A frame lifting/lowering portion configured to lift/lower the frame 4313 may include a cylinder 4316 and the piston 4317. The piston 4317 may be disposed in an inner space C1 of the cylinder 4316 and move upward/downward according to an inflow of a fluid.

The piston 4317 may include a first rod 4317a which extends upward and through which a fluid is injected and a second rod 4317b which extends downward and is connected to the frame 4313.

A cylinder holder 4340 may include fluid ports 4341 and 4342 configured to inject a fluid into the inner space C1 of the cylinder 4316. Also, fluid paths 4317a-1 and 4317a-2 connected to the fluid ports 4341 and 4342 of the cylinder holder 4340 may be formed in the first rod 4317a.

5 For example, when a fluid is injected into a first fluid path 4317a-1, the fluid is discharged to a lower space R1 of the piston 4317, and thus the piston 4317 is lifted. Conversely, when a fluid is injected into a second fluid path 4317a-2, the fluid is injected into an upper space R2 of the piston 4317, and thus the piston 4317 is lowered. By lifting/lowering the piston 4317 using the above configuration, the
10 grippers 4312 may be driven.

However, the present disclosure is not necessarily limited thereto, and the configuration for lifting/lowering the piston 4317 may be modified in various ways. For example, a motor may be used. Also, the structure for gripping the cap 22 using the grippers 4312 may also be modified in various ways.

15 The cylinder 4316 may be coupled to a rotating shaft of the rotating portion 4320 and rotate. A cylinder holder 4400 may support the rotating cylinder 4316. A first fastening member 4343 and a second fastening member 4333 may fix the cylinder holder 4400 to the connection frame 4332. A tip of the cylinder 4316 may protrude from the cylinder holder 4400 and be connected to the buffer portion 4350.

20 Referring to FIG. 48, the buffer portion 4350 may include a buffer housing 4351 having a space portion C3 formed at one side, a buffer cover 4354 configured to cover the one side of the buffer housing 4351, a moving member 4352 disposed in the space portion C3, and an elastic member 4353 disposed between the moving member 4352 and the buffer cover 4354.

The buffer housing 4351 may include the space portion C3 into which the moving member 4352 is inserted. The moving member 4352 may slide upward/downward inside the space portion C3 due to the buffer cover 4354. The elastic member 4353 may have one end fixed to the buffer cover 4354.

5 Since the tip of the cylinder 4316 is connected to the moving member 4352, the moving member 4352 may be lowered due to the weight of the grip portion 4310. Accordingly, the elastic member 4353 is pressed by the moving member 4352 and thus may have an elastic force in an upward lifting direction. Accordingly, by the elastic member 4353, the weight that the grip portion 4310 applies to the sampling
10 bottle 21 may be reduced.

For example, in the case where the weight of the grip portion 4310 is 1.5 kg, the weight applied to the sampling bottle 21 may be reduced to 0.8 kg by the elastic member 4353. The stronger the elastic force of the elastic member 4353, the more the weight applied to the sampling bottle 21 is reduced.

15 Accordingly, when the cap 22 is separated from the sampling bottle 21 and gradually lifted, the grip portion 4310 may be lifted due to a lifting force of the cap 22. Also, as the cap 22 is fastened to the sampling bottle 21, the grip portion 4310 may be lowered. However, the structure of the buffer portion 4350 is not necessarily limited thereto, and various other buffer structures may be applied as
20 long as the structure is capable of controlling the weight of the grip portion 4310.

The buffer housing 4351 may include a protruding portion 4355 which protrudes from the other side and is connected to the rotating portion 4320. The protruding portion 4355 may be connected to the rotating shaft of the rotating portion 4320 by a connection module 4321.

The cylinder 4316 of the grip portion 4310 may be fixed to the moving member 4352. Accordingly, during rotation of the rotating portion 4320, the buffer portion 4350 and the grip portion 4310 may rotate along with the rotating portion 4320.

5 Referring to FIG. 49, it can be seen that the more the grip portion 4310 is lifted, the more the distance of the buffer portion 4350 is reduced. Accordingly, a lifting distance d_1 of the grip portion 4310 may correspond to the adjustment distance d_2 of the buffer portion 4350.

FIG. 50 is a view showing a state in which the attaching/detaching module in
10 a deformed state is lifted and lowered along with the cap.

Referring to FIG. 50, the buffer portion 4350 may be disposed between the grip portion 4310 and the lifting/lowering portion 4330. Specifically, the buffer portion 4350 may include a sliding member 4357 which protrudes upward from the lifting/lowering portion 4330 and passes through the connection frame 4332, a
15 stopper 4356 which is disposed at an upper portion of the sliding member 4357, and the elastic member 4353 disposed to lift the connection frame 4332 upward. For example, the elastic member 4353 may have one end fixed to the stopper 4356 and the other end fixed to the connection frame 4332.

According to such a configuration, since the elastic member 4353 may reduce
20 the weight of the grip portion 4310 as described above, the grip portion 4310 may be pushed and lifted by the cap 22. However, since the weight applied to the cap 22 is the overall weight of the attaching/detaching module 4300 including the grip portion 4310 and the rotating portion 4320, the weight applied to the sampling bottle 21 may be relatively larger. In contrast, in the structure of FIG. 49, since the buffer portion
25 4350 is disposed between the grip portion 4310 and the rotating portion 4320, the

weight applied to the cap 22 may be reduced by the weight of the grip portion 4310. Accordingly, since the weight is reduced, there is an advantage of minimizing deformation of the sampling bottle.

FIG. 51 is a conceptual diagram of the holder module, FIG. 52 is a view
5 showing a second detection sensor disposed in the holder module, and FIG. 53 is a conceptual diagram of the second detection sensor.

Referring to FIGS. 51 and 52, the holder module 4220 may include a first holder 4221a and a second holder 4221b which are spaced apart from each other and configured to fix the sampling bottle 21, a driving module 4223 configured to move
10 the first holder 4221a and the second holder 4221b, and a movement rail 4222. The first holder 4221a and the second holder 4221b may include a second detection sensor 4224 disposed at surfaces thereof facing each other. The second detection sensor 4224 may be a liquid detection sensor configured to sense chemicals.

Referring to FIG. 53, the second detection sensor 4224 may include first and
15 second metals 4224b and 4224c spaced apart from each other, a cover layer 4224a configured to protect the first and second metals 4224b and 4224c, and a power source 4224d configured to apply power.

Since the cover layer 4224a is formed of a flexible material, the second detection sensor 4224 may be fixed to an inner side surface of the first holder 4221a
20 and the second holder 4221b.

A voltage may be applied to the first and second metals 4224b and 4224c. Since the first and second metals 4224b and 4224c are spaced apart from each other, current does not flow at ordinary times, but current flows when the first and second metals 4224b and 4224c are stained with a conductive chemical CH. Accordingly,
25 when the second detection sensor 4224 detects a current flow, the controller 4110

may determine that the chemical is exposed and output a warning signal. However, a method of detecting whether the chemical is exposed is not limited thereto. For example, resistance may be measured to measure exposure of the chemical, or a change in a voltage may be used.

5 Also, the second detection sensor 4224 may be disposed in the case 4100 and sense chemicals falling from the sampling lines L1, L2, and L3. Also, the second detection sensor 4224 may sense chemicals overflowing from the sampling bottle 21 due to an error of a sensor measuring a sampling amount or an error in time checking. In this case, the second detection sensor 4224 may be disposed at a lower portion or a
10 side surface of the sampling lines L1, L2, and L3, but is not necessarily limited thereto.

FIG. 54 is a flowchart showing a sampling method according to an embodiment of the present disclosure.

Referring to FIG. 54, the sampling method according to the embodiment may
15 include fixing a container (S10), separating a cap coupled to the container (S20), filling the container with chemicals (S30), coupling the cap to the container (S40), and transferring the container to a standby space (S50). A cap opening/closing method may include fixing the container (S10), separating the cap coupled to the container (S20), and coupling the cap to the container (S40).

20 Referring to FIG. 39, in the fixing of the container (S10), when a worker opens the door 4103 and places the sampling bottle 21 in the standby space 4100a, the holder module 4220 may grip the sampling bottle 21.

Referring to FIG. 40, in the separating of the cap coupled to the container (S20), when the holder module 4220 transfers the sampling bottle 21 to a lower
25 portion of the attaching/detaching module 4300, the grip portion 4310 of the

attaching/detaching module 4300 may be lowered to be coupled to the cap 22 of the sampling bottle 21. Then, as the grip portion 4310 rotates, the cap 22 may be separated from the sampling bottle 21.

Here, when the cap 22 is lifted in a process in which a screw thread of the cap 22 is separated from a screw thread of the sampling bottle 21, the grip portion 4310 may be lifted along with the cap 22 by the buffer portion 4350. According to such a configuration, it is possible to address a problem in that the shape of the sampling bottle 21 is deformed due to the grip portion 4310 not being lifted despite the cap 22 being lifted.

Even when the lifting/lowering portion 4330 lifts the grip portion 4310, the rotating portion 4320 may keep rotating the grip portion 4310. According to such a configuration, since the cap 22 keeps rotating, it is possible to prevent the screw thread of the sampling bottle 21 from being caught at a tip portion of the screw thread of the cap 22. Accordingly, it is possible to prevent lifting of the sampling bottle 21 or damage to the screw thread of the sampling bottle 21 due to the sampling bottle 21 being caught at the cap 22.

Referring to FIG. 44, in the filling of the container with the chemicals (S30), the sampling bottle 21 may be transferred to a set position to fill the sampling bottle 21 with chemicals that need testing. Chemicals remaining in the sampling lines L1, L2, and L3 may be discharged before the sampling bottle 21 is filled with chemicals from the sampling lines L1, L2, and L3. The chemicals filled in the sampling lines L1, L2, and L3 may stagnate after a certain period of time, which is highly likely to cause precipitates to be generated or the chemicals to be contaminated through an open outlet. Accordingly, the reliability of chemical contamination analysis may be improved through drain work.

Here, since the second detection sensor 4224 is disposed in the holder module 4220 as illustrated in FIG. 42, when a detection signal is output from the second detection sensor 4224, the controller 4110 may determine that the chemicals are exposed to the outside and output a warning signal. Alternatively, the controller 5 4110 may output a warning signal when a detection signal is sensed by the second detection sensor 4224 disposed at a lower portion of the case 4100.

Referring to FIG. 45, in the coupling of the cap 22 to the container (S40), when the sampling bottle 21 is disposed at the lower portion of the attaching/detaching module 4300 in a state in which the sampling bottle 21 is filled 10 with chemicals, the grip portion 4310 may be lowered to place the cap 22 on an upper portion of the sampling bottle 21, and then the grip portion 4310 may rotate to couple the cap 22 to the sampling bottle 21.

Here, since the weight at which the grip portion 4310 presses the sampling bottle 21 may be reduced by the buffer portion 4350 as described above, the 15 sampling bottle 21 may sufficiently support the grip portion 4310.

Then, as the cap 22 and the sampling bottle 21 are coupled by rotation, the cap 22 is lowered, and the grip portion 4310 may be lowered along with the cap 22.

When the grip portion 4310 is lowered along with the cap 22 to a coupling completion position, the detection sensor 4371 may transmit a closing detection 20 signal to the controller 4110. Also, the torque measuring portion may measure a torque value of a motor of the rotating portion 4320 and transmit the measured torque value to the controller 4110.

When the torque value of the rotating portion 4320 is within a predetermined torque range, the controller 4110 may determine that the cap 22 is coupled to the 25 sampling bottle 21. When the torque value does not reach the predetermined torque

range, the controller 4110 may determine that the cap 22 is running idle without being coupled to the sampling bottle 21.

When a closing signal of the cap 22 is detected by the detection sensor 4371 and the torque value is within the predetermined range, the controller 4110 may
5 determine that the cap 22 is coupled to the sampling bottle 21.

Accordingly, when the cap closing signal is detected but the torque value does not reach the predetermined range, the controller 4110 may determine that the cap 22 is running idle without being coupled to the sampling bottle 21.

Also, when the torque value reaches the predetermined range but the cap
10 closing signal is not detected, the controller 4110 may determine that the cap 22 is erroneously fastened to the sampling bottle 21. In this case, the controller 4110 may output an error signal to the outside, and thus risks and accidents due to the cap 22 being unfastened may be prevented.

When the cap closing signal is detected and the torque value reaches the
15 predetermined range, the controller 4110 may separate the grip portion 4310 from the cap 22 and lift the attaching/detaching module 4300.

In the transferring of the container to the standby space, the sampling bottle 21 having the cap 22 coupled thereto may be transferred to the standby space, and an alarm signal may be output to the outside. Accordingly, the worker may open the
20 door 4103 and recover the sampling bottle 21.

The present disclosure has been described above on the basis of embodiments thereof, but the embodiments are merely examples and are not intended to limit the present disclosure. Those of ordinary skill in the art to which the present disclosure pertains should understand that various modifications and applications that are not
25 described herein are possible within the scope not departing from essential

characteristics of the present embodiments. For example, each element specifically described in the embodiments may be modified and embodied. Also, all differences relating to the modifications and applications should be interpreted as falling within the scope of the present disclosure defined by the attached claims.

5

[CLAIMS]

[Claim 1]

A chemical sampling device comprising:

a case in which a container having a cap fastened thereto is accommodated;

5 a cap attaching/detaching unit configured to selectively separate or fasten the container and the cap inside the case;

a sampling line configured to supply a chemical to the container separated from the cap inside the case;

10 an end cap member provided to be able to seal an outlet end of the sampling line; and

a moving unit configured to selectively move the end cap member so that the end cap member is located at a first position for sealing the outlet end or a second position for opening the outlet end.

[Claim 2]

15 The chemical sampling device of claim 1, wherein the end cap member rotates from the first position to the second position.

[Claim 3]

The chemical sampling device of claim 2, wherein the moving unit includes:

a driving portion; and

20 a rotating member configured to support the end cap member, rotate due to the driving portion, and move the end cap member from the first position to the second position.

[Claim 4]

The chemical sampling device of claim 3, wherein the rotating member horizontally rotates about an axis in a vertical direction and moves the end cap member from the first position to the second position.

5 [Claim 5]

The chemical sampling device of claim 1, further comprising a holder member configured to support the sampling line,

wherein the outlet end passes through the holder member and is exposed to a lower portion of the holder member, and at the first position, the end cap member is
10 disposed at the lower portion of the holder member to wrap around the outlet end.

[Claim 6]

The chemical sampling device of claim 5, wherein:

an accommodation groove is formed in an upper surface of the end cap member; and

15 when the end cap member is located at the first position, the outlet end is accommodated in the accommodation groove to be spaced apart from an inner wall surface of the accommodation groove.

[Claim 7]

The chemical sampling device of claim 5, wherein:

20 a protruding portion is formed to protrude from an upper surface of the end cap member that faces the lower portion of the holder member; and

a recessed portion that corresponds to the protruding portion is formed in the holder member.

[Claim 8]

The chemical sampling device of claim 6, further comprising a detection sensor provided in the accommodation groove and configured to detect a chemical spilling to the accommodation groove.

5 [Claim 9]

The chemical sampling device of claim 6, further comprising a first lifting/lowering unit configured to selectively lift/lower the holder member, which supports the sampling line, with respect to the end cap member.

[Claim 10]

10 The chemical sampling device of claim 9, wherein:

the first lifting/lowering unit moves the holder member so that the holder member moves from a lowering position at which the outlet end is disposed in the accommodation groove to a lifting position at which the outlet end is disposed outside the accommodation groove; and

15 the moving unit moves the end cap member in a state in which the outlet end is disposed at the lifting position.

[Claim 11]

The chemical sampling device of claim 10, wherein the first lifting/lowering unit includes:

20 a fixing block; and

a lifting/lowering member connected to the holder member and configured to move in an up-down direction with respect to the fixing block.

[Claim 12]

The chemical sampling device of claim 11, further comprising a support block connected to the lifting/lowering member,

wherein the holder member is supported by the support block.

5 [Claim 13]

The chemical sampling device of claim 10, further comprising a sealing member interposed between the holder member and the end cap member.

[Claim 14]

10 The chemical sampling device of claim 13, wherein, when the holder member moves to the lowering position, the sealing member is pressed between the holder member and the end cap member.

[Claim 15]

15 The chemical sampling device of claim 6, further comprising a second lifting/lowering unit configured to selectively lift/lower the moving unit with respect to the holder member supporting the sampling line.