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(54) **Title**: HAND CLEANING APPARATUS

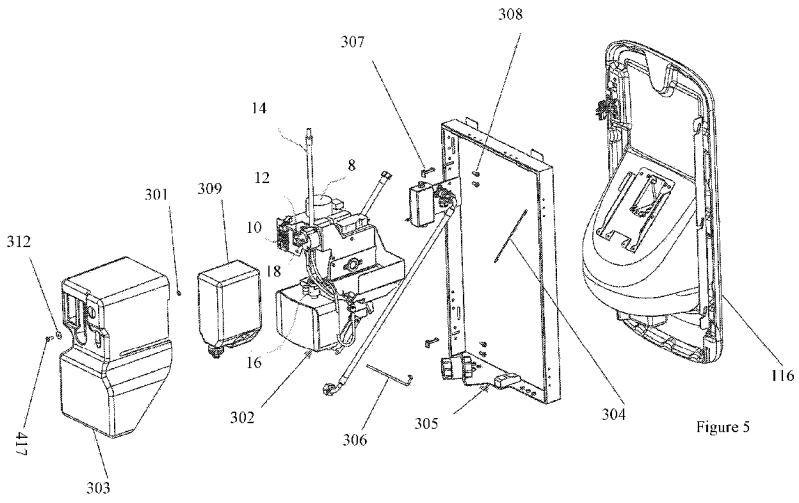

Figure 5

(57) **Abstract**: Hand cleaning apparatus (1) is disclosed having a frame (305), fixing means for fixing the frame to a structure (2), a facia (116) comprising a hand port (4) for receiving the hands of a user, frame connecting means for connecting the facia to the frame, a chassis (302) and chassis connecting means for connecting the chassis to the facia and/or the frame. Usually, the chassis will include a hand-sensor, an air blower and a connection to a controller, and optionally a soap dispenser and a water dispenser. The apparatus is modular which is of benefit in manufacture, use and maintenance.

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HAND CLEANING APPARATUS

The present invention relates to hand cleaning apparatus.

A combined hand washing and drying device is described in the applicant's UK patent GB 1,365,763. The device comprises a warm water dispenser, a soap dispenser and an air dispenser intended to be used to both wash and dry the hands of a user. Devices according to GB 1,365,763 have been produced and sold and often find use in public facilities such as public lavatories and public washrooms.

Such devices are usually produced in such a way that they are mounted to a structure (e.g. an aperture in a wall of the structure or a hollow unit which is itself mounted on a wall of the structure) in order to reduce or prevent vandalism to the device. In the past, the two types of mounting have required different designs of device. Maintenance and access to the device differs according to the mounting type, and may be difficult.

There is now a need to provide hand cleaning apparatus with more convenient access for maintenance whilst maintaining a good degree of vandal-resistance.

It is an aim of the present invention to address that need.

The present invention accordingly provides hand cleaning apparatus comprising a frame, fixing means for fixing the frame to a structure, a facia comprising a hand port for receiving the hands of a user to be cleaned, frame connecting means for connecting the facia to the frame, a chassis, and chassis connecting means for connecting the chassis to the facia and/or to the frame.

Preferably, the chassis connecting means comprises (or is) facia connecting means for connecting the chassis to the facia.

Preferably the frame comprises the fixing means, and/or the facia comprises the frame connecting means, and/or the chassis comprises the facia connecting means.

The apparatus is intended to perform one or more of the steps in hand cleaning such as hand drying or hand washing (which generally involves providing soap, providing water and subsequently performing hand drying).

The great advantage of the present invention is that it provides in a modular apparatus for hand cleaning wherein the chassis of the hand cleaning apparatus is accessible by moving the facia. Consequently, the same design of hand cleaning apparatus may enable access through the front and through the rear of the device. Thus, the apparatus according to the present invention provides more convenient access for maintenance whilst still retaining a good degree of vandal resistance. Furthermore, the modular nature of the apparatus enables parts of the apparatus to be interchanged. Thus, for example, the facia may be changed (i.e. to a facia of a different material and/or different design), or the chassis or components of the chassis may be replaced to enable speedy repair.

Preferably, the frame connecting means comprises a hinge for hingedly connecting the facia to the frame. This arrangement enables the frame connecting means to be opened for ready access to the chassis. Preferably the hinge of the frame connecting means is positioned such that the facia may be opened horizontally (e.g. the hinge(s) are preferably mounted on the side of the facia).

The frame connecting means for connecting the facia to the frame is preferably a lockable connecting means, in other words it preferably comprises a locking mechanism to lock the facia to the frame. This is advantageous because it reduces the chances of the chassis being accessed by an unauthorised person. Preferably, the locking mechanism is a spring-loaded locking mechanism.

Preferably, the chassis connecting means comprises a hinge for hingedly connecting the chassis to either the facia or the frame. This is convenient because it enables access to other parts of the chassis by, once the facia has been opened, (partially) rotating the chassis on the hinge of the chassis connecting means for access to otherwise relatively inaccessible parts of the chassis. It is preferred if the chassis connecting means

comprises a hinge for connecting the chassis to the facia (in this case, the chassis connecting means would comprise a facia connecting means).

Generally, the chassis comprises the functional parts of the hand cleaning apparatus. Preferably, the chassis will comprise a hand sensor (which is preferably an infra-red hand sensor and is adapted to detect the hands of the user when within the range of the hand sensor) and an air blower (to perform at least the hand drying step in hand cleaning) and connection to a controller. Preferably, the chassis comprises the controller. For hand cleaning apparatus that is designed to both wash and dry hands of the user, the chassis will preferably further comprise a soap dispenser and/or a water dispenser.

The air blower will preferably be a variable speed air blower, the speed being controllable either through factory setting or by the installer/owner of the hand cleaning apparatus using the controller. Generally, the air blower will have at least three different speeds (e.g. fast, medium and slow).

The air blower may or may not provide heated air. An advantage if heated air is not provided is a reduction in power consumption by removing the need for an air heater. Instead, of providing a separate air heater the air flow from the air blower may pass through the body of the chassis thereby exchanging heat from the heat generated within the chassis (e.g. from the blower motor) and thereby warming the air above ambient. The air blower preferably comprises an impeller, in particular a relatively shallow impeller and most preferably a high-speed impeller.

If an air heater is provided it enables a relatively lower power air blower to be used.

An optional feature of the apparatus is a decontamination trap which preferably comprises a heatable vessel for collecting water draining from the apparatus and which is capable of being heated to sterilise the water in the trap.

In a preferred embodiment of the present invention, the controller is adapted to control the operation of the air blower, soap dispenser, water

dispenser and/or the optional decontamination trap, preferably in response to a signal from the hand sensor.

The controller will generally comprise one or more microprocessors and memory components (e.g. non-volatile memory) and will be programmed to control the operation of the air blower, soap dispenser, water dispenser and/or decontamination trap in response to a signal from the hand sensor.

Generally, the controller will be adapted so that the operation of the air blower, soap dispenser, water dispenser and/or decontamination trap comprises the time of operation and/or the sequence of operation of one or more of these components. In other words, the controller may be adapted so that the timing of each of the component parts of the hand washing procedure and the sequence of that procedure is controllable through the controller.

A typical hand washing procedure will generally begin with insertion of the user's hands within the hand port of the apparatus. Such insertion is detected by the hand sensor which then sends a signal to the controller. This results in the operation of a typical hand-washing sequence of: soap being dispensed, a pause, water being dispensed for a set period of time, a pause and then air being blown in the hand port in order to dry the hands of the user.

If the optional decontamination trap is present, the controller may also be adapted to operate the decontamination trap at set periods of time (e.g. every 12 hours and/or particular days of the week).

Generally, the apparatus according to the invention will further comprise input means for the controller. Input means for the controller will usually comprise a control panel for providing control signals and programming e.g. the microprocessor of the controller. Such a control panel is preferably a manual control panel in communication with and/or incorporated in, the chassis. Further input means may comprise further sensors in the water, soap or air supply systems (e.g. flow rate, level and/or temperature sensors) and clock means (e.g. a real time clock and/or timing mechanism) to enable the sequence and timing of the various operations of the apparatus to be controlled.

The great benefit of manual control panels is that the owners of the apparatus are able to fully control the sequence and timing of the operation of the apparatus e.g. to reduce power or water use or, in circumstances where more extensive hand washing is necessary, to increase supply of soap, water or air during the hand washing sequence.

In a preferred embodiment, the controller is programmable to produce a hygiene flush in the apparatus at one or more predetermined time(s). The hygiene flush comprises identifying that the apparatus has not been used for a predetermined period (which may be a period selected by the installer of the apparatus and may be typically from 1 hour to 2 days or any other convenient period), and activating the water dispenser to flush the system. The hygiene flush function is particularly advantageous in situations where the apparatus has not been used for a period and it prevents or reduces water in the supply becoming stagnant and reduces growth of micro-organisms. The hygiene flush function finds particular utility in low-volume use facilities, e.g. hospitals, offices or schools (especially during holidays and the weekend). The pre-determined time is preferably set using the real time clock. Often the hygiene flush function will find use in apparatus which comprises the decontamination trap.

The hand cleaning apparatus of the invention will preferably further comprise a water heater. It is preferred if the water heater is an in-line water heater which operates (i.e. switches on) on passage of water through the heater. This is convenient because it simplifies the control of the apparatus and enables the controller to merely control the water valve without the complexity of further control of the temperature and power supply to a water heater.

The apparatus of the present invention preferably further comprises illumination means to illuminate the hands of the user in the hand port. Illumination means will usually be configured so as to illuminate the hands when they are present within the hand port and optionally to change the colour or intensity of the illumination during the sequence of operation of the apparatus. It is preferred if the sequence, timing and intensity of the

illumination means is fully controllable from the controller and, in particular, from the control panel.

In order that the present invention may be better understood, it will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 illustrates hand cleaning apparatus according to a first embodiment of the present invention installed in a structure; (a) illustrates the apparatus ready for use, (b) illustrates the apparatus with the facia open and (c) illustrates the apparatus with the facia open and the chassis rotated for accessibility.

Figure 2 illustrates a portion of the apparatus of Fig 1 in rear, plan view.

Figure 3 illustrates the facia of Fig 1 in (a) exploded view and (b) assembled view.

Figure 4 illustrates the frame of Fig 1 in (a) exploded and (b) assembled views.

Figure 5 illustrates the apparatus of Fig 1 in exploded view.

Figure 6 is a block diagram illustrating the control system for the apparatus.

Figure 7 illustrates hand cleaning apparatus according to a second embodiment of the present invention installed in a structure; (a) apparatus ready for use, (b) illustrates the apparatus with facia open, and (c) illustrates the apparatus with the facia open and the chassis rotated for accessibility.

Figure 8 illustrates a portion of the apparatus of Fig 7 in rear, plan view.

Figure 9 illustrates the facia of the apparatus of Fig 7 in (a) exploded view and (b) assembled view.

Figure 10 illustrates the frame of the apparatus of Fig 7 in (a) exploded and (b) assembled views.

Figure 11 illustrates the apparatus of Fig 7 in exploded view.

Figure 1 illustrates the hand cleaning apparatus 1 as installed in a structure 2. Structure 2 may be a wall of a building (e.g. a public convenience) or may, alternatively be a box (not shown) attached to a wall of a building. The apparatus in Figure 1a) comprises a facia 116 produced from

polymeric material (for example fire resistant resin) having a hand port 4 and a shroud 20 for supply of air for drying hands, water and soap for washing.

In Figure 1(b) the hand cleaning apparatus 1 is illustrated with the facia 116 open for access to the components of the apparatus especially the main chassis 302. The facia hinges 108 are so arranged as to enable horizontal opening of the apparatus. Connected to the chassis 302 is the facia 116. The chassis 302 comprises an inline water heater 6 (which operates when water flows), soap pump assembly 18 and soap container 309. In the aperture in the frame assembly 305 is the waste connector coupler 214 which connects the drain sump 105 to the waste pipe (not shown) when the facia 116 is closed and the apparatus is ready for use. The facia hinges 108 allow easy access after the locking mechanism comprising locking strip 101 is unlocked.

Figure 1c) illustrates the chassis 302 once the chassis hinge pin 306 is released enabling the chassis 302 to rotate partly on the facia 116 thereby enabling greater access to components of the chassis 302 including soap container 309 and controller 8.

Figure 2 illustrates a rear, plan view of a cropped portion of the apparatus comprising facia 116 and chassis 302. As discussed in relation to Figure 1, the chassis 302 comprises a water heater 6, soap container 309, a soap pump assembly 18 and a controller 8. The controller 8 comprises a display panel 10 and display circuit 12 and also includes a manual control input pad for the owner/installer of the apparatus to modify the operation of the hand cleaning apparatus. The facia hinge 108 is also illustrated together with the water hose 14, water flow regulator assembly 16 and the locking strip 101.

Figure 3 illustrates (a) an exploded view of the facia 116 and (b) the assembled facia. The solid surface facia 116 comprises a bowl in the hand port 4 (the rear of this feature is visible in Figure 3) for convenient hand washing by the user. Connected to the facia 116 are locking screw nut 102, circlip 104 and lock screw 103 for fixing the locking strip to the facia. The drain sump 105, drain sump fastener 106 and drain sump gasket 107 (to reduce leakage) receive waste water from the bowl of the hand port 4. The drain

sump 105 may be connected to an optional decontamination unit (not shown) which is provided with a heating mechanism in order to heat and thereby sterilise waste from the hand wash procedure. The locking strip 101 is connected to the facia 116 including with lock strip spacer 117. Other components connected to the facia are chassis mount plate 119 and the hinge mechanisms including hinge side lock plate 109, lock plate sleeve 110, facia hinge 108 and various fixing mechanisms. In the front of the hand port 4 portion of the facia 116 is the nozzle housing 111 comprising the shroud 20. The nozzle housing 111 provides outlets for air, water and soap during the hand washing procedure.

Figure 4 illustrates the frame assembly 305 in (a) exploded view and (b) assembled view. The frame assembly 305 comprises a wall frame 205 for insertion in an aperture either in a box structure attached to a surface or an aperture in e.g. the wall of a structure itself. The frame assembly 305 also comprises cable strain relief 201 and water connections comprising water inlet hose 206, water inlay elbow and back plate 203, anti-loss washer 202 and fixed elbow 204, block screw 210 and cable grip 211. Other components incorporated within the frame are waste connector coupler 214 and support block 212 and terminal block 213 and connectors to the mains power supply protected by mains input cover 207.

Figure 5 illustrates the apparatus in exploded form including the facia 116, the frame assembly 305, the chassis 302 and chassis cover 303. The chassis cover 303 is connected to the chassis 302 by frame screw 417 and washer 312 together with cover anti-loss washer 301. The soap container 309 is inserted into the chassis 302. The hinge release lock 307 and frame screws 308 are inserted together with the chassis stay 304 and the chassis hinge pin 306 (which as indicated in Figure 1, upon removal enables the chassis to hinge down for ready access).

Figure 6 illustrates in schematic form the control system operated by the controller. Controller 402 comprises a microprocessor which contains non-volatile memory. The controller 402 can be modified by the display circuit and panel 410 by the user in order to adjust the sequence and timing of the

various parts of the hand wash operation. The controller 402 receives input from the hand sensor circuit 404 which is connected to an infrared sensor situated in the hand port to detect the entry of hands within the hand port. The controller 402 is arranged to operate the hand dryer/air blower circuit 406 and the soap pump circuit 408 together with water valve circuit 414 according to the program set in terms of sequence and timing by the display circuit and panel 410.

The second embodiment of the apparatus as illustrated in Figs 7 to 11 is similar to the first embodiment illustrated in Figs 1 to 5, and the description of Figs 1 to 5 generally also applies to the corresponding figures of Figs 7 to 11.

The differences are as follows. In the second embodiment, the soap container 309 is mounted so the cap is on top. This design feature simplifies manufacture, reduces leaks and improves ease of maintenance.

The locking strip 101 (see Fig 9) is of different design with a spring arranged so the lock activates when the facia is shut. To this end the locking mechanism comprises a lower lock spring 103_1 arranged with lock screw 103 and anti rotation pin 103_4 at the bottom of lock cam plate 103_3 with upper lock spring 103_4 positioned above. The arrangement of the locking strip 101 is such that the lock must be rotated and pushed up in order to open it, reducing the ease of opening by vandals. The anti-rotation pin 103_4 is to reduce damage to the lock when rotated. The circlip 104 is removed.

Referring to Fig. 8, the flow regulator 16 of the first embodiment has been removed in the second embodiment, because the regulator built into the water heater is often sufficient to control water flow over usual pressure ranges of the water supply. The water hose 14 is straight with an elbow to ease manufacture and maintenance.

As illustrated in Fig 10, the wall frame 205 is of sheet metal (for ease of manufacture) and the support block 212 is of lower profile to improve operation. The water supply system is of different design with push fit connectors 415, a shut off valve 416 connecting to pipes, usually of copper.

In operation, a typical hand wash cycle would involve the following steps:

1) The user inserts hands into the hand port 4 which is detected by the infrared hand sensor resulting in a signal from the hand sensor circuit 404 to the controller 402.
2) The controller 402 operates the soap pump circuit 408 to release a measured quantity of soap (either foamed or unfoamed depending on how the owner/installer arranges the settings of the soap pump unit).
3) After a timed delay (typically 1 to 5 seconds) water is released via the controller operating the water valve circuit 414 for a predetermined period (typically 5 to 10 s). Flow of water through the water valve circuit 414 results in the water heater 412 (an in-line water heater with its own temperature controls) being operated and heating the water. Consequently, warm water is released into the hand port 4 from the shroud 20.
4) A time delay (typically 1 to 5 seconds) is followed by air being released by the controller 402 operating the hand dryer/air blower circuit 406. Air is provided for a predetermined time and at a predetermined flow rate as set by the owner/installer.

The air blower is preferably a high velocity air blower with or without a separate heater unit, however passage of the air through the chassis in association with the relatively warm components of the hand wash apparatus will raise the temperature of the air somewhat.

In the preferred embodiment of the invention there is a light (not shown) which acts as illumination means for hands in the hand port. The light will typically be operated upon detection of hands in the hand port through the hand sensor circuit 404 and will be operated by the controller 402. The colour and intensity of the light may vary between predetermined conditions determined by the owner/installer.

The component parts illustrated in the Figures are as follows:

Reference Numeral	Description
1	Hand cleaning apparatus
2	Structure
4	Hand port
6	Water heater
8	Controller
10	Display panel
12	Display circuit
14	Water hose
16	Water flow regulator assembly
18	Soap pump assembly
20	Shroud
22	Blower cover
101	Locking Strip
102	Lock Screw Nut
103	Lock Screw
103_1	Lower lock spring
103_2	Upper lock spring
103_3	Lock cam plate
103_4	Anti-rotation pin
104	Circlip
105	Drain Sump
106	Drain Sump Fastener
107	Drain Sump Gasket
108	Facia Hinge
109	Hinge Side Lock Plate
110	Lock Plate Sleeve
111	Nozzles Housing
116	Solid Surface Facia with Bowl
117	Lock Strip Spacer
118	Star Lock Washer
119	Chassis Mount Plate
201	Cable Strain Relief
202	Anti Loss Washer
203	Water Inlet Elbow and Back Plate
204	Fixed Elbow
205	Wall Frame
206	Water Inlet Hose
207	Mains Input Cover
210	Block Screw
211	Cable Grip
212	Support Block
213	Terminal Block
214	Waste Connector Coupler
301	Cover Anti Loss Washer
302	Main Chassis
303	Chassis Cover
304	Chassis Stay
305	Frame Assembly

306	Chassis Hinge Pin
307	Hinge Release Lock
308	Frame Screws
309	Soap Container
310	Solid Surface Facia
312	Washer
402	Controller
404	Hand sensor circuit
406	Hand dryer/air blower circuit
408	Soap pump circuit
410	Display circuit and panel
412	Water heater
414	Water valve circuit
415	Push fit connectors
416	Shut off valve
417	Cover screw

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CLAIMS

1. Hand cleaning apparatus comprising,

a water dispenser;

a frame;

fixing means for fixing the frame to a structure;

a facia comprising a hand port for receiving the hands of a user; and

frame connecting means for connecting the facia to the frame

wherein the frame connecting means comprises a first hinge connecting the facia to the frame whereby access to the rear of the facia is provided by hinged movement of the facia relative to the frame

and in that the hand cleaning apparatus further comprises:

a chassis on which is mounted said water dispenser; and

chassis connecting means for connecting the chassis to the facia, the chassis connecting means comprising a second hinge connecting the chassis to the rear of the facia whereby greater access to said water dispenser is provided by hinged movement of the chassis relative to the rear of the facia.

2. Hand cleaning apparatus as claimed in claim 1, wherein the chassis comprises a hand-sensor and a connection to a controller.

3. Hand cleaning apparatus as claimed in claim 2, wherein the chassis further comprises all of an air blower, and a soap dispenser.

4. Hand cleaning apparatus as claimed in any one of the preceding claims, wherein the frame connecting means comprises a locking mechanism to lock the facia to the frame.

5. Hand cleaning apparatus as claimed in claim 1 wherein the chassis connecting means comprises a locking mechanism, preferably a sprung locking mechanism.

6. Hand cleaning apparatus as claimed in any one of the preceding claims, further comprising a decontamination trap.

7. Hand cleaning apparatus as claimed in claim 1, wherein the hand cleaning apparatus further includes a variable speed air blower.

8. Hand cleaning apparatus as claimed in claim 3, wherein the controller is adapted to control the operation of the air blower and/or the soap dispenser and/or the water dispenser in response to a signal from the hand-sensor.

9. Hand cleaning apparatus as claimed in claim 2, wherein the hand cleaning apparatus includes a decontamination trap and the controller is adapted to control operation of the decontamination trap.

10. Hand cleaning apparatus as claimed in claim 8, wherein operation of the air blower, soap dispenser, water dispenser and/or decontamination trap comprises the time of operation and/or sequence of operation thereof.

11. Hand cleaning apparatus as claimed in any one of claims 8 to 10, further comprising input means for the controller.

12. Hand cleaning apparatus as claimed in claim 8, wherein the controller is programmable to produce a hygiene flush at a pre-determined time.

13. Hand cleaning apparatus as claimed in any one of claims 3 to 12, further comprising a water heater.

14. Hand cleaning apparatus as claimed in any one of the preceding claims, further comprising illumination means to illuminate the hands of a user in the hand port.

15. Hand cleaning apparatus as claimed in claim 1 wherein the first hinge is arranged to enable the facia to hinge relative to the frame about a vertical axis and the second hinge is arranged to enable the chassis to hinge relative to the rear of the facia about a horizontal axis.

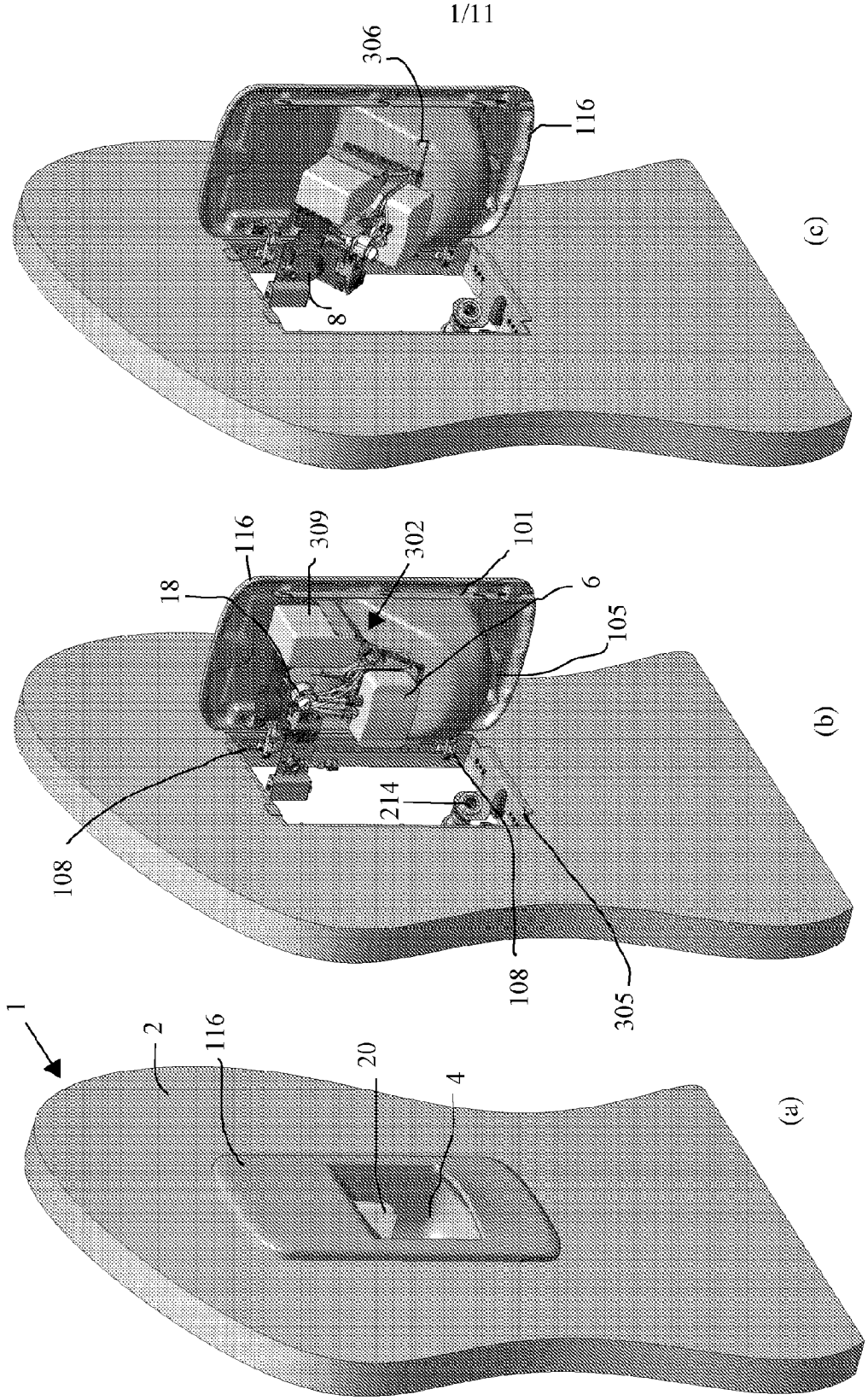


Figure 1

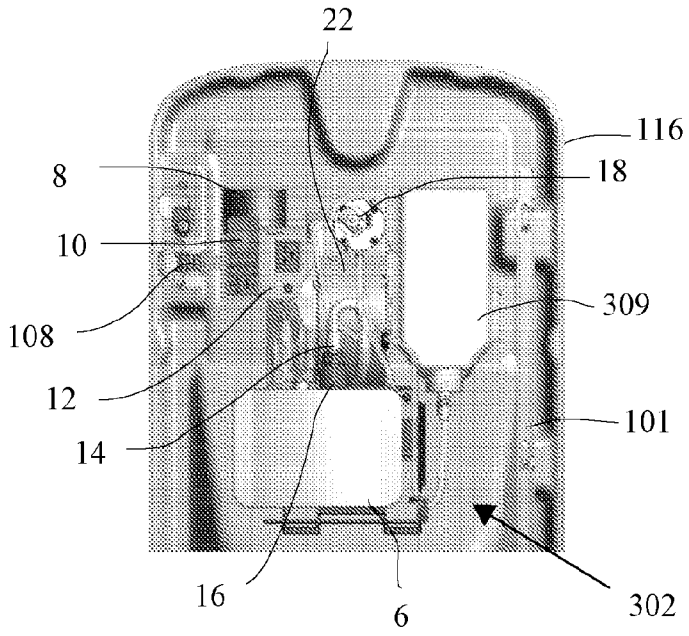
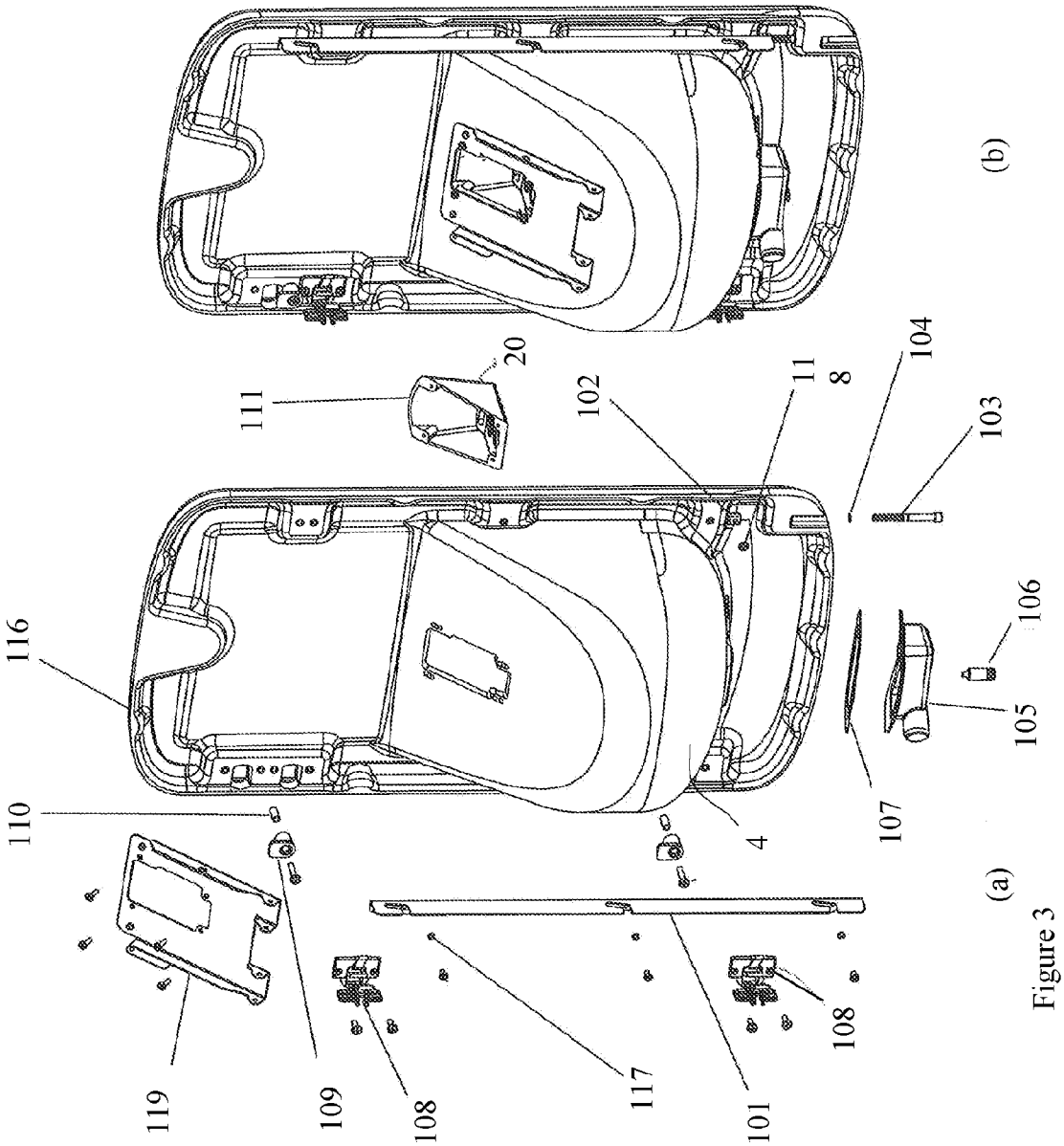


Figure 2


(b)
20
111
102
11
8
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4
(a)
119
109
108
117
101
108

Figure 3

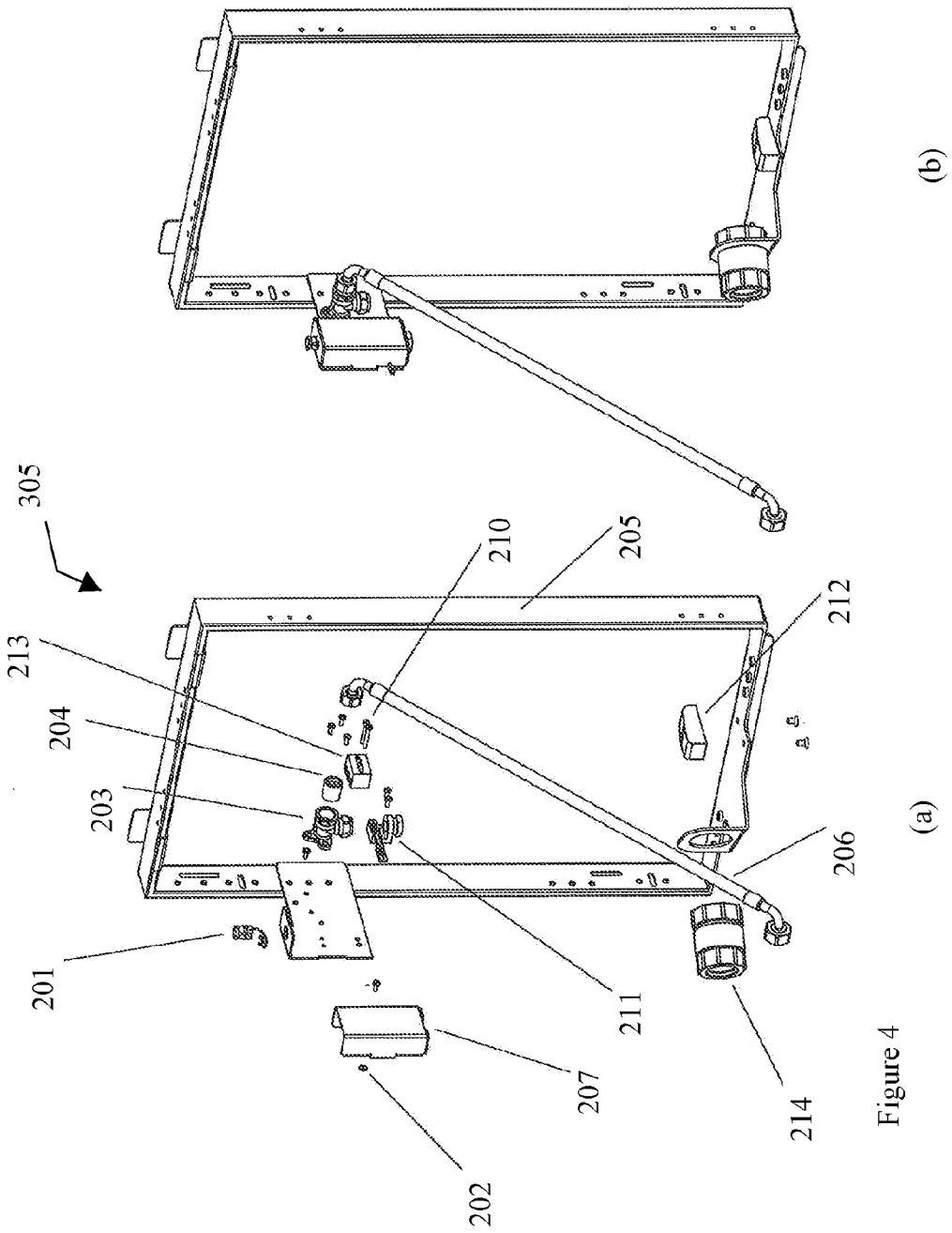

Figure 4

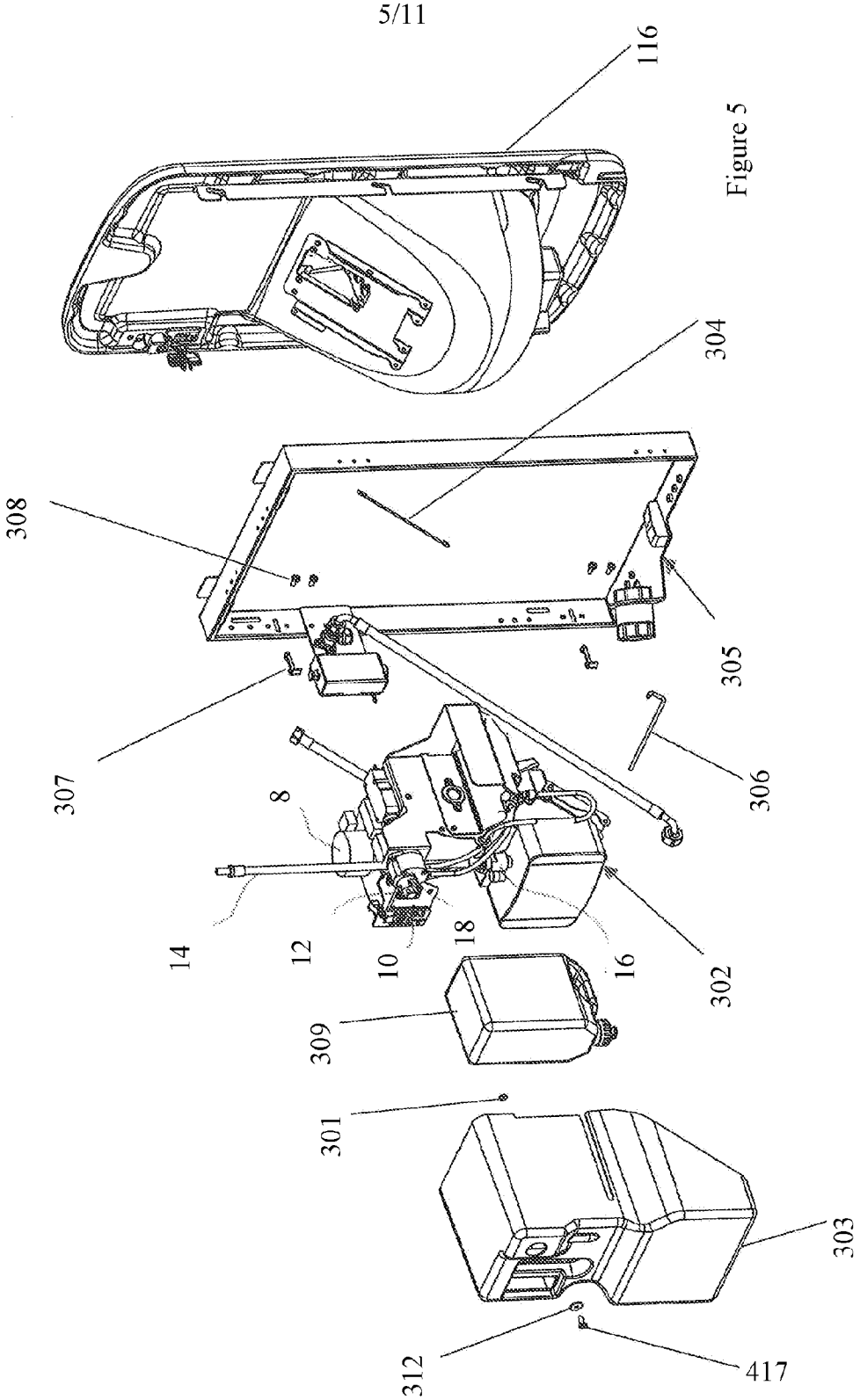

Figure 5

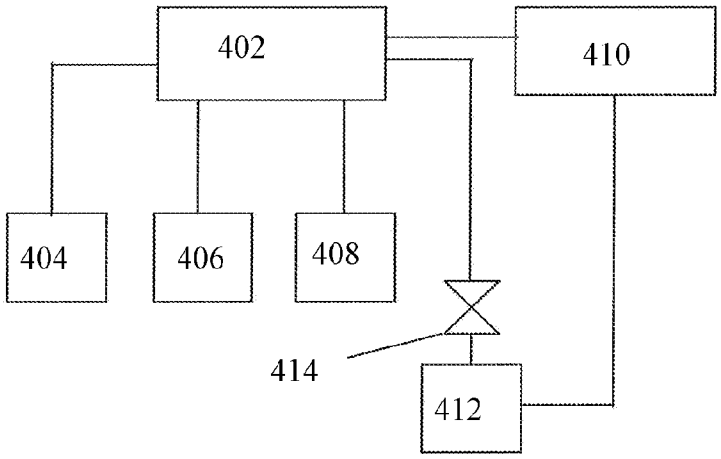

Figure 6

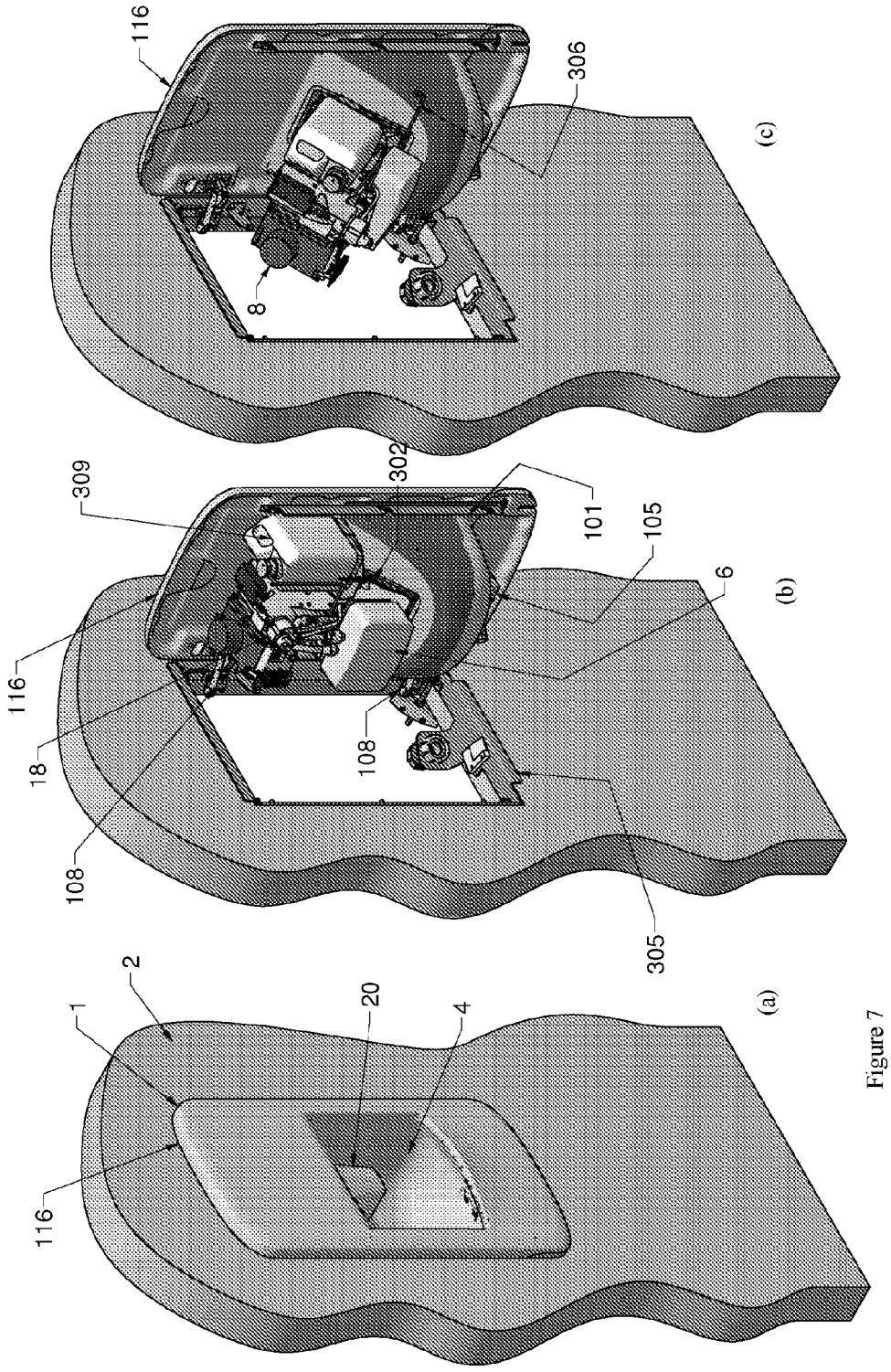

Figure 7

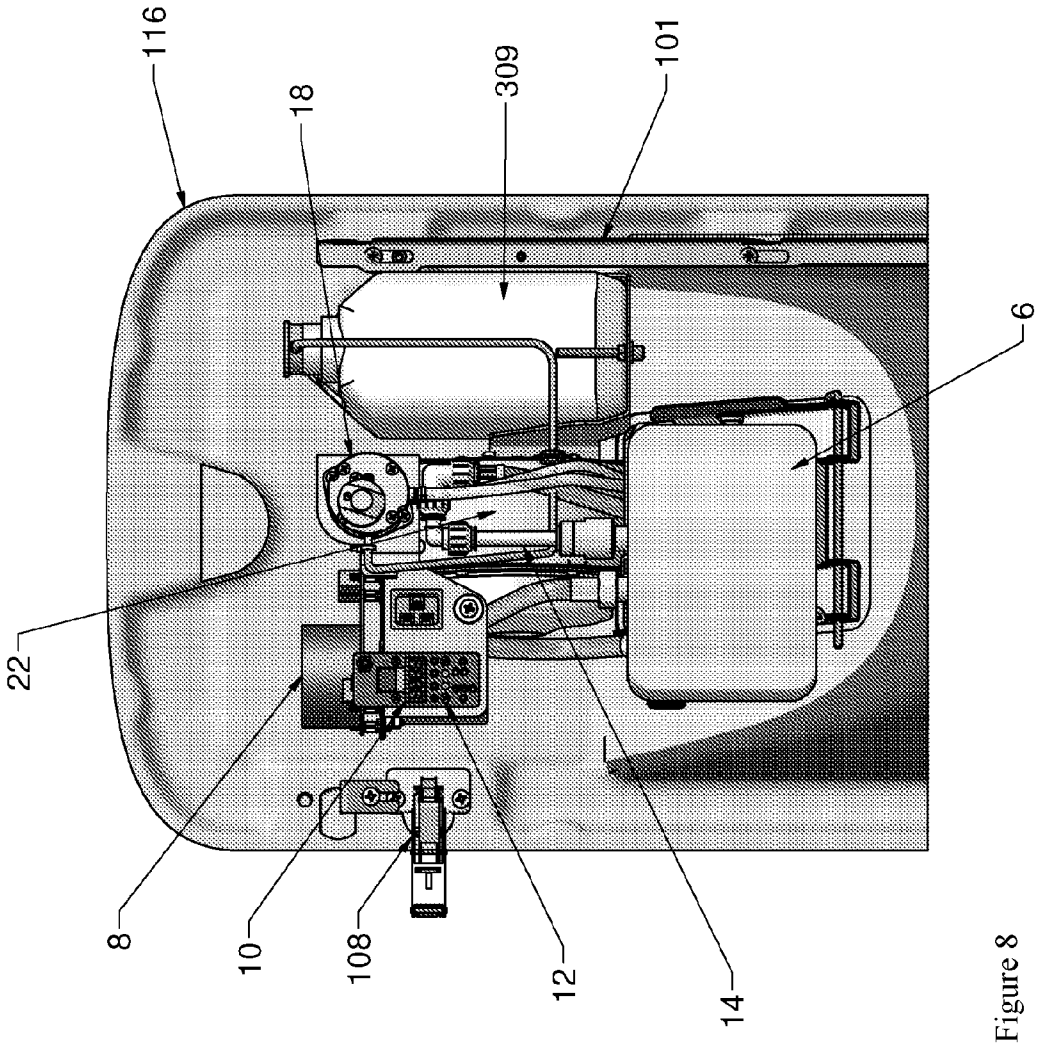

Figure 8

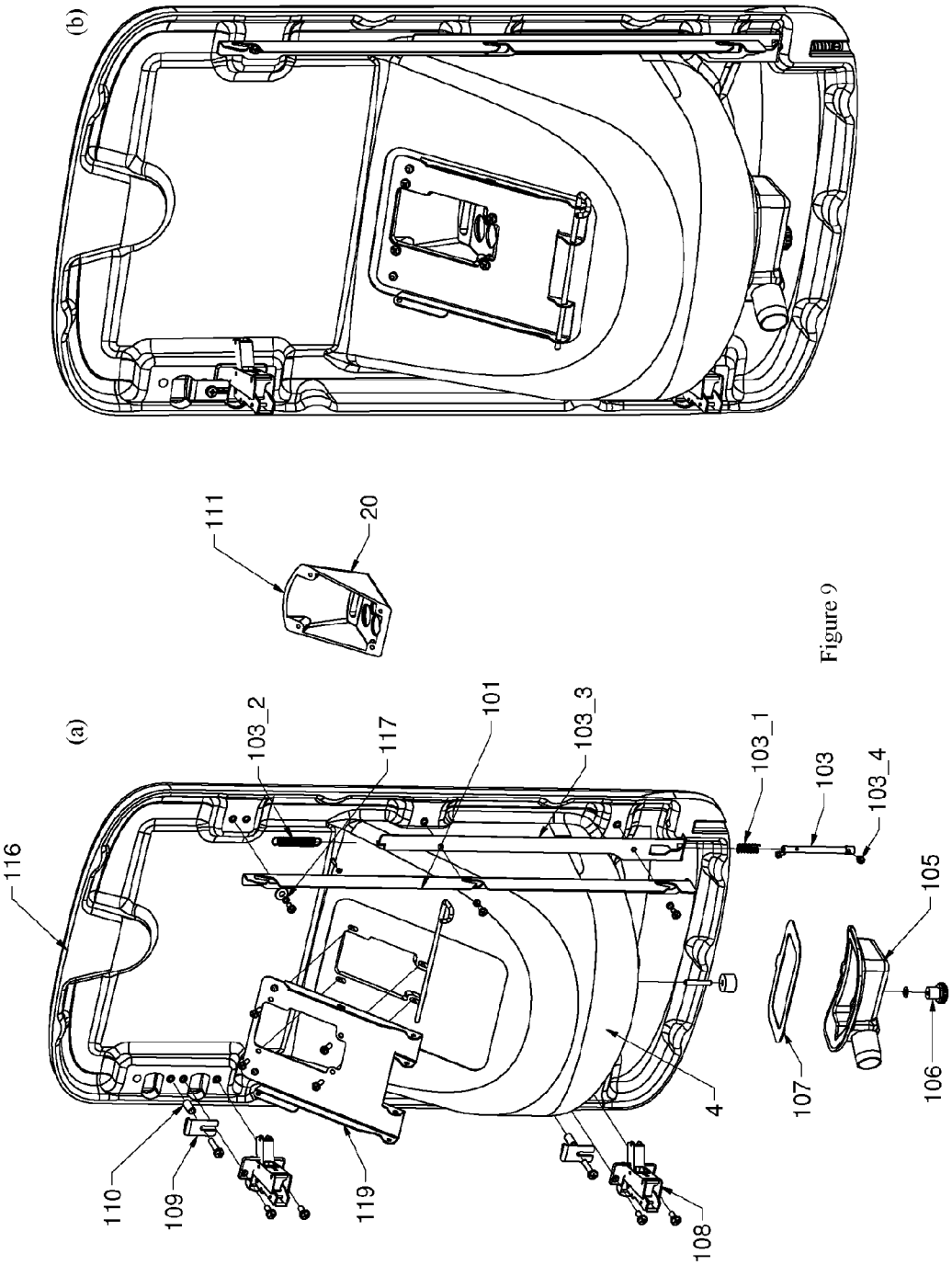
(b)
111
20
(a)
103_2
117
101
103_3
103_1
103
103_4
116
105
4
107
106
110
109
119
108

Figure 9

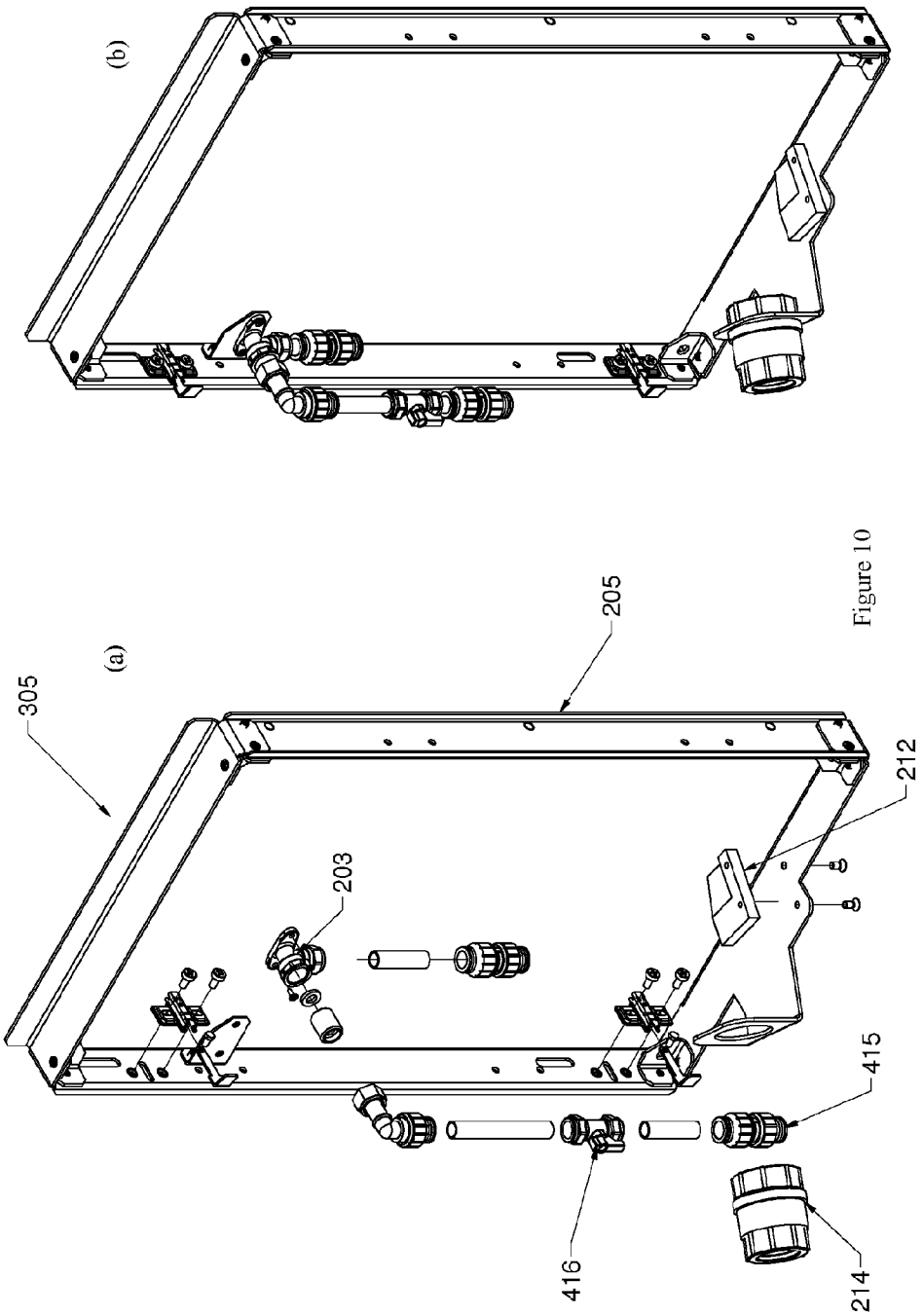

Figure 10

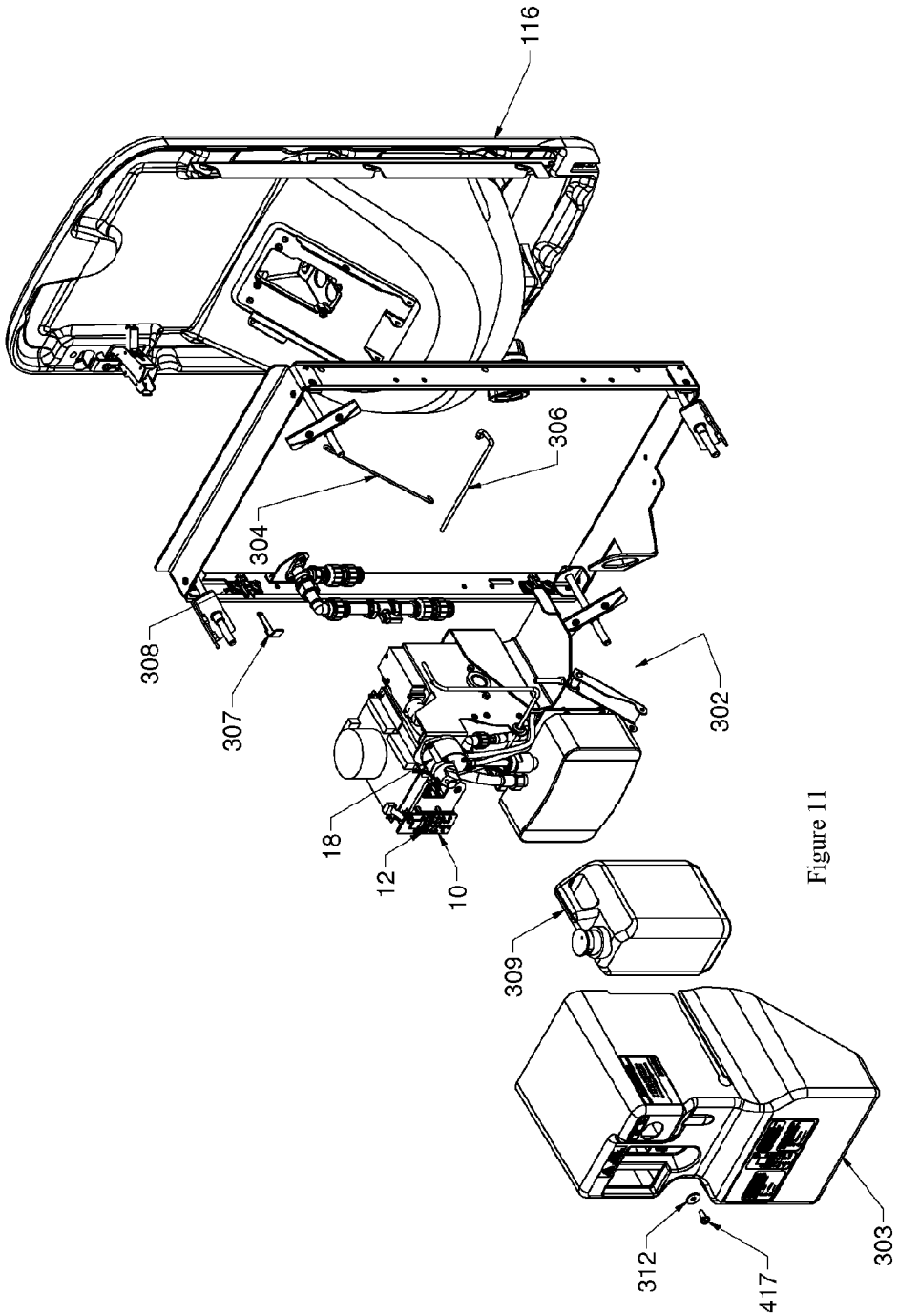

Figure 11