

[DESCRIPTION]

[Invention Title]

APPARATUS AND METHOD FOR AUTOMATIC TRANSPORT OF
CHEMICAL CONTAINERS

5 [Technical Field]

The present disclosure relates to an apparatus and method for automatic transport of chemical containers, and more particularly, to an apparatus and method for automatic transport of chemical containers, the apparatus and method capable of, after inspecting chemical information of a chemical container to inspect whether the
10 chemical information of the chemical container matches chemical information required by a chemical supply device, automatically transporting the chemical container.

[Background Art]

Generally, in all companies that use hazardous chemicals, such as
15 pharmaceutical companies, paint companies, and companies that manufacture semiconductors, semiconductor equipment, liquid crystal displays (LCDs), and organic light-emitting diode (OLED) displays, various kinds of chemicals are used, and ways of safely supplying such chemicals are being diversified.

According to the type, amount of use, and process characteristics of the
20 chemicals, the chemicals are supplied in large quantities by tank lorry vehicles or supplied in small quantities while being held in containers having various volumes ranging from 20 to 1,000 L.

In general, the chemical containers are packaged in bundles on pallets that are movable by a forklift, a hand lift, or the like and shipped out from chemical
25 manufacturing plants, and when the chemical containers are unloaded using a forklift

at an entrance to a factory that uses chemicals, a worker uses a hand lift to take the chemical containers into the factory building.

Then, the worker wears safety gear and equipment such as chemical-resistant clothing and a gas mask and transfers as many chemical containers that can be
5 mounted on a cart which can be mounted on a chemical supply device.

Then, the worker opens a door of the chemical supply device to mount the cart, which has the chemical containers mounted thereon, on the chemical supply device. In this case, rollers may be installed on an upper portion of the cart and a floor inside the chemical supply device to allow only the chemical containers to be
10 mounted on the chemical supply device, or the chemical containers may be mounted on an outer portion, instead of the inner portion, of the chemical supply device.

Then, the worker connects a coupler with a nozzle to a chemical inlet/outlet of each chemical container inside the chemical supply device. After completing the connection of the coupler, the worker operates a chemical transport pump to
15 transport the chemicals of the chemical containers to the place of use. In this case, the worker may inject nitrogen gas into the chemical containers to transport the chemicals to the place of use under a predetermined pressure. The chemical containers that are empty due to the chemicals therein being used up through the above process are taken out in the reverse order of the above process.

20 Since the conventional chemical container transport method requires a worker to manually transport each container accommodating a chemical to the chemical supply device using a hand lift, a cart, or the like, there is a problem in that the worker's safety is threatened.

Korean Patent Publication No. 10-2017-0017958 has been disclosed as the
25 related art.

[Disclosure]

[Technical Problem]

The present disclosure is directed to providing an apparatus and method for automatic transport of chemical containers, the apparatus and method capable of automatically supplying a chemical container, of which chemical information is confirmed as that required by a chemical supply device, to the chemical supply device.

The present disclosure is also directed to providing an apparatus and method for automatic transport of chemical containers, the apparatus and method capable of varying an input position and a discharge position of the chemical containers using a transport car to facilitate the transport and discharge of the chemical containers.

The present disclosure is also directed to providing an apparatus and method for automatic transport of chemical containers, the apparatus and method capable of easily transporting and discharging a plurality of chemical containers, which accommodate a plurality of different chemicals, to and from a chemical supply device.

[Technical Solution]

One aspect of the present disclosure provides an apparatus for automatic transport of chemical containers, the apparatus including at least one transport line configured to transport a chemical container (2), which is input into an input unit (110), to a chemical supply device (5), a controller configured to control the chemical container (2), which is transported through the transport line, to be supplied to the chemical supply device (5), and a transport car (600) configured to deliver the chemical container (2) from the transport line to the chemical supply device (5) or from the chemical supply device (5) to the transport line.

An inspection unit (602) configured to check chemical information of the chemical container (2) may be provided in the transport car (600), and when the chemical information checked by the inspection unit (602) matches chemical information required by the chemical supply device (5), the controller may control
5 the chemical container (2) to be supplied to the chemical supply device (5).

The transport car (600) may be provided as a plurality of transport cars (600).

The plurality of transport cars (600) may include a first transport car configured to input the chemical container (2) to the chemical supply device (5) and a second transport car configured to discharge the chemical container (2) from the
10 chemical supply device (5) to the transport line.

The plurality of transport cars (600) may include a first transport car (600-1) configured to input and discharge a first chemical container, which accommodates a first chemical, to and from the chemical supply device (5) and a second transport car (600-2) configured to input and discharge a second chemical container, which
15 accommodates a second chemical, to and from the chemical supply device (5).

The chemical supply device (5) may include a first chemical supply device (5-1) and a second chemical supply device (5-2), and the plurality of transport cars (600) may include a first transport car (600-1) configured to input and discharge a first chemical container, which accommodates a first chemical, to and from the first
20 chemical supply device and a second transport car (600-2) configured to input and discharge a second chemical container, which accommodates a second chemical, to and from the second chemical supply device.

The chemical supply device (5) may be provided as a plurality of chemical supply devices (5), the chemical container (2) may be provided as a plurality of
25 chemical containers (2) that accommodate a plurality of different chemicals, and the

transport car (600) may input or discharge any one of the plurality of chemical containers (2) to or from any one of the plurality of chemical supply devices (5).

The transport car (600) may linearly move along a transport car rail (500) that is provided between the transport line and the chemical supply device (5) so as to be
5 parallel to at least a portion of the transport line and, at an input position, may deliver the chemical container (2) from the transport line to the chemical supply device (5) or, at a discharge position that is spaced apart from the input position along the transport car rail (500), may deliver the chemical container (2) from the chemical supply device (5) to the transport line.

10 A waiting place for the transport car (600) may be provided at both sides of the transport car rail (500) while the chemical supply device (5) is disposed therebetween.

The inspection unit (602) may include a chemical container scanner configured to scan chemical information on a surface of the chemical container (2).

15 A pallet (3) configured to be transported along the transport line in a state in which the chemical container (2) is loaded thereon may be provided, and the inspection unit (602) may include a chemical container scanner configured to scan chemical information on a surface of the pallet (3).

The transport car (600) may include a transport member (601) configured to
20 input the pallet (3), which has the chemical container (2) loaded thereon, to the chemical supply device (5) and a chemical base (603) provided at a lower portion of the transport member (601) to accommodate the chemical falling from the chemical container (2).

The transport car (600) may include a drain valve (605) configured to drain
25 the chemical accommodated in the chemical base (603).

The transport car (600) may include a chemical sensor configured to sense the chemical that falls into the chemical base (603).

5 A space in which the transport car (600) is stored and waits may be formed at one side end portion of the transport car rail (500) configured to move the transport car (600), and in a case in which the transport car (600) is stored and waits in the space, a safety bar including a safety sensor may be provided at an inlet side, through which the transport car (600) enters, to prevent collision with another transport car.

A safety sensor configured to sense detachment of the safety bar from a support base may be provided.

10 The transport car (600) may include a transport member (601) on which the pallet (3) having the chemical container (2) loaded thereon is loaded and a driving unit configured to drive the transport member (601) to transport the pallet (3) having the chemical container (2) loaded thereon to the chemical supply device (5) or to the transport line.

15 The transport car (600) may include an emergency stop switch (604) configured to stop the transport car (600) in case of emergency.

The emergency stop switch (604) may be provided as a plurality of emergency stop switches (604) on a frame (610) provided on the transport car (600).

20 A stopper (501) configured to prevent deviation of the transport car (600) from the transport car rail (500) may be provided at an end portion of the transport car rail (500).

The stopper (501) may include an impact absorbing unit to mitigate impact in a case in which collision of the transport car (600) occurs.

A sensor (502) configured to sense whether an object is present between both side end portions of the transport car rail (500) may be provided at an end portion of the transport car rail (500).

5 In a case in which an object is sensed by the sensor (502), the transport car (600) may be stopped.

In a case in which the transport line at the discharge position malfunctions, the chemical container (2) may be discharged from the chemical supply device (5) through the transport line at the input position.

10 In a case in which the transport line at the input position malfunctions, the chemical container (2) may be input to the chemical supply device (5) through the transport line at the discharge position.

The transport car (600) may linearly move along the transport car rail (500) that is provided between the transport line and the chemical supply device (5) so as to be parallel to at least a portion of the transport line, and the transport car rail (500)
15 may include a transport member driven by the driving unit and, in a case in which the transport member provided on the transport line is driven and transports the chemical container (2) in a direction toward the chemical supply device (5), the driving unit may be driven at the input position, which is disposed between the transport line and the chemical supply device (5), to deliver the chemical container (2) from the
20 transport line to the chemical supply device (5).

Another aspect of the present disclosure provides a method for automatic transport of chemical containers, the method including: a) putting a chemical container (2) into an input unit (110); b) transporting the chemical container (2) through at least one transport line; c) in order to deliver the chemical container (2)
25 from the transport line to a chemical supply device (5), placing a transport car (600),

which linearly moves along a transport car rail (500) provided to be parallel to at least a portion of the transport line, at an input position; and d) putting the chemical container (2) placed on the transport line into the chemical supply device (5) via the transport car (600).

- 5 The operation b) may further include checking chemical information of the chemical container (2) by an inspection unit provided on the transport line.

 The operation d) may include, when the chemical information checked by the inspection unit matches chemical information required by the chemical supply device (5), transporting the chemical container (2) placed on the transport line to the
10 chemical supply device (5).

 The chemical supply device (5) may include a plurality of chemical supply devices configured to supply a plurality of different kinds of chemicals, and the inspection unit may check whether the chemical information checked from the chemical container (2) is one of pieces of chemical information on the plurality of
15 different kinds of chemicals.

 The operation d) may include placing the chemical container (2), which is placed on the transport line, on the transport car (600), checking chemical information of the chemical container (2) using an inspection unit provided in the transport car (600), and, when the chemical information checked using the inspection
20 unit matches chemical information required by the chemical supply device (5), transporting the chemical container (2), which is placed on the transport line, to the chemical supply device (5).

 The checking of the chemical information of the chemical container (2) may include checking chemical information on a surface of a pallet that is transported
25 along the transport line while the chemical container (2) is loaded thereon.

The method may further include: e) when the chemical container (2) transported to the chemical supply device (5) is mounted inside the chemical supply device (5) and the chemical accommodated in the chemical container (2) is used up, discharging the chemical container (2) to the outside of the chemical supply device (5) and loading the chemical container (2) on the transport car (600) placed at the input position; f) in a state in which the chemical container (2) is loaded on the transport car (600), moving the transport car (600) along the transport car rail (500) to place the transport car (600) at a discharge position that is spaced apart from the input position; and g) mounting the chemical container (2), which is on the transport car (600) placed at the discharge position, on the transport line and then transporting the chemical container (2) along the transport line to discharge the chemical container (2) to the outside.

The chemical supply device (5) may include a first chemical supply device (5-1) configured to supply a first chemical and a second chemical supply device (5-2) configured to supply a second chemical, the transport car (600) may include a first transport car (600-1) configured to input a first chemical container, which accommodates the first chemical, to the first chemical supply device (5-1) and a second transport car (600-2) configured to input a second chemical container, which accommodates the second chemical, to the second chemical supply device (5-2), the operation c) may include placing the first transport car (600-1) at an input position of the first chemical supply device (5-1) or placing the second transport car (600-2) at an input position of the second chemical supply device (5-2), and the step d) may include transporting the first chemical container to the first chemical supply device (5-1) via the first transport car (600-1) or transporting the second chemical container to the second chemical supply device (5-2) via the second transport car (600-2).

The chemical container may be provided as a plurality of chemical containers that accommodate a plurality of different chemicals, the chemical supply device (5) may be provided as a plurality of chemical supply devices (5) to which the plurality of chemical containers are input, and in a case in which the transport car (600) is
5 provided as a plurality of transport cars (600), after one transport car inputs the plurality of chemical containers to the plurality of chemical supply devices, the plurality of chemical containers may be discharged from the plurality of chemical supply devices.

In the case in which the transport car (600) is provided as a plurality of
10 transport cars (600), the chemical container may be input to the chemical supply device (5) using at least one transport car, and the chemical container may be discharged from the chemical supply device (5) using another transport car.

The chemical supply device (5) may include a first chemical supply device (5-1) configured to supply a first chemical and a second chemical supply device (5-2)
15 configured to supply a second chemical, the transport car (600) may include a first transport car (600-1) and a second transport car (600-2), the chemical container may include a first chemical container accommodating the first chemical and a second chemical container accommodating the second chemical, the first transport car (600-1) may input the first chemical container to the first chemical supply device (5-1) and
20 input the second chemical container to the second chemical supply device (5-2), and the second transport car (600-2) may discharge the first chemical container from the first chemical supply device (5-1) and discharge the second chemical container from the second chemical supply device (5-2).

In a case in which the transport line at a discharge position, which is spaced
25 apart from the input position, malfunctions, the chemical container (2) may be

discharged from the chemical supply device (5) through the transport line disposed at the input position, or in the case in which the transport line at the discharge position malfunctions, the chemical container (2) may be discharged from the chemical supply device (5) through the transport line disposed at the input position.

5 Another aspect of the present disclosure provides a transport car for transporting chemical containers, the transport car including: a transport member driven by a driving unit to input a chemical container (2), which is placed on a transport line for transporting the chemical container (2) to the chemical supply device (5), to the chemical supply device (5) or to discharge the chemical container
10 (2) from the chemical supply device (5) onto the transport line; and a controller configured to control the transport car to move between an input position at which the chemical container (2) is input to the chemical supply device (5) and a discharge position at which the chemical container (2) inside the chemical supply device (5) is discharged onto the transport line.

15 An inspection unit configured to check chemical information on the chemical container (2) may be provided, and when the chemical information checked by the inspection unit matches chemical information required by the chemical supply device (5), the chemical container (2) may be input to the chemical supply device (5).

 The transport car may further include a transport member (601) configured to
20 input a pallet (3), on which the chemical container (2) is loaded, to the chemical supply device (5) and a chemical base (603) provided at a lower portion of the transport member (601) to accommodate the chemical falling from the chemical container (2).

 The transport car may include a transport member (601) on which a pallet (3),
25 on which the chemical container (2) is loaded, is loaded and a driving unit configured

to drive the transport member (601) to transport the pallet (3) having the chemical container (2) loaded thereon to the chemical supply device (5) or to the transport line.

The transport car may include an emergency stop switch (604) configured to stop the transport car in case of emergency.

5 [Advantageous Effects]

According to the present disclosure, since a chemical container, of which chemical information is confirmed as that required by a chemical supply device, can be automatically supplied to the chemical supply device, it is possible to reduce man-hours required for the supply of chemicals and to smoothly supply the chemicals.

10 Also, by varying an input position and a discharge position of the chemical containers using a transport car, it is possible to facilitate the input and discharge of the chemical containers.

Also, by including a plurality of transport cars, in a case in which one transport car malfunctions, another transport car may be used to facilitate the input
15 and discharge of the chemical containers.

In addition, a plurality of chemical containers accommodating a plurality of different chemicals can be easily transported to a plurality of chemical supply devices, each of which corresponds to one of the plurality of chemical containers, and used chemical containers can be promptly discharged.

20 [Description of Drawings]

FIG. 1 is a perspective view illustrating an apparatus for automatic transport of chemical containers according to the present disclosure.

FIG. 2 is a plan view of the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

FIG. 3 is a perspective view illustrating a state in which chemical containers and a pallet are input to an input unit of the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

FIG. 4 is a perspective view illustrating the input unit of the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

FIG. 5 is a perspective view illustrating a transport car and a transport car rail according to the present disclosure.

FIG. 6 is a perspective view of the transport car and the transport car rail illustrated in FIG. 5 that are viewed in a different direction.

FIG. 7 is a cross-sectional view illustrating a transport member and a chemical base that are provided in the transport car.

FIG. 8 is a plan view illustrating a case in which a chemical supply device and a transport car are provided as a plurality of chemical supply devices and a plurality of transport cars.

FIG. 9 is a plan view illustrating a path along which chemical containers and a pallet are input through an input unit and transported to a chemical supply device in the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

FIG. 10 is a plan view illustrating a path along which empty, used chemical containers are discharged from the chemical supply device and transported to a discharge unit in the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

FIG. 11 is a plan view illustrating a path along which the chemical containers and the pallet are input through the discharge unit and transported to the

chemical supply device in the apparatus for automatic transport of chemical containers that is illustrated in FIG. 1.

****Description of reference numerals****

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|----|--|----------------------------|
| | 1: apparatus for automatic transport of chemical containers | |
| 5 | 2: chemical container | |
| | 3: pallet | 4: forklift |
| | 5: chemical supply device | 6: pump unit |
| | 110: input unit | 111: transport member |
| | 120: first alignment unit | 130: first inspection unit |
| 10 | 140: first connection unit (first transport line connection unit) | |
| | 240: first connection unit (second transport line connection unit) | |
| | 150, 250: second connection unit | |
| | 160, 260: third connection unit | |
| | 210: discharge unit | 220: second alignment unit |
| 15 | 230: second inspection unit | 310: air shower unit |
| | 320, 420: fourth connection unit | |
| | 330, 430: fifth connection unit | |
| | 340, 440: sixth connection unit | 500: transport car rail |
| | 501: stopper | 502: ankle sensor |
| 20 | 510: safety bar | 520: support base |
| | 600: transport car | 601: transport member |
| | 602: third inspection unit | 603: chemical base |
| | 604: emergency stop switch | 605: drain valve |
| | 606a, 606b: bumper | |

25 [Modes of the Invention]

Hereinafter, an apparatus for automatic transport of chemical containers and a transport car for transporting the chemical containers according to the present disclosure will be described in detail with reference to the accompanying drawings.

The apparatus for automatic transport of chemical containers according to
5 the present disclosure will be described with reference to FIGS. 1 and 2. An automatic transport apparatus 1 for chemical containers according to the present disclosure includes one or more transport lines 100, 200, 300, and 400 configured to transport chemical containers 2, which are input to an input unit 110, to a chemical supply device 5, and a controller (not illustrated) that is configured to receive
10 chemical information of the chemical container 2 transported through the transport lines 100, 200, 300, and 400 and, when the received chemical information matches information required by the chemical supply device 5, control the chemical container 2 to be supplied to the chemical supply device 5.

The chemical container 2 is mounted inside the chemical supply device 5 in
15 a state in which the chemical container 2 is loaded on a pallet 3. When the chemical container 2 and the pallet 3 are mounted inside the chemical supply device 5, the chemical supply device 5 automatically opens a lid of the chemical container 2 and connects a coupler to the chemical container 2 to allow a chemical accommodated in the chemical container 2 to be supplied to a place of use of the
20 chemical. In this case, the chemical accommodated in the chemical container 2 may be transported to the place of use of the chemical due to being pressed by a transport pump or nitrogen gas. A pump unit 6 including the transport pump may be installed at one side of the chemical supply device 5.

A first inspection unit 130 configured to inspect the chemical information of
25 the chemical container 2 supplied from the input unit 110 may be provided on the

transport lines 100, 200, 300, and 400, and the controller may be configured to receive the chemical information from the first inspection unit 130.

The one or more transport lines 100, 200, 300, and 400 include a first transport line 100 that is connected to the input unit 110 and formed in a linear shape.

5 The first transport line 100 defines a path for transporting the pallet 3 on which the chemical container 2 is loaded. For transport of the chemical container 2 and the pallet 3, a transport member may be provided from the start to the end of the first transport line 100.

10 For example, the transport member may include a plurality of rollers provided in a longitudinal direction of the first transport line 100 and a roller driving unit configured to rotate the roller. The pallet 3 on which the chemical container 2 is loaded is mounted on the plurality of rollers, and the chemical container 2 and the pallet 3 are transported along the first transport line 100 due to rotation of the rollers.

15 Also, the transport member may include a conveyor belt instead of the rollers or may include a chain block in which a hoist with wheels attached to both sides of a monorail installed on a ceiling moves due to an electric motor.

 The transport member may be provided to be able to be driven in a forward direction and a reverse direction to allow two-way transport of the chemical container 2 and the pallet 3, and the transport member may be provided so that two-
20 way transport of the transport member is possible on all of the transport lines 100, 200, 300, and 400 which will be described below.

 Also, although objects being transported along the transport lines 100, 200, 300, and 400 are the chemical container 2 and the pallet 3 that are loaded vertically, hereinafter, for convenience of description, the objects being transported will be
25 referred to as chemical containers 2. However, when description of the pallet 3 is

necessary, the objects being transported will be referred to as the chemical containers 2 and the pallet 3.

The input unit 110, a first alignment unit 120, and the first inspection unit 130 may be sequentially provided in this order on the first transport line 100, and the
5 transport member is provided as a plurality of transport members on the first input unit 110, the first alignment unit 120, and the first inspection unit 130 in a transport direction to transport the chemical containers 2.

The input unit 110 is a site where the first transport line 100 begins and where a forklift 4 inputs the chemical containers 2 onto the first transport line 100.

10 Hereinafter, “rearward” refers to a direction opposite to an advancing direction in which the chemical containers 2 are transported on the first transport line 100, and “forward” refers to the advancing direction in which the chemical containers 2 are transported on the first transport line 100.

When a shutter (not illustrated) provided to a building is opened, the forklift
15 4 inputs the chemical containers 2 to the input unit 110 through an opening of the input guide.

The first alignment unit 120 is provided to, when the chemical containers 2 are transported in a state of being misaligned on the first transport line 100, align the misaligned chemical containers 2. In this case, the first alignment unit 120 may be
20 configured to align the chemical containers 2 to a central portion of the first transport line 100.

The first inspection unit 130 may inspect chemical information through a unique identifier such as a barcode label or a radio-frequency identification (RFID) tag that is attached to the chemical container 2. The unique identifier attached to
25 the chemical container 2 contains various necessary pieces of production information

as well as the name of a chemical. Also, the first inspection unit 130 may inspect a unique identifier such as a barcode label or an RFID tag that is attached to the pallet

3. The unique identifier attached to the pallet 3 also contains various necessary pieces of production information as well as the name of a chemical.

5 The first inspection unit 130 may scan the unique identifier to check the chemical information, and the controller may check, from the checked chemical information of the chemical container 2 and the pallet 3, whether the chemical is that required by the chemical supply device 5. In this case, the first inspection unit 130 may also be configured to scan a unique identifier attached to an upper surface of the
10 chemical container 2.

Also, the one or more transport lines 100, 200, 300, and 400 may include a second transport line 200 disposed adjacent to the first transport line 100 so as to be parallel thereto.

A discharge unit 210, a second alignment unit 220, and a second inspection
15 unit 230 are sequentially provided in this order on the second transport line 200. The transport member is provided as a plurality of transport members on the discharge unit 210, the second alignment unit 220, and the second inspection unit 230 in a transport direction to transport the chemical containers 2. In this case, the transport member may be rotated to allow two-way transport of the chemical
20 containers 2 along the second transport line 200.

The discharge unit 210 is provided to transport used chemical containers 2 from the chemical supply device 5 through the second transport line 200 and then discharge the chemical containers 2 to the outside. The discharge unit 210 may be provided to be adjacent to a side portion of the input unit 110.

When the chemical containers 2 are transported to the discharge unit 210, from the rear of the discharge unit 210, the forklift 4 lifts the pallet 3 on which the chemical containers 2 are loaded to discharge the chemical containers 2 to the outside.

5 Meanwhile, when a problem such as a failure occurs in the input unit 110 or the first transport line 100, it is not possible to input the chemical containers 2 through the input unit 110. In this case, the discharge unit 210 may serve as the input unit, and the chemical containers 2 may be input through the discharge unit 210. Conversely, when a problem such as a failure occurs in the discharge unit 210 or the
10 second transport line 200, the chemical containers 2 may be configured to be discharged through the input unit 110.

 The second alignment unit 220 performs the same function as the first alignment unit 120. Therefore, when the chemical containers 2 input through the discharge unit 210 are transported in a state of being misaligned, in order to align the
15 misaligned chemical containers 2, the second alignment unit 220 may be configured to align the chemical containers 2 to a central portion of the second transport line 200. Also, even when discharging the used chemical containers 2 through the discharge unit 210, the chemical containers 2 may be discharged after being aligned by the second alignment unit 220. The second alignment unit 220 may be provided to be
20 adjacent to a side portion of the first alignment unit 120.

 The second inspection unit 230 inspects chemical information of the chemical container 2 when the chemical container 2 is input through the discharge unit 210. The second inspection unit 230 may have the same configuration as the first inspection unit 130.

A plurality of connection units 140, 150, 160, 240, 250, and 260 may be provided on the first transport line 100 and the second transport line 200 to connect the first transport line 100 and the second transport line 200.

The plurality of connection units 140, 150, 160, 240, 250, and 260 may
5 include first connection units 140 and 240 configured to connect the first inspection unit 130 and the second inspection unit 230, second connection units 150 and 250 provided at positions that correspond to a third transport line 300 which will be described below, and third connection units 160 and 260 that are provided at positions that correspond to a fourth transport line 400 which will be described below,
10 i.e., at end portions of the first transport line 100 and the second transport line 200.

The first connection units 140 and 240, the second connection units 150 and 250, and the third connection units 160 and 260 may respectively include the first connection unit 140, the second connection unit 150, and the third connection unit 160 that are provided on the first transport line 100 and respectively include the first
15 connection unit 240, the second connection unit 250, and the third connection unit 260 that are provided on the second transport line 200.

A transport member, such as a roller, may be provided as a plurality of transport members on the first connection unit 140 (first transport line connection unit) of the first transport line 100 and the first connection unit 240 (second transport
20 line connection unit) of the second transport line 200 in a direction perpendicular to a transport direction of the first transport line 100 and the second transport line 200 so that, when the transport members are driven, the chemical containers 2 mounted on the transport members of the first transport line connection unit 140 are transported in a direction toward the second transport line 200 and mounted on the second
25 transport line connection unit 240.

For example, when, as a result of the first inspection unit 130 checking chemical information of the chemical container 2 transported from the input unit 110, the chemical contained in the chemical container 2 is not a chemical required by the chemical supply device 5 and thus it is determined that the chemical container 2 has
5 been input mistakenly, a transport direction of the chemical container 2 may be switched to transport the chemical container 2 on the first transport line connection unit 140 to the second transport line connection unit 240 and then discharge the chemical container 2 through the discharge unit 210. The chemical container 2 may also be transported in a direction opposite thereto.

10 The second connection units 150 and 250 and the third connection units 160 and 260 may also have the same configuration as the first connection units 140 and 240 and may transport the chemical container 2 from the first transport line 100 toward the second transport line 200 or from the second transport line 200 toward the first transport line 100.

15 When the chemical container 2 is input to the second transport line 200 through the discharge unit 210, the chemical container 2 is inspected by the second inspection unit 230, passes through the first transport line 100 in a width direction thereof through the second connection units 150 and 250, and then is transported to the third transport line 300.

20 The third transport line 300 is connected perpendicular to the first transport line 100 and is connected to the second connection units 150 and 250.

The fourth transport line 400 is disposed adjacent to an end portion of the first transport line 100 so as to be parallel to the third transport line 300, is connected perpendicular to the first transport line 100, and is connected to the third connection
25 units 160 and 260.

The third transport line 300 and the fourth transport line 400 may also have the transport members provided from a start to an end of each transport line for transport of the chemical containers 2 and the pallet 3. Foreign matter on outer portions of the chemical containers 2 and the pallet 3 may interfere with transporting
5 the chemical containers 2 and the pallet 3 along a transport line or with removing or refitting a lid of each chemical container in the chemical supply device 5 and may cause malfunction or affect purity of a chemical. Therefore, an air shower unit 310 may be provided on the third transport line 300 to remove the foreign matter on the chemical containers 2 and the pallet 3.

10 When the chemical container 2 enters the air shower unit 310 through the second connection unit 150 of the first transport line 100, air may be ejected from the air shower unit 310 for a predetermined amount of time to remove the foreign matter on the chemical container 2 and the pallet 3.

One or more buffer units 301, 302, 303, and 304 are provided on the
15 transport lines 100, 200, 300, and 400 to allow the chemical container 2, which passed through the first inspection unit 130, to temporarily wait before being supplied to the chemical supply device 5.

In the present embodiment, the buffer units 301, 302, 303, and 304 are provided on the third transport line 300 and the fourth transport line 400.

20 The buffer units 301, 302, 303, and 304 include a first buffer unit 301 and a second buffer unit 302 that are provided on the third transport line 300 and a third buffer unit 303 and a fourth buffer unit 304 that are provided on the fourth transport line 400.

The first buffer unit 301 and the fourth buffer unit 304 are provided at
25 positions facing each other so as to be adjacent to each other, and the second buffer

unit 302 and the third buffer unit 303 are provided at positions facing each other so as to be adjacent to each other.

A chemical container input port 331 is provided between the first buffer unit 301 and the second buffer unit 302 to input the chemical container 2 to the chemical supply device 5. The chemical container input port 331 refers to a position at which the chemical container 2 is input, and a fifth connection unit 330, which will be described below, may serve as the chemical container input port 331.

Also, a chemical container discharge port 341 may be provided to discharge the chemical container 2, which is discharged from the chemical supply device 5, to the third transport line 300. The chemical container discharge port 341 refers to a position at which the chemical container 2 is discharged, and a sixth connection unit 340, which will be described below, may serve as the chemical container discharge port 341.

Two or more connection units 320 and 420, 330 and 430, and 340 and 440 are provided between the third transport line 300 and the fourth transport line 400 to allow the chemical container 2 to be transported from the third transport line 300 to the fourth transport line 400 or from the fourth transport line 400 to the third transport line 300.

The two or more connection units 320 and 420, 330 and 430, and 340 and 440 include fourth connection units 320 and 420 configured to connect sides of the third transport line 300 and the fourth transport line 400 that are close to the first transport line 100 and sixth connection units 340 and 440 configured to connect end portions of the third transport line 300 and the fourth transport line 400 that are far from the first transport line 100.

In this case, the chemical container 2 used in the chemical supply device 5 is withdrawn from the chemical supply device 5 and then transported to the sixth connection unit 340 of the third transport line 300 through a transport car 600 which will be described below, and the chemical container 2 on the sixth connection unit 5 340 is transported to the sixth connection unit 440 of the fourth transport line 400. In this way, the sixth connection units 340 and 440 are used to move the chemical container 2 from the fourth transport line 300 to the fourth transport line 400.

Meanwhile, the fourth connection units 320 and 420 are used to supply the chemical container 2, which temporarily waits in the buffer units 303 and 304 10 provided on the fourth transport line 400, to the chemical supply device 5 through the third transport line 300. That is, the chemical container 2 in the third buffer unit 303 or the fourth buffer unit 304 is transported from the fourth transport line 400 to the third transport line 300 through the fourth connection units 320 and 420, is transported to the position of the chemical container input port 331 along the third 15 transport line 300, and then is input to the chemical supply device 5.

The sixth connection units 340 and 440 are used to move the chemical container 2 used in the chemical supply device 5 from the third transport line 300 to the fourth transport line 400. That is, the chemical container 2 inside the chemical supply device 5 is transported to the sixth connection unit 340 of the third transport 20 line 300 and then transported to the sixth connection unit 440 of the fourth transport line 400. The chemical container 2 transported to the sixth connection unit 440 is sequentially transported along the fourth transport line 400, the third connection units 160 and 260, and the second transport line 200 and then discharged through the discharge unit 210.

Fifth connection units 330 and 430 may be provided between the fourth connection units 320 and 420 and the sixth connection units 340 and 440. When the chemical container 2 in the chemical supply device 5 is not able to be transported through the sixth connection units 340 and 440 due to a failure or the like thereof, the
5 chemical container 2 used in the chemical supply device 5 may be transported to the fourth transport line 400 through the fifth connection units 330 and 430.

That is, when a failure occurs in a transport line disposed at the discharge position, the chemical container 2 may be discharged from the chemical supply device 5 through a transport line disposed at the input position. Conversely, when a
10 failure occurs in a transport line disposed at the input position, the chemical container 2 may be input to the chemical supply device 5 through a transport line disposed at the discharge position.

The fifth connection unit 330 provided on the third transport line 300 may serve as the chemical container input port 331 configured to input the chemical
15 container 2 to the chemical supply device 5.

A first driving unit configured to transport the chemical container 2 in a direction toward the third transport line 300 and a second driving unit configured to transport the chemical container 2 in a direction toward the chemical supply device 5, which is a direction perpendicular to the third transport line 300, may be provided at
20 the fifth connection unit 330.

The first driving unit may include the above-mentioned transport members such as rollers. The second driving unit may move in a vertical direction between the transport members, and when the chemical container 2 is disposed on the fifth connection unit 330, the second driving unit may be driven to lift the chemical

container 2 upward from transport member of the first driving unit and then transport the chemical container 2 in a direction toward the chemical supply device 5.

Meanwhile, transport members such as rollers are provided at the above-described first to third connection units 140 and 240, 150 and 250, and 160 and 260
5 to allow two-way transport of the chemical container 2, that is, transport of the chemical container 2 in a direction from the first transport line 100 to the second transport line 200 and in a direction opposite thereto. The transport members such as rollers are also provided at the fourth to sixth connection units 320 and 420, 330 and 430, and 340 and 440 to allow two-way transport of the chemical container 2,
10 that is, transport of the chemical container 2 in a direction from the third transport line 300 to the fourth transport line 400 and in a direction opposite thereto.

When the plurality of buffer units 301, 302, 303, and 304 are provided on the third transport line 300 and the fourth transport line 400 as described above, since it is possible to secure a large quantity of chemical containers 2 to be input to the
15 chemical supply device 5, it is possible to immediately meet the demand for chemicals required by the chemical supply device 5.

Also, since the plurality of connection units 320 and 420, 330 and 430, and 340 and 440 are provided between the third transport line 300 and the fourth transport line 400, and thus it is possible to simultaneously perform an operation of
20 inputting the chemical container 2 to the chemical supply device 5 and an operation of discharging the chemical container 2 from the chemical supply device 5, the process time is reduced.

Also, by allowing the chemical container 2 to temporarily wait on the transport lines 300 and 400, continuous transport of the chemical container 2 is
25 possible without needing to provide a separate waiting place.

Also, by forming the transport lines 100, 200, 300, and 400 for transporting the chemical container 2 vertically and allowing the transport direction to be switched, an area occupied by the automatic transport apparatus 1 for chemical containers and the size of the apparatus may be reduced.

5 Meanwhile, when the chemical container 2 is transported along the first to fourth transport lines 100, 200, 300, and 400, the position of the chemical container 2 may be checked in real time by a sensor (not illustrated) provided on the transport line. In other words, when chemical information of a single chemical container 2 is checked by the first inspection unit 130, since the real-time position of the chemical
10 container 2, of which the chemical information is checked, is sensed by the sensor provided on the transport line, it is also possible to check chemical information of the chemical container 2 temporarily waiting in the buffer units 301, 302, 303, and 304. Therefore, in order to transport the chemical container 2 required by the chemical supply device 5, chemical information of the chemical container 2 temporarily
15 waiting in the buffer units 301, 302, 303, and 304 may be checked, and the checked chemical container 2 may be input to the chemical supply device 5.

 Through an unmanned transport car 600, the chemical container 2 may be input to the chemical supply device 5, or an empty, used chemical container 2 may be discharged from the chemical supply device 5. Operation control of the
20 transport car 600 may be performed by the controller.

 To this end, a transport car rail 500 may be provided between the chemical supply device 5 and the third transport line 300 to allow the transport car 600 to reciprocate.

In the present disclosure, the transport car rail 500 is provided, but the transport car 600 may also be configured to travel along a line drawn on a floor or travel according to set coordinates.

5 A transport member 601 such as a roller may be provided on the transport car 600 to input the chemical container 2 mounted thereon into the chemical supply device 5 or to discharge the chemical container 2 from inside the chemical supply device 5 to the outside. The transport member 601 may be rotated by a driving unit (not illustrated). The transport member 601 may be formed of a conveyor belt instead of a roller. When the transport member 601 is driven by the driving unit,
10 the chemical containers 2 and the pallet 3 that are loaded on the transport member 601 are transported to the chemical supply device 5 or to the third transport line 300, which is the opposite direction.

The configuration of the input unit 110 will be described in detail with reference to FIGS. 3 and 4.

15 A transport member 111, on which the pallet 3 having the chemical containers 2 loaded thereon is mounted, is provided in the input unit 110. The transport member 111 is formed as a roller, and the roller is provided as a plurality of rollers along the first transport line 100.

Fork insertion units 3a passing through in the transport direction are formed
20 in the pallet 3, and a fork that protrudes forward from the forklift 4 may be inserted into the fork insertion units 3a and then lifted to transport the pallet 3 and the chemical containers 2.

The input unit 110 includes the transport member 111 formed of the plurality of rollers that rotate by a driving unit (not illustrated), a pair of side frames 112-1 and
25 112-2 configured to support both sides of the transport member 111, support frames

113-1 and 113-2 configured to support side portions or lower portions of the side frames 112-1 and 112-2, and an inlet frame 114 provided at an inlet side of the input unit 110.

5 The transport member 111 provided in the input unit 110 and the driving unit configured to rotate the transport member 111 may be identically provided throughout sections of the first to fourth transport lines 100, 200, 300, and 400.

The configuration of the transport car 600 and the transport car rail 500 will be described with reference to FIGS. 5 to 7.

10 A third inspection unit 602 configured to check chemical information of the chemical container 2 may be provided on the transport car 600. The third inspection unit 602 scans a surface of the chemical container 2 or the pallet 3 loaded on the transport member 601 of the transport car 600 and transmits the chemical information checked by the scanning to the controller.

15 When the chemical information checked by the third inspection unit 602 matches chemical information required by the chemical supply device 5, the controller controls the chemical container 2 and the pallet 3 to be input to the chemical supply device 5.

20 A pair of frames formed in an upside-down U-shape and an upper frame 610 formed of a connecting frame configured to connect the pair of frames may be provided in the transport car 600.

An emergency stop switch 604 configured to stop the transport car 600 in case of emergency is provided at four corners of the upper frame 610 of the transport car 600. When the emergency stop switch 604 is provided at the four corners of the upper frame 610, prompt action may be taken in case of emergency.

A first bumper 606a and a second bumper 606b configured to mitigate impact when collision occurs may be respectively provided at front and rear portions of the transport car 600. Also, a collision sensor (not illustrated) configured to sense collision may be provided to the first bumper 606a and the second bumper
5 606b.

As illustrated in FIG. 7, a chemical base 603 configured to prevent leaking of a chemical to the outside when the leaking occurs is provided at a lower portion of the transport member 601. A drain valve 605 configured to discharge the chemical accommodated inside the chemical base 603 is provided at one side of the chemical
10 base 603.

A chemical sensor (not illustrated) configured to sense a falling chemical may be provided inside the chemical base 603. The transport car 600 may be configured to be stopped when a chemical is sensed by the chemical sensor.

A stopper 501 configured to prevent deviation of the transport car 600 from
15 the transport car rail 500 may be provided at an end portion of the transport car rail 500.

An impact absorbing unit may be provided in the stopper 501 to mitigate impact when collision of the transport car 600 occurs. The stopper 501 may be provided as a pair of stoppers 501 that are spaced a predetermined distance apart
20 from each other.

Also, a sensor 502 may be provided between the pair of stoppers 501. The sensor 502 may be configured to sense whether an object is present on the transport car rail 500 and, when the object is sensed, stop the transport car 600. For example, when a worker is on the transport car rail 500, the sensor 502 may sense an ankle of
25 the worker and stop the transport car 600 to prevent an accident.

Also, the sensor 502 may include a light emitting unit provided at one side end portion of the transport car rail 500 and a light receiving unit provided at the other side end portion of the transport car rail 500 and, when a worker's body is disposed between the light emitting unit and the light receiving unit, sense the worker's body.

The transport car 600 may be provided as a single transport car 600 or may be provided as a plurality of transport cars 600 on the transport car rail 500 to deal with a failure.

When the transport car 600 is provided as a single transport car 600, the chemical container 2 disposed on the chemical container input port 331 is input to the chemical supply device 5 through the transport car 600, and an empty chemical container 2 inside the chemical supply device 5 is discharged to the chemical container discharge port 341 through the transport car 600.

When the transport car 600 is provided as a plurality of transport cars 600, transport cars 600-1 and 600-2 may be respectively provided at both side end portions of the transport car rail 500.

In a case in which two or more transport cars 600-1 and 600-2 are provided as described above, a space may be provided to, when a failure occurs in one of the transport cars, store and repair the transport car. The space in which repair may take place may be disposed at one side end portion of the transport car rail 500. When storing a failed transport car 600 in the space, a safety bar 510 having a safety sensor configured to, when collision of the transport car 600 occurs, sense the collision may be installed at an inlet side of the space through which the transport car 600 enters, and another transport car 600 may be prevented from entering the space when the safety bar 510 is locked.

Also, the safety bar 510 may be installed as two or more safety bars 510 in a vertical direction between a pair of support bases 520 installed in a vertical direction, and when a worker drops the safety bar 510 due to carelessness, the safety sensor may sense this and stop the transport car 600 that is traveling.

5 FIG. 8 is a view illustrating a case in which the transport car 600 and the chemical supply device 5 are provided as a plurality of transport cars 600 and a plurality of chemical supply devices 5.

When the transport car 600 is provided as a plurality of transport cars 600, the transport cars 600 may be used separately for input and discharge of the chemical
10 containers 2. That is, the plurality of transport cars 600 may include a first transport car 600-1 configured to input the chemical container 2 to the chemical supply device 5 and a second transport car 600-2 configured to discharge the chemical container 2 from the chemical supply device 5 to the transport line. To this end, the first transport car 600-1 may wait at a position close to the chemical container input port
15 331, and the second transport car 600-2 may wait at a position close to the chemical container discharge port 341.

Also, the transport car 600 may be provided as a plurality of transport cars 600 to input or discharge different chemicals to or from the chemical supply device 5. That is, the plurality of transport cars 600 may include a first transport car 600-1
20 configured to input or discharge a first chemical container accommodating a first chemical to or from the chemical supply device 5 and a second transport car 600-2 configured to input or discharge a second chemical container accommodating a second chemical to or from the chemical supply device 5.

In this case, the chemical supply device 5 may include a first chemical
25 supply device 5-1 to which the first chemical container accommodating the first

chemical is input and a second chemical supply device 5-2 to which the second chemical container accommodating the second chemical is input.

Of course, other chemical supply devices configured to supply chemicals other than the first chemical and the second chemical may be further provided.

5 The first transport car 600-1 may be configured to input the first chemical container to the first chemical supply device 5-1, and the second transport car 600-2 may be configured to input the second chemical container to the second chemical supply device 5-2.

10 Although FIG. 8 illustrates a case in which the second chemical supply device 5-2 is provided adjacent to the chemical container discharge port 341, the present disclosure is not limited thereto, and the second chemical supply device 5-2 may be provided at various other positions such as at a portion between the chemical container input port 331 and the chemical container discharge port 341.

15 When the second chemical container is input to the second chemical supply device 5-2, a portion between the second chemical supply device 5-2 and the third transport line 300 becomes an input position.

20 Meanwhile, in another embodiment of the apparatus for automatic transport of chemical containers according to the present disclosure, in a case in which a failure occurs in one of the two transport cars 600-1 and 600-2, the other transport car may be used to input a plurality of chemical containers to a plurality of chemical supply devices and to discharge the plurality of chemical containers from the plurality of chemical supply devices.

25 That is, the chemical container is provided as a plurality of chemical containers each accommodating a different chemical, and the chemical supply device 5 is provided as a plurality of chemical supply devices 5-1 and 5-2 to which the

plurality of chemical containers are respectively input. When the transport car 600 is provided as a plurality of transport cars 600, one transport car 600-1 of the plurality of transport cars 600-1 and 600-2 may be configured to respectively input the plurality of chemical containers to the plurality of chemical supply devices 5-1 and 5-2 and then respectively discharge the plurality of chemical containers from the plurality of chemical supply devices 5-1 and 5-2.

Also, in another embodiment, when the transport car 600 is provided as a plurality of transport cars 600, at least one transport car may be used to input the chemical container to the chemical supply device 5, and the other transport car may be used to discharge the chemical container from the chemical supply device 5. In this case, the chemical container and the chemical supply device 5 may be provided as a plurality of chemical containers and a plurality of chemical supply devices 5.

This will be described in more detail. The chemical supply devices 5 include a first chemical supply device 5-1 configured to supply a first chemical and a second chemical supply device 5-2 configured to supply a second chemical. Also, the transport cars 600 include a first transport car 600-1 and a second transport car 600-2. Also, the chemical containers include a first chemical container accommodating the first chemical and a second chemical container accommodating the second chemical. In this case, the first transport car 600-1 is for input of the chemical containers and inputs the first chemical container to the first chemical supply device 5-1 and inputs the second chemical container to the second chemical supply device 5-2. The second transport car 600-2 is for discharge of the chemical containers and discharges the first chemical container from the first chemical supply device 5-1 and discharges the second chemical container from the second chemical supply device 5-2.

A transport path when the chemical containers 2 and the pallet 3 are input through the input unit 110 will be described with reference to FIG. 9.

When the forklift 4 inputs the chemical containers 2 to the input unit 110, the chemical containers 2 are transported along the first transport line 100 due to driving
5 of the transport member.

The chemical containers 2 are aligned by the first alignment unit 120. Then, the first inspection unit 130 inspects chemical information of the chemical containers 2 and whether positions of the chemical containers 2 are abnormal, and when there is no abnormality as a result of the inspection, the chemical containers 2 are transported
10 along the first transport line 100, and when an abnormality is found, an alarm is generated so that a worker re-checks the chemical containers 2. When, after re-checking the chemical containers 2, the worker decides to return the corresponding chemical containers 2 and the pallet 3, the chemical containers 2 and the pallet 3 are transported from the first transport line connection unit 140 to the second transport
15 line connection unit 240, transported to the discharge unit 210 along the second transport line 200, and then returned to the forklift 4.

In a case in which a portion of the chemical container 2 from which an abnormality is found by the first inspection unit 130 is checked and then handled by the worker, when the chemical container 2 is re-inspected by the first inspection unit
20 130 and an abnormality is not found, the chemical container 2 is transported along the first transport line 100.

The chemical container 2 that is confirmed by the first inspection unit 130 as not having any abnormality is transported to the air shower unit 310 after a transport direction of the chemical container 2 is rotated 90° at the second connection unit 150.

In the air shower unit 310, air is ejected for a predetermined amount of time to remove foreign matter on outer portions of the chemical container 2 and the pallet 3.

The chemical containers 2 that passed through the air shower unit 310 are transported to any one of the first to fourth buffer units 301, 302, 303, and 304 to
5 wait temporarily.

When chemicals in the chemical containers 2 input to the chemical supply device 5 are used up, the controller drives the transport members of the third transport line 300 and the fourth transport line 400 to input the chemical containers 2 waiting in the buffer units 301, 302, 303, and 304 to the chemical supply device 5.

10 In this case, since the chemicals in the chemical containers 2 waiting in the first to fourth buffer units 301, 302, 303, and 304 may be hardened over a long period of time, it is preferable that, among the plurality of chemical containers 2, the first chemical container 2 transported to the buffer units 301, 302, 303, and 304 is input to the chemical supply device 5.

15 To this end, the chemical containers 2 transported after passing through the air shower unit 310 are sequentially transported to the first buffer unit 301, the second buffer unit 302, the third buffer unit 303, and the fourth buffer unit 304 and wait therein.

Then, when it is necessary to input the chemical container 2 to the chemical
20 supply device 5, the chemical container 2 in the fourth buffer unit 304 is input first. The chemical container 2 in the fourth buffer unit 304 sequentially passes through the fourth connection units 320 and 420 and the first buffer unit 301 and then is transported to the fifth connection unit 330.

The fifth connection unit 330 serves as the chemical container input port 331
25 and is disposed at the input position, which is between the chemical supply device 5

and the chemical container input port 331, so that the transport car 600 is adjacent to the chemical container input port 331.

At the fifth connection unit 330, the second driving unit is driven to transport the chemical container 2 in a direction toward the chemical supply device 5, which is
5 a direction perpendicular to the third transport line 300, and place the chemical container 2 on the transport car 600.

In this case, in the transport car 600, the third inspection unit 602 may be used to check chemical information of the chemical container 2 and the pallet 3.

When the chemical information checked by the third inspection unit 602
10 matches chemical information required by the chemical supply device 5, the transport member 601 of the transport car 600 is rotated to input the chemical container 2 into the chemical supply device 5.

When the chemical container 2 is mounted inside the chemical supply device 5, the chemical supply device 5 opens a lid of the chemical container 2 and connects
15 a coupler to the chemical container 2 to supply a chemical accommodated in the chemical container 2 to a place of use of the chemical.

A transport path when an empty, used chemical container 2 is discharged from the chemical supply device to the discharge unit 210 will be described with reference to FIG. 10.

20 When an empty, used chemical container 2 is transported from the chemical supply device 5, the transport car 600 is disposed between the chemical supply device 5 and the fifth connection unit 330, and the empty chemical container 2 is loaded on the transport member 601 of the transport car 600.

The transport car 600 on which the chemical container 2 is loaded moves from a position of the fifth connection unit 330, which is the input position, to positions of the sixth connection units 340 and 440, which are discharge positions.

5 The chemical container 2 loaded on the transport car 600 is sequentially transported from the transport car 600 to the sixth connection unit 340 of the third transport line 300 and the sixth connection unit 440 of the fourth transport line 400.

The chemical container 2 is transported along the fourth transport line 400 after a transport direction of the chemical container 2 is switched at the sixth connection unit 440, and then the chemical container 2 is placed on the second
10 transport line 200 through the third connection units 160 and 260. Also, the chemical container 2 is transported along the second transport line 200 after a transport direction of the chemical container 2 is switched at the third connection unit 260, and then the chemical container 2 is loaded on the forklift 4 through the discharge unit 210.

15 A transport method when the chemical supply device 5 includes the first chemical supply device 5-1 and the second chemical supply device 5-2 and the transport car 600 includes the first transport car 600-1 and the second transport car 600-2 will be described.

First, the first transport car 600-1 is placed at the input position of the first
20 chemical supply device 5-1, or the second transport car 600-2 is placed at the input position of the second chemical supply device 5-2. In this case, the first transport car 600-1 and the second transport car 600-2 may be configured to be simultaneously placed at the respective input positions, or any one of the two may be configured to be placed at the corresponding input position first. Also, only one of the first

transport car 600-1 and the second transport car 600-2 may be configured to be placed at the corresponding input position.

Then, the first chemical container is transported to be loaded on the first transport car 600-1, chemical information of the first chemical container is checked
5 in the first transport car 600-1, and then the first chemical container is transported to the first chemical supply device 5-1. Also, the second chemical container is transported to be loaded on the second transport car 600-2, chemical information of the second chemical container is checked in the second transport car 600-2, and then the second chemical container is transported to the second chemical supply device 5-
10 2.

A transport path when the chemical containers 2 and the pallet 3 are input through the discharge unit 210 will be described with reference to FIG. 11.

When it is not possible to transport the chemical containers 2 through the input unit 110 or the first transport line 100, the chemical containers 2 are input to
15 the discharge unit 210.

The chemical containers 2 in the discharge unit 210 are aligned by the second alignment unit 220. Then, the second inspection unit 230 inspects chemical information of the chemical containers 2 and whether positions of the chemical containers 2 are abnormal, and when there is no abnormality as a result of the
20 inspection, the chemical containers 2 are transported along the second transport line 200. The second inspection unit 230 may be provided in case of emergency when an abnormality occurs in the input unit 110.

The chemical container 2 that is confirmed by the second inspection unit 230 as not having any abnormality is transported to the air shower unit 310 after a
25 transport direction of the chemical container 2 is rotated 90° at the second connection

unit 250 and the chemical container 2 passes through the second connection unit 150 of the first transport line 100. In the air shower unit 310, air is ejected for a predetermined amount of time to remove foreign matter on outer portions of the chemical container 2 and the pallet 3.

5 Since the process by which the chemical container 2 that passed through the air shower unit 310 is input to the chemical supply device 5 is the same as that described above with reference to FIG. 9, description thereof will be omitted.

 According to the present disclosure, since the chemical container 2, of which chemical information is confirmed as that required by the chemical supply device 5,
10 may be automatically supplied to the chemical supply device 5, it is possible to reduce man-hours required for the supply of chemicals and to smoothly supply the chemicals. Also, by varying an input position and a discharge position of the chemical containers 2 using the transport car 600, it is possible to facilitate the input and discharge of the chemical containers. Also, by including the plurality of
15 transport cars 600-1 and 600-2, in a case in which one transport car malfunctions, the other transport car may be used to facilitate the input and discharge of the chemical containers. In addition, a plurality of chemical containers accommodating a plurality of different chemicals may be easily transported to a plurality of chemical supply devices 5-1 and 5-2, each of which corresponds to one of the plurality of
20 chemical containers, and used chemical containers may be promptly discharged.

 Exemplary embodiments of the present disclosure have been described above in detail, but the present disclosure is not limited to the above-described embodiments. The present disclosure may be modified and embodied in various other ways within the scope of the claims, the detailed description, and the

accompanying drawings, and such modifications also belong to the present disclosure,

[CLAIMS]

[Claim 1]

An apparatus for automatic transport of chemical containers, the apparatus comprising:

5 at least one transport line configured to transport a chemical container (2), which is input into an input unit (110), to a chemical supply device (5);

 a controller configured to control the chemical container (2), which is transported through the transport line, to be supplied to the chemical supply device (5); and

10 a transport car (600) configured to deliver the chemical container (2) from the transport line to the chemical supply device (5) or from the chemical supply device (5) to the transport line.

[Claim 2]

 The apparatus of claim 1, wherein an inspection unit (602) configured to
15 check chemical information of the chemical container (2) is provided in the transport car (600), and when the chemical information checked by the inspection unit (602) matches chemical information required by the chemical supply device (5), the controller controls the chemical container (2) to be supplied to the chemical supply device (5).

20 [Claim 3]

 The apparatus of claim 1, wherein the transport car (600) is provided as a plurality of transport cars (600).

[Claim 4]

 The apparatus of claim 3, wherein the plurality of transport cars (600)
25 include:

a first transport car configured to input the chemical container (2) to the chemical supply device (5); and

a second transport car configured to discharge the chemical container (2) from the chemical supply device (5) to the transport line.

5 [Claim 5]

The apparatus of claim 3, wherein the plurality of transport cars (600) include:

a first transport car (600-1) configured to input and discharge a first chemical container, which accommodates a first chemical, to and from the chemical supply
10 device (5); and

a second transport car (600-2) configured to input and discharge a second chemical container, which accommodates a second chemical, to and from the chemical supply device (5).

[Claim 6]

15 The apparatus of claim 3, wherein:

the chemical supply device (5) includes a first chemical supply device (5-1) and a second chemical supply device (5-2); and

the plurality of transport cars (600) include a first transport car (600-1) configured to input and discharge a first chemical container, which accommodates a
20 first chemical, to and from the first chemical supply device and a second transport car (600-2) configured to input and discharge a second chemical container, which accommodates a second chemical, to and from the second chemical supply device.

[Claim 7]

The apparatus of claim 1, wherein:

the chemical supply device (5) is provided as a plurality of chemical supply devices (5);

the chemical container (2) is provided as a plurality of chemical containers (2) that accommodate a plurality of different chemicals; and

5 the transport car (600) inputs or discharges any one of the plurality of chemical containers to or from any one of the plurality of chemical supply devices.

[Claim 8]

The apparatus of claim 1, wherein:

the transport car (600) linearly moves along a transport car rail (500) that is
10 provided between the transport line and the chemical supply device (5) so as to be parallel to at least a portion of the transport line; and

at an input position, the transport car (600) delivers the chemical container (2) from the transport line to the chemical supply device (5) or, at a discharge position that is spaced apart from the input position along the transport car rail (500), the
15 transport car (600) delivers the chemical container (2) from the chemical supply device (5) to the transport line.

[Claim 9]

The apparatus of claim 8, wherein a waiting place for the transport car (600) is provided at both sides of the transport car rail (500) while the chemical supply
20 device (5) is disposed therebetween.

[Claim 10]

The apparatus of claim 2, wherein the inspection unit (602) includes a chemical container scanner configured to scan chemical information on a surface of the chemical container (2).

25 [Claim 11]

The apparatus of claim 2, wherein:

a pallet (3) configured to be transported along the transport line in a state in which the chemical container (2) is loaded thereon is provided; and

the inspection unit (602) includes a chemical container scanner configured to
5 scan chemical information on a surface of the pallet (3).

[Claim 12]

The apparatus of claim 1, wherein the transport car (600) includes:

a transport member (601) configured to input the pallet (3), which has the chemical container (2) loaded thereon, to the chemical supply device (5); and

10 a chemical base (603) provided at a lower portion of the transport member (601) to accommodate the chemical falling from the chemical container (2).

[Claim 13]

The apparatus of claim 12, wherein the transport car (600) includes a drain valve (605) configured to drain the chemical accommodated in the chemical base
15 (603).

[Claim 14]

The apparatus of claim 12, wherein the transport car (600) includes a chemical sensor configured to sense the chemical that falls into the chemical base (603).

20 [Claim 15]

The apparatus of claim 1, wherein:

a space in which the transport car (600) is stored and waits is formed at one side end portion of the transport car rail (500) configured to move the transport car (600); and

in a case in which the transport car (600) is stored and waits in the space, a safety bar including a safety sensor is provided at an inlet side, through which the transport car (600) enters, to prevent collision with another transport car.

[Claim 16]

- 5 The apparatus of claim 15, wherein a safety sensor configured to sense detachment of the safety bar from a support base is provided.

[Claim 17]

The apparatus of claim 1, wherein:

the transport car (600) includes:

- 10 a transport member (601) on which the pallet (3) having the chemical container (2) loaded thereon is loaded; and

a driving unit configured to drive the transport member (601) to transport the pallet (3) having the chemical container (2) loaded thereon to the chemical supply device (5) or to the transport line.

- 15 [Claim 18]

The apparatus of claim 1, wherein the transport car (600) includes an emergency stop switch (604) configured to stop the transport car (600) in case of emergency.

[Claim 19]

- 20 The apparatus of claim 18, wherein the emergency stop switch (604) is provided as a plurality of emergency stop switches (604) on a frame (610) provided on the transport car (600).

[Claim 20]

The apparatus of claim 8, wherein a stopper (501) configured to prevent deviation of the transport car (600) from the transport car rail (500) is provided at an end portion of the transport car rail (500).

[Claim 21]

- 5 The apparatus of claim 20, wherein the stopper (501) includes an impact absorbing unit to mitigate impact in a case in which collision of the transport car (600) occurs.

[Claim 22]

- 10 The apparatus of claim 8, wherein a sensor (502) configured to sense whether an object is present between both side end portions of the transport car rail (500) is provided at an end portion of the transport car rail (500).

[Claim 23]

The apparatus of claim 22, wherein, in a case in which an object is sensed by the sensor (502), the transport car (600) is stopped.

- 15 [Claim 24]

The apparatus of claim 8, wherein, in a case in which the transport line at the discharge position malfunctions, the chemical container (2) is discharged from the chemical supply device (5) through the transport line at the input position.

[Claim 25]

- 20 The apparatus of claim 8, wherein, in a case in which the transport line at the input position malfunctions, the chemical container (2) is input to the chemical supply device (5) through the transport line at the discharge position.

[Claim 26]

The apparatus of claim 1, wherein:

the transport car (600) linearly moves along the transport car rail (500) that is provided between the transport line and the chemical supply device (5) so as to be parallel to at least a portion of the transport line; and

the transport car rail (500) includes a transport member driven by the driving
5 unit and, in a case in which the transport member provided on the transport line is driven and transports the chemical container (2) in a direction toward the chemical supply device (5), the driving unit is driven at the input position, which is disposed between the transport line and the chemical supply device (5), to deliver the chemical container (2) from the transport line to the chemical supply device (5).

10 [Claim 27]

A method for automatic transport of chemical containers, the method comprising:

a) putting a chemical container (2) into an input unit (110);
b) transporting the chemical container (2) through at least one transport line;
15 c) in order to deliver the chemical container (2) from the transport line to a chemical supply device (5), placing a transport car (600), which linearly moves along a transport car rail (500) provided to be parallel to at least a portion of the transport line, at an input position; and

d) putting the chemical container (2) placed on the transport line into the
20 chemical supply device (5) via the transport car (600).

[Claim 28]

The method of claim 27, wherein:

the operation b) further includes checking chemical information of the chemical container (2) by an inspection unit provided on the transport line; and

the operation d) includes, when the chemical information checked by the inspection unit matches chemical information required by the chemical supply device (5), transporting the chemical container (2) placed on the transport line to the chemical supply device (5).

5 [Claim 29]

The method of claim 28, wherein:

the chemical supply device (5) includes a plurality of chemical supply devices (5) configured to supply a plurality of different kinds of chemicals; and

10 the inspection unit checks whether the chemical information checked from the chemical container (2) is one of pieces of chemical information on the plurality of different kinds of chemicals.

[Claim 30]

The method of claim 28, wherein the operation d) includes:

15 placing the chemical container (2), which is placed on the transport line, on the transport car (600);

checking chemical information of the chemical container (2) using an inspection unit provided in the transport car (600); and

20 when the chemical information checked using the inspection unit matches chemical information required by the chemical supply device (5), transporting the chemical container (2), which is placed on the transport line, to the chemical supply device (5).

[Claim 31]

The method of claim 30, wherein the checking of the chemical information of the chemical container (2) includes checking chemical information on a surface of a

pallet that is transported along the transport line while the chemical container (2) is loaded thereon.

[Claim 32]

The method of claim 27, further comprising:

- 5 e) when the chemical container (2) transported to the chemical supply device (5) is mounted inside the chemical supply device (5) and the chemical accommodated in the chemical container (2) is used up, discharging the chemical container (2) to the outside of the chemical supply device (5) and loading the chemical container (2) on the transport car (600) placed at the input position;
- 10 f) in a state in which the chemical container (2) is loaded on the transport car (600), moving the transport car (600) along the transport car rail (500) to place the transport car (600) at a discharge position that is spaced apart from the input position; and
- g) mounting the chemical container (2), which is on the transport car (600)
- 15 placed at the discharge position, on the transport line and then transporting the chemical container (2) along the transport line to discharge the chemical container (2) to the outside.

[Claim 33]

The method of claim 27, wherein:

- 20 the chemical supply device (5) includes a first chemical supply device (5-1) configured to supply a first chemical and a second chemical supply device (5-2) configured to supply a second chemical;
- the transport car (600) includes a first transport car (600-1) configured to input a first chemical container, which accommodates the first chemical, to the first
- 25 chemical supply device (5-1) and a second transport car (600-2) configured to input a

second chemical container, which accommodates the second chemical, to the second chemical supply device (5-2),

the operation c) includes placing the first transport car (600-1) at an input position of the first chemical supply device (5-1) or placing the second transport car
5 (600-2) at an input position of the second chemical supply device (5-2); and

the step d) includes transporting the first chemical container to the first chemical supply device (5-1) via the first transport car (600-1) or transporting the second chemical container to the second chemical supply device (5-2) via the second transport car (600-2).

10 [Claim 34]

The method of claim 27, wherein:

the chemical container is provided as a plurality of chemical containers that accommodate a plurality of different chemicals;

the chemical supply device (5) is provided as a plurality of chemical supply
15 devices (5) to which the plurality of chemical containers are input; and

in a case in which the transport car (600) is provided as a plurality of transport cars (600), after one transport car inputs the plurality of chemical containers to the plurality of chemical supply devices, the plurality of chemical containers are discharged from the plurality of chemical supply devices.

20 [Claim 35]

The method of claim 27, wherein, in a case in which the transport car (600) is provided as a plurality of transport cars (600), the chemical container is input to the chemical supply device (5) using at least one transport car, and the chemical container is discharged from the chemical supply device (5) using another transport
25 car.

[Claim 36]

The method of claim 35, wherein:

the chemical supply device (5) includes a first chemical supply device (5-1) configured to supply a first chemical and a second chemical supply device (5-2)

5 configured to supply a second chemical;

the transport car (600) includes a first transport car (600-1) and a second transport car (600-2);

the chemical container includes a first chemical container accommodating the first chemical and a second chemical container accommodating the second chemical;

10 the first transport car (600-1) inputs the first chemical container to the first chemical supply device (5-1) and inputs the second chemical container to the second chemical supply device (5-2); and

the second transport car (600-2) discharges the first chemical container from the first chemical supply device (5-1) and discharges the second chemical container
15 from the second chemical supply device (5-2).

[Claim 37]

The method of claim 27, wherein:

in a case in which the transport line at a discharge position, which is spaced apart from the input position, malfunctions, the chemical container (2) is discharged
20 from the chemical supply device (5) through the transport line disposed at the input position, or

in the case in which the transport line at the discharge position malfunctions, the chemical container (2) is discharged from the chemical supply device (5) through the transport line disposed at the input position.

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