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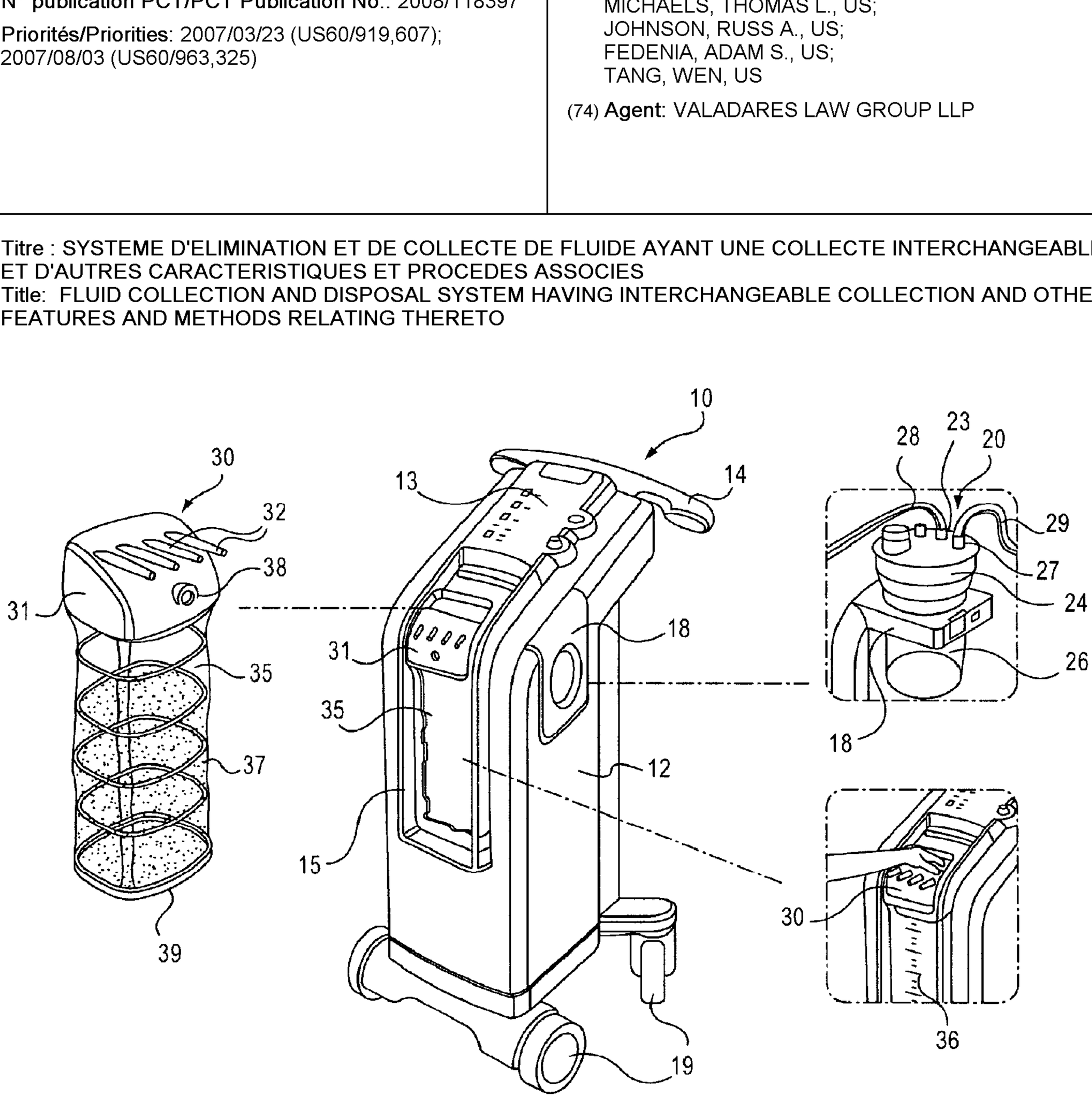
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(54) Titre : SYSTEME D'ELIMINATION ET DE COLLECTE DE FLUIDE AYANT UNE COLLECTE INTERCHANGEABLE ET D'AUTRES CARACTERISTIQUES ET PROCEDES ASSOCIES

(54) Title: FLUID COLLECTION AND DISPOSAL SYSTEM HAVING INTERCHANGEABLE COLLECTION AND OTHER FEATURES AND METHODS RELATING THERETO



(57) Abrégé/Abstract:
Various implementations of a fluid collection system having a flexible liner are disclosed. In one exemplary variation, the fluid collection system may include a flexible liner configured to collapse, a plurality of containers, back storage, specimen collection

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containers, and/or automatic connection to a suction source to reduce the volume of medical wastes, reduce the frequency of disposal cycles, reduce risk of exposure to potentially hazardous waste.

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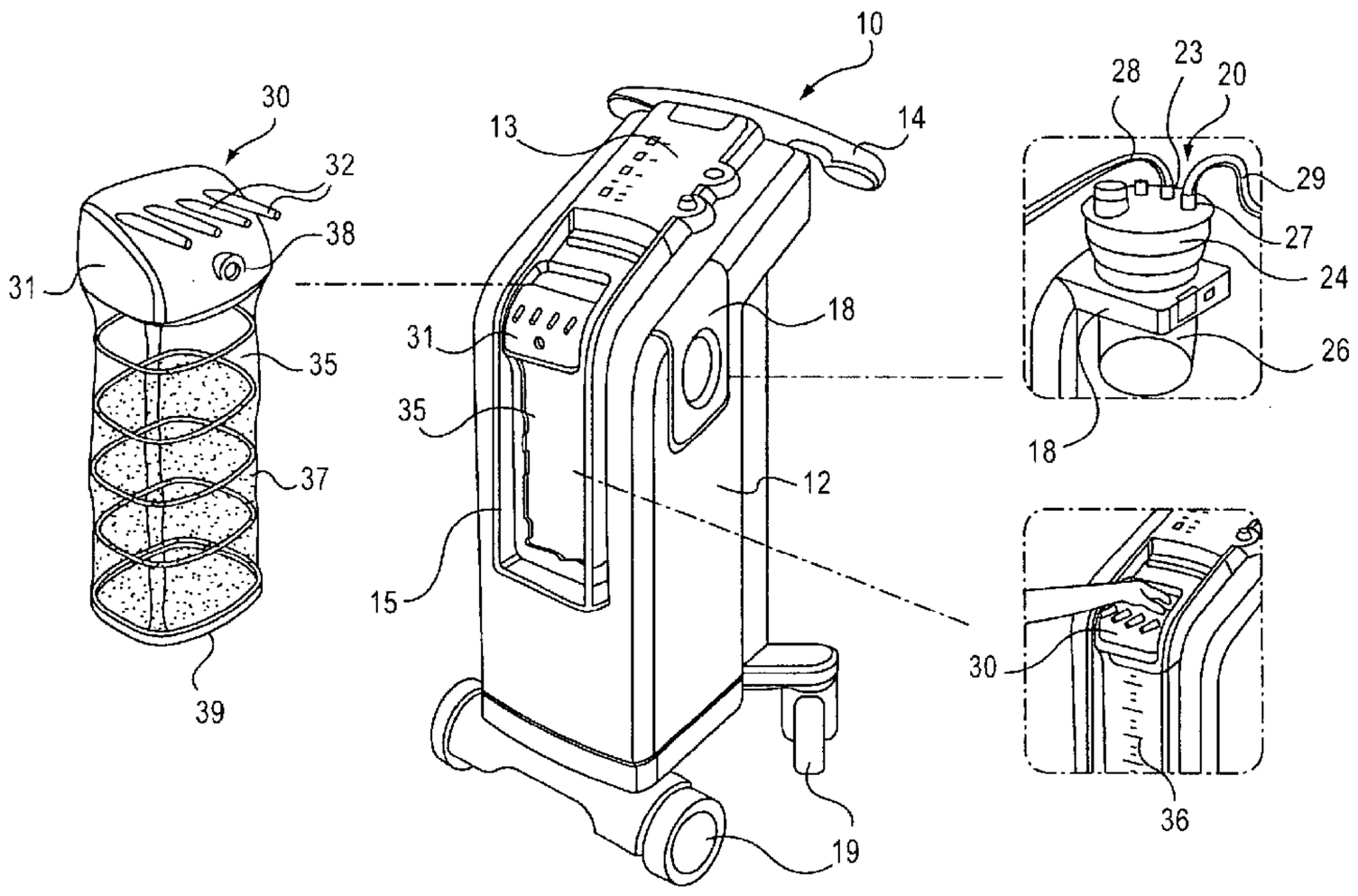
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[Continued on next page]

(54) Title: FLUID COLLECTION AND DISPOSAL SYSTEM HAVING INTERNCHANGEABLE COLLECTION AND OTHER FEATURES AND METHODS RELATING THEREOF



(57) Abstract: Various implementations of a fluid collection system having a flexible liner are disclosed. In one exemplary variation, the fluid collection system may include a flexible liner configured to collapse, a plurality of containers, back storage, specimen collection containers, and/or automatic connection to a suction source to reduce the volume of medical wastes, reduce the frequency of disposal cycles, reduce risk of exposure to potentially hazardous waste.

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TITLE OF THE INVENTION

FLUID COLLECTION AND DISPOSAL SYSTEM HAVING INTERCHANGEABLE COLLECTION AND OTHER FEATURES AND METHODS RELATING THERETO

CROSS REFERENCE TO RELATED APPLICATIONS

[001] This application is based upon and claims the benefit of priority from prior U.S. provisional application no. 60/919,607, filed on March 23, 2007, titled LIQUID COLLECTION AND DISPOSAL SYSTEM AND RELATED METHODS and U.S. provisional application no. 60/963,325, filed on August 3, 2007, titled LIQUID COLLECTION AND DISPOSAL SYSTEM AND RELATED METHODS, and copending U.S. patent application no. _____, filed on March 24, 2008, titled FLUID COLLECTION AND DISPOSAL SYSTEM AND RELATED METHODS, the entire contents of each of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

[002] Aspects of the present invention relate generally to fluid collection and disposal systems and related methods. More specifically, particular variations relate to waste collection and disposal systems that utilize flexible liners, a plurality of containers, back storage, specimen collection containers, and/or automatic connection to a suction source, and related methods of use thereof.

2. Brief Description of Related Art

[003] Hospital operating rooms, emergency rooms, and other healthcare facilities generate a large volume of fluid waste, which may include irrigation fluids and secretions removed from a patient's body (e.g., blood and other bodily liquids). To collect and dispose of such fluid waste, suction canisters are typically used. A typical suction canister is a

temporary storage container that uses suction to create a negative pressure inside the canister to drain fluids or secretions from the patients' body. After each medical procedure (e.g., surgery), the canister containing the fluid waste is transported to a utility area to be disposed of as red-bag waste or to be emptied, cleaned, and disinfected for reuse. A new or cleaned canister is then brought into the operating room for a next medical procedure. This process can be labor intensive and time consuming. Furthermore, since this process is performed following every medical procedure, the frequency of the process may increase the clinicians' risk of exposure to potentially hazardous waste.

[004] Accordingly, there is a need for an improved waste collection and disposal system that may overcome one or more of the problems discussed above.

SUMMARY OF THE INVENTION

[005] Among others, various aspects of the present invention may include providing a fluid collection system that utilizes flexible liners, a plurality of containers, back storage, specimen collection containers, and/or automatic connection to a suction source to reduce the volume of medical wastes, reduce the frequency of disposal cycles, reduce risk of exposure to potentially hazardous waste. Also, certain aspects of the present invention may provide a waste disposal system, for use with the liquid collection system, that may improve labor efficiency, safety, and convenience of the medical personnel participating in a medical procedure.

[006] While aspects and exemplary variations of the present invention will be described in connection with a particular medical waste collection and disposal process, aspects of the invention may be used in other suitable medical and non-medical applications, such as medical or non-medical cleaning devices and processes.

[007] To attain the advantages and other features of aspects of the present invention, as embodied and broadly described herein, one exemplary aspect may provide a waste

collection system having a container having a top opening, a lid configured to close the top opening, and the flexible liner attached to the lid. The liner may be interposed between the lid and the container when the lid closes the top opening. The liner and the lid may define a substantially sealed interior space therebetween. The lid may include an access port through which the interior space receives fluid. The flexible liner may also be configured to collapse into a substantially collapsed state as the fluid is removed from the interior space.

[008] Additional objects and advantages of aspects of the present invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice thereof. Such objects and advantages may be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[009] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE FIGURES

[0010] A better understanding of the invention will be had upon reference to the following description in conjunction with the accompanying drawings in which like reference numerals represent like parts.

[0011] Fig. 1 is a perspective view of a liquid collection system, in accordance with exemplary aspects of the present invention, illustrating various components.

[0012] Fig. 2 is a partial perspective view of an exemplary embodiment of an interface board for the system shown in Fig. 1.

[0013] Fig. 3 is a schematic illustration of various components inside the liquid collection system of Fig. 1.

[0014] Fig. 4 is a perspective view of a liquid collection bag in a collapsed state, in accordance with aspects of the present invention.

[0015] Fig. 5 is a perspective view of the liquid collection bag during a liquid collection stage, in accordance with aspects of the present invention.

[0016] Fig. 6 is a perspective view of an exemplary collection system, illustrating a placement of the liquid collection bag into a cavity of the liquid collection system, in accordance with aspects of the present invention.

[0017] Figs. 7(a)-(c) are perspective views of an exemplary collection system, in accordance with aspects of the present invention.

[0018] Fig. 8 is a schematic illustration of a liquid collection and disposal sequence, in accordance with aspects of the present invention.

[0019] Figs. 9 and 10 are schematic illustrations of a back-up storage container, in accordance with aspects of the present invention.

[0020] Figs. 11-16 show exemplary variations of a back-up storage container, in accordance with aspects of the present invention.

[0021] Figs. 17 and 18 are perspective views of a disposable, separable tube junction, in accordance with aspects of the present invention.

[0022] Fig. 19 is a perspective view of a liquid collection bag, in accordance with aspects of the present invention.

[0023] Figs. 20 and 21 are cross-sectional views of the liquid collection bag shown in Figs. 15 and 16, respectively.

[0024] Figs. 22 and 23 are perspective views of a lid for a liquid collection bag, in accordance with aspects of the present invention.

[0025] Fig. 24 is a perspective cut-away view of the lid shown in Figs. 22 and 23.

[0026] Fig. 25 is a perspective view of an exemplary lid and main body in accordance with aspects of the present invention.

[0027] Figs. 26 and 26(a) are a schematic illustrations of a fluid trap usable in accordance with aspects of the present invention.

[0028] Fig. 27 is a schematic illustration of a liquid disposal process, in accordance with aspects of the present invention.

[0029] Fig. 28 is a perspective view of the liquid collection system of Fig. 1, engaged with a liquid disposal station, in accordance with aspects of the present invention.

[0030] Figs. 29-35 are schematic illustrations of a liquid collection and disposal system, in accordance with aspects of the present invention.

[0031] Figs. 36-38 show exemplary features of a liquid collection and disposal system in accordance with aspects of the present invention.

[0032] Fig. 39 is a schematic diagram of a liquid disposal station, illustrating various components and operational characteristics associated with a liquid collection system, in accordance with aspects of the present invention.

[0033] Figs. 40(a) and 40(b) depict aspects of an exemplary disposal system, in accordance with aspects of the present invention.

[0034] Fig. 40(c) depicts aspects of an exemplary disposal system, in accordance with aspects of the present invention.

[0035] Fig. 41(a-e) and 42(a-c) show an exemplary liquid collection system, in accordance with aspects of the present invention.

[0036] Fig. 43(a-c) show an exemplary liquid collection container, in accordance with aspects of the present invention.

[0037] Figs. 44-46 illustrate an exemplary liquid collection method and system, in accordance with aspects of the present invention.

[0038] Figs. 47-49 illustrate exemplary variations of liquid collection container, in accordance with aspects of the present invention.

[0039] Figs. 50-52 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0040] Figs. 53-55 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0041] Figs. 56 and 57 illustrate a liquid collection and disposal process, in accordance with aspects of the present invention.

[0042] Fig. 58 illustrates a liquid collection and disposal process, in accordance with aspects of the present invention.

[0043] Fig. 59 illustrates a liquid collection and disposal process, in accordance with aspects of the present invention.

[0044] Figs. 60-62 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0045] Figs. 63 and 64 illustrate a liquid collection and disposal process, in accordance with aspects of the present invention.

[0046] Figs. 65-66 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0047] Figs. 67-69 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0048] Figs. 70-71 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0049] Figs. 72-74 illustrate an exemplary liquid collection system including a back-up container or specimen collector, in accordance with aspects of the present invention.

[0050] Fig. 75 illustrates an exemplary liquid collection system, in accordance with aspects of the present invention.

[0051] Fig. 76 illustrates an exemplary liquid collection container, in accordance with aspects of the present invention.

[0052] Fig. 77(a-c) illustrates an exemplary liquid collection and disposal process, in accordance with aspects of the present invention.

[0053] Figs. 78-80 illustrate an exemplary liquid collection system, in accordance with aspects of the present invention.

[0054] Fig 81 illustrates an exemplary liquid collection and disposal process, in accordance with aspects of the present invention.

[0055] Figs. 82-92 illustrate exemplary variations of a liquid collection container, including illustrations of methods of storage and methods of use thereof, in accordance with aspects of the present invention.

[0056] Figs. 93 is a perspective views illustrating an exemplary engagement between a liquid disposal station and a lid of a liquid collection system, in accordance with aspects of the present invention.

[0057] Figs. 94 and 95 are cross-sectional views illustrating the exemplary engagement of the devices of Fig. 93, as located between the disposal interface of the liquid disposal station and an evacuation port of the lid.

[0058] Fig. 96 is a cross-sectional view of the disposal interface and valve of Figs. 94 and 95 in engagement with the evacuation port, illustrating an exemplary flow of cleaning water for cleaning the interface, in accordance with aspects of the present invention.

[0059] Fig. 97 is a cross-sectional view of the interstitial interface of Fig. 93 in engagement with an interstitial port of the lid.

[0060] Fig. 98 is a block diagram of one variation of a liquid collection system illustrating various components and their operational characteristics thereof, in accordance with aspects of the present invention.

[0061] Figs. 99-101 illustrate exemplary implementations of a fluid collection container.

DETAILED DESCRIPTION

[0062] Reference will now be made in detail to aspects of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0063] Figs. 1-3 show a portable fluid collection system 10 (herein referred to interchangeably as a liquid collection system), according to exemplary aspects of the present invention. The system 10 includes a main body, also interchangeably referred to herein as a container receiving housing, 12 defining a cavity 15 for receiving a fluid collection container 30(herein referred to interchangeably as a liquid collection container), shown in this figure as an exemplary fluid collection bag 30 (herein referred to interchangeably as a liquid collection bag). The liquid collection container is also interchangeably referred to herein as a "liquid collection bag." The system 10 may also include a handle 14 and wheels 19 to facilitate transport of the system 10. The wheels 19 may be permanently fixed to the main body 12 or, alternatively, to a support platform on which the main body 12 may be placed. The system 10 may also include a cord reel 43 for storing a power cable. Although the system 10 is illustrated as being mobile, the system may be stationary. The system may be configured to incorporate a disposal system, such as the disposal systems described herein. The system 10 may also be stationary and configured to function with a mobile disposal station.

[0064] The term "liquid," as used herein, does not merely refer to a state of matter as defined in the thermodynamic and/or fluid mechanics art. Instead, the term "liquid" also includes any solid particles or gases that may incidentally flow with a liquid medium (e.g., irrigation fluid or blood) or that may be intentionally collected using a liquid medium. For example, when the fluid collection system 10 is used in a surgical procedure, the term "liquid" may refer to a combination of liquid medium (e.g., irrigation fluid, blood, and other bodily liquid from the patient) and any solid particles including, but not limited to, resected tissue removed from the patient's body or harmful particles mixed with smoke or other particulates and/or gases such as may occur in connection with laser, cauterization, and/or other medical procedures. The term "fluid," as used herein may also refer to a liquid medium, solid particles, smoke, gases, particulates, and combinations thereof.

[0065] The main body 12 may also include a container holder for receiving a back-up storage container 20, such as a suction canister. The holder may include a foldable mounting bracket 18 having an opening sized and configured to receive the container 20. When not in use, the bracket 18 may be folded substantially flush with a side surface of the main body 12, so as not to interfere with the normal use of the system 10. Alternatively, the holder may include a planar support structure (e.g., a flat structure without a hole) on which the container 20 may be rested. Alternatively still, storage container 20 may be affixed to the main body 12 by a sliding-type bracket, such as shown in US Patent No. 5,470,324, which is hereby incorporated by reference herein in its entirety. As a further modification, vacuum pressure may be supplied to the interior space of the container 20 directly through the bracket, such as via a connector provided on the sidewall of the main body 12.

[0066] As shown in Fig. 3, the main body 12 may include one or more storage units 16 for storing, for example, medical supplies associated with the system 10. In some

exemplary embodiments, the storage units 16 may be configured to store multiple liquid collection bags 30.

[0067] The system 10 may include a vacuum pump 44 for supplying a suction force to the cavity 15 and to the liquid collection bag 30. Although not shown in Fig. 3, the system 10 may include appropriate suction conduits connecting the vacuum pump 44 to the cavity 15 and the liquid collection bag 30. In certain exemplary embodiments, instead of, or in addition to, providing the vacuum pump 44 in the main body 12, an alternative suction source may be separately supplied to the system 10. For example, suitable conduits, tubing, fittings, connectors, and/or other hookups may be provided on the main body 12 to allow connection to an external source of vacuum or suction force, such as a wall vacuum in a hospital setting. The availability of an alternative suction source may enable a continuous liquid collection process even when the vacuum pump 44 malfunctions or becomes otherwise unavailable, for example.

[0068] In certain variations, the system 10 may include a filter unit 70 (e.g., a HEPA filter) to prevent relatively large particles from entering the vacuum pump 44.

[0069] The system 10 may include an interface board 13 for enabling control of various features of the system 10. For example, as shown in Fig. 2, the board 13 may include a selection button 56 for controlling the power supplied to the system 10 and a selection button or variable control knob 58 for regulating suction power. The interface board 13 may also include one or more visual or audible indicators that provide various information relating to operational characteristics and/or status of the system 10. For example, the interface board 13 may include one or more light indicators 55, 52, 54 for indicating whether the system 10 is ready for operation, whether the storage bag 30 is full (or filled to an indicated level), or whether the filter 70 needs to be replaced. The board 13 may also include a vacuum level indicator 59 to provide visual feedback on the level of suction pressure as controlled by the

variable control knob 58. An audio source may be provided to supply audio indicators alone or in conjunction with one or more of the visual indicators.

[0070] The interface board may also include any one or more visual and/or audible indicators that the liquid collected in the liquid collection bag has reached a predetermined or selected level. The visual indicator may include a light or other visual indicator on the interface board. The visual indicator may also include a light or other display for projection onto a wall or ceiling of the room in which the system is located. For example, a visual indicator may show that the bag is "almost full" when the liquid collected in the bag reaches more than 80% of the capacity of the bag. This indication may also or alternatively occur at 85%, 90%, or 95%, for example. The interface board may include a selection button for enabling/disabling the audible alarm. The interface board may include additional visual indicators to signal that the filter should be replaced, or that the bag is full.

[0071] The liquid collection bag 30 may be a disposable unit. As shown in Fig. 1, the collection bag 30 may include a lid 31 and a flexible liner 35 attached to or integrally formed with the lid 31, such that the liner 35 and the lid 31 define a substantially sealed interior space therebetween. The flexible liner 35 may attach to the lid 31 via a snap ring, via adhesive, via hot melt, ultrasonic weld, sealing such as heat sealing, etc.

[0072] The flexible liner 35 may comprise a sufficiently durable, yet collapsible material, so that, upon applying a negative pressure inside the interior space (e.g., during and/or after fluid is removed from the interior space), the liner 35 can collapse into a smaller volume. In some exemplary applications, the liner 35 may additionally include one or more support structures that guide the liner 35 to expand/extend and collapse/retract in a predetermined manner. For example, as shown in Fig. 1, the liner 35 may include a plurality of support rings or a spiral shaped support 37 (e.g., ribs or spirals made of flexible wires), spaced apart from one another along the length of the liner 35, so that the liner 35 may

expand and collapse in a bellow-like manner. The term collapse as used herein, includes and is interchangeably referred to herein as actions in which the sides of the liner 35 fall in, cave in, retract, unextend, compress in, fold, or roll, among other things, and/or which may optionally be forced or otherwise collapsed via a scraping or other squeegee type apparatus. Alternatively, as seen in Fig. 5, the liner 35 may not include such support rings 37. In either case, in variations the liner 35 extends and retracts along its longitudinal axis. Other variations may include other directions in which the liner 35 extends and retracts.

[0073] The liquid collection bag 30 may also include a flexible pathway located along the flexible liner 35 configured to communicate a disposal device with contents that are collected at the bottom of the flexible liner 35. This flexible pathway may include a channel provided in the material of the liner, a flexible tube attached to the side of the liner 35, etc. This flexible pathway may be used during evacuation of the collection bag by providing a straw-type communication with the lower contents of the bag. In this embodiment, the waste collected in the liquid collection bag may be evacuated from the lower portion of the bag using the flexible pathway. As the bag is evacuated, the flexible liner collapses in a controlled manner.

[0074] The flexible pathway may be used to evacuate the entire contents of the liquid collection bag. The flexible pathway may also be used in connection with another disposal source. For example, during evacuation through a disposal port in the lid of the liquid collection bag 30, the sides of the liner 35 may collapse together preventing liquid in the lower portion of the liner 35 from being evacuated. A disposal suction source may be applied to the flexible pathway to access the trapped liquid in the lower portion of the liner 35. This disposal suction source may be applied at the same time as a suction source is applied through the disposal port in the lid, or the suction source may be applied to the flexible

pathway at the end of an evacuation process, after a suction source has been applied to the disposal port in the lid.

[0075] At least the front portion of the main body 12 may comprise a transparent or translucent material that allows visualization of the liquid being collected in the collection bag 30. In some exemplary implementations, the front portion of the main body 12, the liner 35 and/or the cylindrical body 86, may include gradation marks 36 to indicate the amount of liquid being collected in the collection bag 30, as shown in Fig. 1.

[0076] The lid 31 may include one or more collection ports 32 configured to connect to various medical devices/instruments that draw liquid into (or extract liquid from) the collection bag 30. The collection ports 32 may have various different sizes and shapes to accommodate various medical devices that may be used with the system 10. The lid 31 may also include a vacuum port 33 (see Fig. 8) for connecting to the vacuum pump 44 to supply suction force to the interior space of the collection bag 30.

[0077] In an exemplary implementation, as shown in Figs. 4-6, the lid 31 may also include a back-up vacuum port 34 for connecting to a back-up storage container 20 in case the collection bag 30 becomes full or inoperable during a liquid collection process. The back-up vacuum port 34 may be in communication with the vacuum port 33, such that the vacuum pressure supplied by the vacuum pump 44 can also supply vacuum pressure to the back-up storage container 20 via the backup vacuum port 34. Alternatively, the backup vacuum port 34 may be in communication with an alternate source of vacuum pressure (e.g., wall vacuum in a hospital setting). Alternatively or additionally, the backup storage container 20 may be connected to one or more of the collection ports 32 using, for example, conventional tubing so as to supply vacuum pressure to the backup storage container 20. In some alternative variations, the backup vacuum port 34 may be located on the main body 12, rather than on the lid 31, and connected either to the vacuum pump 44 or an alternate source

of suction force. The operation of the back-up storage container 20 will be explained in more detail later with reference to Figs. 9 and 10.

[0078] The lid 31 may also include a discharge port 38 for evacuating the collected liquid from the collection bag 30, such as after a medical procedure is completed. In an alternative variation, the lid 31 may not have any separate discharge port 38. Instead, one or more of the collection ports 32 may be used to empty the collection bag 30.

[0079] As mentioned above, the main body 12 defines a cavity 15 configured to receive the liquid collection bag 30. The cavity 15 may have various sizes and shapes. By way of example only, the cavity 15 may have a volume of approximately 12L, 15L, 20L, etc.. Alternatively, even very small volume bags 30 could be used. When having a relatively large volume, the liquid collection bag 30 may be used continuously over multiple medical procedures without emptying the collection bag 30.

[0080] In certain variations, the cavity 15 may be provided with an interface connector to facilitate engagement of the top portion of the cavity 11 with the lid of a liquid collection bag in a manner so as to enhance sealing therebetween. The interface connector may comprise a flexible material, such as a polymer, elastomer, or rubber. The interface connector may include an annular member configured to removably engage with the top portion 11 of the cavity 15. For example, the top portion 11 of the cylindrical body 15 may include a flange extending circumferentially along its external side wall, and the interface connector may have a corresponding snap-on structure configured to engage the flange.

[0081] A lid may include a rigid rib configured to contact the seal flap 8 when the lid is inserted into the top opening of the cavity 15. As the lid is inserted, the rigid rib may press down on a surface of the seal flap, causing the seal flap to resiliently deform from an unstressed state to a stressed state. At this stressed state, the seal flap exerts a counteracting force against the rigid rib 564, which enhances the sealing effect between the lid and the

receptacle. To further enhance the sealing effect, the interface connector may include a pressure rib extending from its top surface to contact with a bottom surface of the peripheral edge of the lid .

[0082] The collection bag 30 may be delivered to the medical facility in its fully-collapsed state, as shown in Fig. 4. The collapsibility of the collection bag 30 into a smaller volume may reduce not only the volume of the medical waste generated, but also the storage area required to store the collection bags 30 prior to their use. For example, in an exemplary implementation, instead of storing the collection bags 30 in a separate storage location, they may be stored inside the storage space 16 of the main body 12 for convenient access. Alternatively, the exterior of the main body 12 may have one or more attachment members to which extra collection bags 30 may be secured or otherwise attached.

[0083] During use, the liner 35 is extended to receive fluid, as shown in Fig. 5. As will be explained in detail herein, while the collection bag 30 is being emptied, the liner 35 may collapse again into a state that is substantially similar to its original fully-collapsed state. After an acceptable quantity of liquid is removed from the collection bag 30, it may be removed for disposal in its near-collapsed state.

[0084] To begin a liquid collection process, the collection bag 30 is positioned, in its collapsed state, on the mouth portion 11 of the cavity 15, as shown in Fig. 6. An unused, collapsed liquid collection bag may include a holding mechanism such as a strap or band that assists in maintaining the liner portion of the collection bag in a suitable collapsed position. This holding mechanism assists in maintaining the flexible liner in a suitable collapsed position and holds the flexible liner away from any seals on the lid. This feature allows the bag to be easily positioned at the mouth portion 11 of the cavity 15 and assists in preventing the flexible liner from being pinched between a seal on the lid and the mouth portion 11 of the cavity. The holding mechanism may be configured of a breakable material that breaks,

for example, when suction pressure is applied to expand the bag into the interior of the cavity, or as collected liquid expands the bag. Thus, a user does not need to break the band prior to placing the collection bag 30 on the mouth portion 11 of the cavity 15. The holding mechanism may comprise, for example, paper, plastic, or other suitable material. Once positioned in place, the lid 31 of the collection bag 30 may sealingly engage the mouth portion 11 of the cavity 15, so as to form a substantially air-tight enclosure inside the cavity 15 and exterior to the collection bag 30. Figs. 7(a-c) show various features of an exemplary fluid collection system, in accordance with aspects of the present invention.

[0085] Fig. 12 illustrates a fluid collection and disposal sequence, according to exemplary aspects of the present invention. As shown in Fig. 8, the cavity 15 may include three vacuum connectors: a first connector 62, a second connector 64, and a third connector 66, each of which may be connected to a vacuum pump 44 positioned at the lower portion of the main body 12, or alternatively may be connected to an external source of suction pressure. As discussed above, a filter (e.g., filter 70 shown in Figs. 6-8) may be disposed between the vacuum pump 44 and at least one of those three vacuum connectors. When the collection bag 30 is placed in the cavity 15, the vacuum port 33 of the lid 31 may automatically connect to the first connector 62, so as to supply suction force to the interior space of the collection bag 30. This suction force, in turn, is communicated to the collection ports 32. Each of the vacuum connectors 62, 64, 66 may include a suitable valve to selectively open and close communication with the vacuum pump 44 or to an alternate source of vacuum pressure. In some exemplary variations, the valve associated with the third connector 66 may comprise a three-way valve that can selectively establish fluid communication between the cavity 15 (exterior to the bag 30) and atmosphere. As will be explained in greater detail below, this valve arrangement may allow the pressure inside the cavity 15 to reach atmospheric pressure during an evacuation process, so as not to interfere

with the collapsing of the liner 35. Alternatively, the second connector 64 may be open to vacuum pressure or may be closed off entirely, so as to provide selective regulation of air pressure within the cavity 15 exterior to the collection bag 30.

[0086] The collection bag 30 may also include various valves associated with the collection ports 32 and the discharge port 38. The collection bag 30 may also include an overflow valve associated with the vacuum port 33. As will be discussed in greater detail herein, the overflow valve may be configured to close a passageway leading to the vacuum port 33 when the liquid level reaches the elevational position of the overflow valve or when the liquid level reaches some preselected cutoff elevational position spaced below the overflow valve by some distance. In addition, a sensor may be provided to detect when the level of the liquid has reached a preselected position, upon which the sensor may then provide visual and/or audio feedback to the operator to indicate that the level of liquid within the collection bag 30 is nearing the overflow valve position. These valves associated with the collection ports 32, discharge port 38, and vacuum port 33 are schematically shown in Fig. 12 with circles adjacent the corresponding ports. Solid circles represent closed valves, and open circles represent open valves.

[0087] Once the collection bag 30 is positioned within the cavity 15, the third connector 66 is opened to a suction force so as to be in fluid and/or pressure communication with the interior space of the cavity 15 external to the liner 35, thereby expanding the liner 35 into the cavity 15, as shown in Fig. 8(B). At this stage, although the figure shows the collection ports 32 to be closed, at least one of the collection ports 32 and the discharge port 38 may be opened to allow air flow into the collection bag 30. This action draws the liner 35 into the cavity 15 without distorting the shape of the bag 30. Alternatively, some other vent may be provided, so as to allow ambient air to enter the interior space of the liner 35 as the liner is drawn down into the cavity 15. To draw the liner 35 into the cavity, the liner 35 may

include a sealing member 39 (e.g., one or more sealing rings) positioned adjacent its bottom end.

[0088] In some exemplary variations, the sealing member may include a more substantial structure, such as a molded plastic disc with sealing rings, as described in U.S. patent application no. _____, filed on March 24, 2008, titled FLUID COLLECTION AND DISPOSAL SYSTEM AND RELATED METHODS. The sealing member 39 provides a substantially fluid-tight seal between the liner 35 and the surface defining the cavity 15. In an alternative implementation, the liner 35 may not be drawn into the bottom portion of the cavity 15 prior to receiving the liquid. Instead, as the liquid is being collected, the weight of the liquid may cause the liner 35 to expand into the cavity 15. Although the second connector 64 is shown in the figures to be located at a position vertically below the lowermost end of the collection bag 30, as shown in Fig. 12, it will be apparent to one of ordinary skill in the art that the second connector 64 may selectively not be opened to atmosphere until the lowermost end of the collection bag 30 is positioned vertically below the elevational position of the second connector 64.

[0089] Once the liner 35 is drawn into the cavity 15, communication with the first connector 62 is opened so as to supply suction force into the interior space of the collection bag 30 and, in turn, via the collection bag 30 to the collection ports 32. One or more medical devices, such as a suction catheter or a patient tubing, may be connected to the collection ports 32 to draw liquid into the collection bag 30, as shown in Fig. 8(C). At this stage, the collection ports 32 may open to allow liquid to flow through the collection ports 32. During this liquid collection process, the second connector 64 may be opened to counterbalance the vacuum force applied to the interior space of the collection bag 30, so that the liner 35 may substantially maintain its normal shape. That is, opening the second connector 64 to a

suction force thereby prevents the liner 35 from being drawn back up towards the lid 31 under the influence of the negative pressure within the interior space of the collection bag 30.

[0090] When the collection bag 30 is full and/or otherwise needs to be emptied, the collection system 10 may be transported to a disposal station to extract the collected liquid out of the collection bag 30, as shown in Fig. 8(D). At this stage, the collection ports 32 are closed, and the discharge port 38 is opened. As mentioned above, as the collected liquid is drawn out of the collection bag 30, the second connector 64 is closed and the third connector 66 may communicate with atmosphere to increase the pressure inside the cavity 15 to atmospheric pressure. Maintaining the pressure inside the cavity 15 at atmospheric pressure may provide a sufficient pressure difference between the cavity 15 and the interior space of the collection bag 30, such that the liner 35 may collapse itself towards the lid 31 as the collected liquid is drawn out of the collection bag 30.

[0091] After an acceptable quantity of the collected liquid is removed from the collection bag 30, the liner 35 may return to a collapsed state, as shown in Fig. 8(E). For practical purposes, it may be sufficient for the liner 35 to compact itself enough so as to make subsequent handling and disposal thereof more efficient.

[0092] After the collected liquid is substantially removed from the collection bag 30, the valves associated with the collection ports 32, the discharge port 38, and the overflow valve are closed sufficiently to inhibit air from flowing into the interior space of the collection bag 30. Minimizing the amount of air flow into the collection bag 30 allows the collection bag 30 to remain in a substantially collapsed state for disposal. That is, large quantities of air will not be allowed to leak back into the interior space of the bag 30 once the vacuum pressure is removed therefrom. The used collection bag 30 may then be removed from the cavity 15 and, for example, placed in a red bag for disposal. Thereafter, a new

collection bag 30 may be placed onto the cavity 15 and the fluid collection process described above may be repeated for the next series of medical procedures.

[0093] An additional safety feature is provided through at least one valve in the lid of the liquid collection bag 30. Implementations of such a valve are shown, for example, as valve 226 in Figs. 31-32 and 35. The valve may be an anti-drip check valve, such as a diaphragm valve, a biased valve, a two-way valve, such as any of a number of two-way valves manufactured by Liquid Molding Systems, Inc. (LMS) of Midland, Michigan, etc. that also provides an access port to the collection bag. The valve provides a connection port, wipes the connector as it is removed, thereby preventing drips, and prevents liquid in the liquid collection valve from leaking out of the collection bag. For example, after an evacuation process, the valve prevents any remaining liquid in the collection bag from exiting the bag. Thus, a technician or other person involved in use of the system, including disposal of the liquid collection bag, is further protected from contact with the waste material collected in the liquid collection bag.

[0094] In certain circumstances, the collection bag 30 may become full or temporarily inoperable during a liquid collection process. To mitigate the negative effect this condition may have on a medical procedure, a back-up storage container 26 may be provided to temporarily store the liquid waste without interrupting the medical procedure, as shown in Fig. 1. In the exemplary variation shown in Figs. 9and 10, the storage container 20 may have a frustoconical, generally tapering cylindrical body 26 and a cap 25 configured to close the top opening of the body 26 in a leak-tight manner. By way of example only, the storage container 20 may have a volume of approximately 3L. Of course, the storage container 20 may have any other suitable shapes and sizes. The body 26 of the storage container 20 may be made of a material that is sufficiently strong to withstand the negative pressure applied

thereto. In addition, the body 26 may comprise a sufficiently transparent material to allow visualization of the liquid being collected in the storage container 20.

[0095] To engage the storage container 20 with the main body 12, the mounting bracket 18 may be extended laterally from the side surface of the main body 18. As shown in Fig. 9, the cylindrical body 26 of the storage container 20 may then be inserted into the opening of the bracket 18 to retain the container 20 in an upright position. In certain variations, cap 25 may include at least two access ports: a vacuum port 23 and one or more collection ports 27. As shown in Fig. 10, the vacuum port 23 may communicate with the back-up vacuum port 34 of the collection bag 30 via a suitable suction conduit 28, and the collection port 27 may communicate with a proximal end of a suitable medical instrument attached to a collection tube (for the sake of illustration, both the suction instrument itself and the tubing used to connect to the suction instrument will be referred to using reference numeral 29) that is configured to draw liquid into the storage container 20. This arrangement allows the back-up storage container 20 to function as a separate, independent suction canister, thereby enabling continuous operation of the system 10, even when the collection bag 30 is full or inoperable. Sufficient valving and connections may be provided for either simultaneous operation of the main unit and the storage container 20, or independent operations thereof.

[0096] Although Figs. 9-10 show a variation with a vacuum port 34 in the lid that provides for communication with the back-up storage container 26, in other variations, a vacuum port for the back up storage container may be provided in other locations on the main body. For example, Figs. 1, 20, 25, and Figs. 99-101 illustrate variations of a collection container lid without a vacuum port for a back up storage container. For example, the lid may include an opening 546 configured to provide communication with an evacuation source. The opening may include a breakable member 544, a two-way check valve 542, and

a pin 541, for example. The lid may also include an interstitial opening 516 for communicating atmospheric pressure, for example, with an interstitial space between the cavity and liner, wherein the interstitial opening is closed by a breakable member 514. The lid may also include a plurality of ports 532, each configured to communicate with a suction instrument, through which fluid is drawn into the fluid collection container. Each port may include a tethered cap 132b. The lid may include a shelf 1910 located between the interior opening of the plurality of ports and the opening communicating with the vacuum source to divert collected fluids away from the vacuum source. The shelf may be shaped to direct entering fluid toward the liner walls and away from the shut off valve. The lid may also include a screen 1920 surrounding the opening to the evacuation opening. The screen may be shaped to prevent solids collected in the fluid from exiting the collection container during disposal. The lid may also include additional features illustrated in Figs. 99-101.

[0097] Among other attachment mechanisms and methods, the liner may be attached to the lid via hot melt, for example at ridge 1930. Prior to use, the liner may also include a breakable band maintaining the liner in a collapsed position against the lid.

[0098] Instead of in the lid, a vacuum connection can be provided for the back-up container, for example, as a port 26a on the side of liquid collection system 10, as shown in Fig. 11(a). In this variation, the communication between the suction source and the back up storage container 26 bypasses the disposable container 30, allowing the back up storage container 26 to directly connect to the vacuum source. Port 26a may be capped or may include a valve, and may be configured to accept tubing or other connecting devices. Bracket 18, which is configured to hold the back up storage container 26, in this exemplary implementation may also be configured to control the opening/closing of port/valve 26a.

[0099] In addition to a separate vacuum port 34 or 26a, one of the plurality of ports 32 may provide communication with a back-up storage container 26. This enables the back-up container to be further used as a trap or specimen collection container.

[00100] The back-up storage container may be configured to require a manual connection before use. Alternatively, the back-up storage may be configured to automatically collect overflow liquid from the liquid collection bag once the liquid collection bag has reached its capacity. This automatic arrangement allows the back-up storage container to operate as an overflow canister rather than an independent canister, as described above. The back-up storage container 20 may also be configured to be attached to an independent suction source. Although a back-up storage container without a disposable bag is shown, other embodiments may incorporate a disposable liquid collection bag similar to the bag 30 used inside the cavity 35 of device 10.

[00101] Figs. 11-16 illustrate additional variations of a back-up storage container. As shown in Fig. 11, the main body 12 of the liquid collection may include a holder 18a integrally formed in the side of the main body, rather than a bracket that folds out from the side of the main body.

[00102] Figs. 12-14 illustrate a back up container 26a configured to attach over the liquid collection container 30. This variation accepts the manifold from the liquid collection container 30. This feature removes the need to unplug and replug tubing and suction instruments. Fig. 13 illustrates an implementation in which the main body 12 is configured to accept the back-up storage container 26a in a compartment. This variation is shown as a rectangular, drawer type back-up container that has the appearance of a drawer when placed in the compartment in the main body.

[00103] Figs. 15-16 illustrate a main body configured to receive a back up storage container 26b in a groove 2701 in the exterior of the main body 12. The back up storage

container 26b has a shape corresponding to the groove 2701 in the main body, and is configured to have a face flush with the external of the main body 12. The back up storage container communicates with at least one port 27b configured to communicate with a suction instrument, for example, via tubing 29b. This communication may be made via a lid on the back-up storage container, or via a manifold attached to the main body 12 In addition, the main body may include an inset space 2700 providing access to reach and replace the back-up storage container 26b.

[00104] Figs. 17-21 illustrate another exemplary variation of a collection bag 130, according to one aspect of the present invention. This variation is different from the previous implementations shown in Figs. 1 and 4-8, in that it includes a removable hose junction 134 and a safety valve 142, 144 that operates in connection with the hose junction 134. As shown in Fig. 17, the collection bag 130 includes a lid 131 and a liner 135 attached to the lid 131 to form a substantially sealed interior space therebetween. The liner 135 is substantially similar to the liner 35 of the variation described above and, therefore, a detailed description thereof is omitted herein.

[00105] As shown in Figs. 17 and 18, the lid 131 includes a hose junction 134 removably engageable with a slot 136, located at the top of the lid 131. The hose junction 134 may include a latch 137 having a hook portion configured to releasably engage a corresponding indentation 138 formed inside the slot 136. When the hose junction 134 is pushed into the slot 136, the hook portion of the latch 137 engages the indentation 138, shown in Fig. 21, thereby securely attaching the hose junction 134 onto the lid 131. The hook portion may be sufficiently flexible to allow slight deflection when engaging the indentation 138. To remove the hose junction 134, the latch 137 may be depressed, for example, so as to release the hook portion from the indentation 138. Of course, other conventional methods of removably securing the hose junction 134 to the lid 131 may be

employed. The lid 131 may also include a hand grip 133 to facilitate handling of the collection bag 130, as shown in Fig. 19.

[00106] The hose junction 134 carries one or more collection ports 132, each configured to mate with one or more suction devices by way of suction tubings for the purpose of drawing liquid into the collection bag 130. Because the hose junction 134 provides a plurality of collection ports 132, a single collection bag 130 may be used to collect liquid simultaneously from multiple suction instruments or other devices (interchangeably referred to herein as "suction instruments") by way of suction tubings for the purpose of drawing liquid into the collection bag 130. Because the hose junction 134 provides a plurality of collection ports 132, a single collection bag 130 may be used to collect liquid simultaneously from multiple suction instruments. As best shown in Figs. 20and 21, the hose junction 134 defines one or more fluid passageways 141 via which liquid is transported from the individual (or multiple) suction instruments to the interior space of the collection bag 130. Thus, the hose junction 134 may function as an interface between the collection bag 130 and the suction instruments and tubings used to collect liquid in the collection bag 130. In addition, the hose junction 134 may include suitable valves (e.g., duckbill valves, check valves, spring loaded plungers) to prevent, or at least minimize, liquid dripping while the suction instruments and tubings are disconnected from the collection bag 130 and disposed of in a suitable disposal container (e.g., a red bag). Thus, the hose junction 134 may reduce the risk of the clinicians' exposure to potentially hazardous materials.

[00107] Each of the collection ports 132 may be covered with a flap 132a, which closes the respective collection port 132 when not in use. The flaps 132a may be spring-loaded or otherwise biased such that, when the suction devices and tubings are disconnected from the collection ports 132, the flaps 132a may automatically close the collection ports 132. The flaps 132a may include conventional sealing members so as to define a substantially

fluid-tight seal when the flap 132a covers its respective collection port 132. Alternatively, conventional caps or plugs may be frictionally positioned relative to the open ends of the collection ports 132. For example, as shown in Fig. 25, the collection ports 132 may include a tethered cap132b. Alternatively, flaps 132a may be biased to remain in an open position until an operator manually closes them, relative to the collection ports 132. Alternatively still, collection ports 132 may be closed by other devices, such as plugs that are sized and configured to frictionally engage the respective ports 132, in which case, the plugs may be tethered to any portion of the lid 131 (e.g. via a resilient, integrally-molded connector).

[00108] The hose junction 134 may enable an easier, cleaner, and faster disposal process since various suction instruments and tubings can be disconnected at once by removing the hose junction 134. These instruments and tubings then can be disposed of with, and while connected to, the hose junction 134. That is, multiple instruments may be connected in parallel to one another and to the hose junction 134, such that each instrument is connected to the hose junction 134 with its own tubing. Detaching the hose junction 134 from the lid 131 then allows for all of the attached instruments (and their individual connection tubes) to be disposed of together without individually detaching each medical instrument from the hose junction 134, such as would be required with conventional suction/irrigation devices. Because the hose junction 134 and the lid 131 may include a non-drip or low-drip valve 142, 144 (as described in greater detail below), such an arrangement minimizes the risk of drippage occurring when the hose junction is disengaged and/or disassembled following a medical procedure.

[00109] The lid 131 may also include a non-drip valve 142, 144 to prevent any dripping or splashing of liquid from the interior space of the collection bag 130 when the hose junction 134 is removed from the lid 131. For example, in the exemplary variation shown in Fig. 20, the lid 131 may include two separate components: an upper lid 131a and a

lower lid 131b. As shown in Fig. 20, the upper lid 131a defines an inlet opening 139 located at the bottom of the slot 136. The opening 139 is configured to communicate with the individual fluid passageways 141 of the collection ports 132 provided in the hose junction 134. In an alternative arrangement, the inlet opening 139' may be formed on a side surface of the slot 136, as shown in Fig. 19. To facilitate a fluid-tight connection between the fluid passageways 141 and the inlet opening 139, 139', at least one of the fluid passageways 141 and the inlet opening 139, 139' may include a suitable sealing member, such as a sealing ring to provide a sealing fit between the hose junction 134 and the upper lid 131a.

[00110] The lower lid 131b defines a valve housing 145 configured to receive the valve 142, 144. The housing 145 defines an opening (e.g., located at its bottom end), which extends into and is open to the interior space of the collection bag 130. The valve 142, 144 may be interposed between the upper lid 131a and the lower lid 131b. The valve 142, 144 may be in the form of a spring-loaded or otherwise suitably biased plunger. The spring 144 may be seated in the housing 145 and the plunger 142 depressed against the inlet opening 139 to close the opening 139, for example. The hose junction 134 may include a projection 143 such that, when the projection 143 engages the slot 136, the projection 143 displaces the plunger 142, thereby establishing fluid communication via opening 139 between the fluid passageway 141 of the hose junction 134 and the interior space of the collection bag 130. Conversely, when the hose junction 134 is removed from the slot 136, the projection 143 releases the plunger 142, and the plunger 142 returns to its biased position to close opening 139. It should be understood that, instead of the spring-loaded plunger 142, 144, any other suitable valve mechanism may be employed. For example, the positioning of the spring 142 and the plunger 144 may be inverted, and these features placed within the tube junction 134, rather than in the lid 131. Alternatively, a ball or flap may be substituted for the plunger 144. In some exemplary implementations, elastomeric or other self-sealing valves may be used.

[00111] The lid 131 may also include an overflow valve 146 positioned in a vacuum passageway 149 defined by the upper lid 131a and the lower lid 131b, as shown in Fig. 21. In an exemplary variation, the overflow valve 146 may comprise a floating check valve or a hydrophilic valve, such as described below. As the liquid level in the collection bag 130 reaches the elevational position of the valve 146, the valve 146 rises to close the vacuum passageway 149 thereby preventing the liquid from flowing into the vacuum pump 44. In this manner, the overflow valve 146 may form part of an auto shut-off feature that prevents filling of the bag 130 beyond its capacity or beyond reasonable safety limits. Although Fig. 21 depicts the elevational position of the overflow valve 146 as being vertically above the elevational position of the valve 142, 144, one of ordinary skill in the art will appreciate that the overflow valve 146 may be placed at an elevational position below that of the valve 142, 144.

[00112] According to other exemplary aspects of the present invention, the lid 530 may be integrally formed (e.g., molded) as a single piece, as shown in Figs. 22-24. Forming the lid 530 as a single piece may lower the manufacturing cost and also simplify the fluid collection process by eliminating the need for a removable hose junction 134, described above with reference to Figs. 17-21.

[00113] The lid 530 illustrated in Figs. 22-24 differs from the lids 31, 131 depicted in Figs. 9-12 and 15-19, in that, among other things, it includes a breakable closure member 544 (e.g., a foil, plastic film, rubber) for closing an evacuation port 546 of the lid 530, as shown in Fig. 24. Fig. 25 shows a variation of the lid for a liquid collection bag in which the exterior of the passageway providing communication between the liquid collection bag 30 and the suction source 559 is configured as a gripping member 501 on the exterior of the disposable lid. This gripping member 501 provides an area removed from the collection ports 532 and from the disposal port 546 by which a user can grip the disposable lid to attach and remove

the disposable lid. This gripping member 501 both enhances the ease of installation and removal of the liquid collection bag, while allowing the user to avoid contact with the port areas through which waste material is collected and evacuated.

[00114] Unlike the collection ports 32 shown in Fig. 4-8, and the inlet openings 139, 139' of the embodiments shown in 18-19, which are used to both collect and remove liquid for the collection bag 30, 130, the evacuation port 546 of Figs. 22-24 is not used during liquid collection operation and remains sealed by the closure member 544 until the collection bag is full and/or otherwise needs to be emptied. Structural features of the evacuation port 546 and operational characteristics associated with a disposal station (herein referred to interchangeably as a "docking station"). Although one variation described herein refers to a breakable closure member, such as foil, other sealing mechanisms may be used in place thereof. For example, a sliding or pivoting door may be configured to rest over the evacuation port 546 when access thereto is not required, and further configured to move away therefrom, either manually or automatedly, when access to the evacuation port 546 is desired.

[00115] The lid 530 of Figs. 22-24 also differs from the lids 30, 130 of Figs. 4-8 and 17-21, in that it forms an interstitial opening 516 in the lid 530 for supplying a source of suction pressure (e.g., see the eductor 350 shown in Figs. 33, 34, and 39) to a space between the rigid receptacle defining a cavity and the collection bag during an evacuation process. The source of suction pressure may be used to equalize the pressures inside and outside of the collection bag during an evacuation process, so that the collection bag may substantially maintain its normal shape during that process. The interstitial opening 516, like the evacuation port 546, is closed off during the liquid collection process by a breakable closure member 514.

[00116] In the suction pressure shown in Fig. 22-24, the lid 530 defines a vacuum passageway 550 having a U-shaped configuration. The first end 551 communicates with an

interior space of the collection bag, and the second end 559 communicates with a vacuum source. Near the first end 551 of the vacuum passageway 550, in one exemplary suction pressure the lid 530 includes an overflow valve having a floating ball 555 housed in a cage-like structure 558. Other exemplary lids 530 may include a hydrophilic valve such as a porous plastic valve (PPV), as shown and described in connection with Figs. 29-35. The PPV or other hydrophilic valve comprises a hydrophilic material that blocks the pores of the material, for example using surface tension, and thereby prevents liquid from flowing past the material. A similar valve is shown as element 238 and described in connection with Figs. 29-35. When the liquid level in the collection bag reaches the elevational position of the floating ball 555, the ball 555 rises along the longitudinal axis of the cage-like structure 558, thereby closing the first end 551 of the vacuum passageway 550. The operational characteristics of the floating ball 555 are substantially similar to those of the overflow valve 146 of Figs. 20 and 21 and, therefore, a detailed description thereof is omitted herein.

[00117] Fig. 98 shows a block diagram of a liquid collection system 800, illustrating various components and corresponding operational characteristics, according to certain exemplary aspects of the present invention. Many features applicable to the illustrated system 800 have been already described in detail above. The liquid collection system 800 includes a controller 810 for controlling operation of various components of the system 800. For example, the controller 810 may include a motor controller 820 configured to control the vacuum pump 860. The motor controller 820 may be coupled to an interface board 830 configured to display the status of the system 800 and/or provide an input signal to the motor controller 820 for controlling various components of the system 800. For example, the interface board 830 may include a selection button 834 for controlling the power supply to the system 800 and a vacuum regulator 836 (e.g., variable control knob) for regulating the vacuum level created by the vacuum pump 860. The interface board 830 may also include

one or more visual or audible indicators 833, 835, 837 for providing various information relating to operational characteristics and/or status of the system 800. For example, the one or more indicators may include a vacuum level indicator 833 (e.g., a Light Emitting Diode "LED" light bar), light indicators 835 for indicating whether the filter needs to be replaced and/or whether the storage bag is almost full. Audible alarms 837 may also provide audio warnings or indicators of the status of the system 800. The audio warnings or indications provided by the audible alarms 837 may be redundant to, or independent from, those provided by the visual indicators 833, 835. The interface board 830 may also include a switch 839 (e.g., toggle key) for disabling the audible alarms 837. The interface board 830 may be powered by an isolated power supply 832 (e.g., a battery).

[00118] The system 800 may include a filter unit 870 disposed between the vacuum pump 860 and various components requiring connection to the vacuum pump 860. As mentioned above, the filter unit 870 may include a filter made of a hydrophobic material, so as to function as a safety shutoff valve. For example, an overflow shutoff valve 851 in the collection bag 855 may malfunction when the liquid collection bag 855 is full, causing the liquid collected in the bag 855 to flow into the filter unit 870 through the first suction line 879a. Also, the liquid collection bag 855 may be defective, causing leakage of liquid collected therein to flow into the cavity 856. The leaked liquid in the cavity 856 may flow into the filter unit 870 via the interstitial line 898, the base vacuum line 899, and the second suction line 879b, for example. When the liquid enters the filter unit 870 and makes contact with the filter, the hydrophobic material blocks the pores of the filter, for example using surface tension, and shuts off the filter unit 870, thereby preventing the liquid from flowing to the vacuum pump 860.

[00119] The system 800 may also include one or more additional safety features. For example, the system 800 may include an optional fluid trap 890 disposed between the filter

unit 870 and the interstitial and base lines 898, 899 shown in Fig. 98. The system may also include a fluid trap or a vacuum check valve located between the vacuum pump 860 and the HEPA housing 870. The optional fluid trap 890 may operate under a similar principle to that of the overflow valves 146, 555 disposed inside the liquid collection bag. For example, Figs. 26 and 26(a) illustrate exemplary variations of a fluid trap 890, according to exemplary aspects of the present invention. The fluid trap 890 may include a container 895 defining an internal volume in fluid communication with one or more inlets (e.g., the interstitial and base lines 898, 899 connected to the cavity 856) and an outlet (e.g., the second suction line 879b leading to the filter unit 870). The container 895 may include a removable cap 897, to which the one or more inlets and the outlet may be secured. Although the interstitial line 898 is shown in the figure branch out from the base line 899, the interstitial line 898 may alternately be separately and independently connected to the container 895. The container 895 may include a conduit 893 (e.g., a tube) extending from the outlet 879b into the container 895, with a PPV or other hydrophilic valve 894' or floating ball 894 (e.g., a polypropylene ball) being attached to or otherwise interacting with the conduit 893. The floating ball 894 rises inside the conduit 893 as the liquid level inside the container 895 rises. When the liquid level rises above the top of the conduit 893, the floating ball 894 presses against the opening 892 defined by the top of the conduit 893, thereby shutting off the outlet 879b leading to the filter unit 870. To ensure a tight seal between the floating ball 894 and the opening 892, an O-ring 891 may be provided in the opening 892. The PPV or other hydrophilic valve comprises a hydrophilic material that blocks the pores of the material, for example using surface tension, and thereby prevents liquid from flowing past the material. A similar valve is shown as element 238 and described in connection with Figs. 29-35. By way of example only, the container 895 may have a volume of about 16 oz.

[00120] The system 800 may also include an emergency backup tube 879c, which is normally closed by an end cap or valve. The backup tube 879c may be configured to connect to an alternate source of suction force 840 (e.g., a wall vacuum), such that, when the vacuum pump 860 becomes inoperable or otherwise unavailable, for example, or when the filter unit 870 shuts off, the system 800 can continue to operate with the alternate source of suction force, without interrupting an on-going medical procedure. In addition, the backup tube 879c may function as a vacuum supply line for a backup storage container. For example, when the collection bag 855 becomes full or temporarily inoperable during a liquid collection process, the backup tube 879c may be connected to a backup storage container to supply suction force to the storage container, so that the storage container may function as a suction canister to temporarily store the liquid being collecting during the liquid collection process.

[00121] Once the collection bag 30, 130 is full or otherwise needs to be emptied, the portable liquid collection system 10 may be transported to a disposal station by, for example a clinician 170 to evacuate the collected liquid from the collection bag 30, 130, as shown in Fig. 27. Although evacuation of the collection bag 30, 130 is not necessary for disposal thereof (e.g., a filled collection bag 30, 130 may be disposed of with liquid still present within the interior space thereof), one aspect of the present invention allows for the evacuation of the collection bag 30, 130 to reduce the volume of red-bag waste produced by disposal thereof.

[00122] In some exemplary variations, the disposal station may comprise a docking station 180 having a fluid connector configured to automatically (or manually) connect to the discharge port 38 (for the implementation shown in Fig. 1), the inlet port 139, 139' (for the variations shown in Figs. 17-21), or the evacuation port 546 (for the embodiment shown in Figs. 22-24) of the collection bag 30, 130. For the variations shown in Figs. 18-19, prior to engaging the system 10 into the docking station 180, the hose junction 134 may be removed.

The docking station 180 may include a suitable indicator 185 for indicating that the collection system 10 is properly engaged and/or the evacuation process is being performed.

[00123] The interface board may include a light indicating a connection to a power source and a visual indication that the disposal station is in use. The interface board may also include a switch that allows termination of the evacuation cycle. The button may stop the cycle completely or only temporarily.

[00124] To evacuate the collected liquid from the collection bag 30, 130, in some exemplary embodiments, the docking station 180 may utilize an eductor of the type described in U.S. Patent Application Publication No. 2005/0183780, entitled "Method and Apparatus for the Disposal of Waste Fluids" and published on August 25, 2005, the entire disclosure of which is incorporated herein by reference. Alternatively or additionally, the disposal station may include a movable connector (not shown) that can be manually connected to the collection bag 30, 130 to evacuate the collected liquid therefrom.

[00125] Figs. 29-35 illustrate another exemplary embodiment of a liquid collection and disposal system. As shown in Fig. 29, the system includes a liquid collection bag 230 and a rigid container 215 configured to receive the collection bag 230. The collection bag 230 may include a lid 231 and a collapsible liner 235 attached to the inner surface of the lid 231 to form a substantially sealed interior space therebetween. When the collection bag 230 is placed on the top of the rigid container 215, the lid 231 may substantially seal the opening of the container 215. As shown in Fig. 29, the collection bag 230 may include a suction conduit 233 for connecting the interior space of the collection bag 230 to a suitable suction source (e.g., vacuum pump 44 shown in Fig. 1). The suction conduit 233 may be arranged such that, when the collection bag 230 is placed on the container 215, the suction conduit 233 automatically connects to the suction source, although the suction source may be configured to be manually connected to the suction conduit 215 by the operator.

[00126] The collection bag 230 may include a suction shutoff device 238 positioned at one end of the suction conduit 233. As will be described in more detail, the shutoff device 238 may close the suction conduit 233 when the liquid level inside the collection bag 235 reaches a predetermined level, so as to prevent the collected liquid from flowing into the suction source. In one exemplary embodiment, the shutoff device 238 may comprise a filter that prevents liquid from passing therethrough, which may be, for example, similar to the device 894' shown in Fig. 26(a). The filter may be positioned at a proximal end of the suction conduit 233, located inside the collection bag 230, such that, when the liquid level in the collection bag 230 rises to the filter and submerges the filter, the filter may close the suction conduit 233, thereby shutting off the supply of suction force and terminating the liquid collection process. The shutoff device 238 may include a hydrophilic material, which may swell and seal the suction conduit 233 upon contact with liquid. The hydrophilic material may be positioned inside a sleeve structure. This structure not only protects the shut off device from prematurely coming in contact with fluid, but also increases the rate of shut off when the liquid level raises to come in contact with the bottom of the sleeve. In certain implementations, the shutoff device may comprise a buoyant article (which may be coated or otherwise covered with a hydrophilic material) disposed within a cage extending from the lid, such that the buoyant article may close off the suction conduit when the level of the liquid rises beyond an acceptable elevational position.

[00127] The lid 231 may define an access port 220 normally closed by a flexible valve 226, such as an elastic slit valve. As will be described in more detail later, the access port 220 may be configured to receive a hose junction 240 and an evacuation connector 340. When the hose junction 240 or the evacuation connector 340 is inserted into the access port 220, the flexible valve 226 may be deflected to open the access port 220. The access port 220 may also include an actuation rod or pin 224 to open a valve associated with the hose

junction 240 and/or the evacuation connector 340, which will also be described in more detail herein.

[00128] The rigid container 215 may have an elongate tubular shape. The rigid container 215 may constitute the cavity 15 of the liquid collection system 10 described above. The container 215 may include a piston 280 (much like a syringe) slidably positioned inside the container 215. The piston 280 may include one or more sealing members, such as O-rings 283 attached to an outer peripheral edge of the piston 280. Thus, the piston 280 may separate the internal space of the container 215 into an upper space 281 and a lower space 289. The piston 280 may also include a piston scraper 285 to prevent the liner 235 from being pinched between the inner wall of the container 215 and the piston 280 during a piston movement. The O-rings 283 and the piston scraper 285 may be coated with a suitable material (e.g., parylene) to enhance lubricity and/or durability.

[00129] The piston 280 may include a through-hole 284 in the middle portion, which enables a vacuum communication between the upper space 281 and the lower space 289. The through-hole 284 thus supplies a vacuum force into the upper space 281, which may counterbalance vacuum force applied inside the interior space of the collection bag 230 to prevent collapse of the liner 235 during a liquid collection stage. The piston 280 may include a check valve 286 positioned inside the through-hole 284. The check valve 286 is biased against an opening of the through-hole 284 by a spring 288 to normally close the through-hole 284. In some exemplary variations, the check valve 286 may be disposed in a modular check valve insert, which may be inserted into the through-hole 284.

[00130] The container 215 may also include a stopper 290 that interacts with the piston scraper 285 near the top of the container 215, as shown in Fig. 36. In addition to stopper 290, the container may further include a pinch prevention mechanism 291 that prevents the collection bag from being caught between the piston scraper 285 and stopper 290 as the

piston moves upward during evacuation of the collection bag. One variation of the pinch prevention mechanism may include a flexible collar 291 located between the inner walls of the container 215. For example, if the container is cylindrical, the flexible collar may include a flexible cylindrically shaped collar. The flexible collar 291 may include grooves 292, as shown in Fig. 36, and may comprise a flexible material such as plastic or rubber. As the piston 280 moves up in the container, the flexible collar 291 flexes toward the interior of the container and compressibly pushes the collection bag 235 away from the walls of the container, while closing the grooves therein as shown in Fig. 37. This prevents the collection bag from being caught between the piston scraper 285 and the stopper 290, as the bag collapses during disposal.

[00131] As shown in Fig. 29, the container 215 may include an optional three-way valve 265 to selectively connect the lower space 289 to either a vacuum source or atmosphere. The container 215 may also be configured without the optional three-way valve, for example when the vacuum source is vented. For example, the three-way valve 265 may have three connections: a first connection 262 communicating with the lower space 289; a second connection 264 communicating with atmosphere; and a third connection 268 communicating with a suction source. The operational characteristics of the three-way valve 265 will be described in detail with reference to Figs. 30-34. The container 215 may also include a stopper 270 near its bottom, as shown in Fig. 29, to prevent the piston 280 from descending below the level of the first connection 262. Alternately, valve 265 may be eliminated, for example, when reverse venting (to atmosphere) might be accomplished naturally, for example, when the pump (not shown) is turned off.

[00132] As shown in Fig. 29, the piston 280 is initially positioned near the top of the container 215 to receive the collection bag 230. After the collection bag 230 is emplaced, in its collapsed state, within the container 215, the hose junction 240 may be inserted into the

access port 220, as shown in Fig. 30. The hose junction 240 is similar to the hose junction 134 shown in Figs. 17, 18, 20, and 21, except that it includes a normally-closed valve 249 (e.g., a duckbill valve, a check valve, a spring-loaded valve, a poppet valve) to open and close its fluid passageway 245. The valve 249 may be opened from its normally-closed position by the actuator pin 224 positioned inside the access port 220. That is, upon insertion into the access port 220, the actuator pin 224 pushes the valve 249 so as to open the passageway 245. The hose junction 240 may be inserted in the access port 220 before the collection bag 230 is placed onto the container 215.

[00133] Once the collection bag 230 is placed in the container 215 and the hose junction 240 is securely positioned in the access port 220 of the collection bag 230, the three-way valve 265 may be rotated to align the first connection 262 with the third connection 268 to communicate such pressure within the lower space 289. The suction pressure applied to the lower space 289 draws the piston 280 down into the container 215, which in turn draws the liner 235 into the cavity, as shown Fig. 31. In one variation, the interior space of the liner 235 is open to atmosphere (or is under some pressure greater than the suction pressure supplied to the lower space 289), so as to facilitate the downward movement of the piston 280. The suction force applied to the lower space 289 may be greater than the opening pressure of the check valve 286, so as to open the through-hole 284 and evacuate any excess air in the upper space 281, which may enhance the seal between the lid 231 and the container 215. However, it may be preferred for the check valve 286 to remain in a closed position during downward movement of the piston 280, so as to further enhance the pressure differential between the lower space 289 and the upper space 281, thereby further facilitating the downward movement of the piston 280 within the cavity. The sensitivity of the check valve 286 may be selected in view of the suction pressure supplied to the lower space 289, any suction pressure supplied to the upper space 281 and the atmospheric (or positive)

pressure supplied to the interior space of the liner 235. In the selection of the check valve sensitivity, an efficient pressure differential and/or balance on both sides of the piston 280 can be utilized to facilitate downward movement thereof, as described further herein.

[00134] Thereafter, liquid may be drawn into the collection bag 230, as shown in Fig. 31. The liquid collection process is substantially similar to the process described above with reference to Fig. 8 and, therefore, a detailed description thereof is omitted at this point. As mentioned above, during the liquid collection process, the continuously applied suction force in the lower space 289 may cause the check valve 286 to open, so as to communicate the suction pressure with the upper space 281, which may counterbalance the suction force applied inside the interior space of the collection bag 230 to prevent or reduce collapse or deformation of the liner 235 during the liquid collection process.

[00135] The liquid collection process may thereafter end because the medical procedure is completed, for example. This action may also end as a result of suction pressure shutoff, which may occur, for example, when the liquid level rises to the level of the shutoff device 238. For example, when the liquid level reaches the level of the shutoff device 238, the shutoff device 238 may automatically shut off the conduit 233 to stop the liquid collection process, as shown in Fig. 32. Should the liquid collection process be continued, a back-up storage container 20, for example, described above with reference to Figs. 9 and 10 may be used to continue the process.

[00136] To empty the collection bag 230, the container 215 carrying the collection bag 230 may be transported to a disposal station 300 (e.g., a pump assembly), as shown in Fig. 33. Prior to connecting the collection bag 230 to the disposal station 300, the hose junction 240 carrying one or more medical devices may be removed and placed in a red bag for disposal, for example. The anti-drip valve 249 of the hose junction 240 closes the fluid passageway 245 upon removal from the access port 220 (e.g., the actuator pin 224 no longer

holds the valve 249 open). Also, upon removal of the hose junction 240, the flexible valve 226 may return to its original shape to close the access port 220. The closure of the access port 220 may keep the collected liquid in the collection bag 230 for transport to the disposal station. The flexible valve 226 may also provide a wiping function on the hose junction 240 during removal from the access port 220. This wiping function may aid in making the hose junction 240 drip free during its removal and disposal.

[00137] As shown in Fig. 33, the disposal station 300 may include an eductor 350 that provides a source of vacuum sufficient to draw the collected liquid out of the collection bag 230. In addition to the eductor 350 depicted in Fig. 33, other vacuum or suction sources may be used to draw the fluid out of the collection bag 230 to the disposal station. For example, a pump such as a rotary pump or piston pump or other suitable device (e.g., a flexible membrane device), may be used to evacuate the contents of the collection bag 230. To connect the collection bag 230 to the disposal station 300, the disposal connector 340 may be inserted into the access port 220 of the collection bag 230 in a similar manner to how the hose junction 240 is inserted into the access port 220. Similar to the hose junction 240, the disposal connector 340 may include a drip-free connector valve 345, which is biased to close the distal end of the disposal connector 340. Inserting the disposal connector 340 may cause the connector valve 345 to open, so as to establish fluid communication between the access port 220 and the eductor 350.

[00138] The eductor 350 may be positioned between a source of water or other rinse fluid 305 and a sanitary sewer 390 to create a pumping force sufficient to draw liquid out of the collection bag 230. Rinse fluid may consist of water, another wash fluid (e.g. a detergent or other fluid), or a mixture of water and another wash fluid. As noted above, the term "fluid" may refer to a combination of a liquid medium along with solid particles, gases and/or particulates. As shown in Fig. 33, the eductor 350 may be connected to the source of water

305 and the sewer 390 via a water conduit 315 and a discharge conduit 380, respectively. The water conduit 315 may include a water valve 310, which may be controlled manually or by other control, such as electric switch. In addition, a venturi 360 may be suitably positioned, (e.g., adjacent the eductor 350 in the discharge conduit 380) so as to create a greater pumping force. The disposal connector 340 may be then connected to the eductor 350 via an evacuation conduit 335.

[00139] In operation, as shown in Fig. 34, opening the water valve 310 causes the water from the source of water 305 to flow into the eductor 350 to create a pumping force in the eductor 350. This pumping force causes the liner 235 to collapse and then liquid collected in the collection bag 230 to flow into the eductor 350 and then into the sanitary sewer 390 via the discharge conduit 380. To control the collapse geometry of the liner 235 in a manner that does not occlude and prevent the desired discharge liquid flow, check valve 286 may be set in a closed position. The closed position of the check valve 286 prevents air from flowing into the space between the liner 235 and the container 215. Because of the relatively limited air in the space outside of the liner 235, the walls of the liner 235 will not be pulled away from the walls of container 215 and therefore will not close off the passage of liquid within the liner 235. At this stage, the three-way valve 265 may be aligned to communicate the lower space 289 with atmosphere via the first and second connections 262, 264, as shown in Fig. 34. This selection allows the pressure inside the lower space 289 to reach atmospheric pressure during the evacuation process, so as not to interfere with the collapse of the liner 235. For example, maintaining the pressure in the lower space 289 at atmospheric pressure allows the piston 280 to rise during the evacuation process, due to a differential pressure between the upper space 281 (which is subject to a suction pressure) and the lower space 289 (which is open to atmosphere). Because the piston 280 moves up as the liner 235 collapses, the collapse of the liner 235 takes place primarily near the piston 280, and

occlusion of the sidewalls of the liner 235 during the evacuation process may be effectively prevented.

[00140] The disposal station 300 may include a pipe conduit 325, that branch from the water conduit 315 to supply cleaning water to the disposal connector 340. The pipe conduit 325 may include a valve 320 (e.g., an electric solenoid valve, a ball valve) that controls the water flow into the interior of the disposal connector 340. After liquid is removed from the collection bag 230, clean water from the source of water 305 may flow into the interior of the disposal connector 340, which can be cycled on and off one or more times for rinsing or flushing purposes, and as preventive maintenance for the disposal connector 340. The operation may occur before the discharge connector 340 is removed from the access port 220, for example, so that cleaning water may flow to the exterior of discharge connector 340 and then be suctioned back through the interior of discharge connector by the suction of the eductor.

[00141] Thus, the disposal connector 340 may communicate with two channels: one channel that supplies clean, rinse fluid and a second channel that evacuates contaminated fluid. The second channel, for example, may be situated within the first channel, as shown in Fig. 32 and as similarly shown and described with respect to Fig. 51. A valve, such as a ball valve, is located within one of the channels. After the collected contents of a liquid collection container have been evacuated, rinse fluid flows from the first channel into and around the valve, flushing the entire surface of the valve. If the valve is a ball valve, the rinse fluid flows in a cylindrical path around the valve housing so that the valve is completely rinsed with the rinse fluid. Via the valve, the rinse fluid enters the second channel and is evacuated, similar to the contents of the liquid collection container. Thus, the second channel is also flushed with rinse fluid. This approach allows the disposal connector to automatically clean both itself and the connection with the liquid collection container. Among other things, this

automatic rinse feature prevents a user from coming into contact with liquid collected in a medical procedure.

[00142] According to one aspect of the present invention, conduit 325 (which supplies cleaning water to the disposal connector 340) is in fluid communication with discharge conduit 380, which is used to "charge" the eductor 350, and to thereby suction fluid from the collection bag 30 (as described above). In this manner, cleaning fluid will not be supplied to the disposal connection 340 unless the eductor is suctioning fluid from the collection bag 30, thereby preventing unintended flooding of the collection bag 30 with cleaning water.

[00143] Once an acceptable quantity of the liquid is removed from the collection bag 230, and the collection bag 230 is collapsed, the discharge connector 340 is removed from the access port 220. The flexible valve 226 then closes the access port 220, so as to seal the collection bag 230 and to maintain the bag 230 in the collapsed state. The collection bag 230 is then removed from the container 215 and placed in a red bag for disposal, for example. A new collection bag 230' may be placed onto the container 215 for the next series of medical procedures, as shown in Fig. 35.

[00144] Access ports may include a normally-closed, flexible slit valve, for example, a flexible, anti-drip, check valve. This valve may be made of a flexible material such as plastic, rubber, or other suitable material. In addition, to serving as an opening for a hose junction, the valve acts as a normally closed two-way check valve. The valve resists back pressure such that it assists in maintaining vacuum pressure within the liquid collection bag. This approach assists in maintaining an unused bag and a previously used, evacuated bag in a substantially collapsed state. This approach further provides a safety feature by preventing waste in the collection bag from dripping from or exiting the bag. Thus, an evacuated collection bag will not leak waste if it is turned upside down or squeezed.

[00145] The piston 580 may also include one or more sealing members, such as O-rings 588 attached to an outer peripheral edge of the main body 585. The main body 585 may form one or more circumferential grooves to receive the sealing members. The piston 580 may also include a scraper ring 583 configured to prevent a liner of a liquid collection bag from being pinched between the inner wall of the cavity and the piston 580.

[00146] Fig. 39 is a schematic diagram of a liquid disposal station 900, illustrating various components and their operational characteristics associated with a liquid collection system 10. When the liquid collection bag becomes full or otherwise needs to be emptied, the portable liquid collection system 10 is transported to the disposal station 900, similarly to as described above with reference to Fig. 27. The disposal station 900 may include a reference structure 987 and a latching member 980 fixed to the reference structure 987 for engaging a corresponding latching member 990 of the liquid collection system 10. Among other things, this approach allows the liquid collection system 10 to be securely and accurately positioned at a predetermined location relative to the disposal station 900.

[00147] In certain exemplary variations, the process for evacuating liquid from the liquid collection system 10 may be automatically initiated upon engagement between the attachment mechanism and the main body of the liquid collection system 10, although the system may be configured such that an operator is required to manually initiate the evacuation process after the system 10 has been operatively engaged with the disposal station 900.

[00148] The disposal station 900 may include a sensor unit 995 afixed to, for example, the reference structure 987 and configured to detect the presence of a liquid collection system 10 in the vicinity of the disposal station 900. The disposal station 900 may be configured such that the presence of a liquid collection system 10 in the disposal station 900 is confirmed by the sensor unit 995 prior to initiation of a liquid evacuation process. Thus, the sensor unit

995 may be used as a safety measure against a false initiation of a liquid evacuation process in the disposal station 900. Alternatively, detection may be electromechanically accomplished.

[00149] When the liquid collection system 10 is securely positioned in the disposal station, an evacuation interface 960 and an interstitial interface970 may align with the evacuation port 540' and the interstitial port 516', respectively, of the liquid collection system 10, as shown in Fig. 41. Use of an interstitial hose is optional. The disposal station may also be configured to function without any interstitial connection or interstitial suction. In an exemplary implementation, the interstitial interface970 may be connected to the evacuation interface960 via a rigid support 965. The evacuation interface960 and the interstitial interface970 may be connected to a suitable draining system for evacuating the liquid from the liquid collection system. In some exemplary variations, the draining system for the disposal station may include an eductor 350 that provides a source of suction pressure sufficient to draw the collected liquid out of the collection bag of a liquid collection system 10, as shown in Fig. 39. The eductor 350 and the associated flow connections for evacuating the collected liquid may operate similarly to those described above with reference to Figs. 33 and 34, for example.

[00150] The flow connection between the eductor 350 and the liquid collection bag 30 in the disposal station may differ from that shown in Figs. 33 and 34, in that this variation includes a side conduit 938 branching from the evacuation conduit 335 for supplying suction force to the interstitial interface970. The interstitial interface970 is configured to connect to an interstitial port 516' formed on a lid 530' of a liquid collection bag 30, as shown in Figs. 41 and 45. As noted above, the interstitial interface is optional, and the disposal system may be configured to function without any vacuum pressure from an interstitial vacuum. For example, when the interstitial interface970 is inserted into the interstitial port 516', the

passageway 917 of the interstitial interface970 may communicate with the interstitial space, as shown in Fig. 45. A suitable sealing member 918 (e.g., an O-ring) may be provided to seal the gap between an interior surface of the interstitial port 516' and an exterior surface of the interstitial interface 970. As mentioned above with reference to Figs. 22-24, the interstitial port 516' of the lid 530' may be in fluid communication with an interstitial space within a cavity external to a liquid collection bag, and the supply of a suction force to the interstitial space may equalize the pressure inside and outside of the collection bag during an evacuation process, so that the collection bag may remain substantially uncollapsed during the evacuation process. Providing the interstitial port 516' in the lid 530' may eliminate the need for a power supply in the liquid collection system 10 during the evacuation process, which may otherwise be required to supply suction source to the interstitial space, similarly to the function of the second vacuum connector 64 in Fig. 8.

[00151] . In other variations, a seal between the lid of the liquid collection bag and the top 11 of cavity 15 and at least seal between the piston and the inner walls of the cavity maintain vacuum pressure on the outside of the collection bag by preventing air from entering the interstitial space so that the sides of the bag do not collapse during an evacuation process. By limiting air flow into the interstitial space between the bag and the inner walls of the cavity, communication between a suction source and the interstitial space is unnecessary/optional during an evacuation process. In addition, air flow into the interstitial space may be controlled via the check valve 575 in the piston. These seals assist in equalizing the pressure inside and outside of the collection bag during a collection process and continue to maintain that pressure up through at least part of an evacuation process.

[00152] In exemplary variations, air flow may be allowed into the interstitial space near the end of an evacuation process in order to fully collapse the liquid collection bag 30 by allowing communication between the atmosphere and interstitial space. For example, air

may be allowed into the interstitial space at a predetermined time in the disposal cycle, such as during approximately the last 30 seconds of an evacuation cycle. In an exemplary implementation, the interstitial space may be accessed by establishing communication with the interstitial port 516' and the atmosphere. For example, the disposal station may pierce the breakable piece in the interstitial port 516' in order to allow air to flow into the interstitial space near the end of the evacuation process. The docking station may include a timer that times the evacuation process and establishes communication with the interstitial space at a predetermined amount of time before the end of the evacuation cycle.

[00153] In other variations, a valve, such as a solenoid valve or electric valve, may be employed to provide air flow into the interstitial space near the end of an evacuation process. However, using the docking station to establish atmospheric communication with the interstitial space enables a disposal cycle to run on an unpowered liquid collection container and mobile unit.

[00154] According to certain exemplary embodiments, the disposal station may include a linear slide 952, along which the evacuation interface 960 and the interstitial interface970 may slidably engage the evacuation port 540' and the interstitial port 516', respectively. Movement of the evacuation interface960 and the interstitial interface970 relative to the linear slide 952 may be controlled, for example, pneumatically by a compressor 958 or other suitable movement mechanism, a flow control pilot 956, and a flow control valve 954 (e.g., a two-way solenoid valve), similarly to as shown and described in Fig. 39. The flow control valve 954 may be configured to maintain pressure when power is lost. Alternatively, interface 960 and interface 970 may be controlled, either automatically or manually, by any other linear actuation device.

[00155] As best shown in Fig. 41, the evacuation port 540' and the interstitial port 516' may remain closed by breakable closure members 544', 514' during the liquid collection

process. These breakable closure members 544', 514' may be pierced or broken when the evacuation interface960 and the interstitial interface970 engage the evacuation port 540' and the interstitial port 516'. To facilitate such piercing, the evacuation interface960 and the interstitial interface970 may each include a sharp distal edge 966, 915.

[00156] As shown in Fig. 94, the evacuation interface960 may include a normally-closed valve 962, 963 (e.g., a duckbill valve, a check valve, a spring-loaded valve, a poppet valve) to open and close its passageway. In the exemplary variation shown in Figs. 94, and 95, the valve includes a ball 963 biased against a distal end of the interface960 by a spring 962. The valve 962, 963 may be opened from its normally-closed position by an actuation rod or pin 541' positioned inside the evacuation port 540', for example.

[00157] Thus, upon insertion of the valve 962, 963 into the evacuation port 540', the actuator pin 541' engages the valve 962,963 so as to open the passageway of the evacuation interface960, as shown in Fig. 95. The evacuation port 540' may include a normally-closed, flexible valve 542, as shown in Fig. 96. The valve 542 may be similar to the slit valve 426 described above and, therefore, further detailed description thereof is omitted at this point. When the evacuation interface960 is inserted into the evacuation port 540', the valve 542 may be deflected to open the evacuation port 540', for example.

[00158] Fig. 96 is a cross-sectional view of the evacuation hose junction 960 in engagement with the evacuation port 540', illustrating an exemplary flow of cleaning water for cleaning the interface960. As shown in Fig. 39, the disposal station 900 may include a pipe conduit 325, branching from the water conduit 315, to supply cleaning water or other cleaning substance to the evacuation interface760. After liquid is removed from a collection bag, clean water or other substance from the pipe conduit 325 may flow into the interior of the evacuation interface760 through a cleaning chamber 974, which can be cycled on and off one or more times to rinse or flush it off as a preventive maintenance for the evacuation

interface760. The cleaning operation may be performed before the evacuation interface760 is removed from the evacuation port 540' so that cleaning substance may flow to the exterior of the evacuation interface760 and then be suctioned back through the interior of the evacuation interface760, thereby flushing any residual fluid or other particles from the components of the interior of the interface760.

[00159] The disposal station 900 may include an interface board 993 for indicating the status of the disposal station 900 and/or for enabling control of various features of the disposal station 900. The interface board 993 may include a stop button for stopping a liquid evacuation process. The interface board 993 may also include one or more visual or audible indicators that provide various information relating to its operational characteristics and/or status, such as, for example, whether the station is being used.

[00160] Figs. 41-43 illustrate an exemplary implementation of a liquid collection system 1810 having a main body 1812 including a cavity 1815 configured to receive a liquid collection container having a lid 1831 and a flexible liner 1835. Figs. 41b-d illustrate that the cavity 1815 and liquid collection container may be configured in various shapes and may be received in the main body at various locations. For example, Fig. 41b illustrates a round liquid collection container having a round lid 1831b. Fig. 41c illustrates a main body having the cavity 1815e formed on a side of the main body 1812.

[00161] Fig. 42(a-c) illustrates a variation in which the liquid collection system may further include a second cavity 1840 configured to receive liquid via the liquid collection container 1830. In Fig. 42, the second cavity is larger than the liquid collection container 1830.

[00162] Fig. 43(a-c) illustrate that the liquid collection container may include a flexible liner 1835 that expands to accept collected liquid and collapses as the collected contents are evacuated from the liquid collection container 1830.

[00163] Figs. 44-46 illustrate an exemplary liquid collection and disposal process, in accordance with aspects of the present invention. First, liquid is collected in a disposable liquid collection container 1830 via at least one opening 1832 in the lid 1831 of the liquid collection container 1830. The disposable liquid collection container may be, for example, less than 5 L. However, the liquid collection container may also be larger. When the disposable liquid collection container 1830 fills to its limit, liquid begins to enter the second cavity 1840, which may be configured to receive a second collection container. At the end of a procedure, the remaining fluid in the disposable liquid collection container 1830 is transferred to the second cavity 1840. Removal of the suction instruments may cause the collected liquid in the disposable liquid collection container 1830 to be drawn into the second cavity 1840, for example. Among other mechanisms for transferring the liquid, a piston in the first cavity 1815 may compress the liner 1835 of the disposable liquid collection container 1830 and force the collected liquid into the second cavity 1840. After the liquid in the disposable liquid collection container 1830 has been transferred to the second cavity 1840, the liquid collection container 1830 may be removed and discarded in the appropriate waste repository. The second cavity may comprise a disposable collection container and/or a reuseable container. As shown in Fig. 46, section 12, disposal may include running a cleaning cycle on the second cavity. Although a cleaning cycle is only shown in connection with the second cavity, a cleaning cycle may be provided in connection with any of the collection containers and disposal stations/methods described herein. For example, a cleaning cycle may be included as part of a disposal cycle for a reuseable container. In the alternative, a cleaning cycle may be provided as part of a disposal cycle for a disposable container. This may allow the disposable container to be thrown in a regular trash or waste depository.

[00164] A new disposable liquid collection container 1830 may then be placed in the first cavity 1815 to prepare for a second procedure. Liquid is collected in the second liquid collection container 1830 until it reaches capacity. Then, collected liquid enters the second cavity. The process is repeated allowing for large amounts of fluid and possibly multiple procedures before the second cavity is filled. When liquid in the second cavity reaches a predetermined amount, a visual or audio indication may be presented at a user interface on the main body 1812. The system may then be transported to a disposal station. The main body may be secure to and communicate with a disposal station as described above. The disposal station may also connect to at least one opening 1850 in a lower portion of the main body. This lower interface allows the collected liquid to drain from the second cavity with the assistance of gravity. Suction may also be applied in removing the collected contents. After the collected contents are removed, a cleaning cycle may be performed to clean the second cavity. This cleaning cycle may include the use of a cleaning fluid, such as detergent, and/or heat. After the cleaning cycle, the main body may be transported for use in a procedure. Once a disposable liquid collection container 1830 is received in the main body, liquid collection may begin, again.

[00165] Fig 47(a-c) illustrate a variation in which contents may be collected in either a first liquid collection container 1930 or a second liquid collection container 1931, based on manual selection via a lever 1932. When lever 1932 is in a first position (a) shown in Fig. 47(a), an opening between fluid collection port 1933 and the first liquid collection container 1930 is opened. Thus, collected fluid will be drawn into the first container 1930. When lever 1932 is in a second position (b) shown in Fig. 47(b), the opening 1934 between the fluid collection port 1933 and the first container 1930 is closed, and a second opening 1935 between the fluid collection port 1933 and the second liquid collection container 1931 is

created, allowing the fluid collection port 1933 to communicate with the second liquid collection container 1931.

[00166] Fig. 48 illustrates and embodiment in which the second liquid collection container is similar to the disposable liquid collection container described in connection with Figs. 44-46. The first liquid collection container may be a rigid container, which may or may not be disposable. Fig. 48 further shows that the first and second liquid collection container may be used in connection with a main body having a second cavity, as described in connection with Figs. 44-46. By providing a first, smallest removable liquid collection container, a second, removable mid-range liquid collection container, and a third, largest collection container configured within the main body of a liquid collection system, a user may use a container suited to each procedure, while having available larger amounts of alternative containers if the amount of liquid that needs to be collected is larger than the anticipated amount.

[00167] Fig. 49 illustrates an exemplary liquid collection and disposal process in a liquid collection system having a disposable liquid collection container and a second cavity for collecting additional liquid inside the main body. This figure illustrates a disposal station 1860 to which the liquid collection system may be attached to evacuate the collected contents.

[00168] Figs. 50-52 show another variation of a liquid collection and disposal system 1010. The main body 1012 of the system 1010 includes a cavity 1015 for receiving collected fluids. The system includes a disposable manifold 1031, which, in turn, includes at least one collection port 1032 configured to connect various medical instruments that draw liquid into (or extract liquid from) the collection container 1030. The cavity may be configured to receive a collapsible liquid collection container 1030 thatincludes a flexible liner that attaches to disposable manifold 1031.

[00169] Fig. 51 shows a variation with an additional portion on the main body 1012. The additional portion may provide a larger user interface, and may be used to house a vacuum source, storage, and/or other features.

[00170] A disposal device 1180 is also shown in Fig. 50. The disposal station 1080 is configured such that the main body 1012 is moved over the top of the disposal station 1080. The disposal station may connect to the main body and remove collected fluid in a similar manner to that described above in connection with Figs. 8, 29-35, and 39, for example. The main body 1012 may also secure to the disposal station 1080 in another manner. As shown in FIG. 50, the disposal station attaches to an evacuation port in the lower portion of the liquid collection container 1030 and evacuates the collected contents of the liquid collection container 1030. Similar to some of the variations described above, the liquid collection container is configured to collapse as the contents are removed. The collapsed liquid collection container and the disposable manifold 1031 may then be removed and thrown away. In this variation, gravity may assist in emptying the liquid collection container.

[00171] The contents of the liquid collection container may also be evacuated through an evacuation port located at the side or top of the main body or liquid collection container, through an opening in the disposable manifold, or through an opening created after the removal of the disposable manifold.

[00172] In each of the variations described herein, a vacuum source may be included in main body 1012. Alternatively, the main body may be configured to attach to an external vacuum source for collecting contents in the liquid collection container. The vacuum source may connected directly to the liquid collection container or via a manifold in communication with the liquid collection container. The liquid collection systems may further include various valves, filters, etc. as described in connection with the other implementations described herein or as described in U.S. patent application no. _____ filed on March

24, 2008, titled FLUID COLLECTION AND DISPOSAL SYSTEM AND RELATED METHODS.

[00173] Figs. 53 and 55 show another variation of a system in accordance with aspects of the present invention. Fig. 53 shows a main body 1101 configured to hold a plurality of liquid collection containers 1102. A user interface is shown at 1125. Fig. 53 depicts three liquid collection containers 1102; however, the main body 1101 may be configured to hold any suitable number of liquid collection containers 1102 for the size of the main body 1101. Each of the liquid collection containers draws in liquid separately. In one variation, the user selects which liquid collection container to use. The main body is configured to attach to a disposable manifold 1103. This implementation allows a single or multiple liquid collection containers to be filled, as needed. A second liquid collection container may be used, without contacting fluid collected in a first container, by replacing the disposable manifold and selecting a second liquid collection container. Among other things, this approach allows the liquid collection system to be used multiple times between disposal of collected fluids.

[00174] Fig. 53 also shows an evacuation port 1104 located on the side of the main body 1102. By placing the evacuation port 1104 at a lower position on the main body 1102, gravity is able to assist in the evacuation process. This evacuation port 1104 may alternatively be located at the top, bottom, upper portion of the side, etc. The contents of the liquid collection container may also be evacuated through an opening in the disposable manifold. The liquid collection container may include a flexible liner configured to extend and collapse during the process of fluid collection and evacuation, as described further herein.

[00175] Fig. 54 illustrates an exemplary disposal station 1105 for removing the collected contents in the liquid collection system 1100 of Fig. 53. The disposal station may

connect to the main body and remove collected fluid in a similar manner to that described above in connection with Figs. 8, 29-35, and 39, for example.

[00176] Fig. 56 illustrates a liquid collection process in accordance with a liquid collection system 1100 similar to the variations depicted in Figs. 53-55. Fig. 56 illustrates that a first side 1100a can be configured to block a view of liquid that is being collected in liquid collection containers 102 in an opposite side 1100b. This arrangement may provide a more aesthetic quality if multiple procedures will be carried out before the liquid collection system is emptied, for example.

[00177] Fig. 57 illustrates an exemplary disposal station 1105 for removing the collected contents in the liquid collection system 1100. The disposal station may connect to the main body and remove collected fluid in a similar manner to that described above in connection with Figs. 8, 29-35, and 39, for example.

[00178] Fig. 58 illustrates an exemplary sequence of operation using liquid collection system 1100. A liquid collection container 1102 holding collected fluid is shown as darkened. An empty liquid collection container 1102 is shown in white. After a procedure, the liquid collection system can be transported to a disposal station 1105 to dispose of the collected fluid. Fig. 2a illustrates that the liquid collection system may be returned for another procedure after disposal. Fig. 2b illustrates that the liquid collection container 1102a may be attached to the disposal station separately from the main body 1101, and a second liquid collection container 1102b may be attached to the main body 1101 and used for another procedure. Fig. 2c illustrates an implementation in which a procedure area includes at plurality of disposal stations. This plurality of disposal stations allows a first liquid collection container 1102a to be disconnected from the main body 1101 and attached to disposal station 1105a for a disposal cycle. A second liquid collection container 1102b that has been previously run through a disposal cycle at disposal station 1105b may then be

attached to the main body and used for a continuation of the procedure or for another procedure. While liquid collection container 1102b is in use, for example, a disposal cycle is being completed on liquid collection container 1102a.

[00179] Fig. 59 illustrates a variation in which a liquid collection system 1101 may be configured to include a plurality of liquid collection containers 1102. In this variation, the main body 1101 is configured with a central portion for receiving a disposable manifold 1103. For example, a first disposable manifold may be placed in communication with the liquid collection system 1101. One of the plurality of liquid collection containers 1102 is selected, and upon collection of liquid, the liquid enters the disposable manifold and flows to the selected one of the plurality of liquid collection containers 1102. The liquid collection container 1102 may be selected, for example by placement of the manifold 1103 in communication with an opening 1120 corresponding to the selected liquid collection container 1102. In other variations, the manifold may be attached in the same position, and the liquid collection container may be selected, for example, using an electronic selection, manually moving a lever. If the first selected liquid collection container is filled to a predetermined amount, liquid collected beyond that amount may then enter a second liquid collection container in the plurality 1102. The second collection container may begin to collect liquid after a manual selection. For example, a manifold may be placed in communication with the opening 1120 corresponding to the second collection container. This second collection container may also being to collect liquid automatically upon the first liquid collection container reaching the predetermined amount. For example, adjacent collection containers may communicate in a tandem or spillover manner. This sequence continues until a procedure is finished. At the end of the procedure, the disposable manifold may be removed and discarded.

[00180] At the beginning of a second procedure, a new disposable manifold may be placed on the main body, and a new liquid collection container may be selected from the plurality of containers 1102. The liquid collection process continues, similar to the first procedure, using as many liquid collection containers in the plurality 1102 as necessary. This sequence of operations may continue until each of the liquid collection containers in the plurality 1102 has been used. Then, the liquid collection system 1100 may be transported to a disposal station as shown in Fig. 57 for emptying, for example.

[00181] This sequence of operation described and shown in Fig. 59 allows the liquid collection system 1101 to be used for a plurality of procedures or for a large amount of liquid collection before disposal is necessary. Through use of a plurality of individual liquid collection containers and attachment of a new disposable manifold between procedures, fluid from one procedure is prevented from coming into contact with fluid from another procedure.

[00182] Figs. 60-62 show another variation in accordance with aspects of the present invention. In Fig. 60, the liquid collection system includes a main body 1201 having a user interface 1202. The main body 1201 is configured to hold a plurality of liquid collection containers 1203. Although six liquid collection containers 1203 are shown in the exemplary implementation of Fig. 60, the main body may be configured to hold any suitable number of liquid collection containers for its size. The main body 1201 and the liquid collection containers 1203 are configured to attach to a plurality of disposable manifolds 1204. Each of the disposable manifolds 1204 include at least one port 1205 for communicating with a medical suction instrument, for example, through which fluid is collected in one of the liquid collection containers 1203.

[00183] Each of the plurality of liquid collection containers 1203 collects fluid separately from the other liquid collection containers. By using individual disposable manifolds 1204, a single liquid collection container, or multiple liquid collection containers,

in the plurality 1203 may be filled, as needed. A user may select which liquid collection container to use, for example. A second liquid collection container in the plurality 1203 may be used without contacting either the previously collected fluid in a first liquid collection container or the disposable manifold for the first collection container, by selecting a second liquid collection container and attaching at least one suction instrument to a port 1205 in the disposable manifold of the liquid collection container. This approach allows the liquid collection system to be used multiple times between disposal operations for collected fluids.

[00184] Exemplary disposal stations 1210 and 1211 are shown in Fig. 62, which are usable with the variation of the disposal system shown in Fig. 60. These disposal stations 1210, 1211 may include an evacuation attachment configured to communicate with and evacuate a plurality of liquid collection containers at one time, or may be configured to communicate with and evacuate one liquid collection container at a time. Disposal station 1211 may be configured to employ a conveyor belt type disposal process in which liquid collection containers 1203 are removed and drained in order, for example. The conveyor belt may remove the liquid collection containers 1203 from the main body 1201 and move them through the disposal station The disposal process may further include a cleaning step.

[00185] In Fig. 62, disposal station 1210 is illustrated as including a manifold section 1220. In the variation shown as 1210, the liquid collection containers 1203 are received in the disposal station having a manifold 1204 attached. As part of the disposal cycle, the used manifold is removed and discarded, for example, in 1230. The manifold section may be used in the process of removing and discarding manifolds, or may be used to store new manifolds to be attached to liquid collection containers after completion of a disposal cycle.

[00186] Fig. 63 shows an exemplary liquid collection and disposal process in accordance with the components and operations shown in and described with respect to Figs. 60-62. Used liquid collection containers are darkened in this figure. Unused or cleaned

liquid collection containers are shown in white. In the exemplary variation of Fig. 63, the disposal station is configured to receive liquid collection containers, for example by removing the liquid collection containers from a main body 1201 of a liquid collection system. Additional liquid collection containers may be maintained in a first position in the disposal station, as shown. The disposal station removes the liquid collection containers 1203 from the main body 1201. The removed liquid collection containers move the liquid collection containers previously held in the disposal station to a second position. In the second position, the main body may receive the liquid collection containers. After receiving the liquid collection containers, the main body may be removed from the disposal station and used for liquid collection. Fig. 63 shows that the removal and receiving process may occur when the main body is moved adjacent to the disposal station. The disposal station 1211 may include a feature that moves the main body 1201 through the disposal station. Disposal station may also include a feature that distinguishes liquid collection containers containing collected fluid and unused liquid collection containers.

[00187] Fig. 64 shows another exemplary liquid collection and disposal process in accordance with the components and operations shown in and described with respect to Figs. 60-62. The disposal station 1210 is configured to receive used liquid collection containers 1203a at a first position 1213 and to transfer new or cleaned liquid collection containers 1203b to the main body 1201 of the liquid collection system at a second position 1214. Used liquid collection containers are drained of collected liquid and/or cleaned before being transferred to the second location to be received by a main body 1201.

[00188] Figs. 65 and 66 show another variation in accordance with aspects of the present invention. In Fig. 65, the liquid collection system includes a main body 1301 having a first portion 1302 and a second portion 1303. The first portion 1302 provides an opening through which at least one liquid collection container 1304 may be accessed. The second

portion 1303 provides an enclosure that shields at least one liquid collection container 1304. The second portion 1303 may also include a user interface. Main body 1301 is configured to hold a plurality of liquid collection containers 1304. Fig. 60 shows a circular configuration of liquid collection containers, although other embodiments may have other shapes. The main body 1301 includes a rotating mechanism that rotates the plurality of liquid collection containers around a central portion 1306. Each of the plurality of liquid collection containers may include a disposable manifold 1305. Each manifold includes at least one port 1307 for attaching a suction instrument, through which liquid is collected into the liquid collection container.

[00189] In order to collect liquid in the liquid collection system, a first liquid collection container accessible through the first portion 1302 of the main body is selected. This selection may be made manually by the user, or may be automatically determined based on the position of the first liquid collection container with respect to the main body, for example. At least one suction instrument may be attached to a port 1307 in the manifold 1305 of the selected liquid collection device. Once suction is established from the vacuum source, liquid may be collected in the liquid collection container via the suction instrument.

[00190] After the first liquid collection container has been used, the main body may be rotated such that a second liquid collection container is placed in proximity with the first portion 1302 of the main body. The second liquid collection container is then ready for communication with at least one suction instrument for collection. These features allow the liquid collection system to be used with multiple liquid collection containers, or to be used in multiple procedures before disposal. The second portion 1303 of the main body shields the used liquid collection container and manifold both from contact and from view. Once the second liquid collection container is either full or the medical procedure is finished, for example, the main body may rotate such that the second liquid collection container is internal

to the second portion 1303 of the main body, and such that a third liquid collection container is accessible through the first portion 1302 of the main body, and so on.

[00191] Central portion 1306 may include a vacuum source, or an external vacuum source may be connected to the main body 1301. Central portion 1306 may also include a mechanism for rotating the liquid collection containers 1304. An evacuation opening 1038 is shown in a lower portion of the main body 1301. In various implementations, the liquid collection containers may be rigid or flexible and may be drained through an opening in communication with evacuation opening 1308. The liquid collection system may be moved to a disposal station, and the disposal station may be placed in communication with evacuation opening 1308. The disposal station then is able to evacuate the contents of at least one liquid collection container. The main body may be configured such that all of the liquid collection containers are evacuated at the same time, only selected liquid collection containers are evacuated at the same time, or liquid collection containers are evacuated individually. This evacuation may occur as the disposal station causes the liquid collection containers to rotate in order for evacuation, or a user may manually cause the liquid collection containers to rotate for evacuation. Alternatively, only used liquid collection containers may be evacuated.

[00192] Another exemplary disposal station 1310 is illustrated in Fig. 65. The disposal station may include at least one disposal interface 1311. Although the disposal interface 1311 is shown in a lower portion of the disposal station, in other implementations, the collected contents may be evacuated through an evacuation opening located at other positions in the main body, or may be evacuated through the manifold or via an opening in the liquid collection container, for example.

[00193] The disposal station may connect to the main body and remove collected fluid in a similar manner to that described above in connection with Figs. 8, 29-35, and 39, for example.

[00194] If the liquid collection container is reusable, after evacuation, it may be disinfected prior to reuse. If the liquid collection container is disposable, after evacuation, it may be discarded.

[00195] Fig. 68 shows another variation in accordance with aspects of the present invention. In Fig. 68, the liquid collection system includes a main body 1401 and a plurality of cavities 1402, 1403. Although two cavities are shown in Fig. 68, any number of cavities may be included on main body 1401. Each cavity is configured to attach to a disposable liquid collection container 1406, having a lid 1407 and a flexible liner 1408. The flexible liner 1408 may be attached to the lid such that a substantially sealed interior space is sealed therebetween. The lid includes at least one port 1409 for communicating with a suction instrument, through which liquid is collected into the liquid collection container. The lid 1407 may further include an additional opening 1410 configured to communicate with an evacuation source. In the alternative, the at least one port 1409 may be used for evacuation of the liquid collection container 1406. The liquid collection container 1406 may be similar to those described in connection with any of Figs. 1-8, 20-25, 82-92, or other variations described herein. The lid 1407 may include similar openings, valves, and seals. The cavity may further include a piston, as described in connection with Figs. 29-35. The main body 1401 may include a central portion 1405, and may further include a user interface 1411. The central portion 1405 may include a vacuum source, filters, etc., similar to those described in other implementations described and/or shown herein.

[00196] Fig. 69 illustrates an exemplary variation of a liquid collection container. This variation includes a lid/manifold 1407, a rigid cavity 1412 configured to attach to the lid

1407, and a flexible liner 1408 with a top configured to abut either the lid 1407 or the rigid cavity 1412. Flexible liner 1408 may include a flexible tube structure 1413 for assistance in evacuating fluid from the flexible liner. This variation includes an interface 1416 that may be configured to communicate with a vacuum source upon insertion of the liquid collection container into the main body 1401. This communication may occur without any additional manual steps. The rigid container 1412 includes an opening 1417 for transferring collected fluid to the flexible liner 1408. The rigid container may also include an additional opening 1414 configured to communicate the flexible liner 1408 with an evacuation source 1417. The rigid container 1412 may be used to collect a smaller amount of fluid, with flexible liner 1408 attached as a back-up or spillover container. Rigid container 1412 may also be used as a specimen collection container.

[00197] Figs. 70-71 show another exemplary implementation of a portable waste collection system 1501, according to exemplary aspects of the present invention. The system 1501 includes a main body 1502, the main body may include a stand 1505 and base 1506. The base in Fig. 71 shows four legs 1507 extending from the stand 1505. However, other embodiments may include a different number of legs (e.g., three legs, five legs) or a solid base, such as a square or circular shaped base. The base may include wheels 1507 or other mobile elements that allow the system 1501 to be easily moved to a desired location.

[00198] The system also includes a plurality of waste collection containers 1503a, 1503b, 1503c, 1503d. Although four containers are shown in Fig. 71, any suitable number of removable waste collection containers 1503 may be used with a given size system. The main body may include a support section 1502 that supports the containers 1503. The main body may also include separators 1504 located between each waste collection container1503. The section of the main body including the separators 1504 and the liquid collection containers 1503 may rotate around a central axis, as shown in Fig. 70. The waste collection containers

each have a lid 1508. Each lid includes at least one port 1509 for communication with a suction instrument. Each lid may also include an additional opening 1510, that may be used, for example, as an evacuation port. The lids may include additional features described in connection with Figs. 1, 4-8, 17-24, and 29-35. For example, each lid may include an interface for connecting with a suction source (including automatically in some variations), as shown in Figs. 22-24. Each lid may additionally connect a liquid collection container 1503 with an adjacent liquid collection container. As with the other variations described herein, the liquid collection container 1503 may be rigid or flexible, may be disposable or reusable, and may include a rigid cavity configured to accept a lid with an attached flexible liner.

[00199] The liquid collection containers may be configured to include a portion 1512 shaped to slidably fit into a groove 1513 in the main body.

[00200] A vacuum source may be included in main body 1502, or the main body may include an interface for connecting to an external vacuum source. This variation may further include an attachment feature for attaching an additional container 1511. The additional container may be configured for use as a back-up or overflow container, and may additionally be configured for use as a trap or specimen collection container.

[00201] Fig. 71(a) shows an exemplary variation of the top of a lid 1508 in more detail. Fig. F2 also shows a variation in which the main body 1501 does not include separators 1504 between the waste collection containers 1503. Each lid 1508 may include at least two openings. One opening 1518 may connect the waste collection container 1503 to at least one device through which waste will be collected, for example. Fig. 71(a) shows a connection member 1519, such as tubing, in communication with the opening. The opening 1518 may include a port or other structure configured to communicate with a connector, such as tubing, and/or one or more medical devices. The opening may also be configured to provide communication with a plurality of medical devices. In operation, waste is drawn

through the medical device, through the connection member 1519, and into the waste collection container 3 using suction.

[00202] A second opening 1516 may be configured to provide communication with a source of suction. For example, tubing or another connection member 1517 may connect the opening 1516 in the lid 1508 to a vacuum or other source of suction. In Fig. 71(a), each lid 1508 includes an opening 1516 configured to communicate with a source of suction.

[00203] Each lid may further include a third opening 1513 configured to provide communication with an adjacent waste collection container 1503b through a conduit or other communication feature1514, such as tubing. In certain circumstances, the waste collection container 1503 may become full or temporarily inoperable during a waste collection process. This communication between adjacent waste collection containers 1503 mitigates the negative effect these may have on a medical procedure by providing a connection to a plurality of back-up containers. For example, this communication between adjacent waste collection containers may allow collected waste to overflow to an adjacent container.

[00204] In an alternative exemplary variation, the second opening 1516 may be configured to provide communication to an adjacent waste collection container 1503b. In this variation, each waste collection container 1503 is connected to at least one adjacent waste collection container. This communication with an adjacent container 1503 allows the source of suction to be communication from the collection container as well. Thus, for example, the source of suction may be communicated directly to only one waste collection container.

[00205] In yet another variation, each waste collection container may be configured to function as a separate, independent suction canister, independently communicating with a source of suction and/or independently providing communication with at least one medical device.

[00206] The waste collection containers 1503 may be configured to require a manual connection to an adjacent waste collection container 1503 before use. Alternatively, the waste collection containers may be configured to automatically collect overflow waste from an adjacent waste collection container once the original waste collection container has reached its capacity.

[00207] Although Figure 71(a) depicts an individual connection 1517 between each liquid collection container and a vacuum source, the system may be configured for one liquid collection container to attach to a vacuum source, and for the other liquid collection containers to communicate with the vacuum source via communication with an adjacent liquid collection container.

[00208] Fig. 71(a) shows an additional opening 15 in the lid 8 of each waste collection container 3. This optional opening may be provided to allow a disposal system to communicate with the container 3. For example, such a disposal system may evacuate the collected waste material. Opening 1515 may further include a breakable closure, such as a layer of plastic or foil that is pierced when connected to the waste disposal system. In other variations, the waste disposal system may communicate with a waste collection container through one of the other openings 1516, 1518, and 1513.

[00209] Figs. 72-74 illustrate a variation in which the liquid collection system of Figs. 70-71 further includes an additional liquid collection container 1511. This additional liquid collection container may be used as a back-up storage container, for example, or as a specimen collection container, among other things. Additional liquid collection container 1511 may communicate with a vacuum source 1520 placed in a central portion of the main body, as shown in Figs. 72 and 73. Alternatively, the additional collection container 1511 may also communicate directly with a liquid collection container 1503 via, for example, its lid 1508 as shown in Fig. 74.

[00210] Fig. 72 illustrates a removable vacuum source 1520. As main body may be configured to receive a removable vacuum source, the vacuum source 1520 may be replaced with a second vacuum source, if necessary. The main body may also be configured to communicate with an external vacuum source.

[00211] Fig. 73 shows a central portion 1521 in the center of the main body 1501 of the fluid collection system. This central portion may be located above vacuum source 1520. If an external vacuum source is being used, central portion 1521 is in communication with the external vacuum source. Communication with either type of vacuum source is established with the liquid collection container via interface 1530. This communication is established as the liquid collection container is received in the main body 1501.

[00212] When additional collection container 1511 is attached to central piece 1521, suction through conduit 1513 draws liquid into the container 1511 via at least one port 1514. a shield 1515 directs fluid away from conduit 1513, preventing liquid from entering the vacuum.

[00213] The additional collection container 1511 may be attached to the lid 1508 of the liquid collection container via opening 1540 in lid 1508. Opening 1540 includes an extension that raises piece 1512 in additional collection container 1511 such that contents collected in the additional collection container 1511 spillover into container 1503. The additional collection container is communicated with the vacuum source via collection container 1503.

[00214] Fig. 75 shows another variation in accordance with aspects of the present invention. In Fig. 75, the liquid collection system includes a main body 1601 including a cavity 1602, the cavity having a top portion 1603 configured to receive a lid 1604 of a collapsible liquid collection container 1605. In the variation shown in Fig. 75, the lid 1604 is attached to a flexible liner 1606, and the flexible liner 1606 is configured to extend and

contract in a bellows-like manner. The liquid collection container may further include a rigid bottom portion 1607.

[00215] The lid 1604 and rigid bottom 1608 may include a securing mechanism, such as the one shown in Fig. 77(a, c), that secures the lid to the rigid bottom portion 1607 prior to use and after evacuation. The exemplary embodiment shown in Fig. 77(a-c) includes a breakable portion 1610 located between a first piece 1611 attached to the rigid bottom and a second piece 1612 located on the lid 1604. This breakable portion may be configured to break when pressure is applied to expand the rigid bottom 1607 away from the lid 1064. For example, the breakable portion may be configured to break when vacuum pressure is applied to an interstitial space between the cavity 1602 and the exterior of the flexible liner.

[00216] The first piece 1611 and the second piece 1612 may be configured such that, after a liquid collection container has been used and evacuated, the first piece 1611 secures to the second piece 1612, as shown in Fig 77(c). This securing may allow the user to easily place the liquid collection container in contact with the opening of the cavity, for example, and thereby avoid pinching the flexible liner between the lid and the top portion of the cavity, among other things.

[00217] The operation of the system shown in Fig. 77(a-c) is similar to that discussed in connection with Fig. 8 and 29-35. Fig. 75 shows an exemplary disposal station 1613 configured to evacuate the contents of the liquid collection container.

[00218] The cavity 1602 may include a piston 1608. Piston 1608 may include features similar to the piston described in connection with Figs. 29-35.

[00219] Figs.78-80 show another variation in accordance with aspects of the present invention. In Fig.78, the liquid collection system includes a main body 1701 having a cavity 1702. The main body is configured to communicate with a manifold 1703. The manifold includes a plurality of ports 1704 for communication with a suction instrument. An

exemplary manifold is shown in Fig. 80. Figs 78 and 80 show a variation of a lid 1703 in which the plurality of ports are provided in a pattern around all sides of the lid 1703. Among other things, this approach allows a user to easily access a port, regardless of the position of the main body 1701. The main body may also include interfaces 1705 and 1706 providing communication between the interior of the cavity and the exterior of the main body. These interfaces may be used to communicate with a vacuum source, and may also be used to communicate with an evacuation source, for examle.

[00220] Fig. 79(a,b) shows an exemplary disposal system 1720 and an optional attachment piece 1710 that may be used with the liquid collection system shown in Fig. 78. The attachment piece 1710 may include additional optional electronics or an attaching vacuum source. The attachment piece 1710 may be configured to removably attach to the main body 1701 of the liquid collection system. The attachment piece 1710 may include wheels or other mobile feature that enable the attachment piece 1710 to move along with the main body, after attachment. The attachment piece may be removed prior to evacuation or in order to attach the attachment piece to another main body.

[00221] Fig. 79(b) shows an exemplary disposal system that may be used in connection with the variation shown in Fig. 78. The disposal station may connect to the main body and remove collected fluid in a similar manner to that described above in connection with Figs. 8, 29-35, and 39.

[00222] Fig 81 shows how one attachment piece 1710 may be used with a plurality of main bodies 1700. A main body with collected liquid is indicated as having a darkened center. An empty main body is indicated as having a white center. The attachment piece may be stationed near a procedure area, for example. When liquid is to be collected, the main body may be transported to the procedure area and connected to the attachment piece. Liquid is then collected either until the procedure is finished or until the liquid in the liquid

collection container reaches a predetermined fill limit. At this point, the liquid collection container and the main body 1700 may be disconnected from the attachment piece 1710 transported to a disposal station 1720. If the procedure is not finished or if another procedure begins before disposal of the collected liquid is finished, a second main body/liquid collection container 1700 may be attached to the attachment piece 1710 and used to collect liquid while the first liquid collection container/main body is in the process of disposal.

[00223] The liquid collection container in connection with each of the above described variations may include a rigid or flexible reusable collection container that is evacuated and disinfected between uses, or a rigid or flexible disposable collection container that is evacuated before being discarded in a waste repository. A flexible, disposable collection container may include aspects described in connection with other implementations described herein, such as those shown and described in connection with Figs. 1-3, 4-8, 17-24, and 29-33.

[00224] Additional variations of liquid collection containers are shown in Figs. 82-92.

[00225] Figs. 82(a-c) illustrate a liquid collection container 2100 having a flexible liner 2102 and a lid 2101 similar to those described in connection with Figs. 1, 5, and 8. Any of the various lids may be used in combination with this liner variation. This liquid collection container includes a mechanism for compressing, rolling, or folding the flexible liner prior to use and after or during disposal of collected liquid. For example, this mechanism may include a roller 2103 and a piece 2104 attached between the roller 2103 and a side of the lid 2101 opposite the side on which the roller 2103 is located. The piece 2104 may include a strip of material configured to surround at least a portion of the exterior of the flexible liner. 2102.

[00226] Fig. 82(c) shows the mechanism holding the flexible liner in a collapsed state prior to use. In the next portion of Fig. 82(c), the mechanism extends to allow the liner 2102

to expand. The liquid collection container is used to collect liquid. After liquid is collected, the liquid collection container is emptied of the collected liquid. The mechanism retracts, thereby rolling, folding, or compressing the flexible liner 2102 of the liquid collection container 2100. The mechanism may retract by rolling piece 2104 around roller 2103. This action may occur after the collected liquid has been removed, or may assist in compressing the liner 2102 while the collected liquid is being removed.

[00227] Fig. 83(a and b) show an additional variation of features for a collection system in accordance with aspects of the present invention. This variation may include ridges or ribs 2203 that extend in a first direction along the liner 2202. Fig. 83b shows a cross section of the lid 2201 and liner 2202. Lid 2201 may include an opening 2211 for communication with a vacuum source, and may also include a fluid trap or filter 2210, such as a PPV filter to block liquid from entering the vacuum source. Fig. 84 shows a cross section of such a liner 2202. Fig. 85 illustrates how the liner functions during liquid collection and disposal.

[00228] Figs. 86-87 illustrate a variation of stacking liquid collection containers having a flexible liner. Fig. 86 illustrates a liquid collection system 2301 configured to receive a plurality of liquid collection containers in a stacked manner. As shown in Fig. 87, each of the plurality of liquid collection containers includes a lid 2302 and a flexible liner 2303. The lid 2302 may hingeably or otherwise be configured to closed an opening at the top of the flexible liner 2303. The lid may include an opening 2304 configured to receive a manifold 2305 having at least one port 2305 through which liquid may be collected into the interior of the liquid collection container. After liquid has been collected, the manifold 2304 may be removed prior to evacuation of the collected contents or used as an interface for evacuation of the collected contents, for example. The flexible liner 2303 collapses as the collected contents are removed. In typical operation, the collapsed liquid collection container is

removed from the stacked plurality of liquid collection containers following collection, and the next liquid collection container is ready to have the lid closed, a manifold attached, and liquid collected.

[00229] Fig. 88(a-c) shows a similar variation to that of Figs. 86 and 87, in which the liquid collection containers are compressed prior to use and stacked adjacent to each other, rather than, for example, nested inside one other. A compartment 2310 may be provided in liquid collection system 2301 for receiving a number of compressed liquid collection containers, as illustrated in Fig. 88(b). Fig. 88(a-c) also illustrates that the liquid collection containers may further include tubing 2306, such as flexible tubing. This tubing may be used to assist with fluid removal during a diposal process as previously described. The tubing 2306 may be, for example, a flexible tube attached to the liner 2303 or a tubular opening formed in the material of the liner.

[00230] Fig. 89(a-c) illustrates another variation that is generally similar in function to that of Fig. 1. Fig. 89(b) shows a cross section of this variation, including a portion 2320 in the bottom 39 of the liquid collection container 30 that is configured to abut a second portion 2321 in the lid 31 of the liquid collection container when the flexible liner 35 is in a compressed state. Portions 2320 and 2321 may be used to provide a securing mechanism that secures the liquid collection container in a collapsed position. For example, portions 2320 and 2321 may snap together, frictionally maintain a connection, and may include an adhesive therebetween. Portions 2320 are drawn apart as part of fluid collection. This may occur via vacuum pressure applied to the exterior of liner 35 prior to fluid collection or via the pressure of collected fluid. Fig. 89(c) illustrates an exemplary liquid collection and disposal in liquid collection container 30.

[00231] A disposal station usable with the variations of Figs. 82-89 may function similarly to those described in connection with Figs. 8 and 29-35. However, other disposal

processes may be used. For example, the disposal process may optionally include one or more of draining or dumping of collected liquid via an opening in a liquid collection container, positioning a tube in a liquid collection container and evacuating the collected contents, such as shown in Figs. 90(a,b), evacuating a liquid collection container using suction, collapsing a flexible liner, adding a solidifier to collected liquid, capping of a liquid collection container, and/or disposal of an entire liquid collection container along with collected contents.

[00232] Figs. 91 and 91(a-c) illustrate another variation of a liquid collection container. This variation includes a lid 2101 and a flexible liner 2100 attached to the lid. The liner may include tubing 2107, as described above. The liquid collection container is received in a cavity 2103 of a mobile unit 2111, not shown. The lid 2101 includes at least one port 2109 configured to communicate with a suction instrument through which fluid is drawn into the collection container. This communicate may be made via tubing 2110. Each port may include a closure mechanism 2104 that closes the port when communicate is not established with such tubing 2110. Fig. 91 a shows an example of such a closure mechanism. Port 2109 may include a closure piece 2108a biased to block the port. Closure piece 2108a may be attached to at least one extension 2108b extending along port 2109, as shown in position (a). When a tube 2110 is connected to port 2109, extension 1208b is biased against closure piece 2108a and forces an opening between closure piece 2108a and port 2109, creating communication between port 2109 and the liquid collection container, as shown in position (b). This communication allows fluid to be suctioned through port 2109. When the tube 2110 is removed, the closure piece 2108a again biases against port 2109, as shown in position (a).

[00233] The lid 2101 may also include an indicator 2105 that indicates whether the liquid collection container is new or used. An embodiment of such an indicator is illustrated

in Fig. 91(b). This indicator may automatically indicate that the liquid collection container has been used, once any amount of fluid has been drawn into the container. Collected fluid may include a very small amount of fluid, and may be clear. Indicator 2105 allows a user to quickly identify used containers without requiring a visual inspection of liquid collection container. This prevents liquid collection containers from mistakenly being used for multiple procedures.

[00234] The liquid collection container in Fig. 91 may also include a non-drip valve 2106 located between the lid 2101 and the main body 2111 and vacuum source. An example of such a non-drip valve 2106 is shown in Fig. 91c. The valve includes a closure piece 2113 biased against an opening. As the lid 2101 is received in the main body 2111 of a liquid collection system, the lid 2101 presses the closure piece 2113 away from the opening. When the vacuum source is started, the suction opens a flexible end portion 2112 of lid 2101, pulling the flexible end portion to position 2114, thereby providing communication between the vacuum source and the liquid collection container.

[00235] Fig. 92 illustrates a process of liquid collection using the liquid collection container 2100 from Fig. 91. In this variation, liquid is drawn into the liquid collection container until a float valve 2116 is raised via contact with collected fluid, as shown in sections 1-4. At this point, collected fluid is drawn through tube 2107 in the liner 2115 and into another container, such as a second container, via the non-drip valve 2106. A second container may be configured similar to those described in connection with Figs. 41-46, for example.

[00236] While aspects of the present invention have been described and illustrated with reference to one or more preferred variations thereof, it is not the intention of the applicants that these aspects be restricted to such detail. Rather, it is the intention of the applicants that aspects of the present invention be defined by all equivalents, both suggested

hereby and known to those of ordinary skill in the art, of the variations falling within the scope thereof.

CLAIMS

I claim:

1. A fluid collection system, comprising:

a container having a top opening;

a lid configured to close the top opening, the container and the lid defining a substantially sealed interior space therebetween,

wherein the lid includes a plurality of access ports through which the interior space receives fluid, and wherein the plurality of access ports are spaced around the perimeter of the lid.

2. The fluid collection system according to claim 1, further comprising:

a flexible liner attached to the lid such that the liner is interposed between the lid and the container when the lid closes the top opening, the liner and the lid defining a substantially sealed interior space therebetween, wherein the flexible liner is configured to collapse into an at least partially collapsed state as the fluid is removed from the interior space.

3. A fluid collection system, comprising:

a container having a top opening;

a lid configured to close the top opening; and

a flexible liner attached to the lid, such that the liner is interposed between the lid and the container when the lid closes the top opening, the liner and the lid defining a substantially sealed interior space therebetween,

wherein the lid includes an access port through which the interior space receives fluid,

wherein the flexible liner is configured to collapse into an at least partially collapsed state as the fluid is removed from the interior space, and

wherein the flexible liner includes an access port, in a portion opposite the portion attaching to the lid, through which the fluid may be removed from the interior space.

4. The fluid collection system according to claim 3, wherein the access portion through which fluid may be removed from the interior space is configured to be at least partially dependent on gravity.

5. A fluid collection container comprising:

a lid;

an at least partially rigid bottom; and

a flexible liner attached between the lid and the bottom, such that the lid, flexible liner, and bottom define a substantially sealed interior space therebetween, the lid including:

an opening configured for communication with at least one suction instrument through which the collection container receives fluid; and

an opening configured for communication with an access port of a suction source,

wherein the flexible liner is configured to extend to a first position and to collapse to a second position .

6. The liquid collection container according to claim 5, further comprising:

a first attachment piece extending from the lid; and

a second attachment piece extending from the bottom, wherein the first and second attachment pieces are configured to communicate the lid to the bottom such that the flexible liner is maintained in a collapsed position.

7. A fluid collection system, comprising:

a plurality of fluid collection containers; and

a disposable collection container receiving housing, the housing including:

at least one attachment point for attachably receiving a plurality of fluid collection containers; and

an interface to a suction source,

wherein each fluid collection container, includes:

a lid configured to attach to the housing; and

an interface configured to communicate with the suction source.

8. The fluid collection system according to claim 7, wherein the interface configured to communicate with the suction source automatically communicates with the suction source when the fluid collection container is placed at one of the at least one attachment points for attachably receiving a plurality of fluid collection containers.

9. The fluid collection system according to claim 8, further comprising:

an additional collection container configured to attach to both a center piece communicating with the suction source and the lid of at least one of the plurality of fluid collection containers.

10. The fluid collection system according to claim 7, wherein fluid collection container automatically communicates with an adjacent fluid collection container when the fluid collection container is placed at one of the at least one attachment points for attachably receiving a plurality of fluid collection containers.

11. The fluid collection system according to claim 7, wherein the housing is rotatable.

12. The fluid collection system according to claim 11, wherein the housing further comprises:

an open portion, wherein the open portion provides access to at least one fluid collection container; and

an enclosing portion, wherein the enclosing portion covers at least one fluid collection container.

13. The fluid collection system according to claim 7, wherein each fluid collection container further includes:

a collapsible liner attached to the lid, such that the lid and collapsible liner form a substantially sealed interior space, and wherein the liner is configured to be expandable within the cavity.

14. A fluid collection system, comprising:

a disposable collection container; and

a fluid collection container receiving housing, the housing including:

a first cavity for receiving the disposable collection container;

a second cavity configured to receive collected fluid from the disposable collection container; and

an interface to a suction source,

wherein the disposable collection container, includes:

a lid configured to attach to the housing;

an interface configured to communicate with the suction source; and

a collapsible liner attached to the lid, such that the lid and collapsible liner form a substantially sealed interior space, and wherein the liner is configured to be expandable within the cavity.

15. A fluid collection system, comprising:

a main body;

a fluid collection container received in the main body;

a removable attachment piece, the removable attachment piece including a vacuum source; and an interface for connecting to a power source,

wherein the main body is configured to removably secure to the removable attachment piece, and wherein the main body includes at least one interface for communicating the fluid collection container with the vacuum source.

16. The fluid collection system according to claim 15, wherein the at least one interface is also configured to communicate with an evacuation source when the removable attachment piece is removed.

17. A fluid disposal station comprising:

a main housing for receiving a plurality of fluid collection containers;

a conduit to a waste repository;

a conduit to a rinse fluid;

a conveyor attachment piece for drawing the plurality of fluid collection containers through the main housing.

18. A fluid collection container comprising:

a lid;

a first collection cavity attached to the lid to define a substantially sealed interior space therebetween;

a second collection cavity attached to at least one selected from a group consisting of the lid and the first collection cavity to define a second substantially sealed interior space therebetween,

wherein at least one of the first and the second collection cavities comprise a flexible liner configured to collapse into an at least partially collapsed state.

19. A fluid collection container comprising:

a lid; and

a flexible liner attached to the lid to define a substantially sealed interior space therebetween, wherein the flexible liner is configured to collapse into an at least partially collapsed state as fluid is removed from the interior space, and

wherein the flexible liner includes at least one selected from a group consisting of a plurality of ribs extending in a longitudinal manner, a plurality of circumferential rings, and a flexible tube.

20. A fluid collection container comprising:

a lid; and

a cavity connected to the lid to define a substantially sealed space therebetween;

an interface for communicating the sealed space with a vacuum source;

at least one opening configured to allow fluid to be drawn into the sealed space; and

a closure piece biased against the at least one opening, wherein the closure piece is configured to move away from the opening when an attachment piece is attached to the at least one opening.

21. A method of evacuating a collapsible collection container, the method comprising:

securing a fluid collection container receiving housing, to a disposal system;

attaching the collapsible collection container so as to communicate via a first conduit with a suction disposal source in the disposal system;

collapsing the fluid collection container by evacuating the contents of the collapsible collection container; and

cleaning the interior of the collapsible collection container.

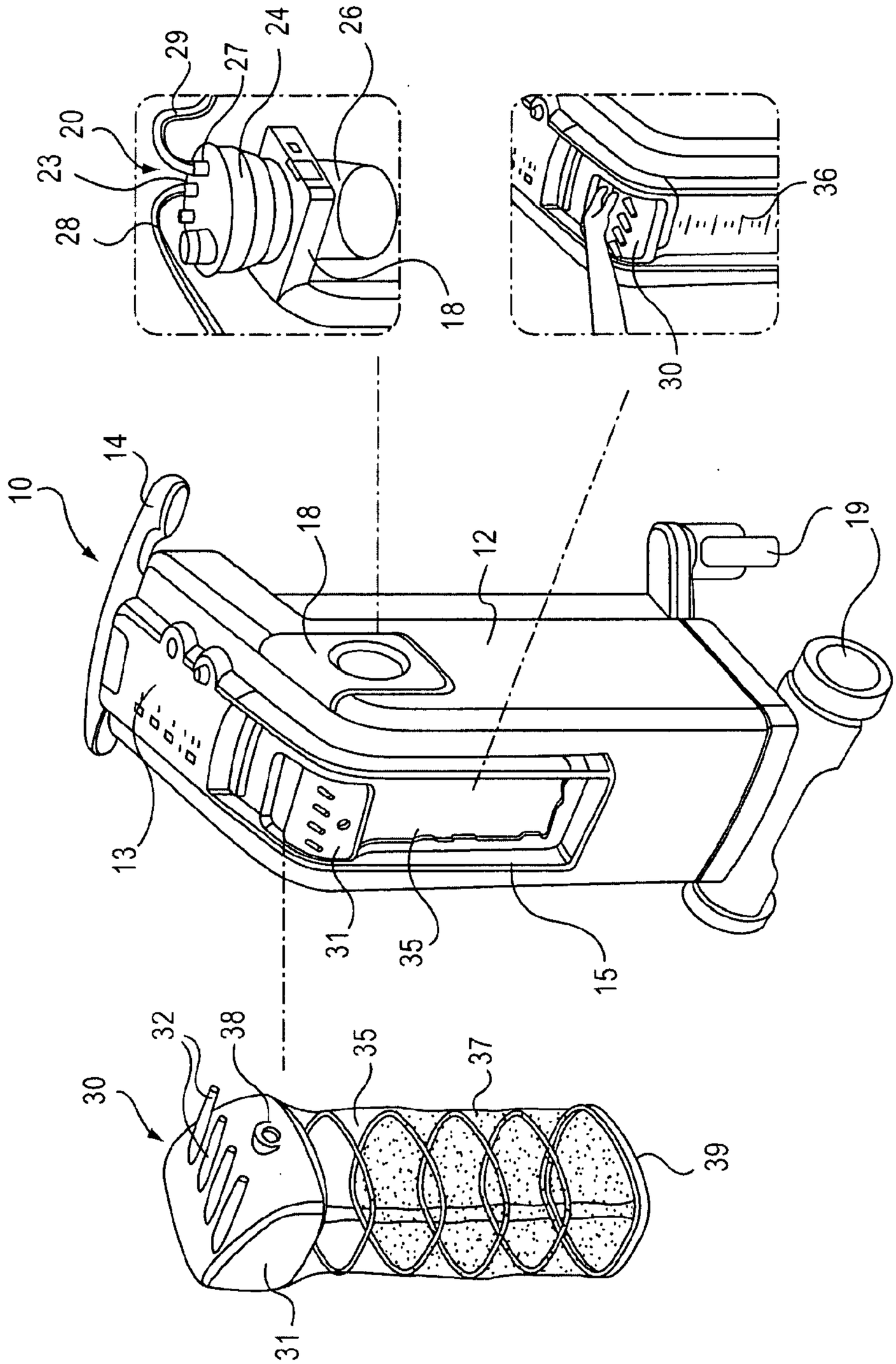

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Fig.1

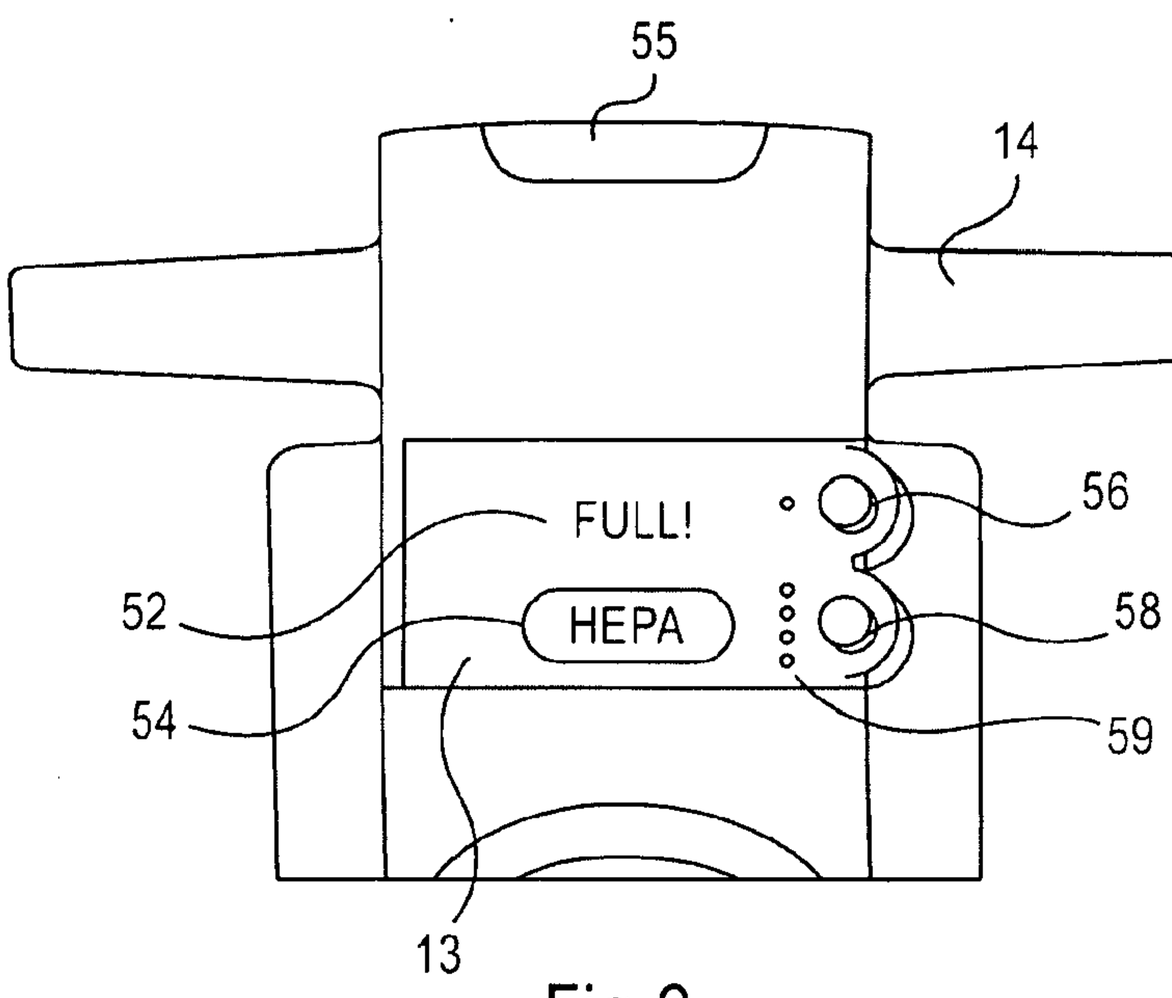


Fig.2

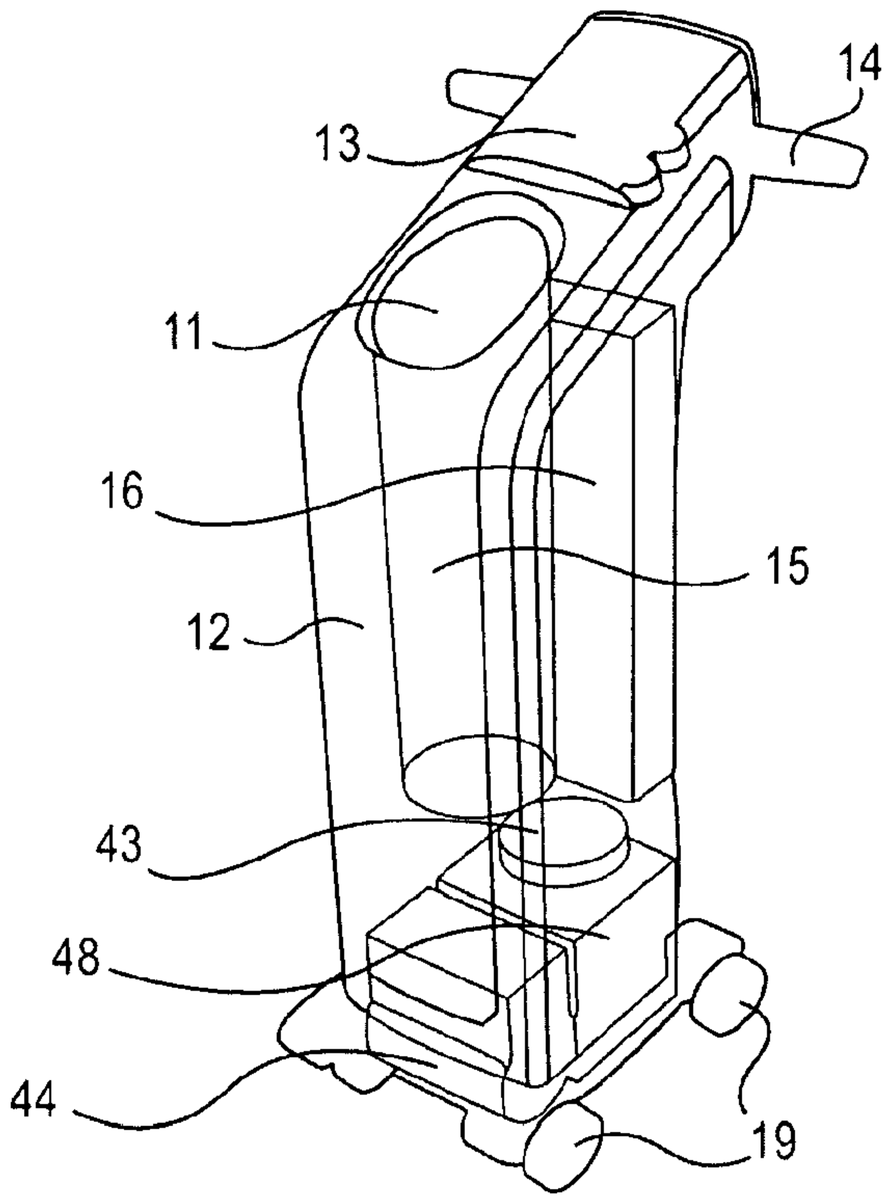


Fig.3

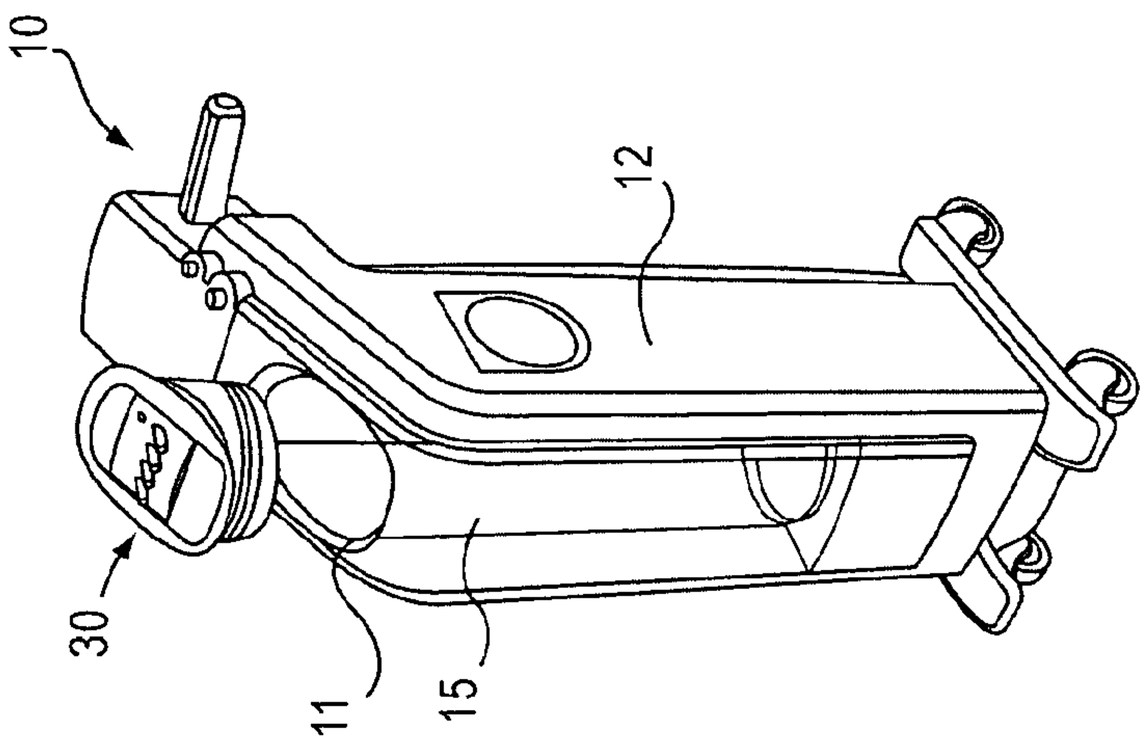


Fig.6

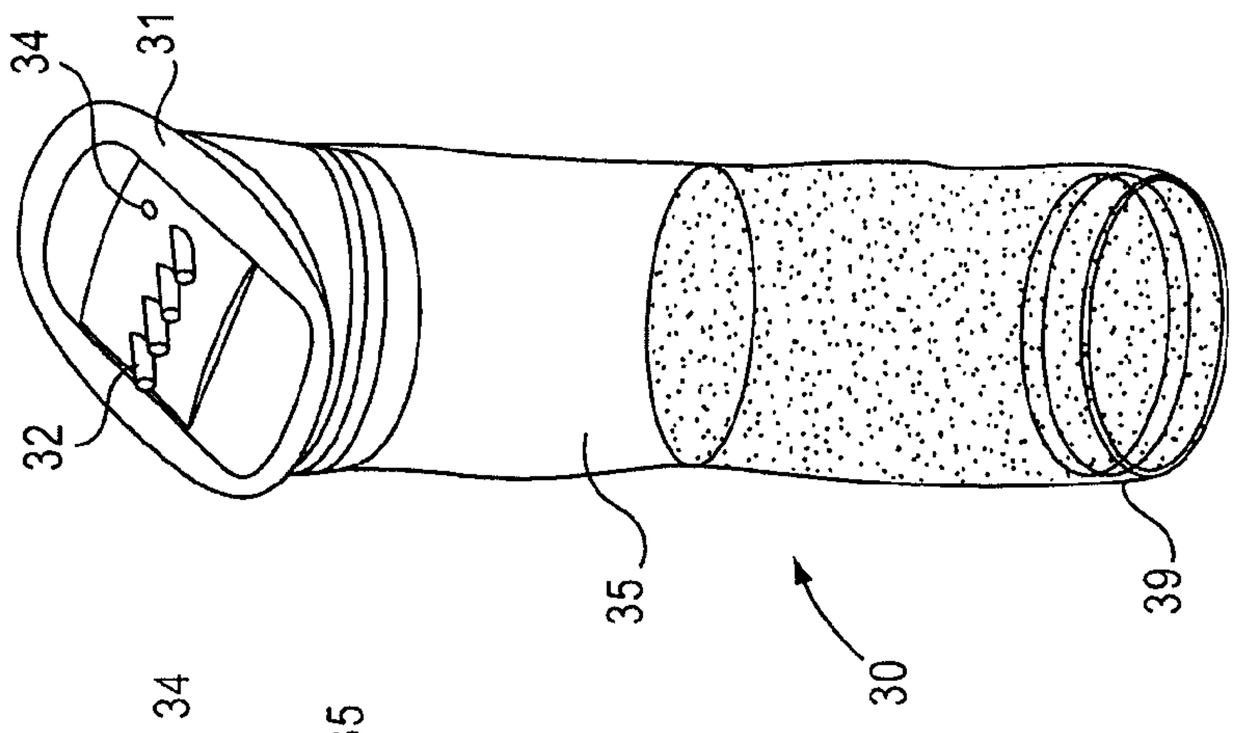


Fig.5

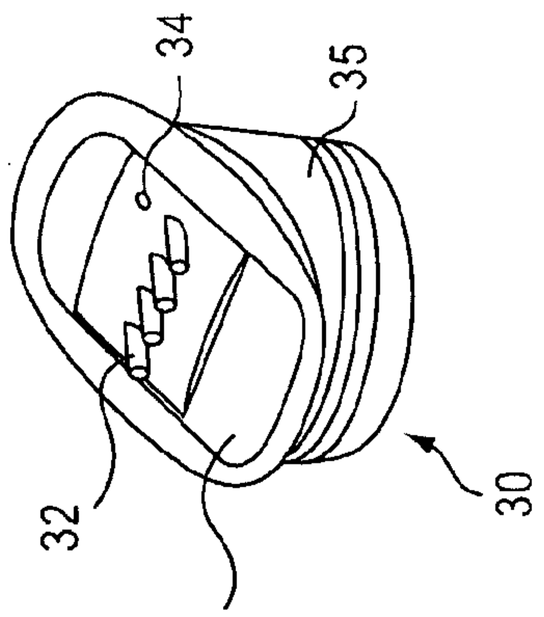
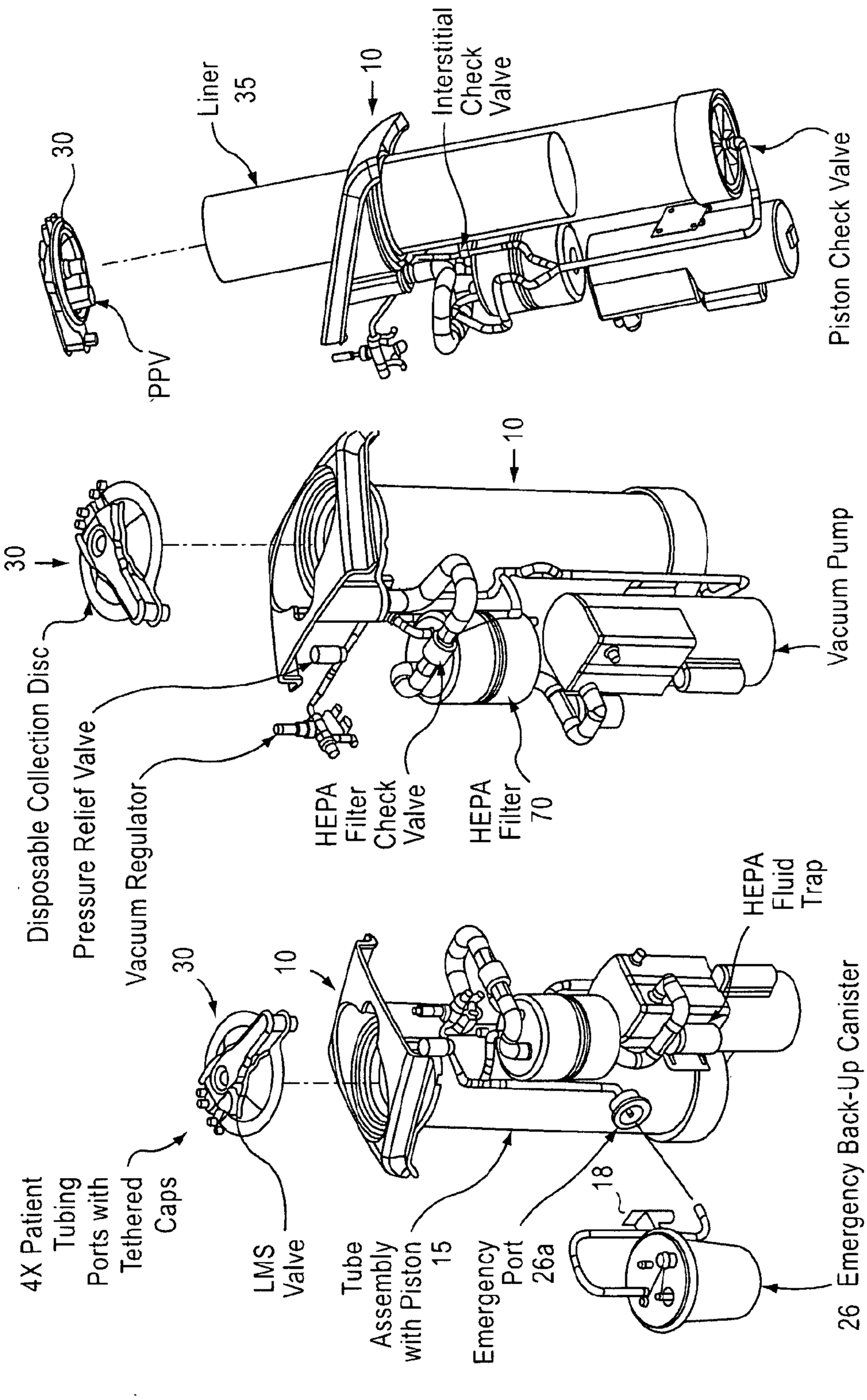


Fig.4


30
PPV
Liner
35
10
Interstitial
Check
Valve
Piston Check Valve
Fig.7(c)
30
Disposable Collection Disc
Pressure Relief Valve
Vacuum Regulator
10
HEPA
Filter
Check
Valve
HEPA
Filter
70
Vacuum Pump
Fig.7(b)
30
10
HEPA
Fluid
Trap
4X Patient
Tubing
Ports with
Tethered
Caps
LMS
Valve
Tube
Assembly
with Piston
15
Emergency
Port
26a
18
26 Emergency
Fig.7(a)

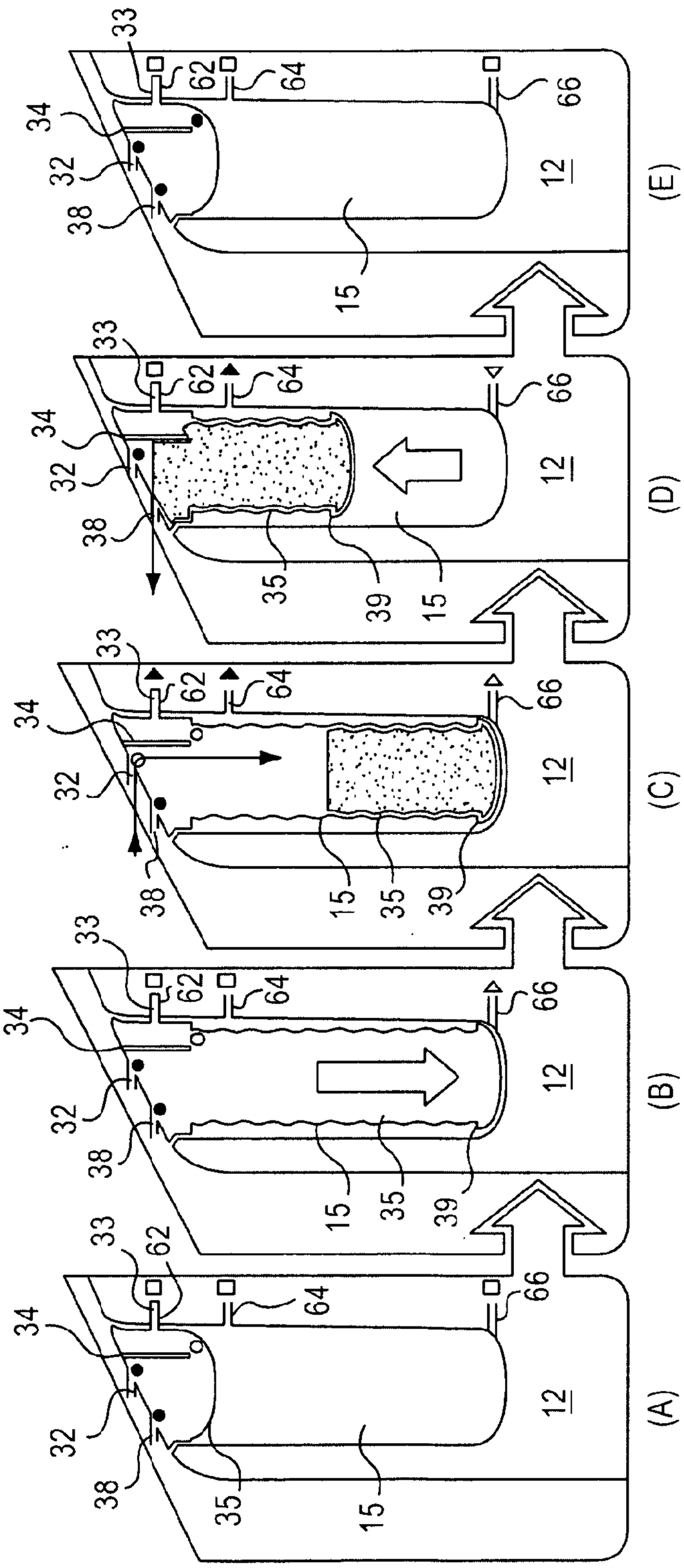

(E)
(D)
(C)
(B)
(A)
33
62
64
66
34
32
38
12
15
35
39
fluid flow
air flow
no air flow
open valve
closed valve

Fig.8

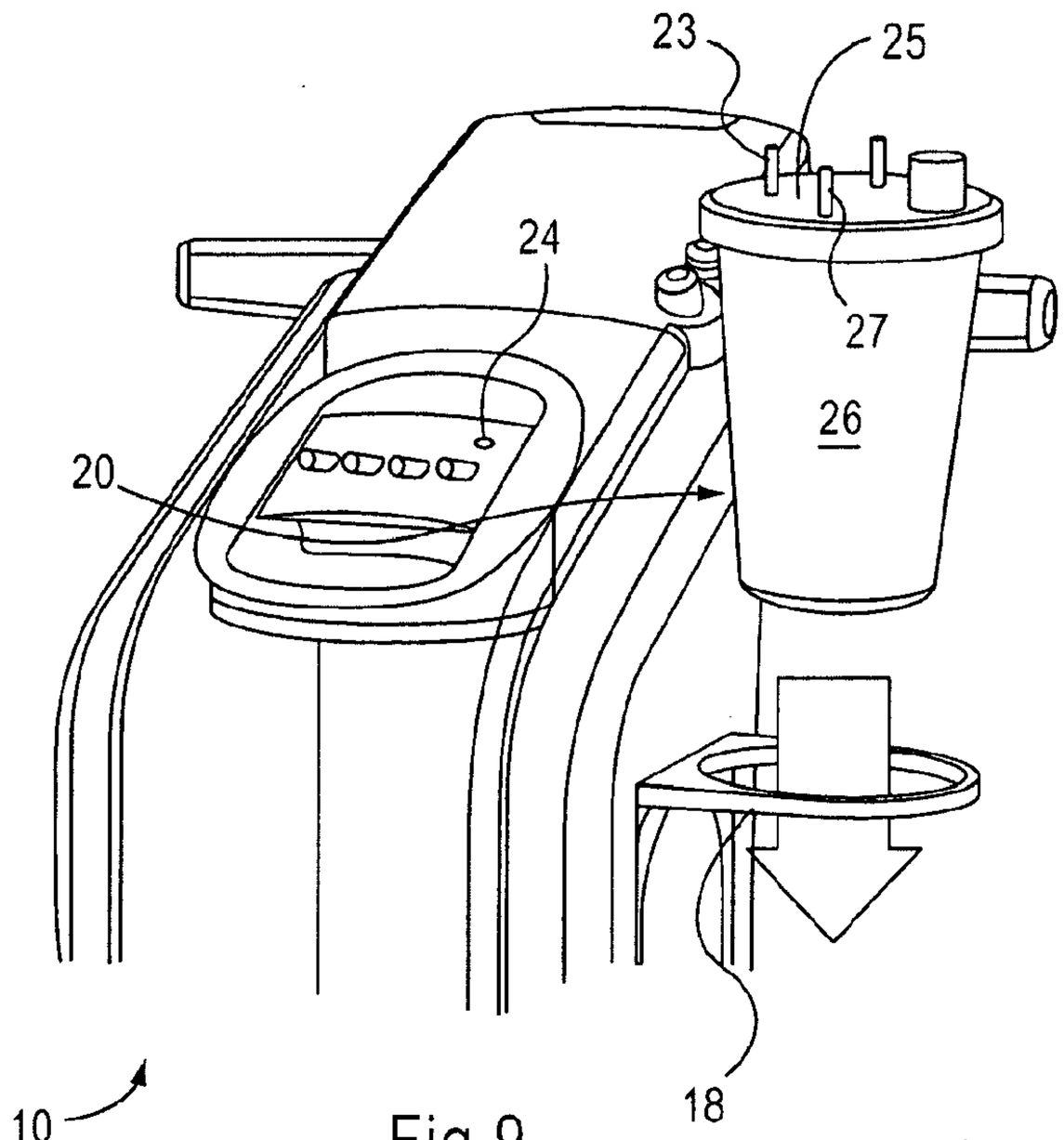


Fig.9

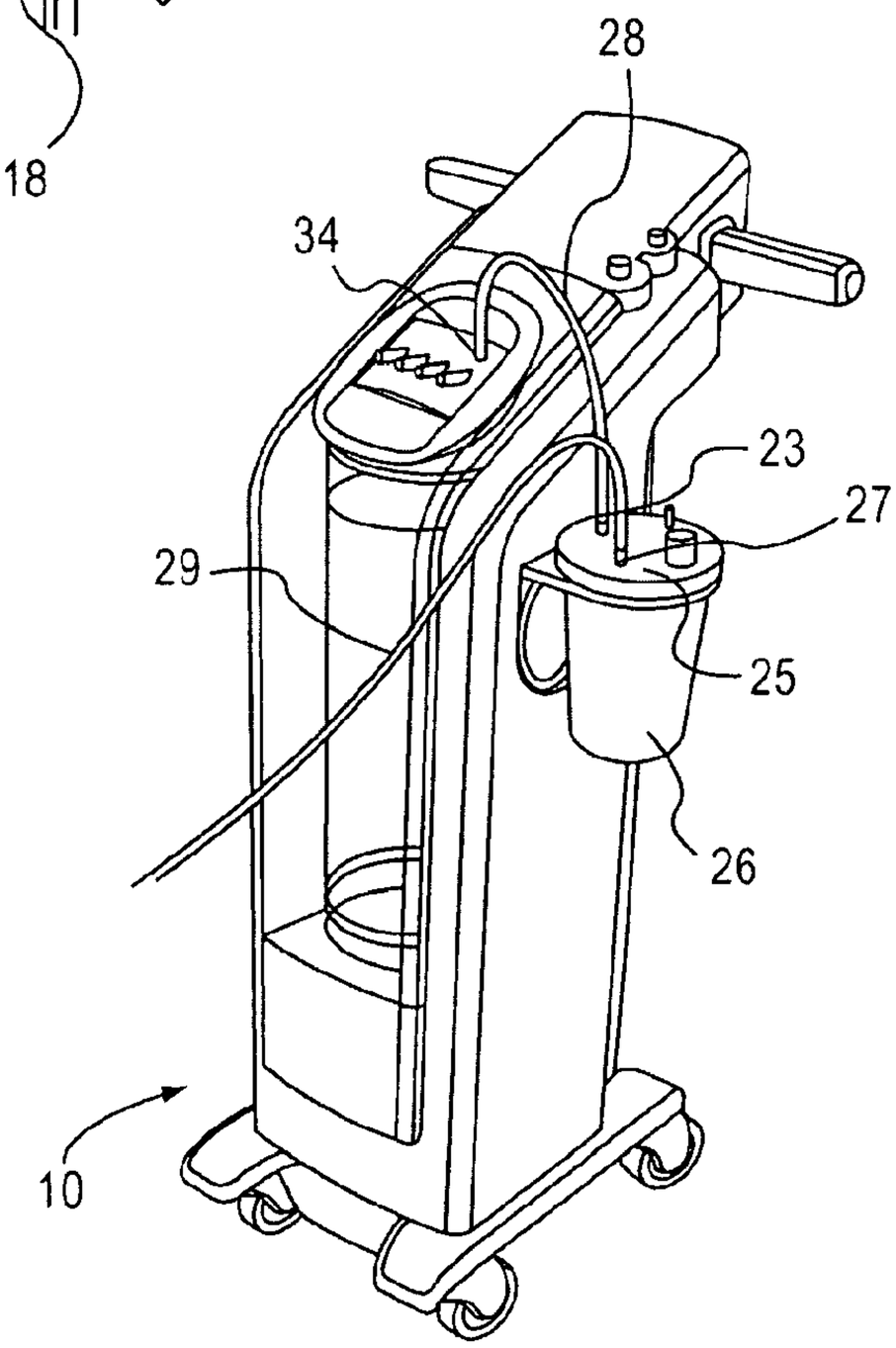


Fig.10

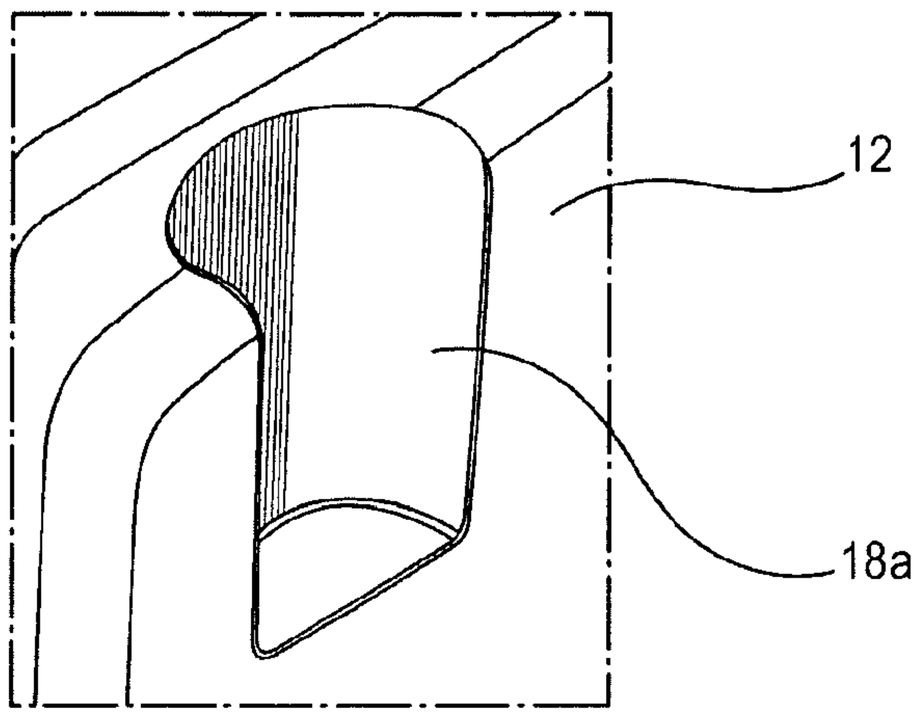


Fig.11

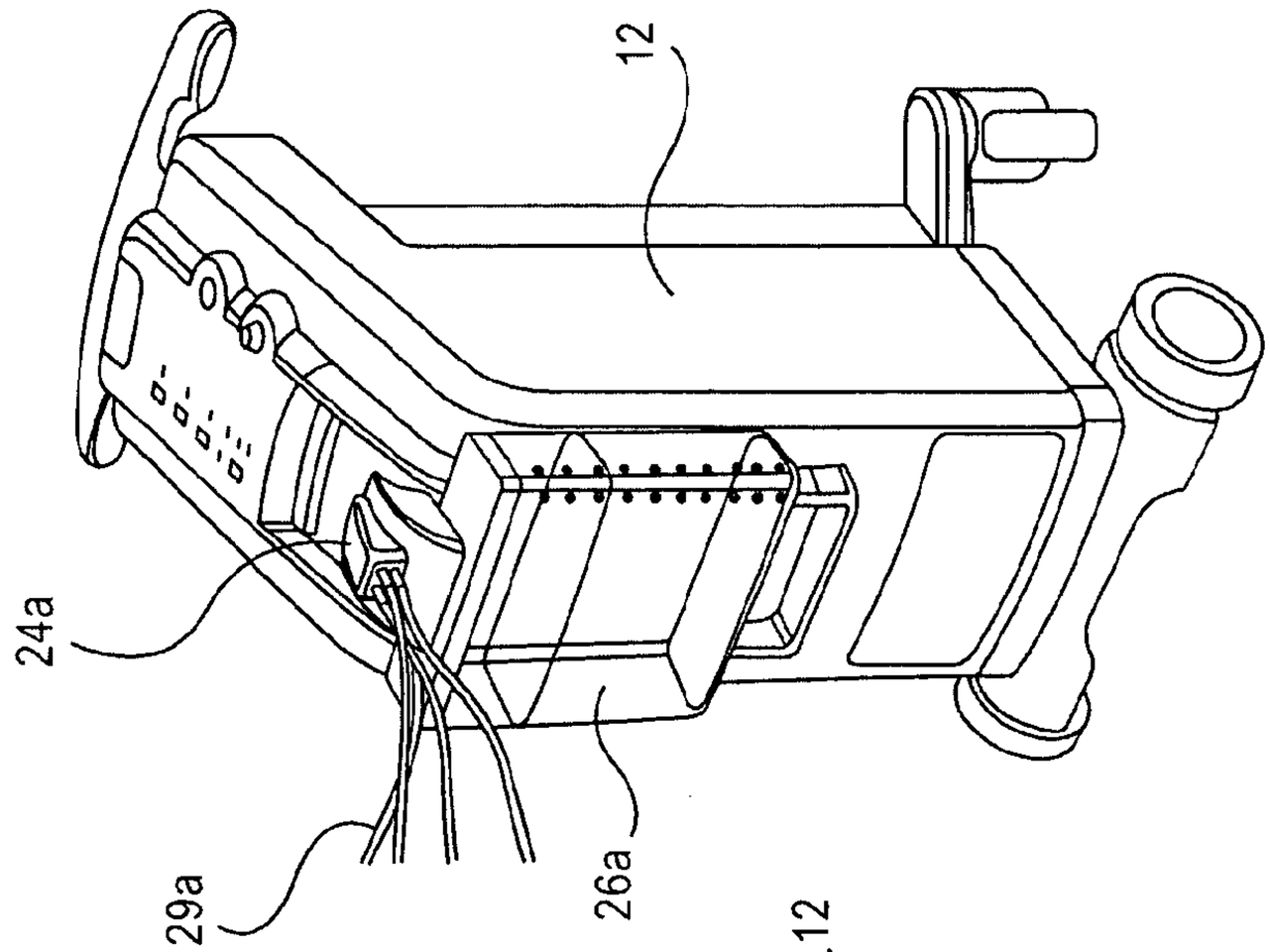


Fig.14

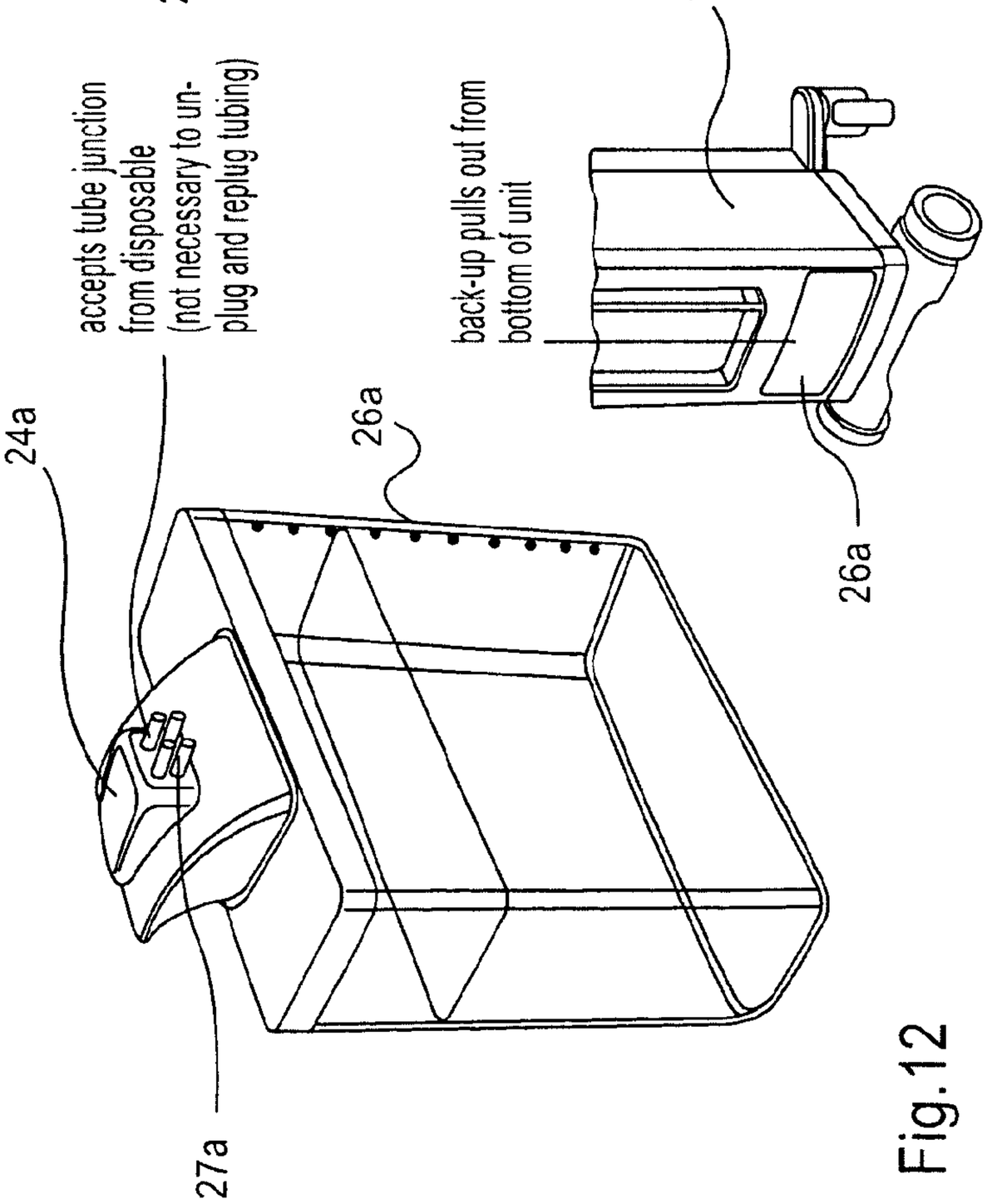


Fig.13

Fig.12

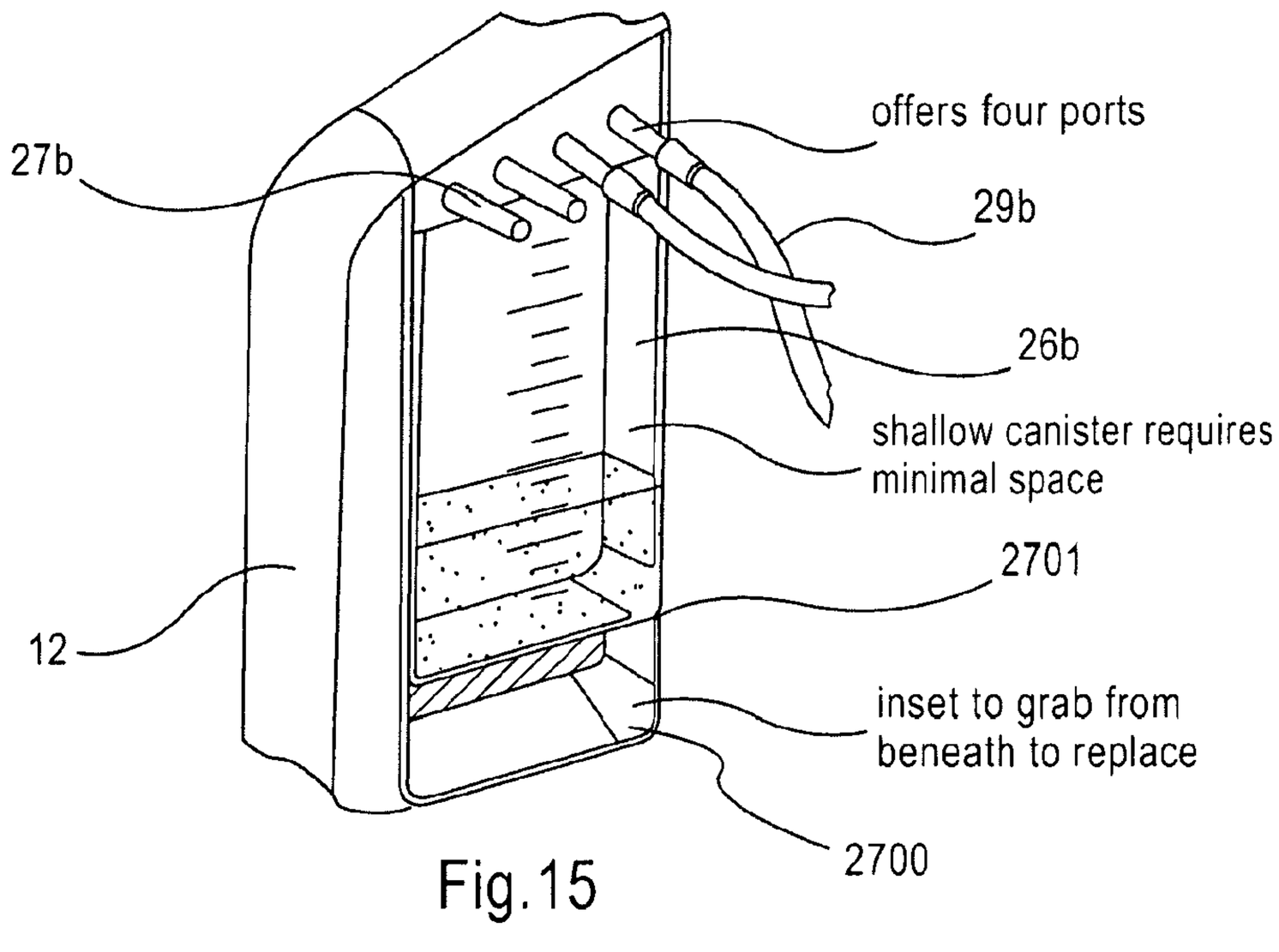

CUSTOMIZE INTEGRATION
offers four ports
27b
29b
26b
shallow canister requires minimal space
2701
12
inset to grab from beneath to replace
2700

Fig.15

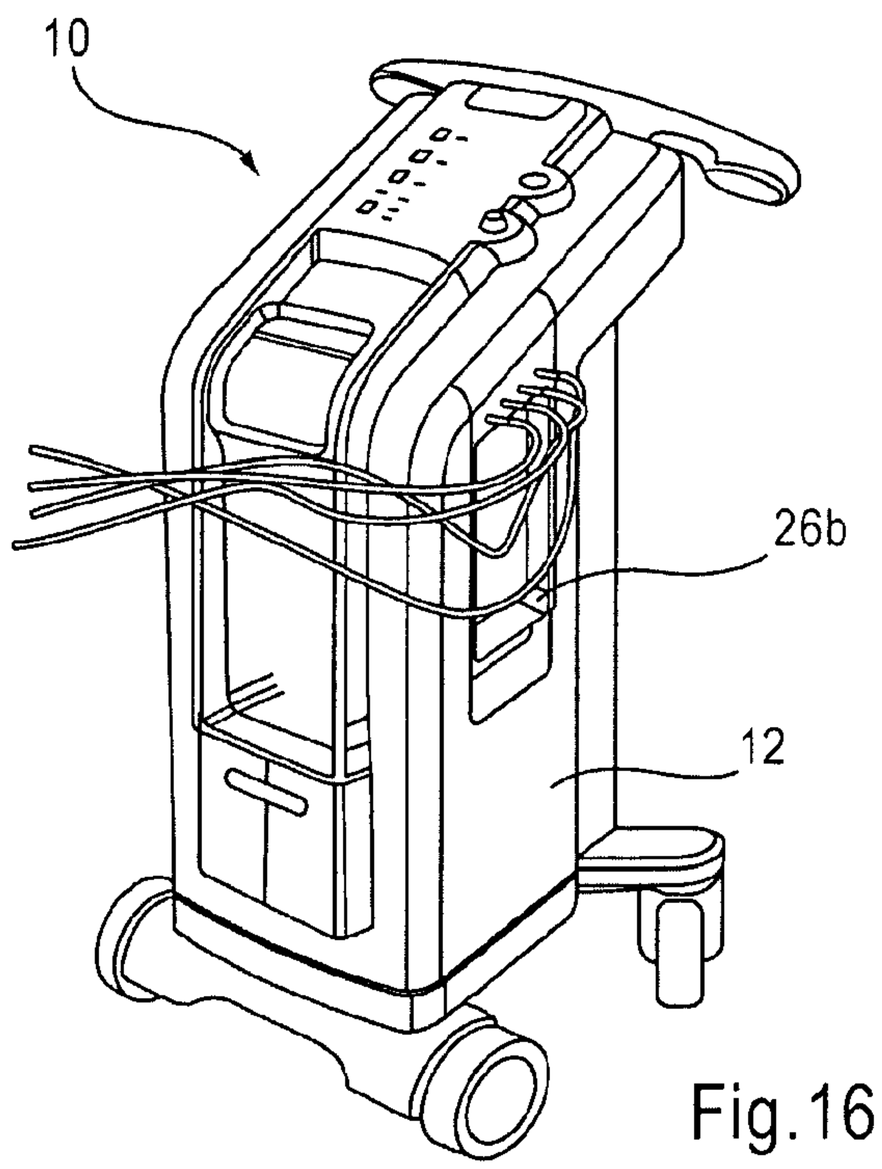

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26b
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Fig.16

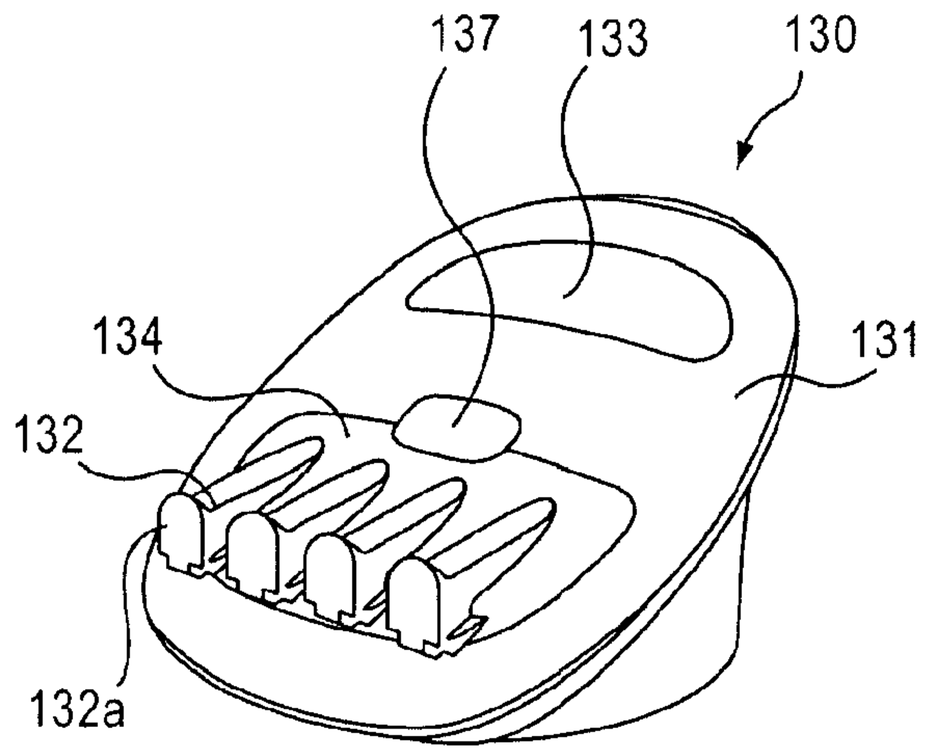


Fig.17

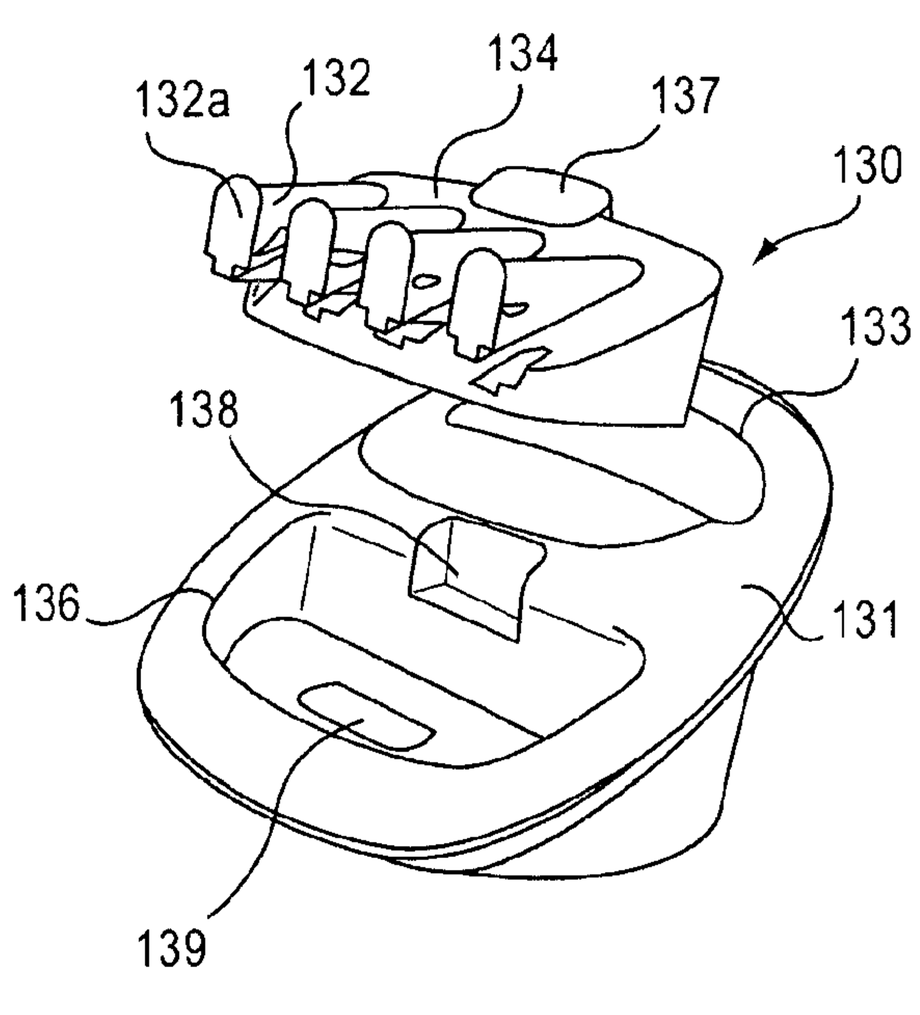


Fig.18

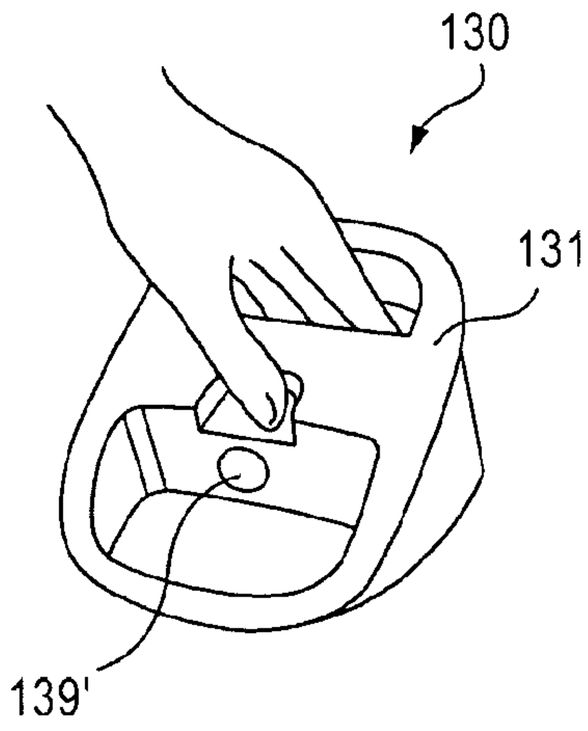


Fig.19

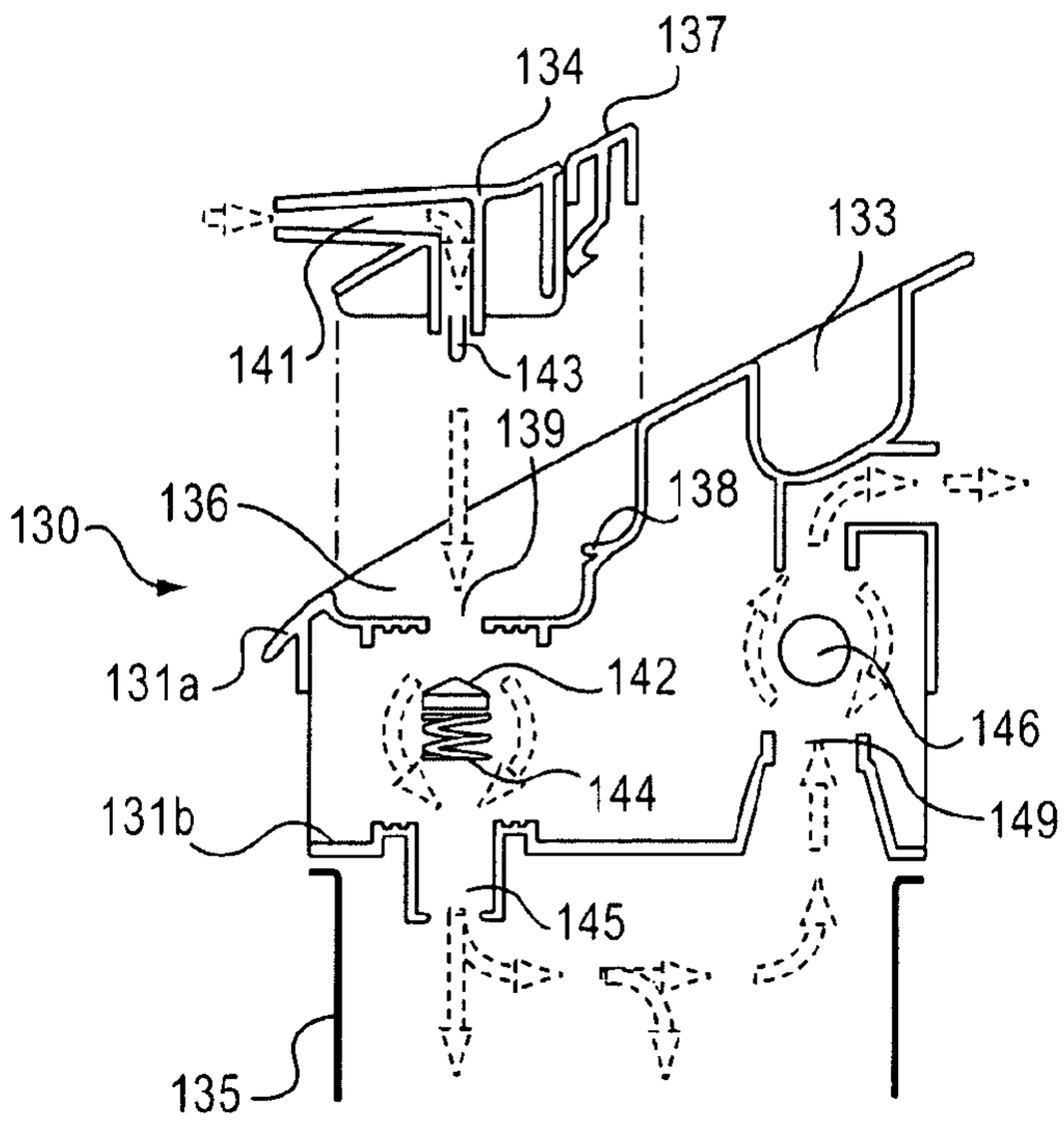

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Fig.20

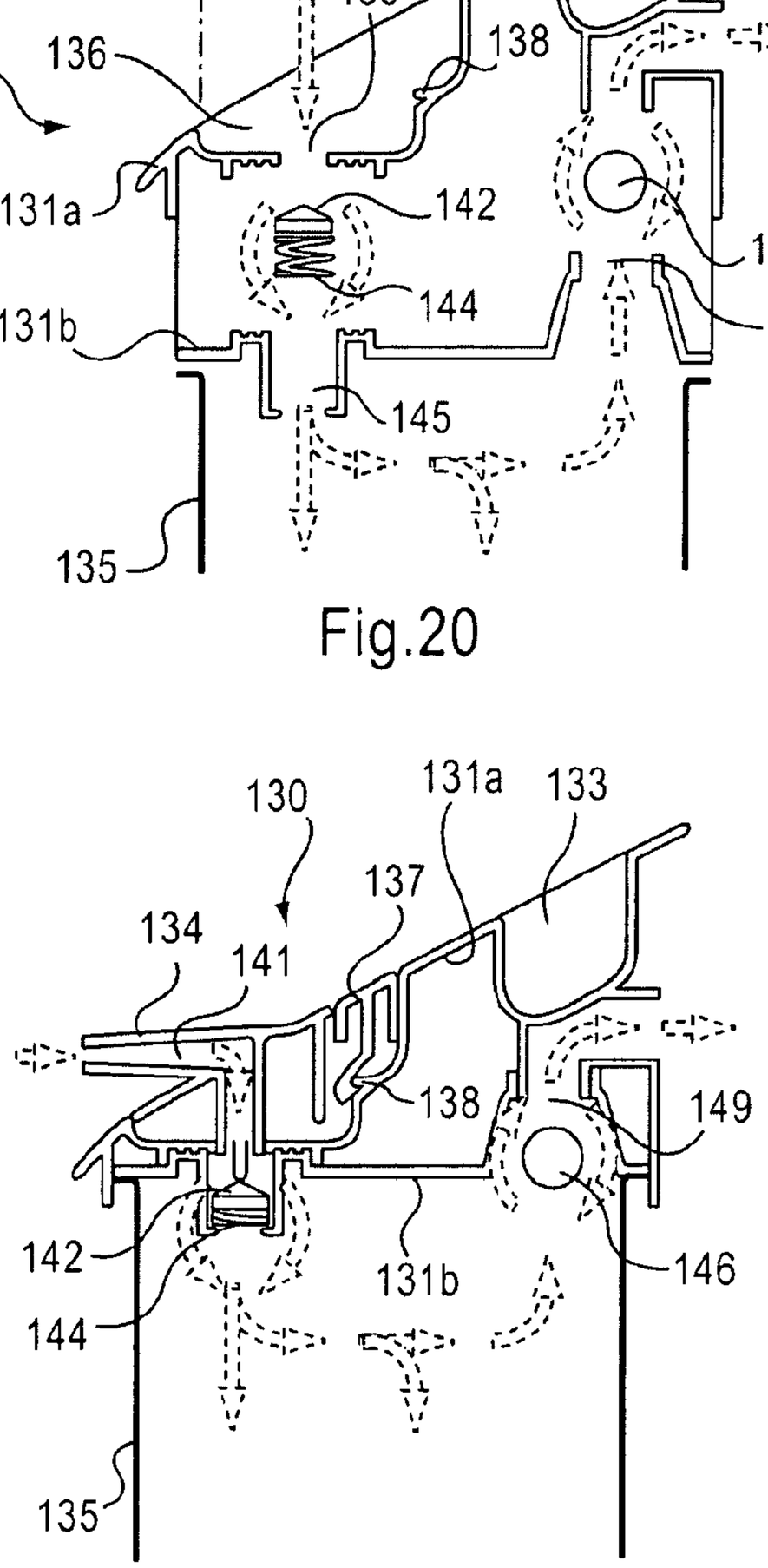

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Fig.21

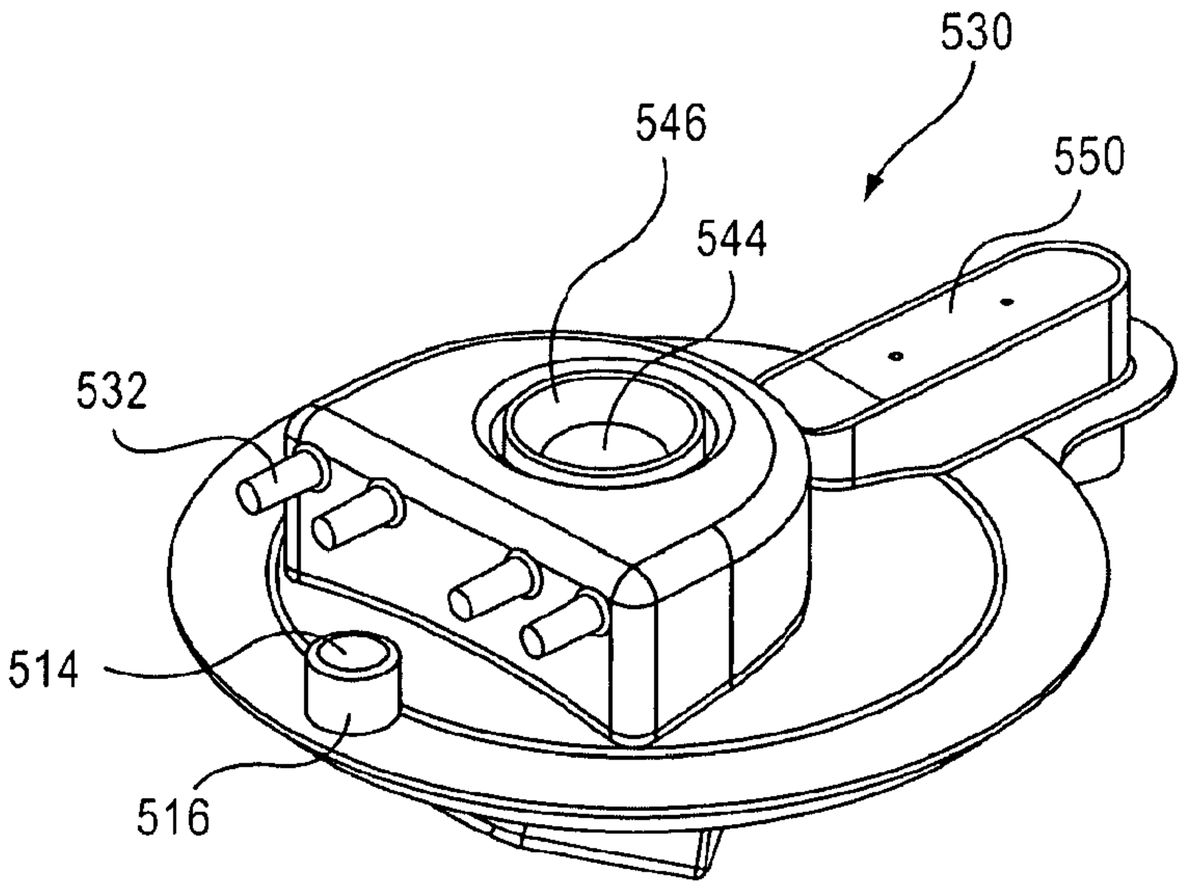


Fig.22

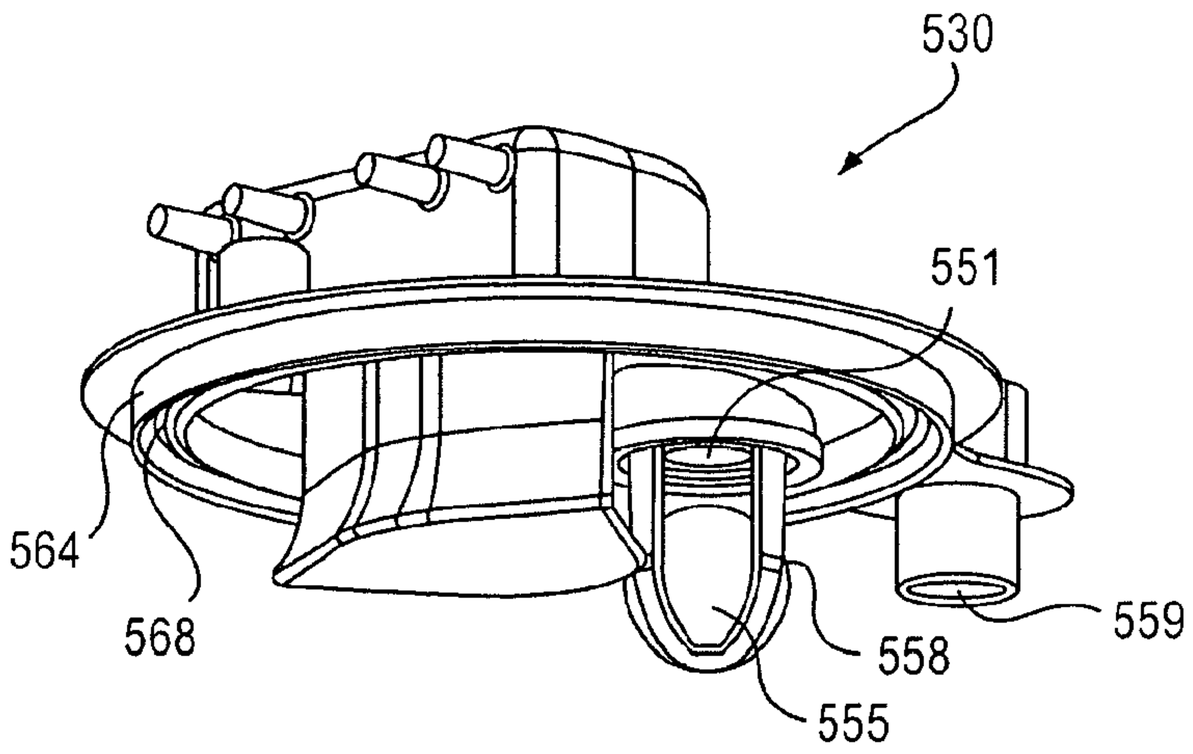


Fig.23

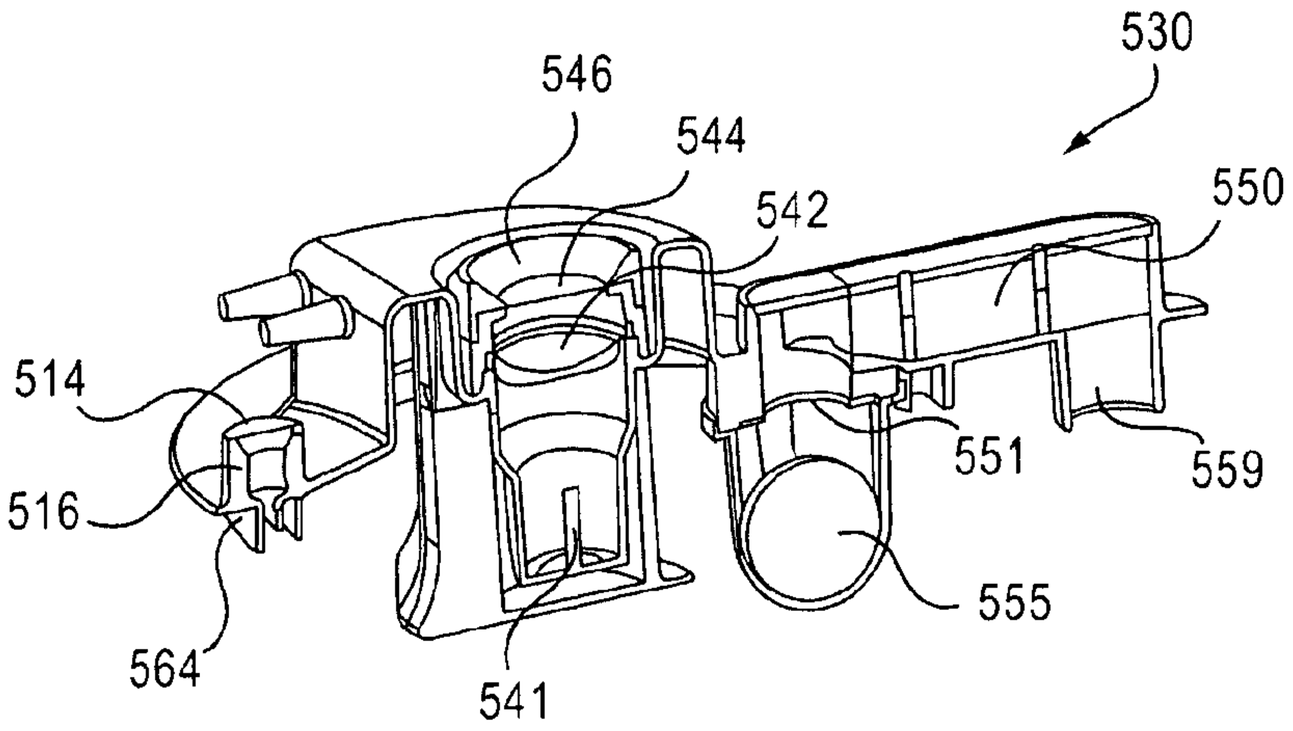


Fig.24

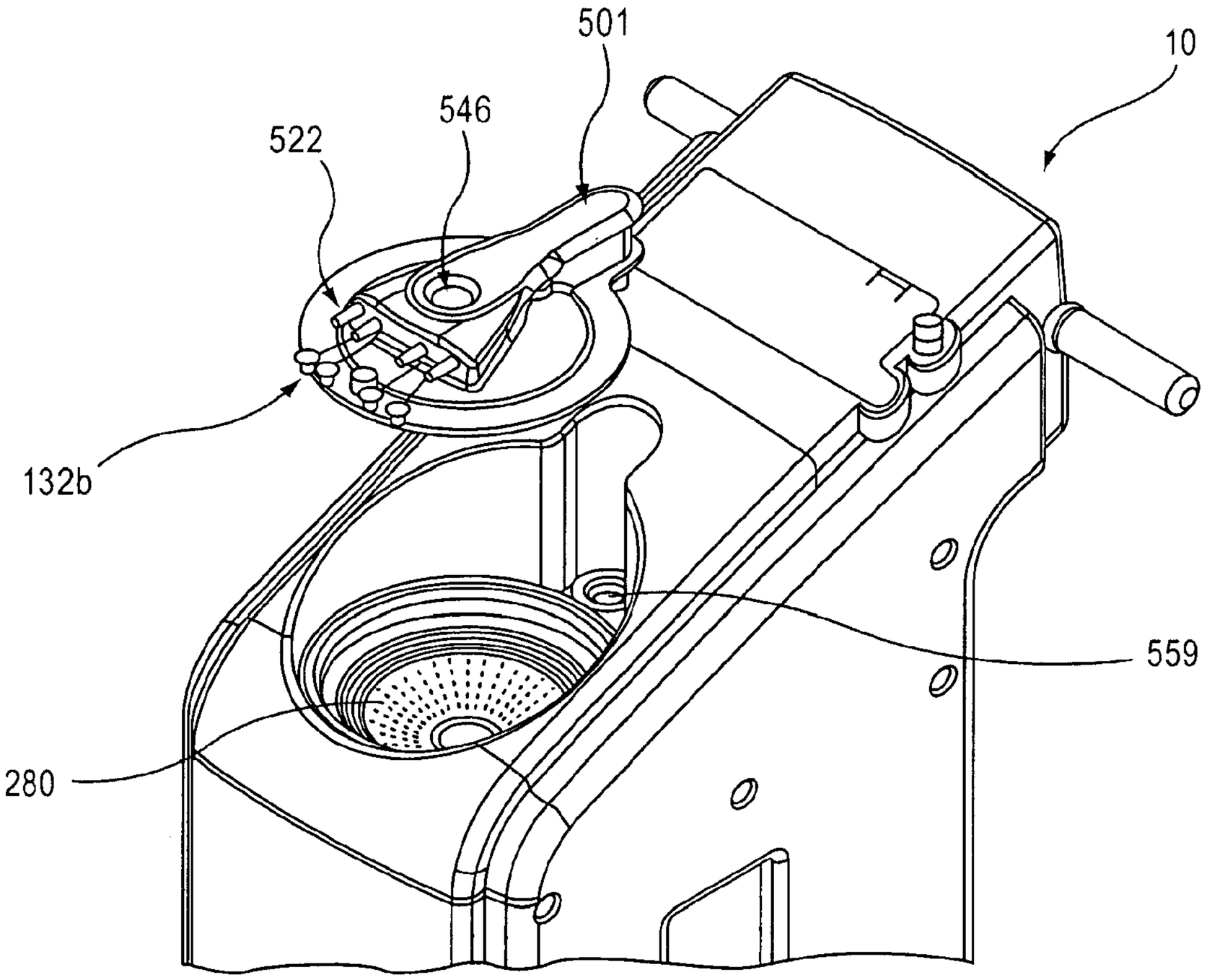


Fig.25

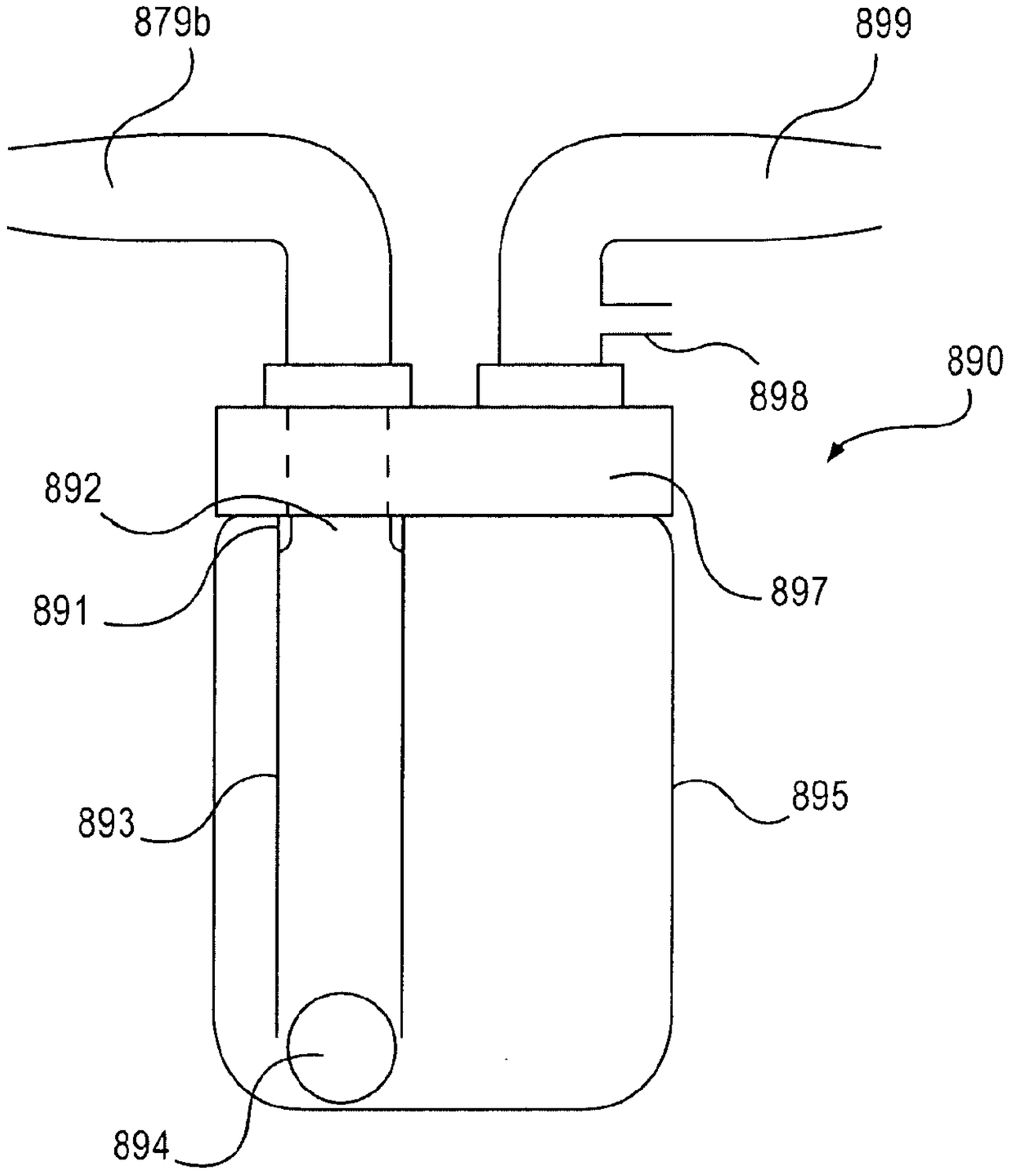
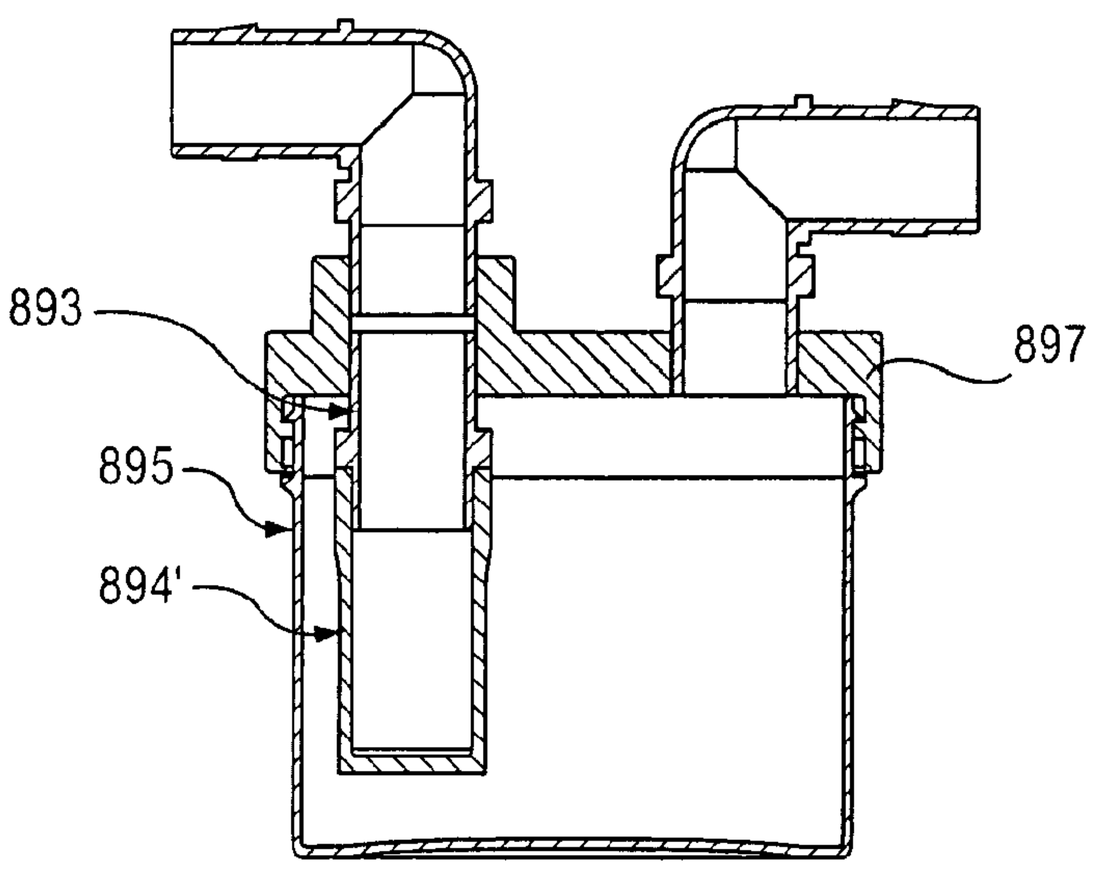


Fig.26

Fig.26(a)



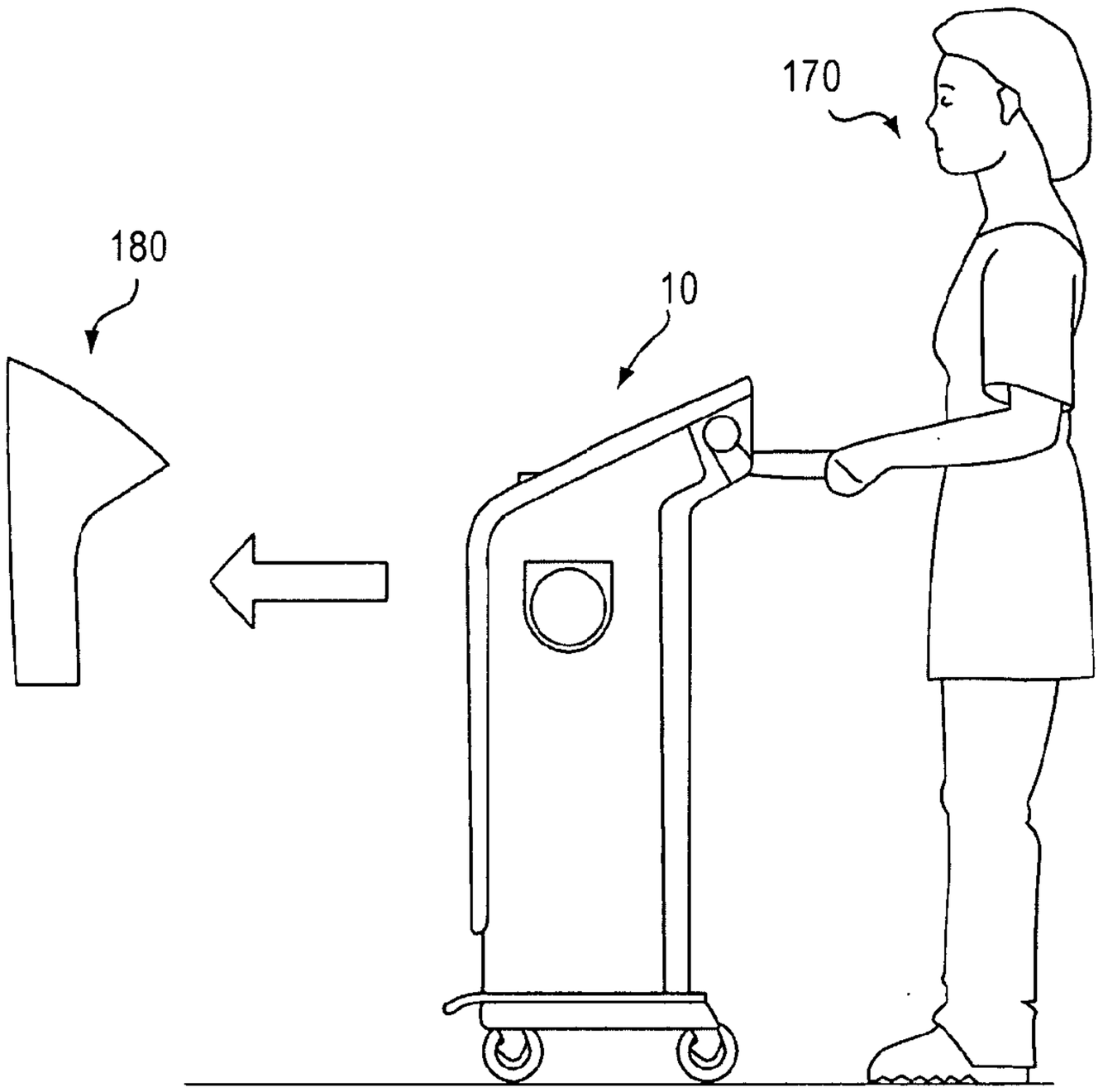


Fig.27

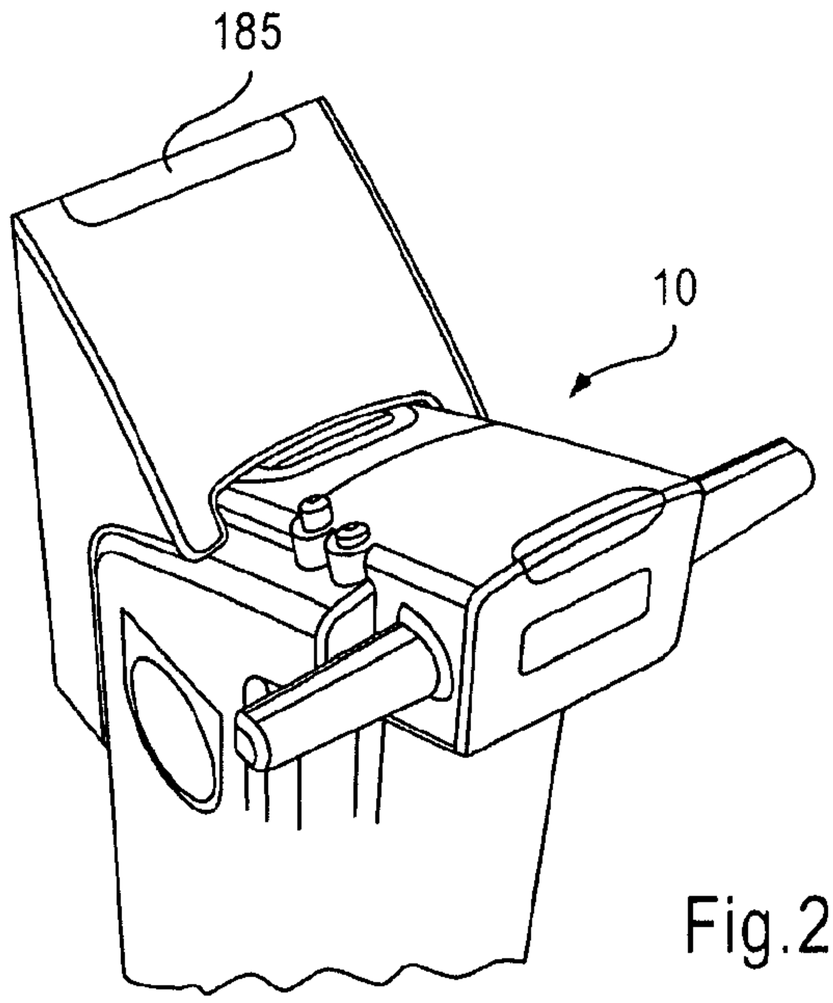


Fig.28

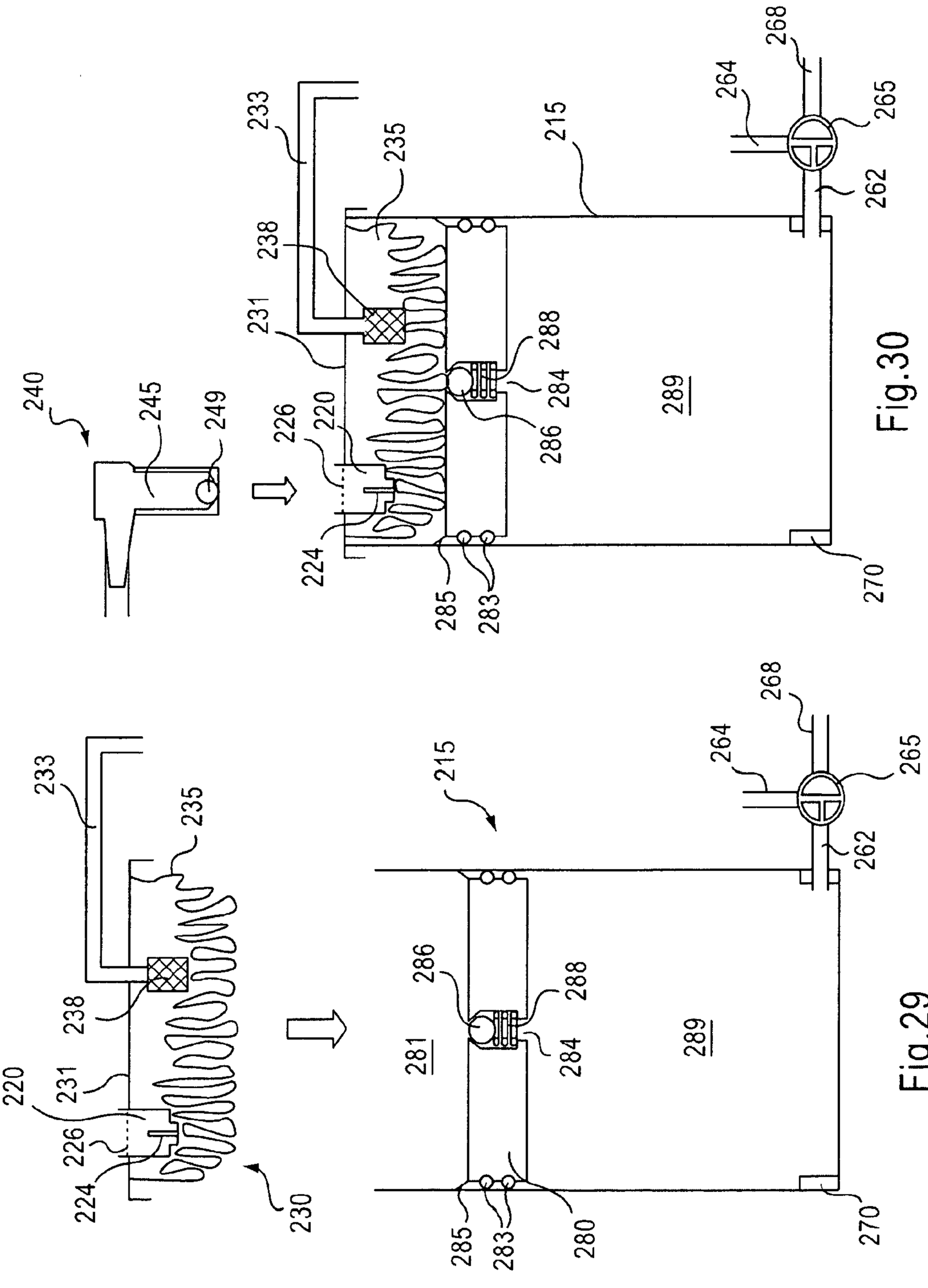

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Fig.30

Fig.29

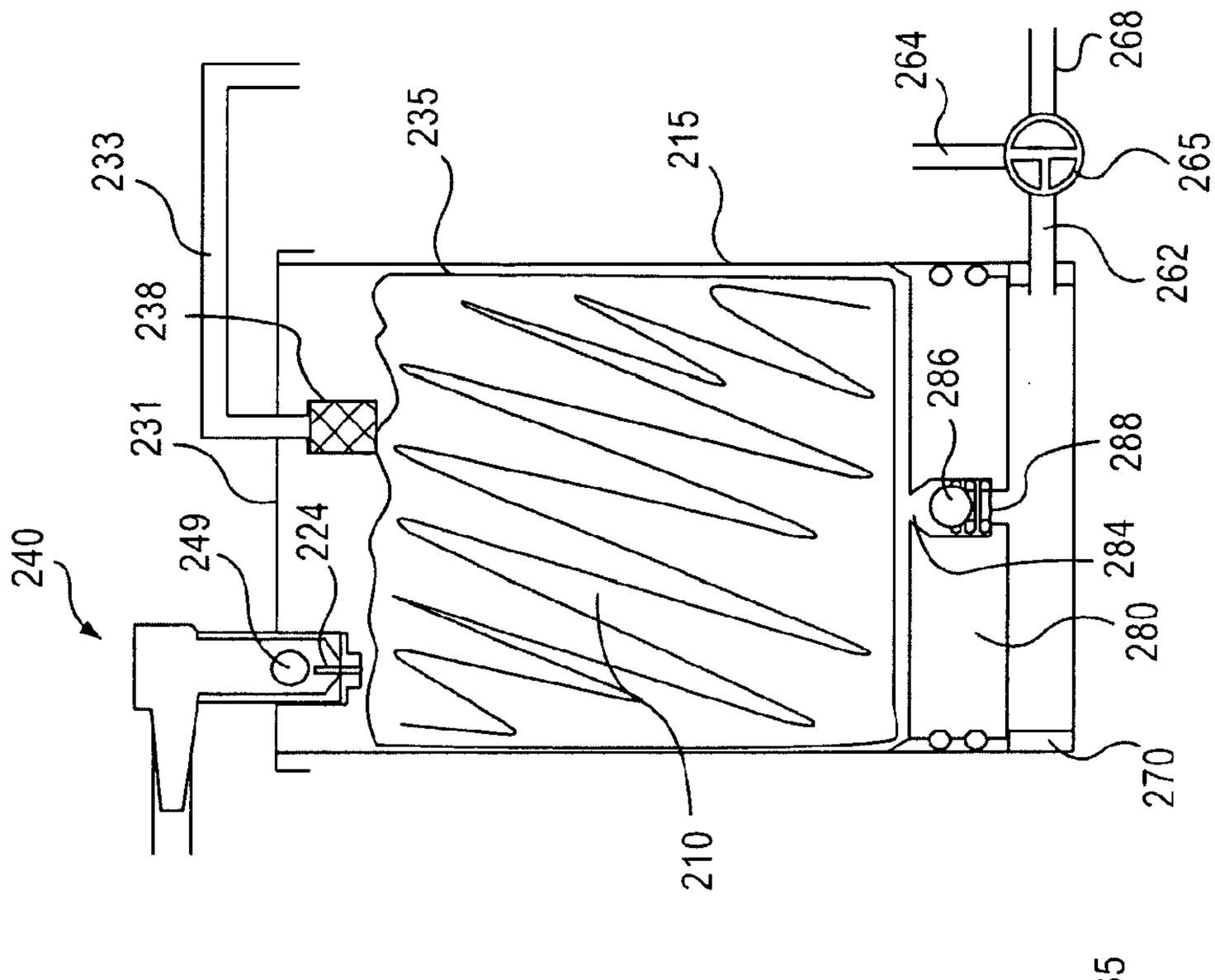

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Fig.32

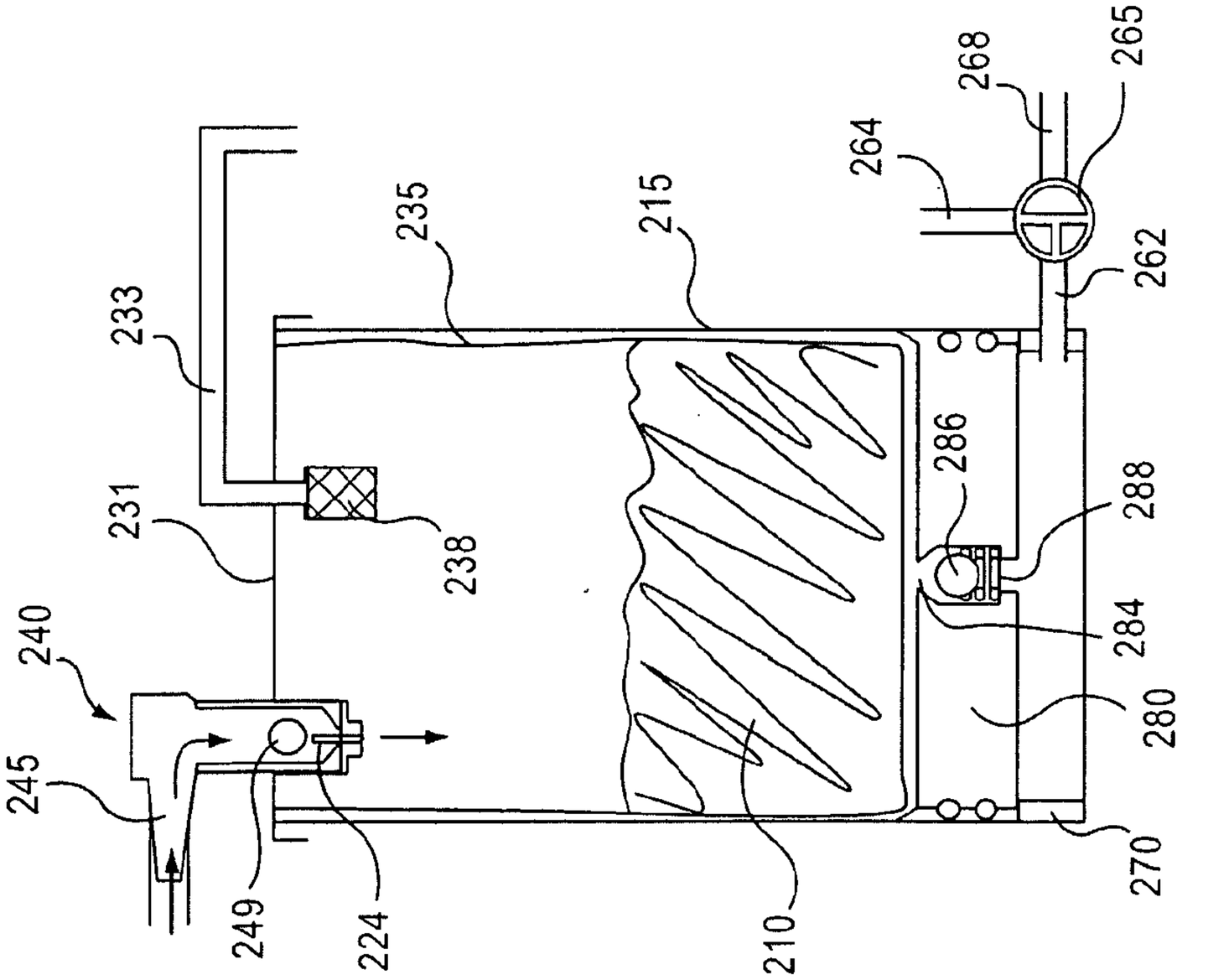

264
262
233
235
215
231
238
286
288
240
284
245
280
249
224
210
270

Fig.31

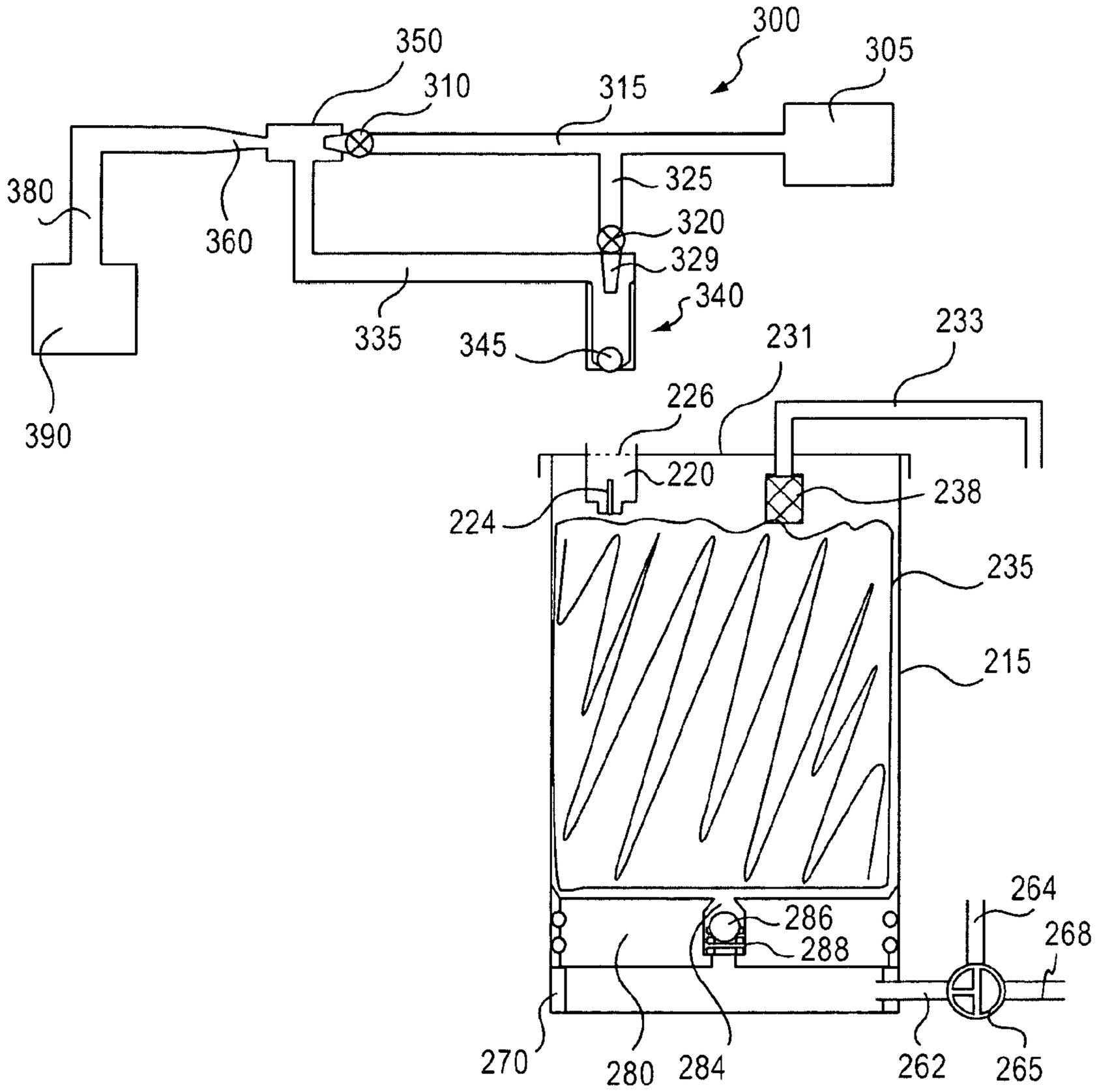

300
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Fig.33

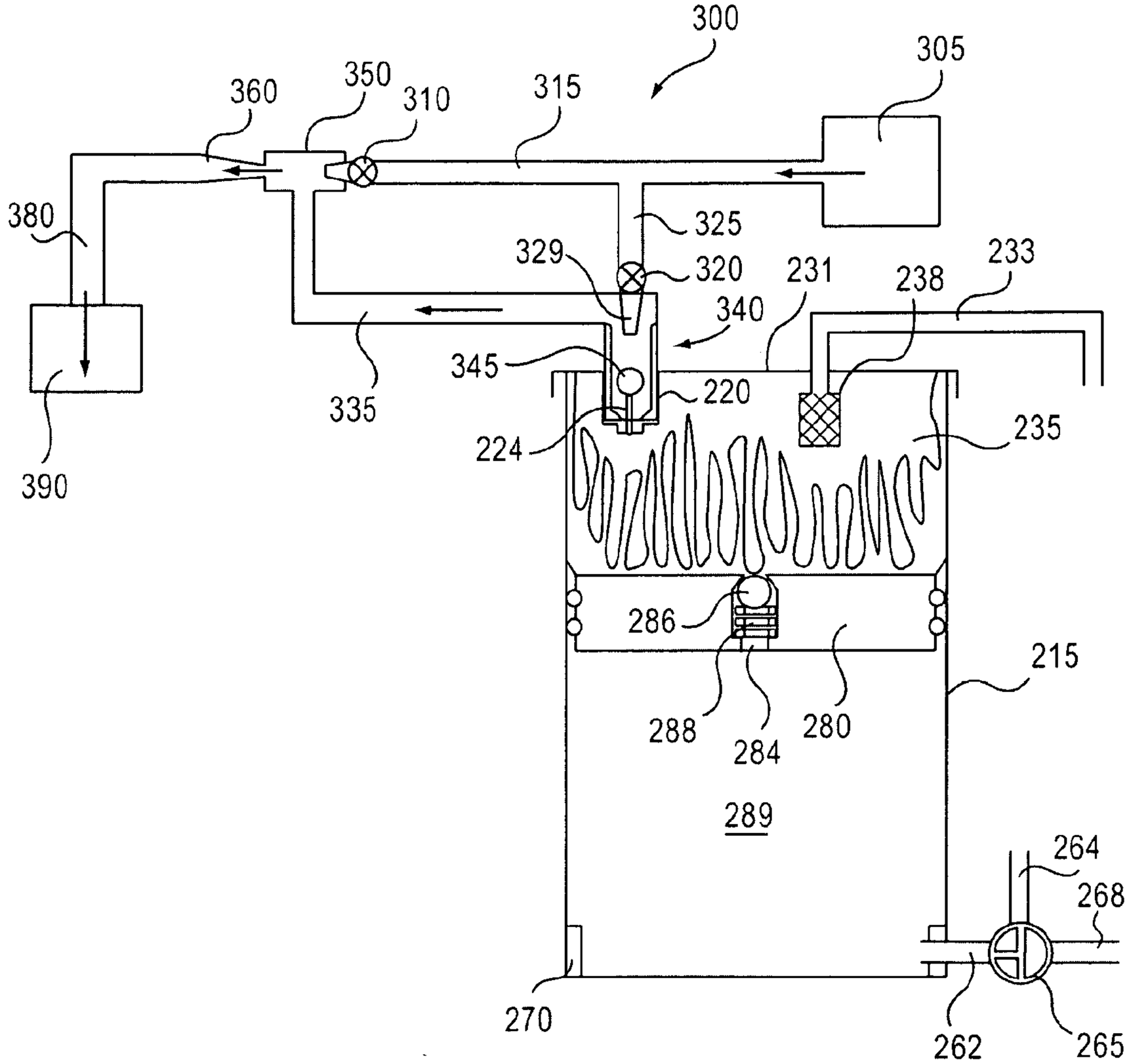

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Fig.34

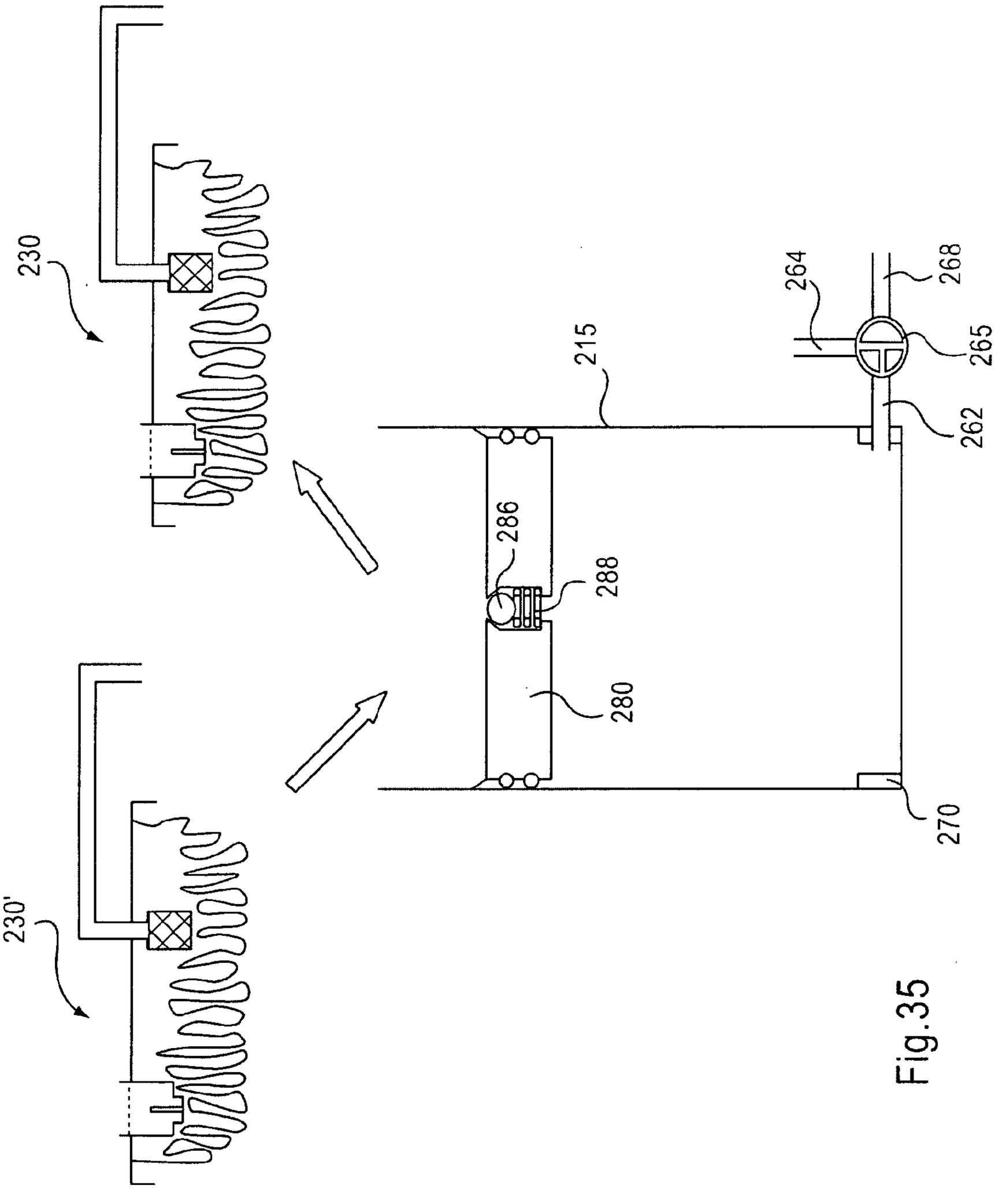


Fig.35

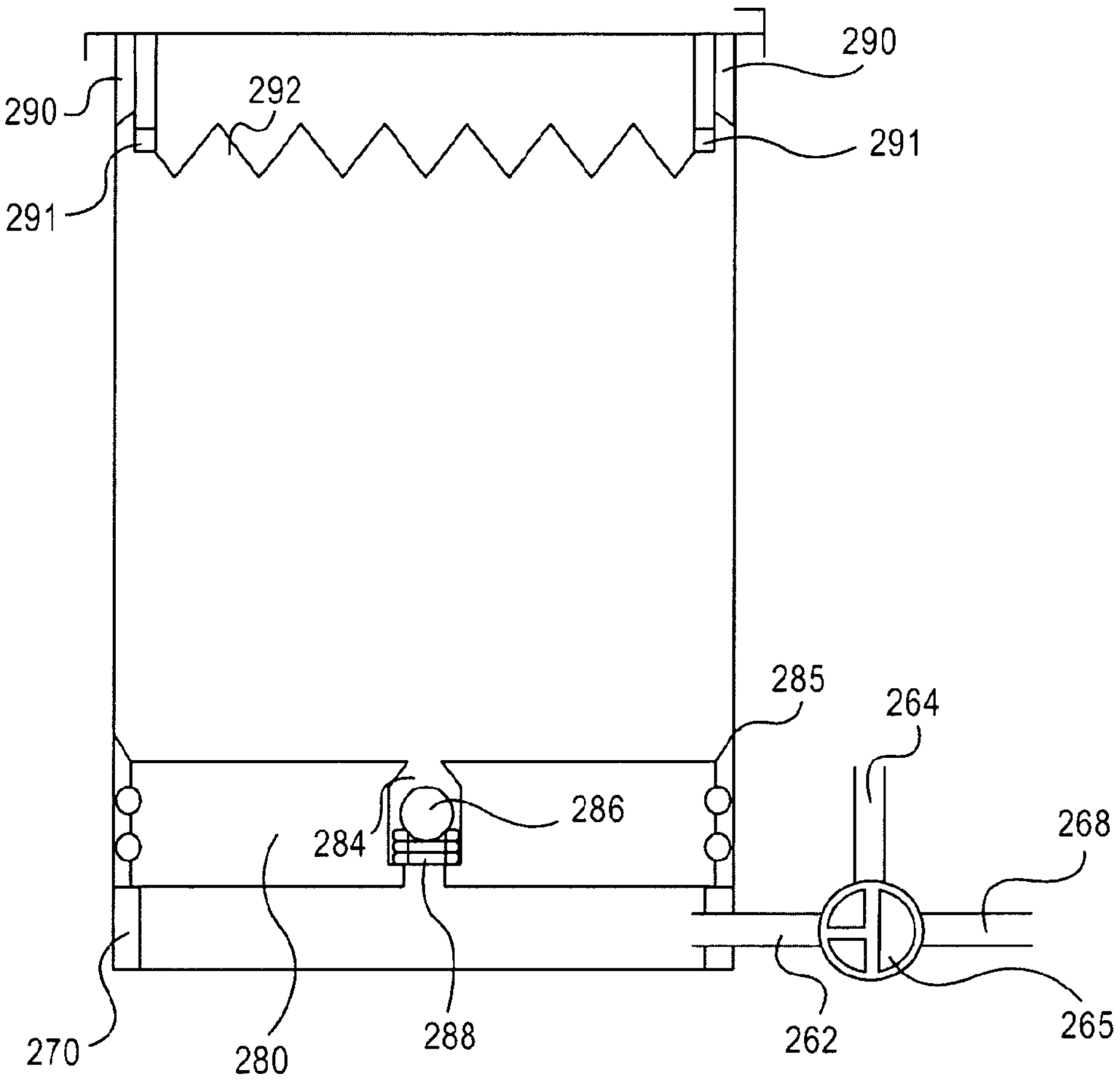


Fig.36

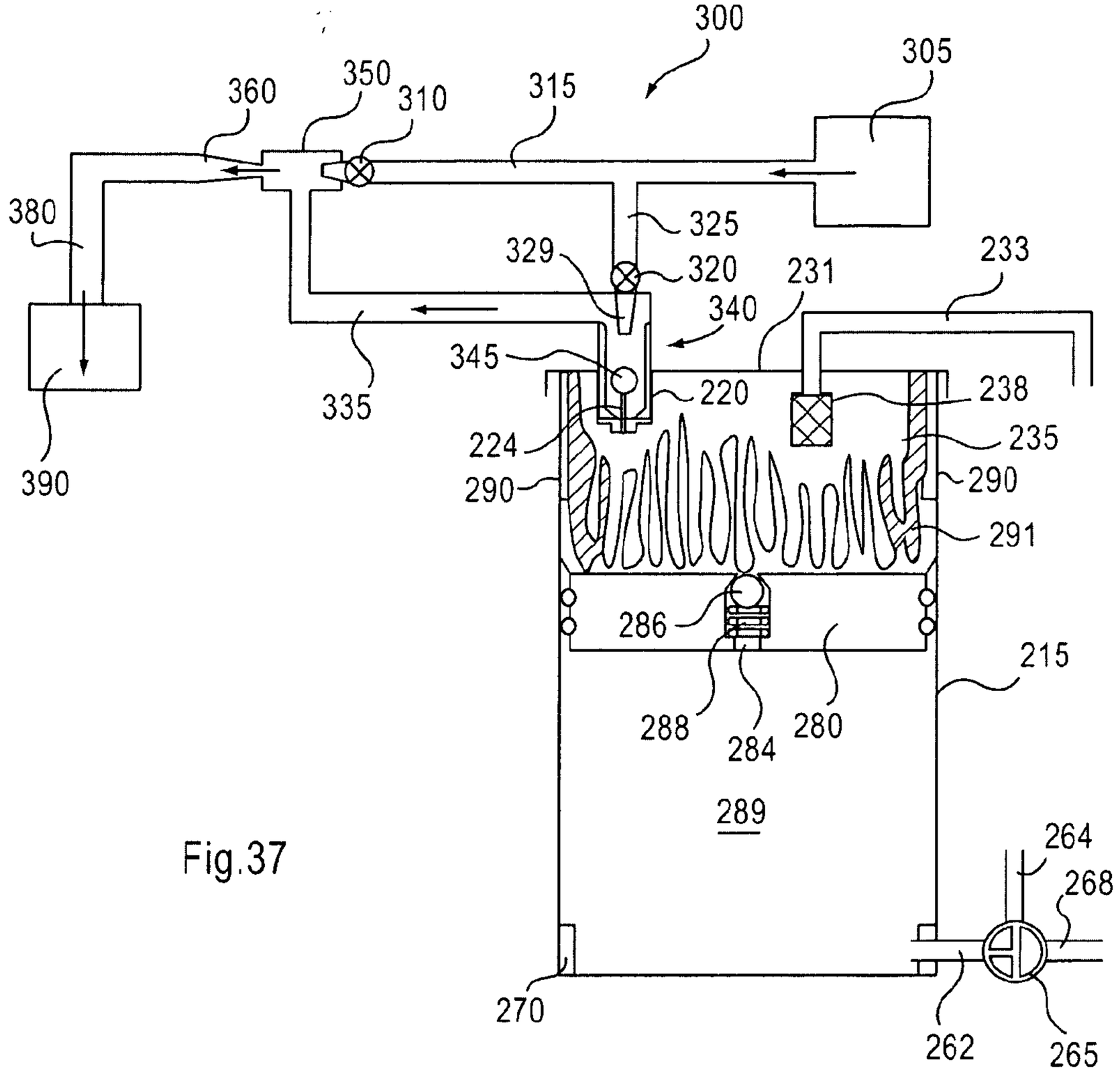

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Fig.37

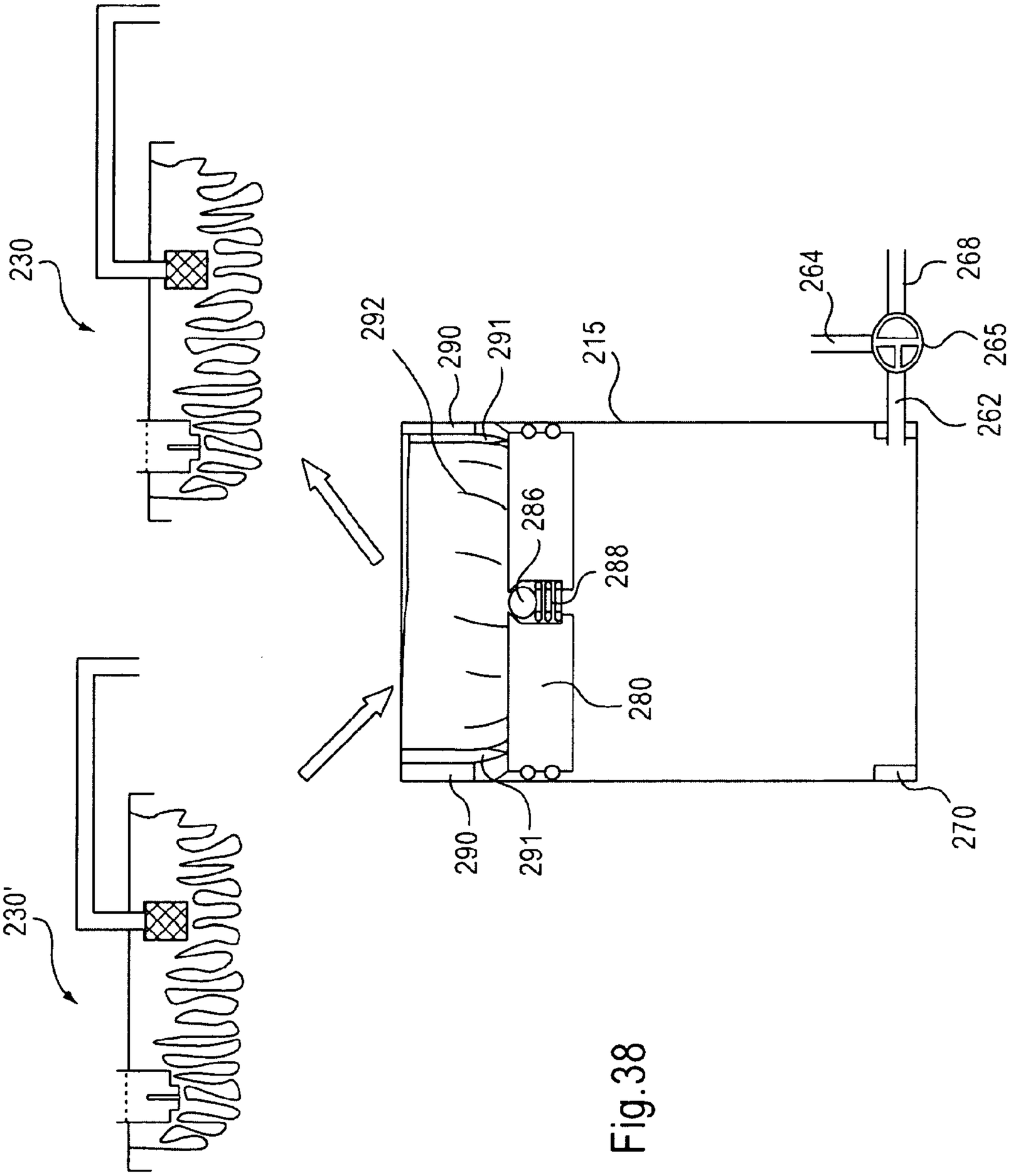
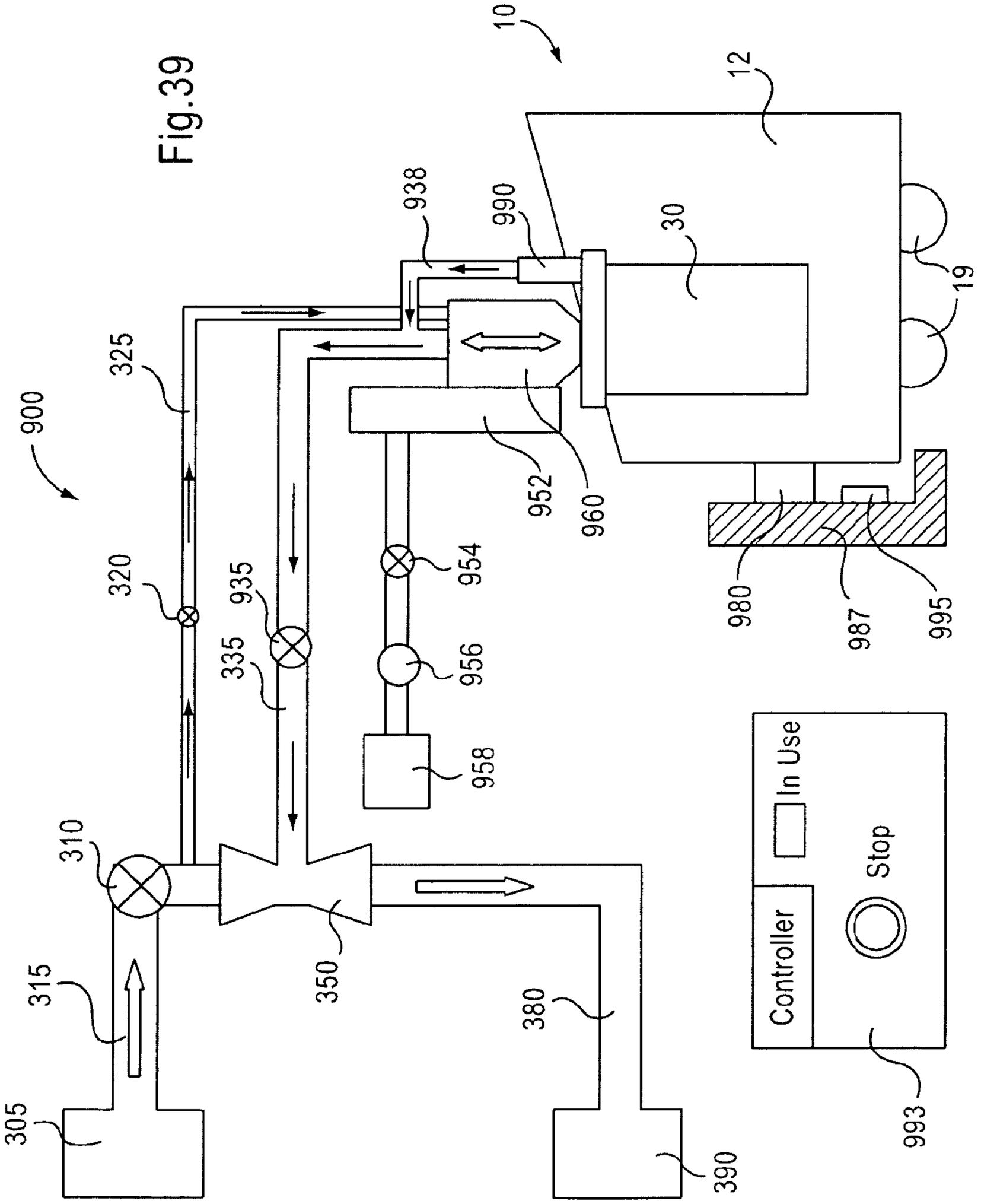


Fig.38

Fig.39


900
325
320
335
935
954
956
958
938
990
952
960
12
30
19
980
987
995
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315
305
350
380
390
993
Controller
In Use
Stop

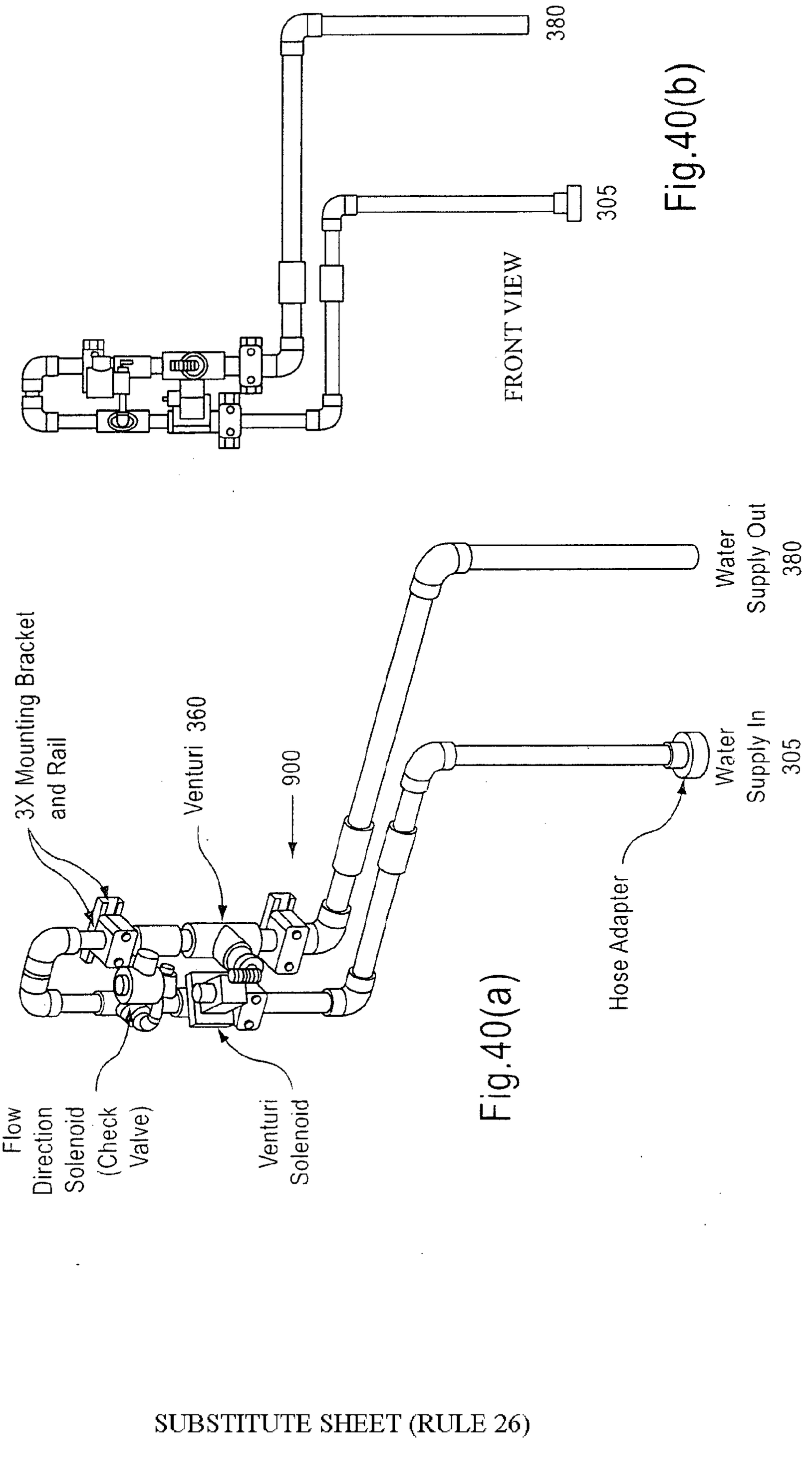


Fig.40(a)

Fig.40(b)

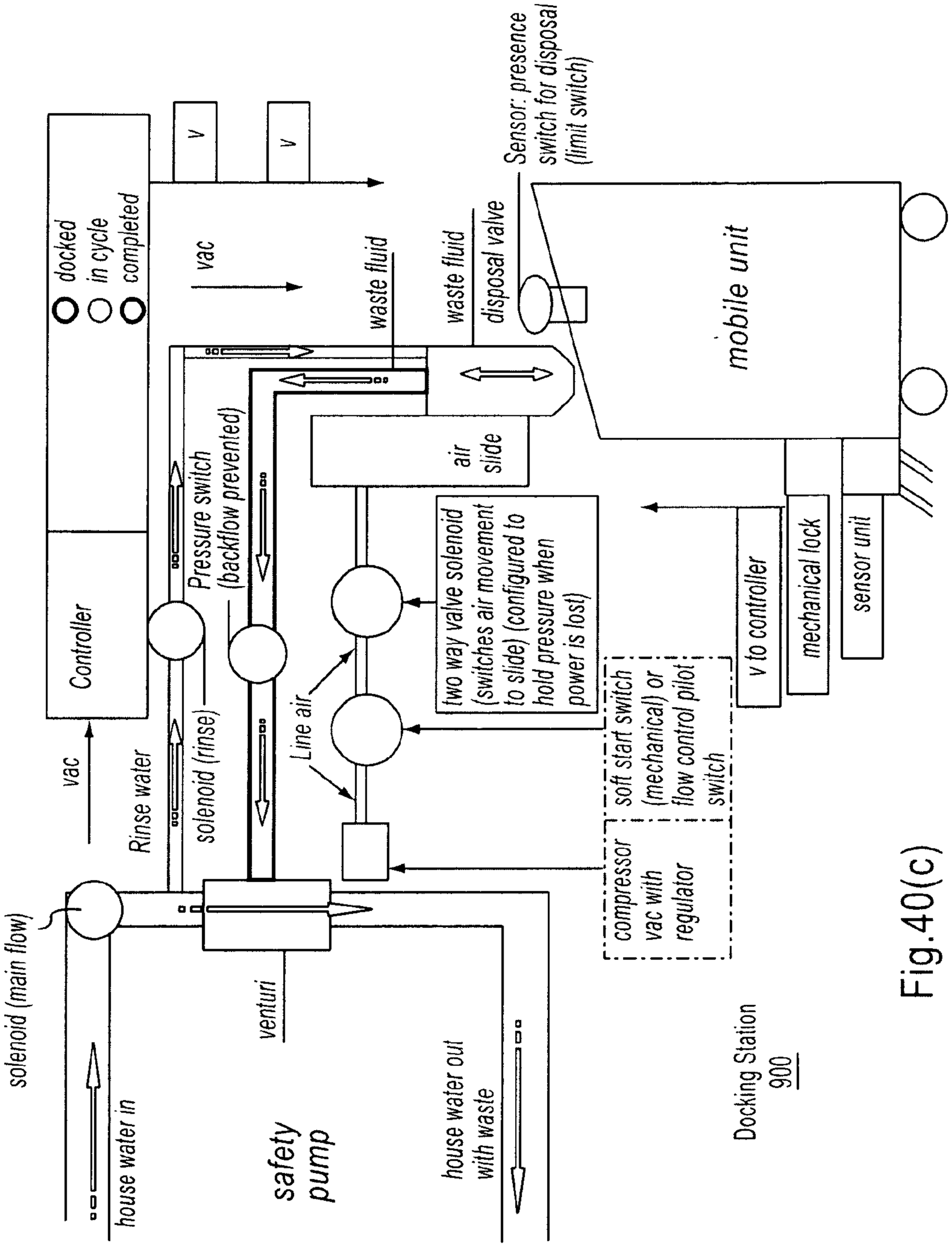

docked
in cycle
completed
Controller
V
V
vac
waste fluid
waste fluid
disposal valve
Sensor: presence switch for disposal (limit switch)
mobile unit
air slide
Pressure switch (backflow prevented)
two way valve solenoid (switches air movement to slide) (configured to hold pressure when power is lost)
Line air
soft start switch
(mechanical) or
flow control pilot
switch
compressor
vac with
regulator
v to controller
mechanical lock
sensor unit
vac
Rinse water
solenoid (rinse)
solenoid (main flow)
venturi
safety
pump
house water in
house water out
with waste
Docking Station
900

Fig.40(c)

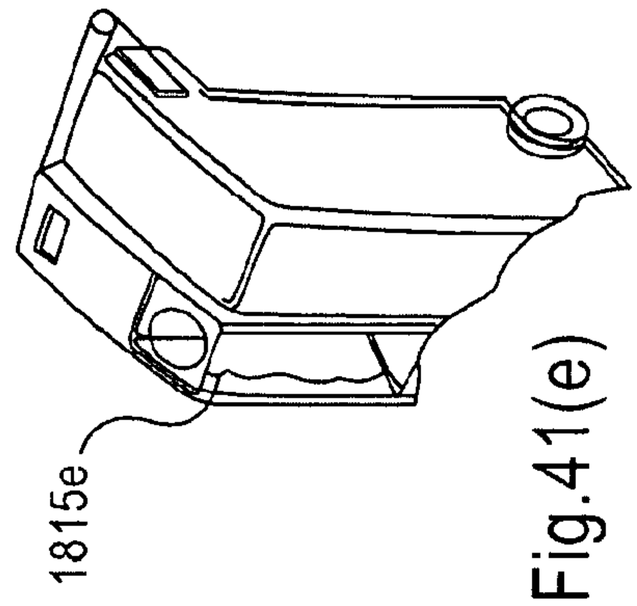


Fig.41(e)

Fig.41(d)

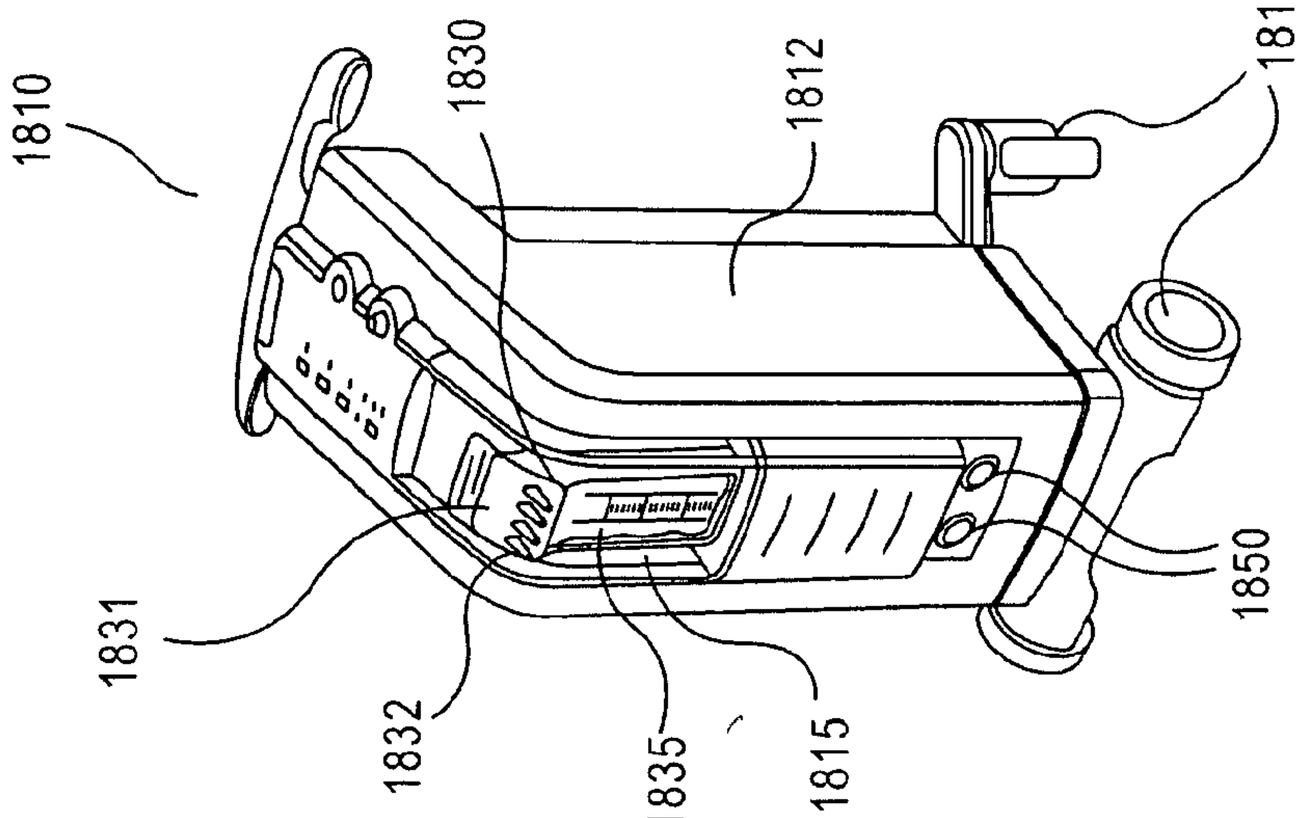


FIG.41(a)

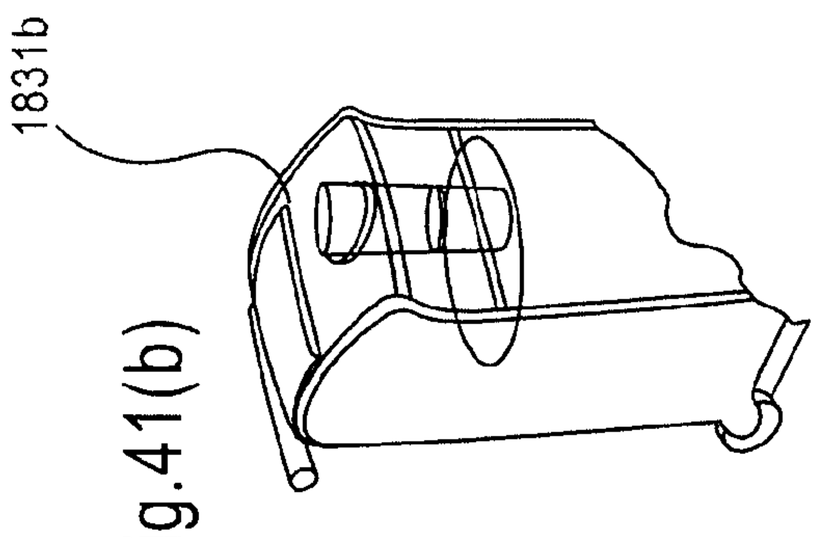


Fig.41(b)

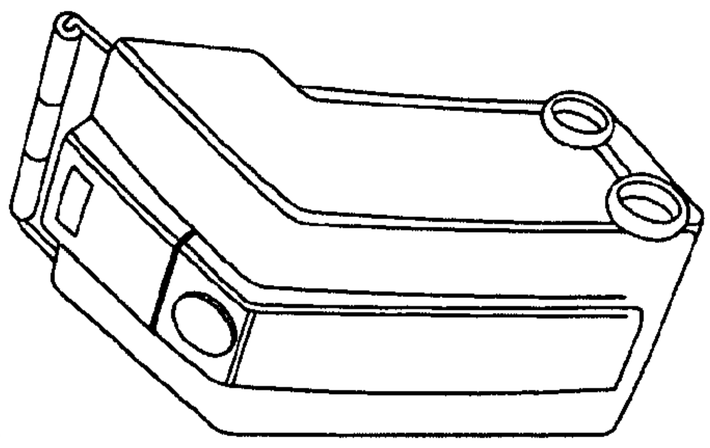


Fig.41(c)

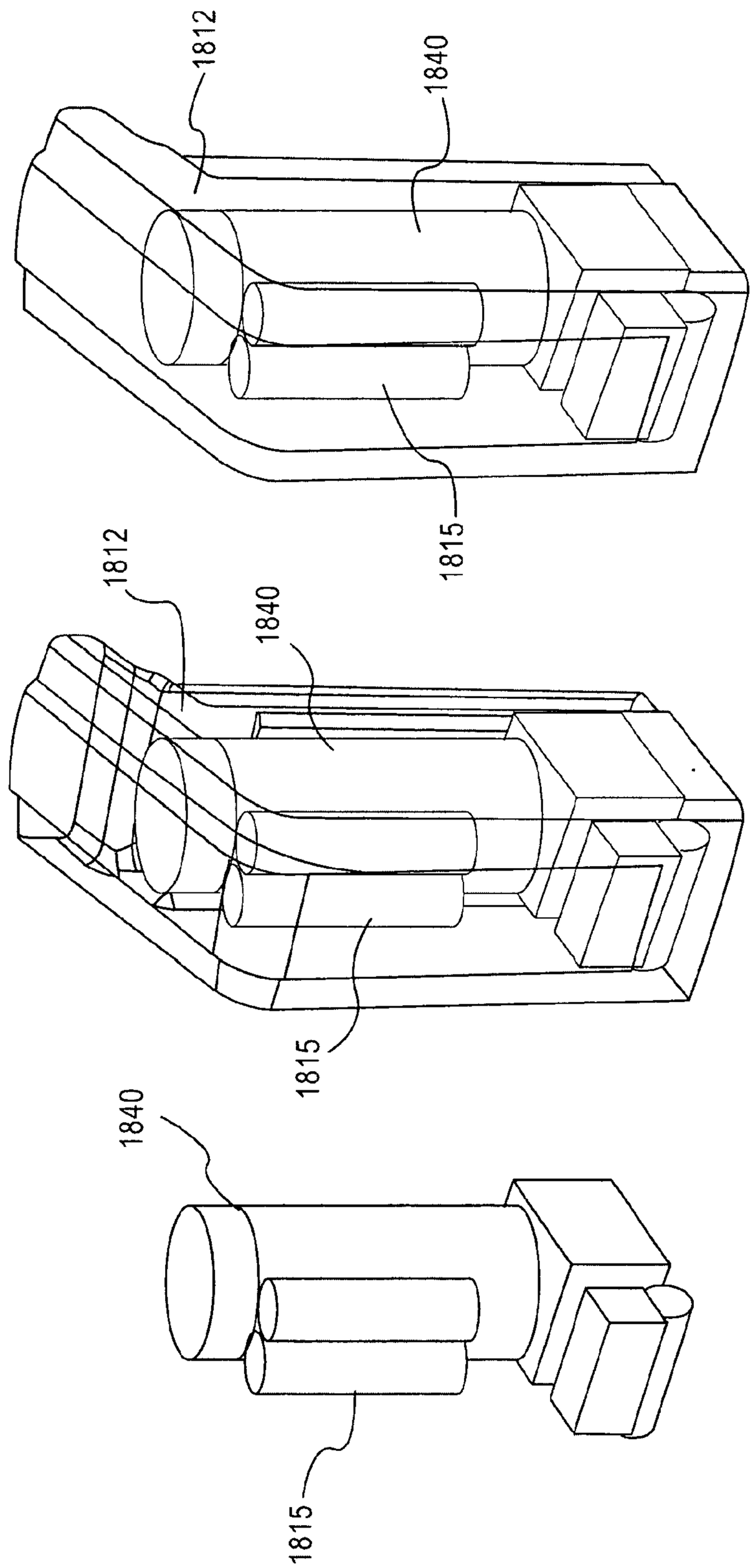


Fig.42(c)

Fig.42(b)

Fig.42(a)

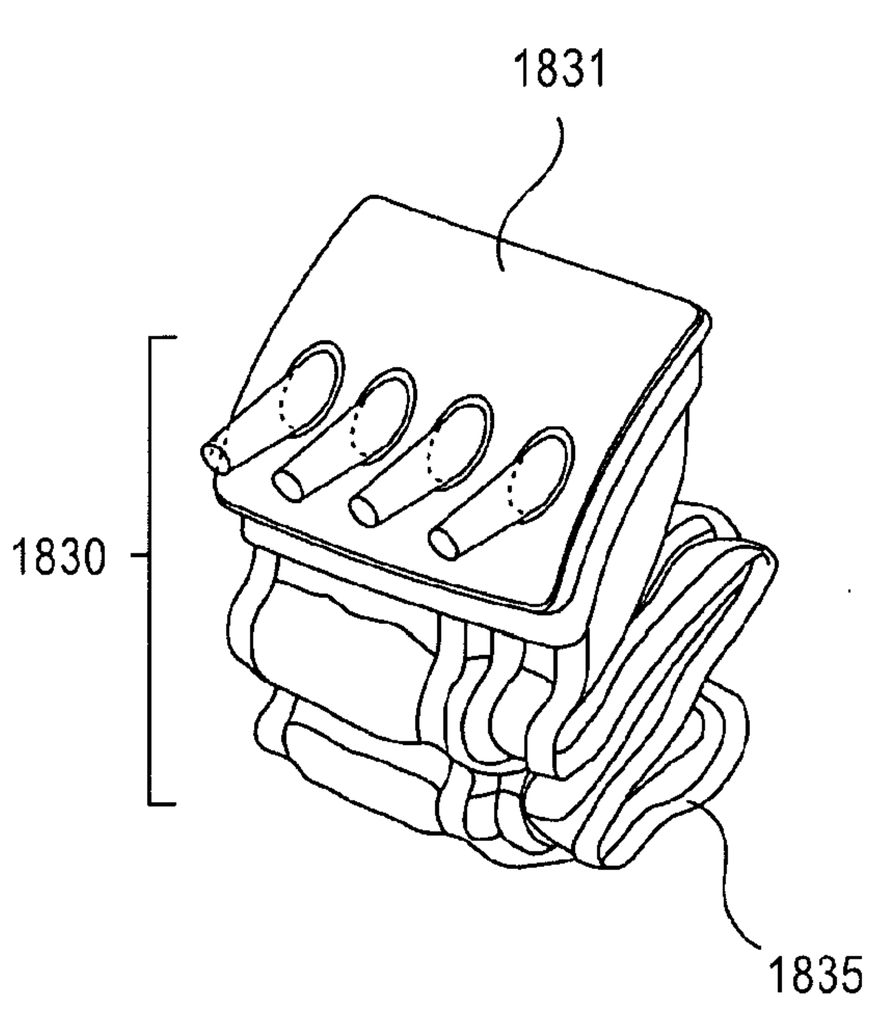


Fig.43(a)

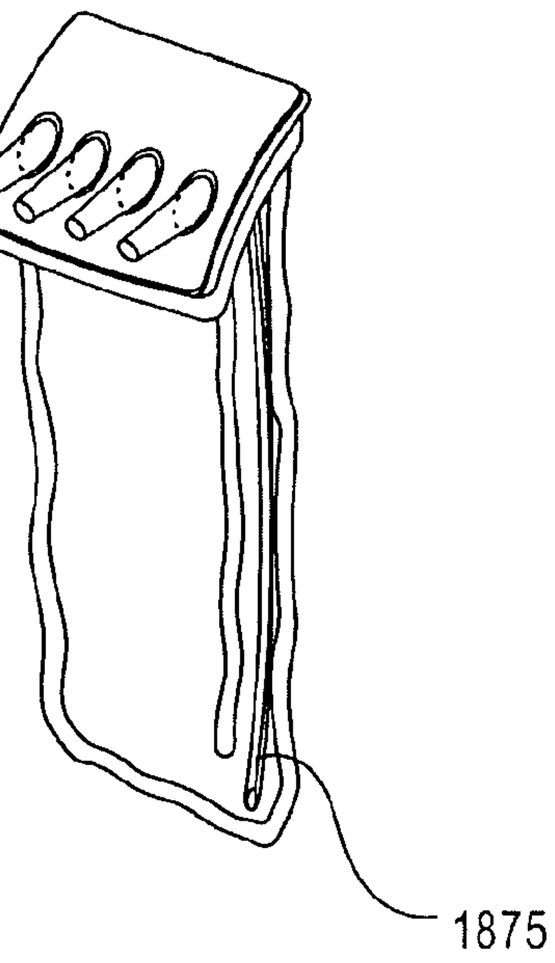


Fig.43(b)

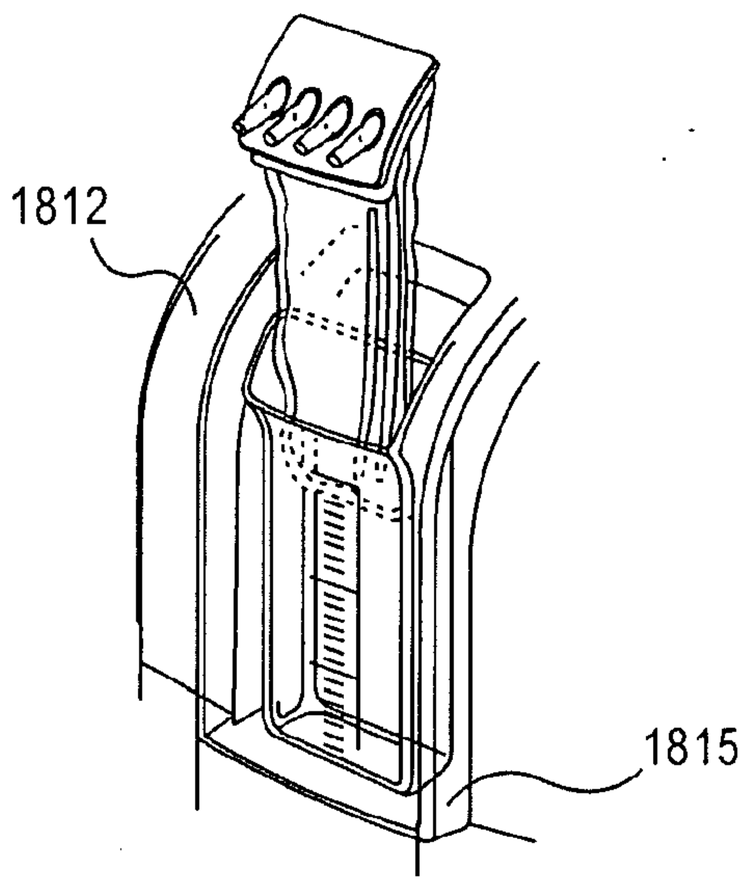


Fig.43(c)

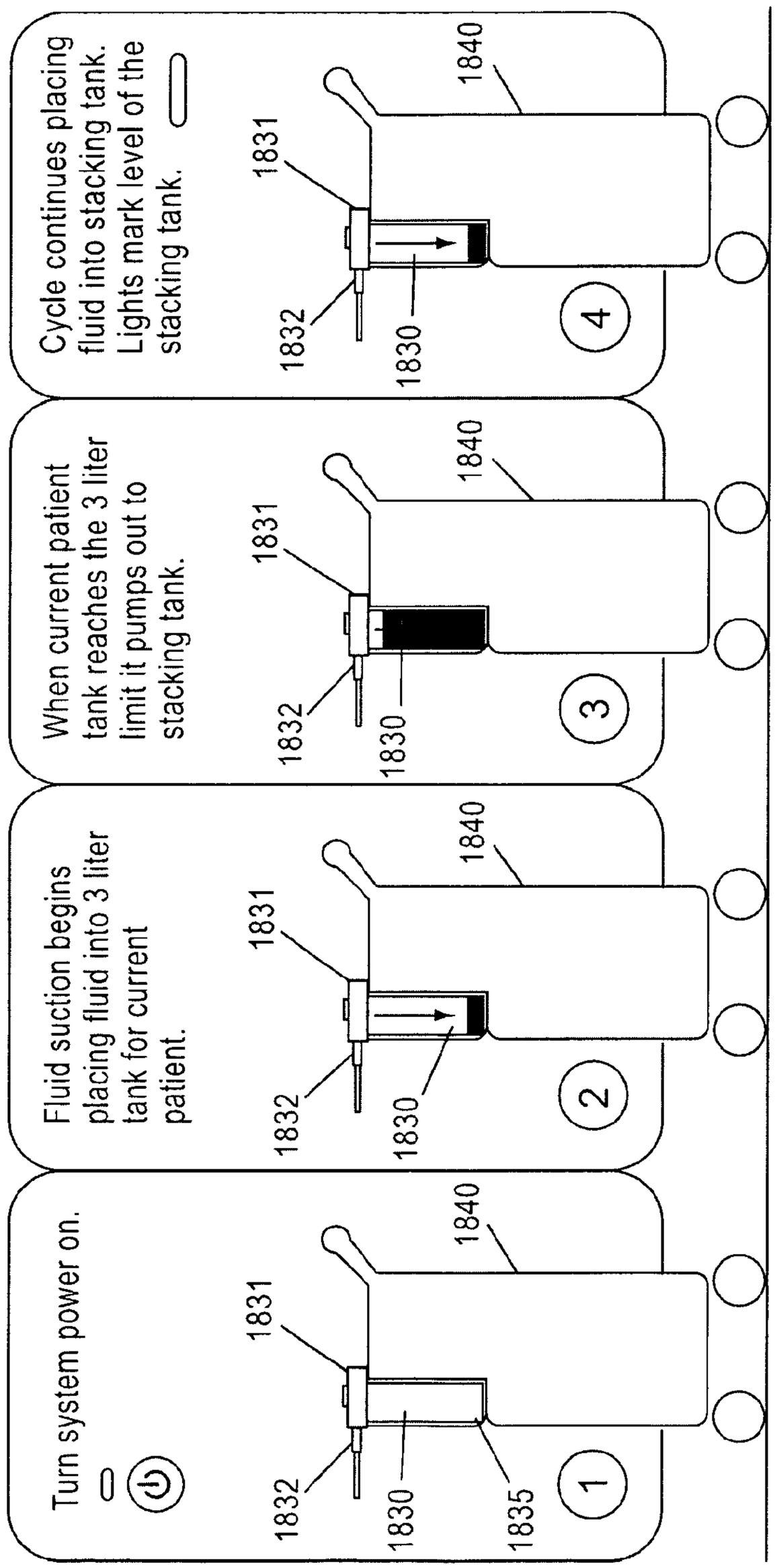

Turn system power on.
1831
1840
1832
1830
1835
1
Fluid suction begins placing fluid into 3 liter tank for current patient.
2
When current patient tank reaches the 3 liter limit it pumps out to stacking tank.
3
Cycle continues placing fluid into stacking tank. Lights mark level of the stacking tank.
4

Fig.44

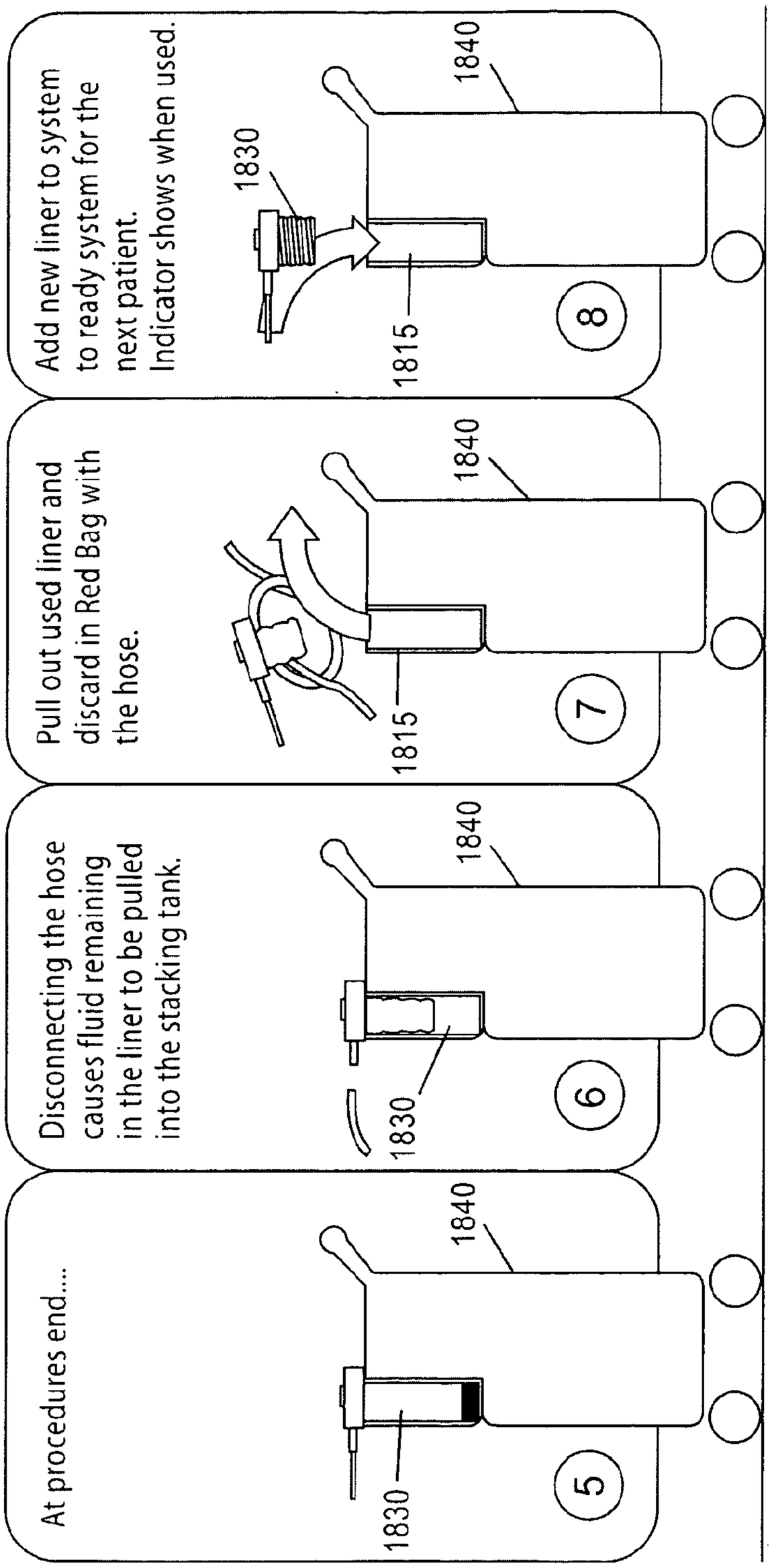

At procedures end....
1830
5
Disconnecting the hose causes fluid remaining in the liner to be pulled into the stacking tank.
1830
1840
6
Pull out used liner and discard in Red Bag with the hose.
1815
1840
7
Add new liner to system to ready system for the next patient.
Indicator shows when used.
1830
1815
1840
8

Fig.45

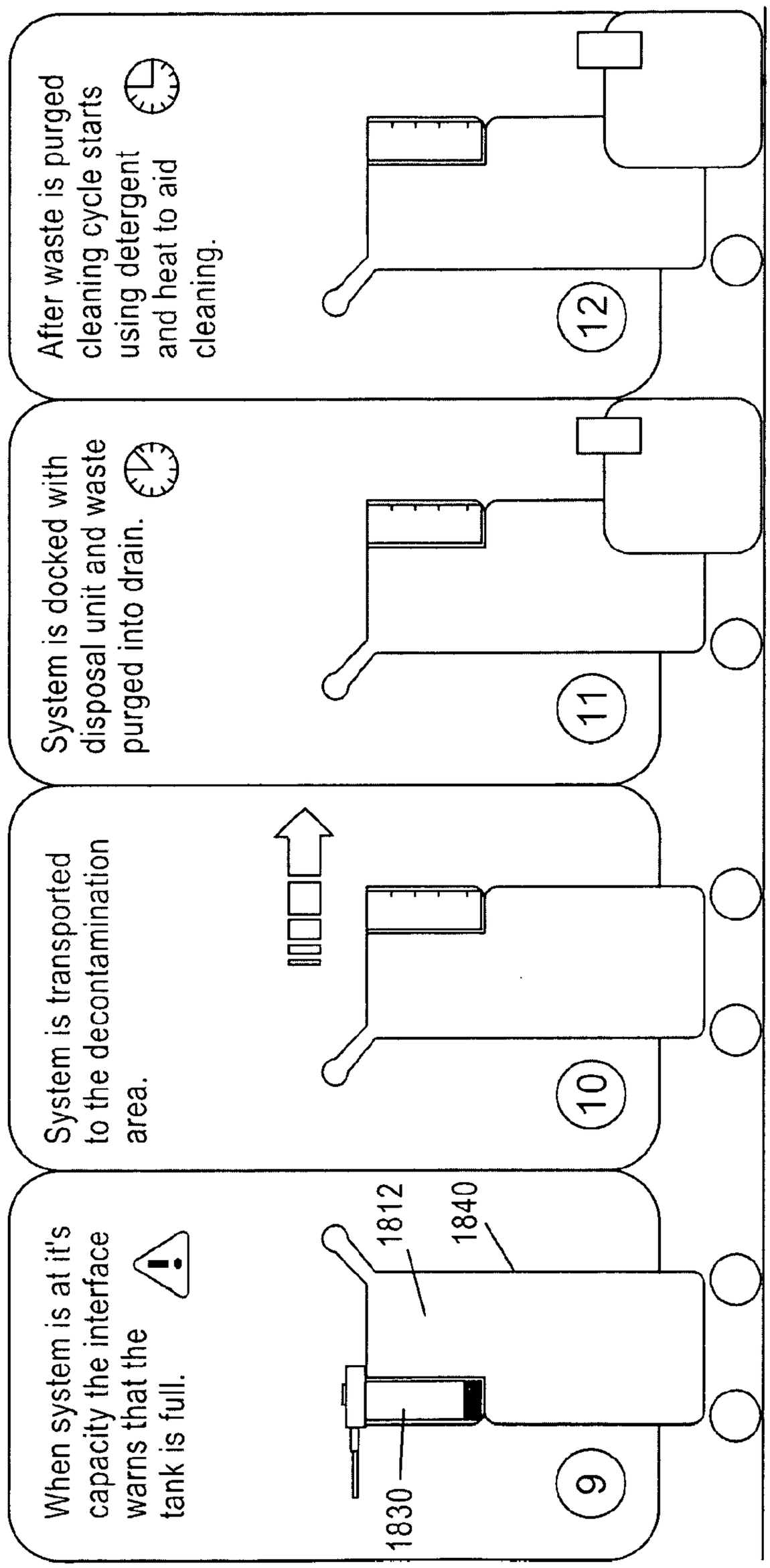

When system is at it's capacity the interface warns that the tank is full.
1812
1840
830
9
System is transported to the decontamination area.
10
System is docked with disposal unit and waste purged into drain.
11
After waste is purged cleaning cycle starts using detergent and heat to aid cleaning.
12

Fig.46

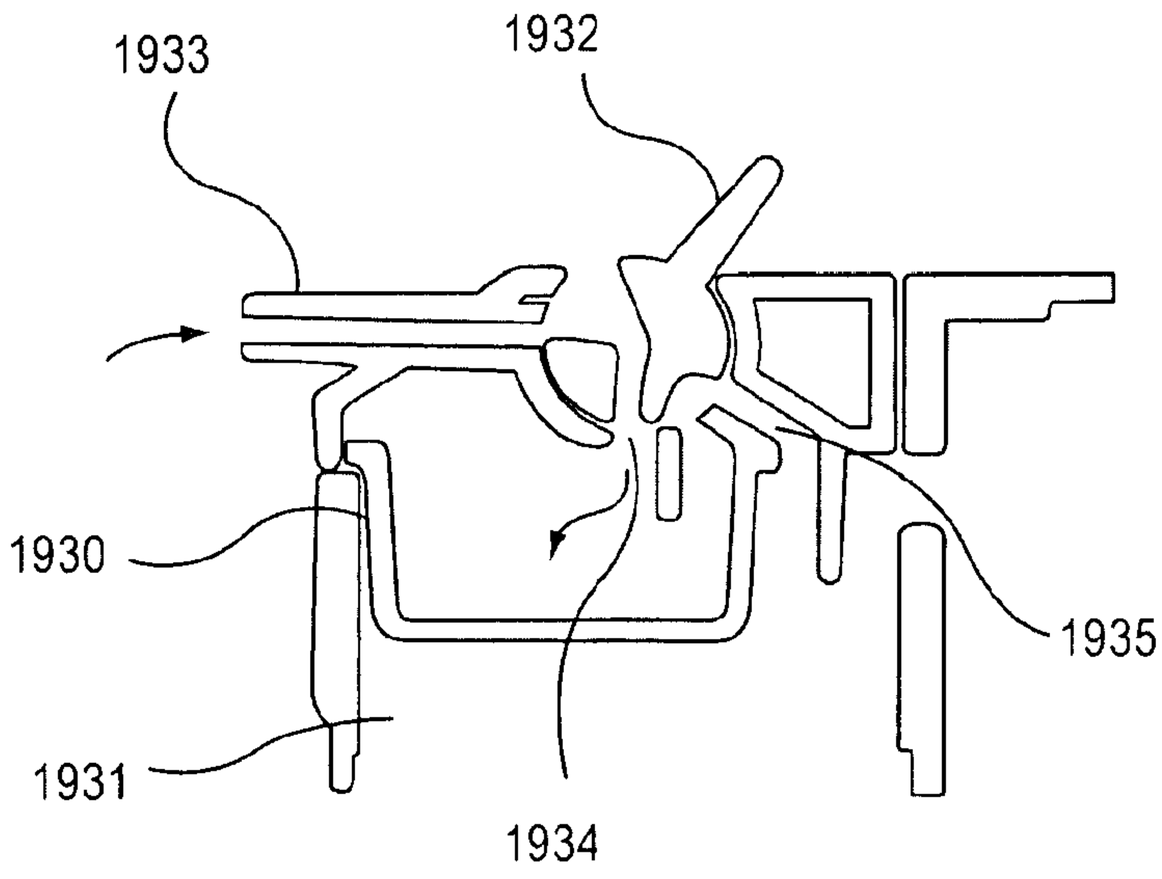


Fig.47(a)

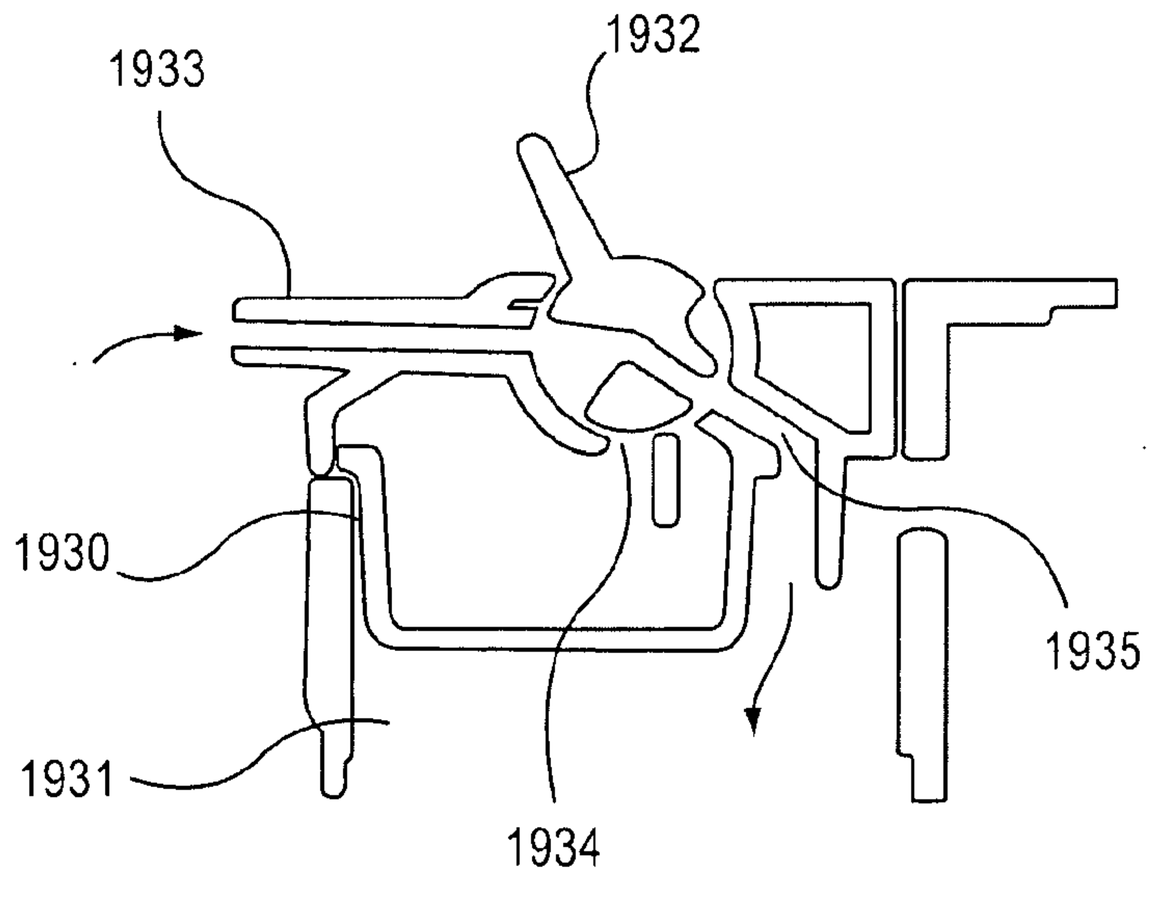


Fig.47(b)

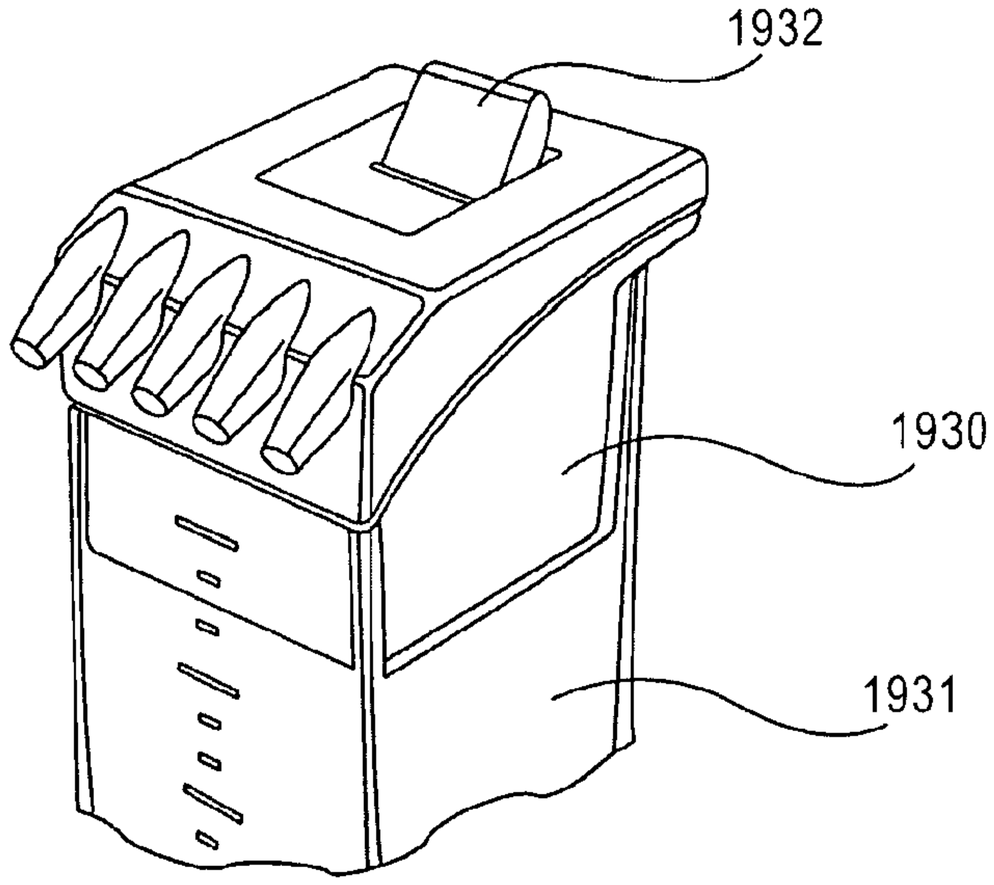


Fig.47(c)

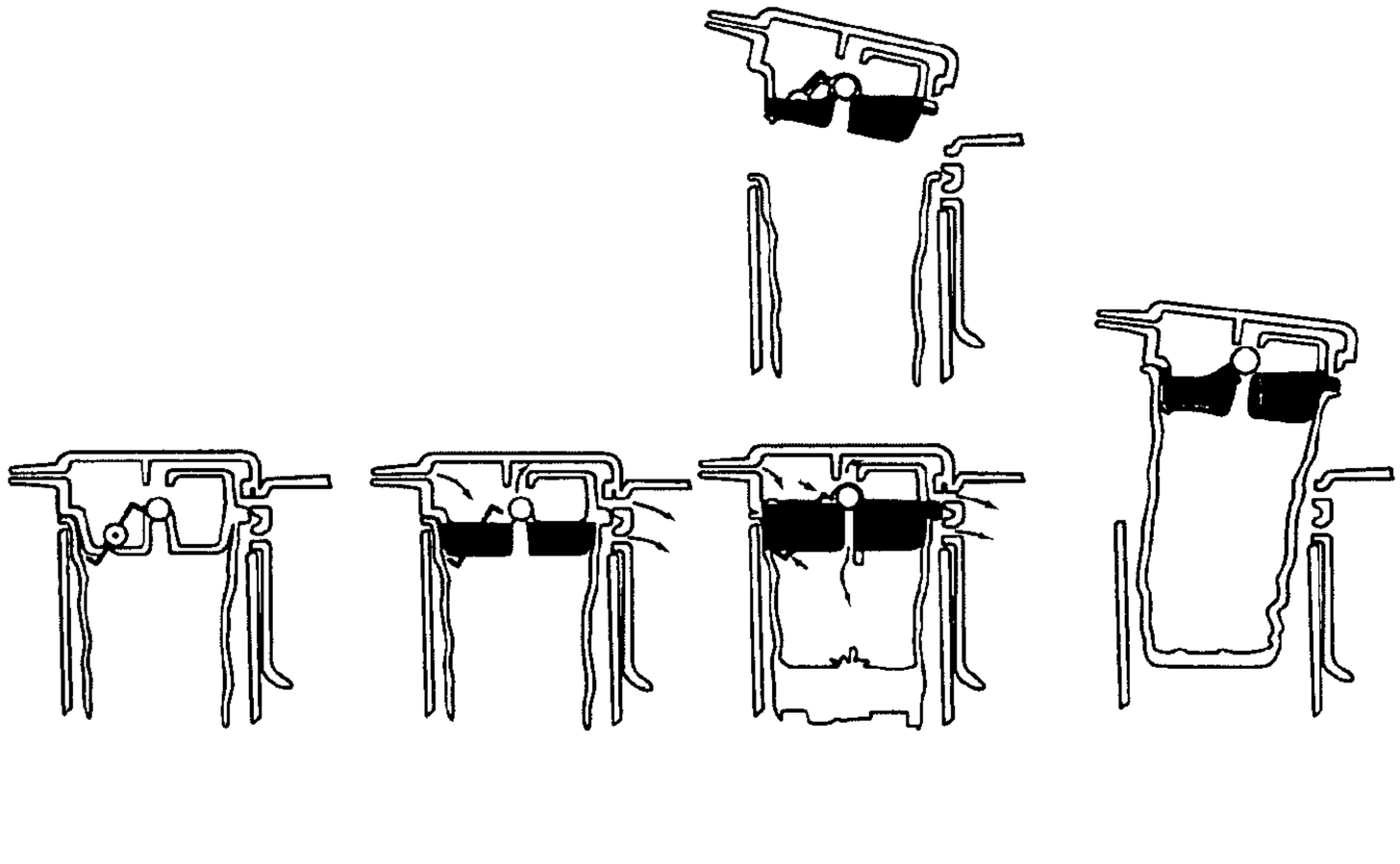


Fig.48

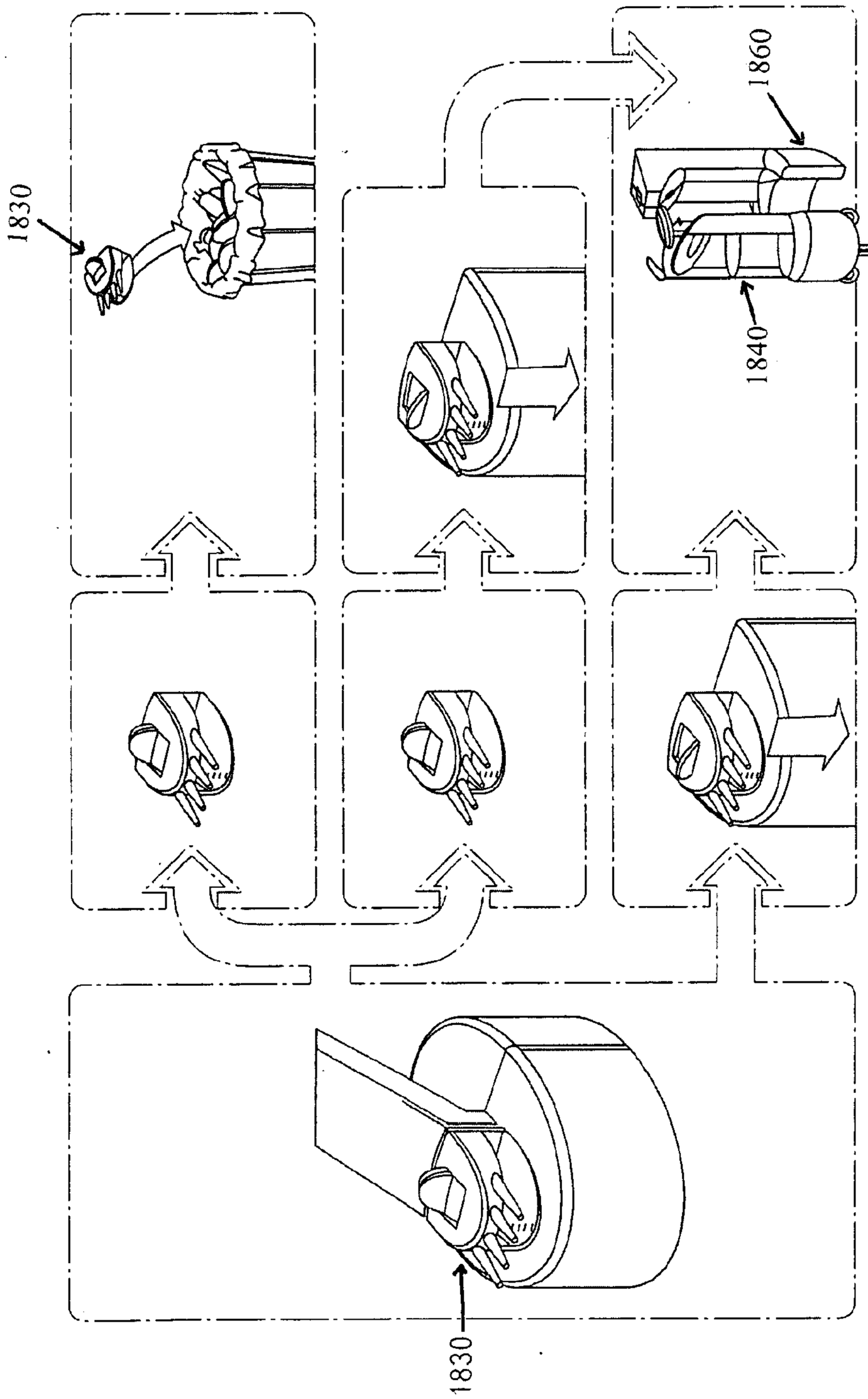


Fig.49

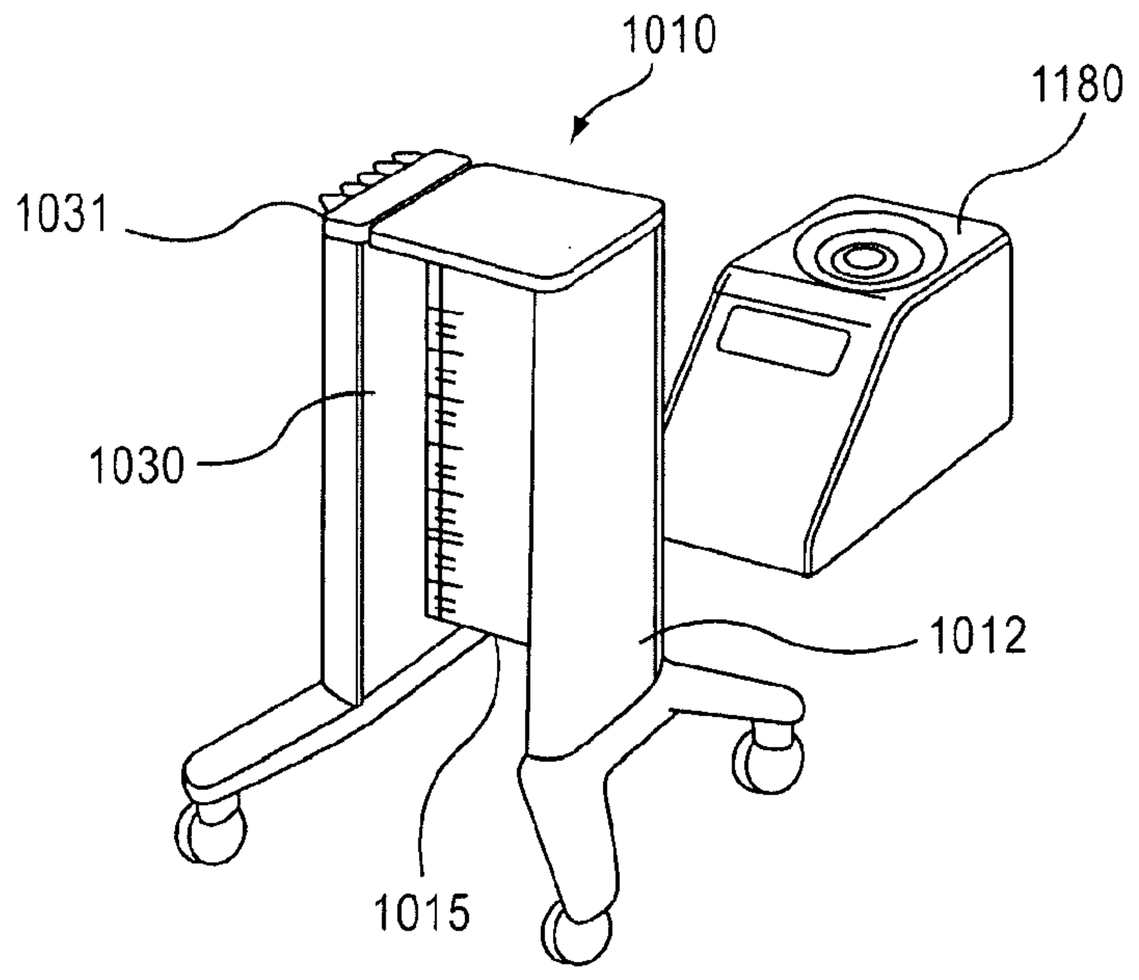


Fig.50

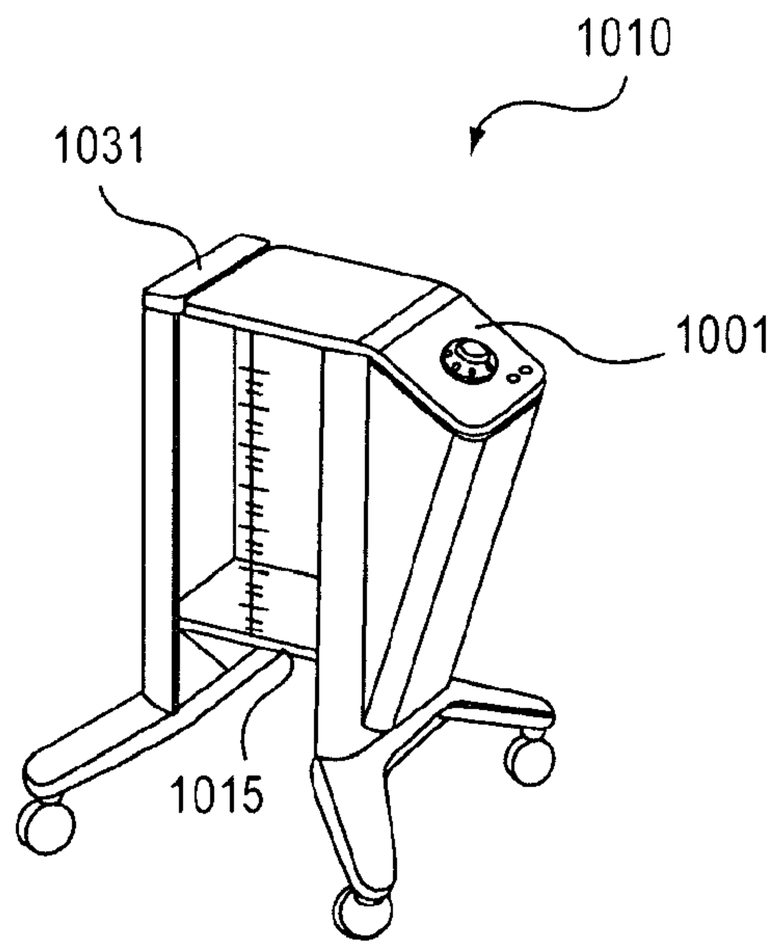


Fig.51

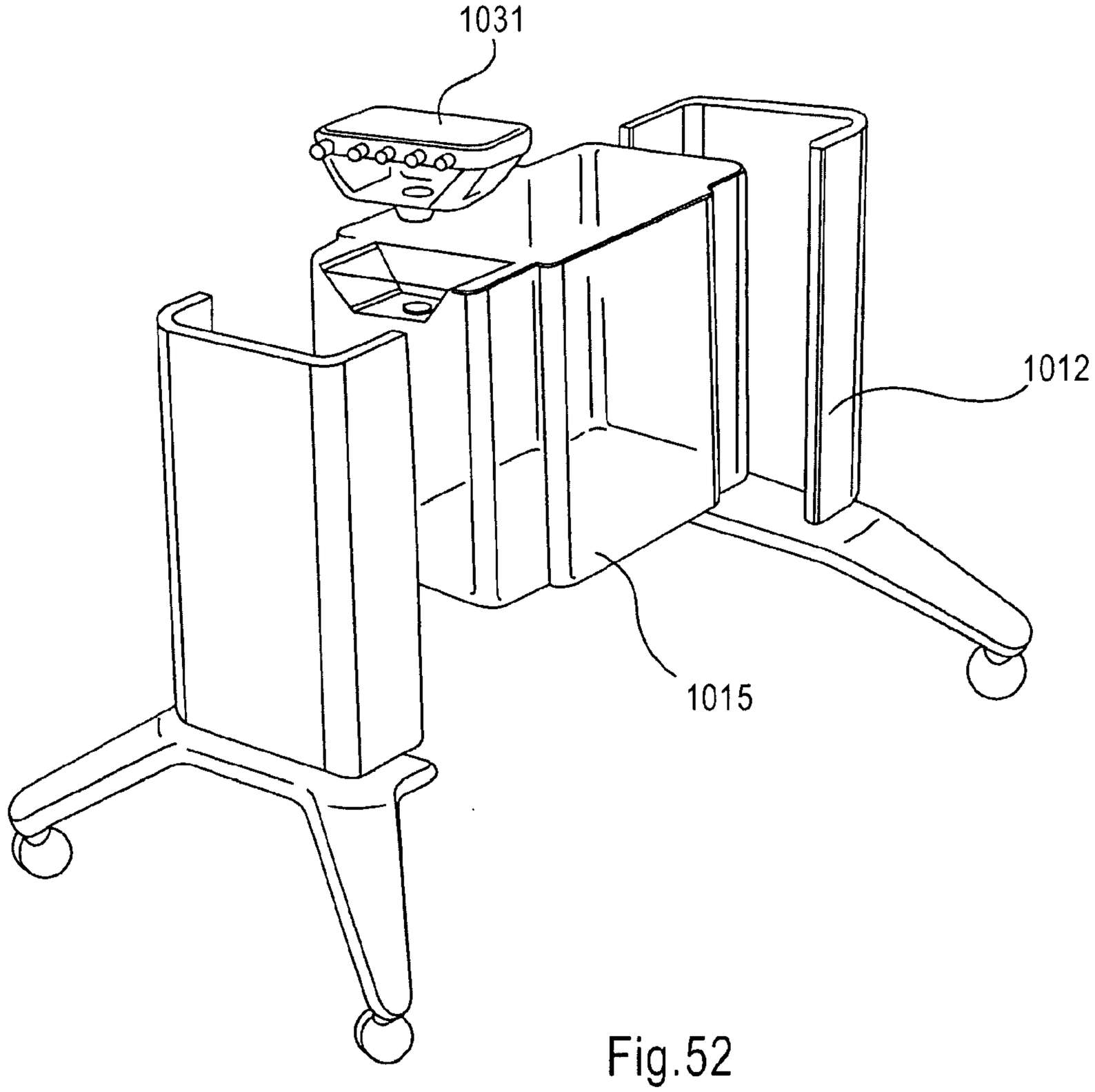


Fig.52

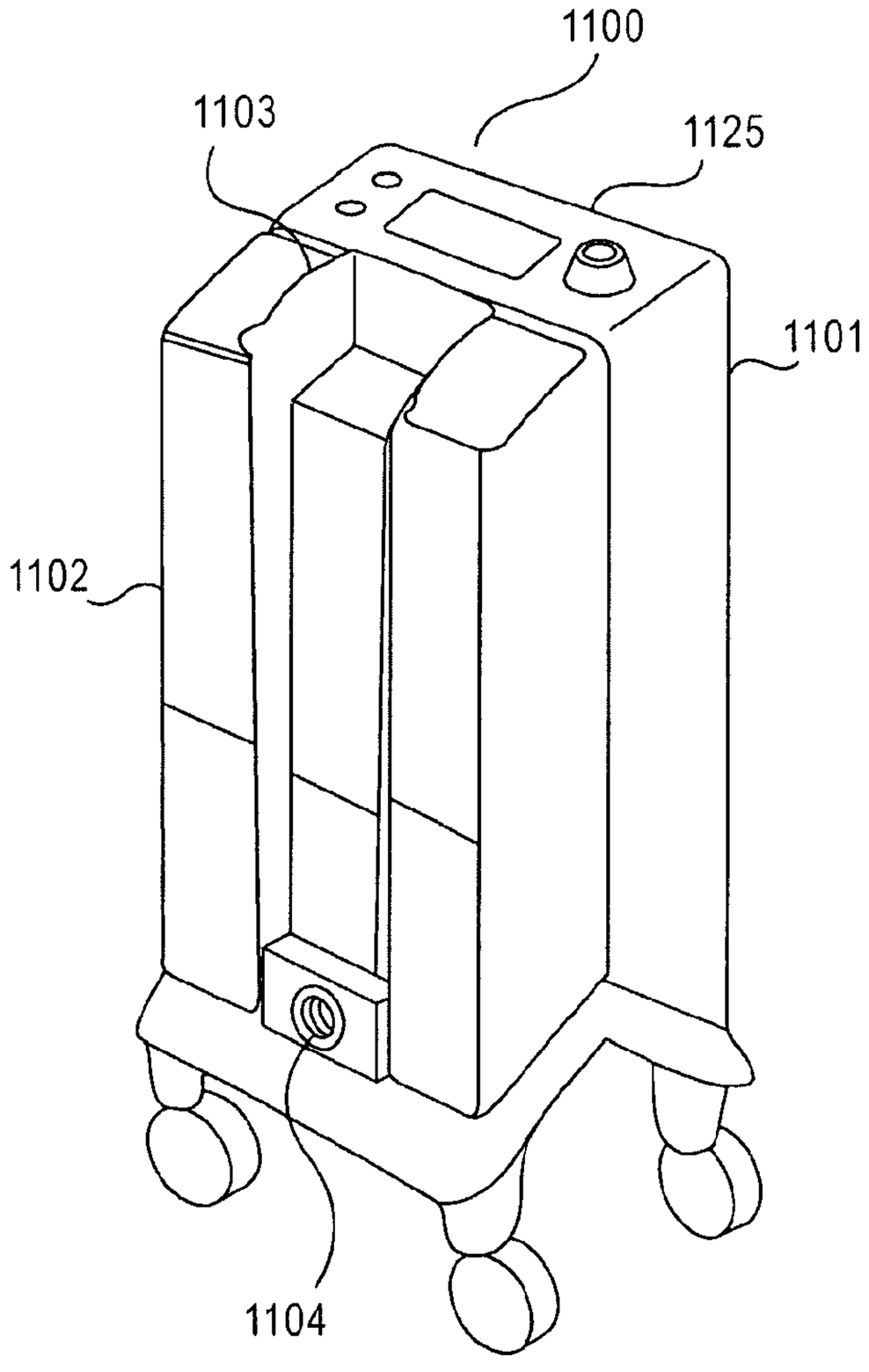


Fig.53

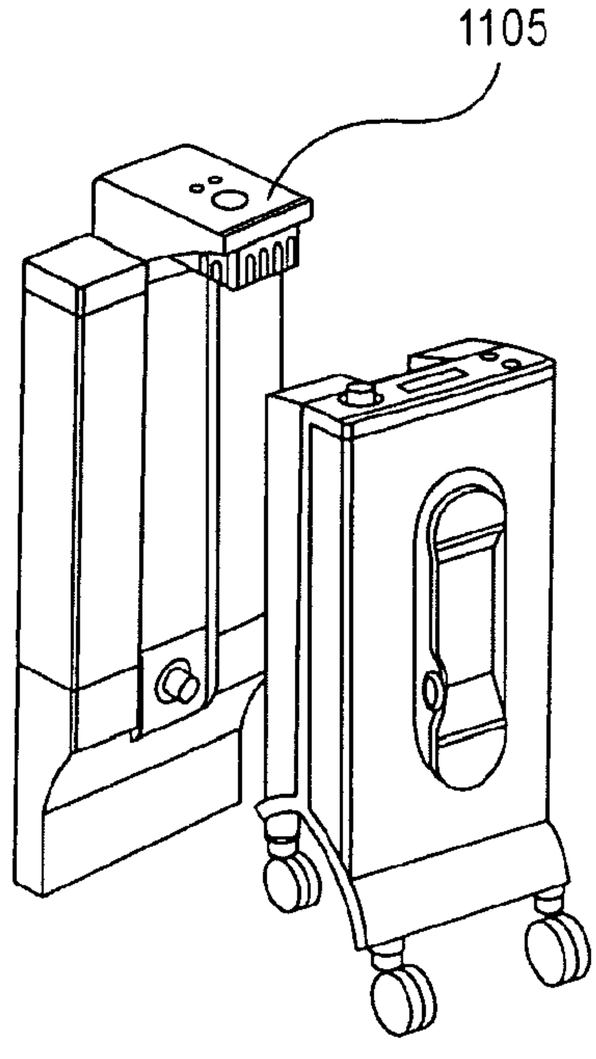


Fig.54

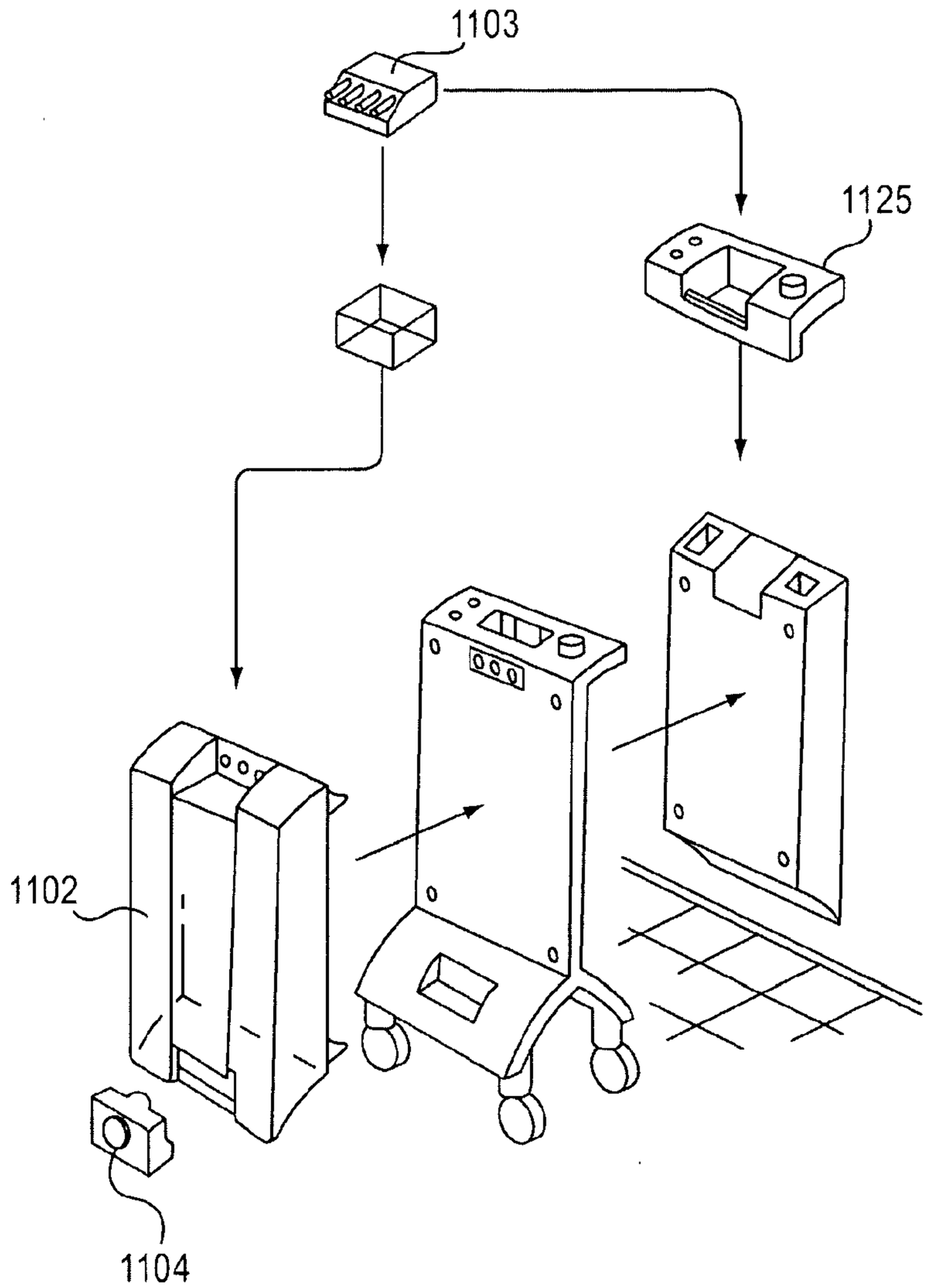


Fig.55

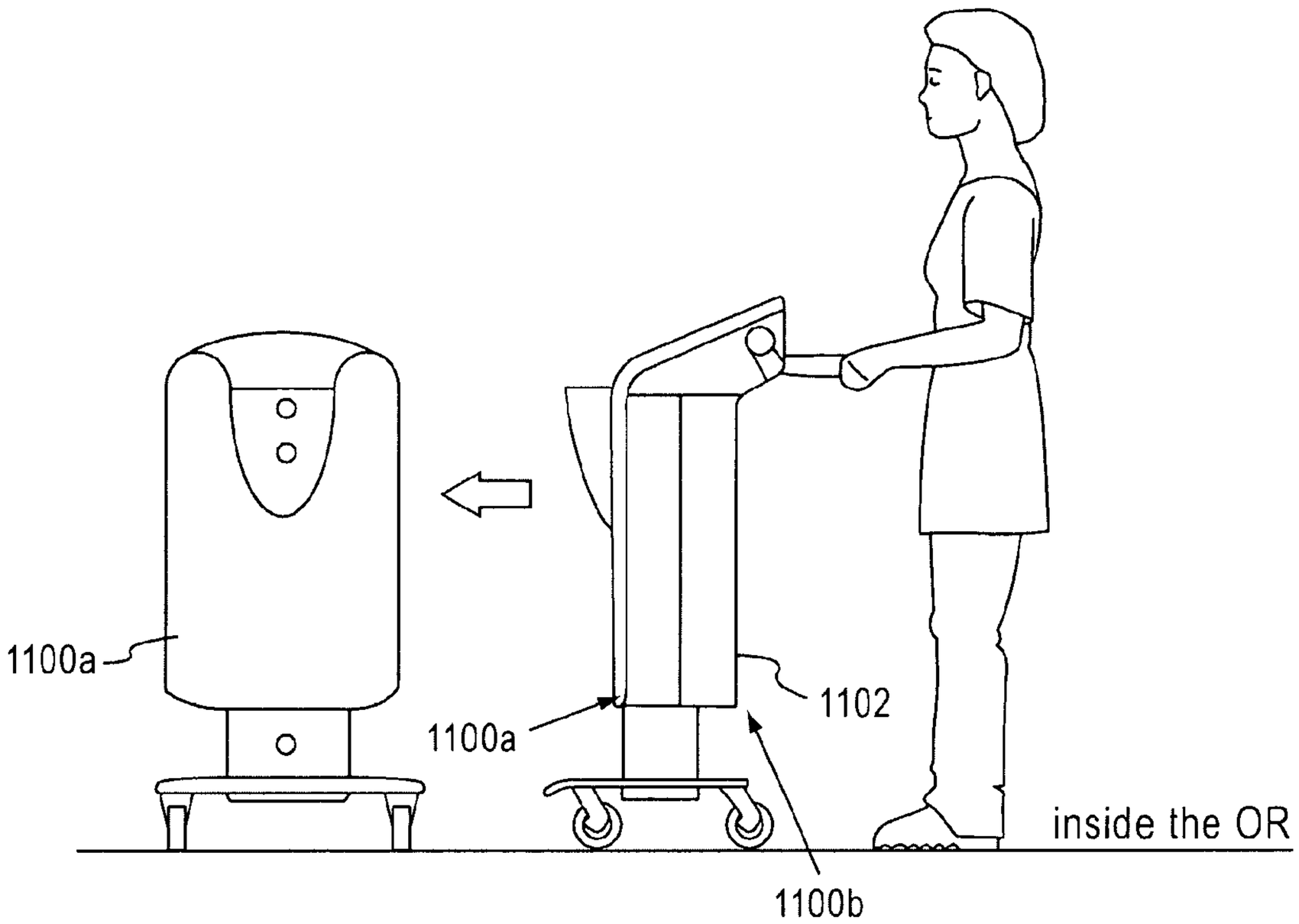


Fig.56

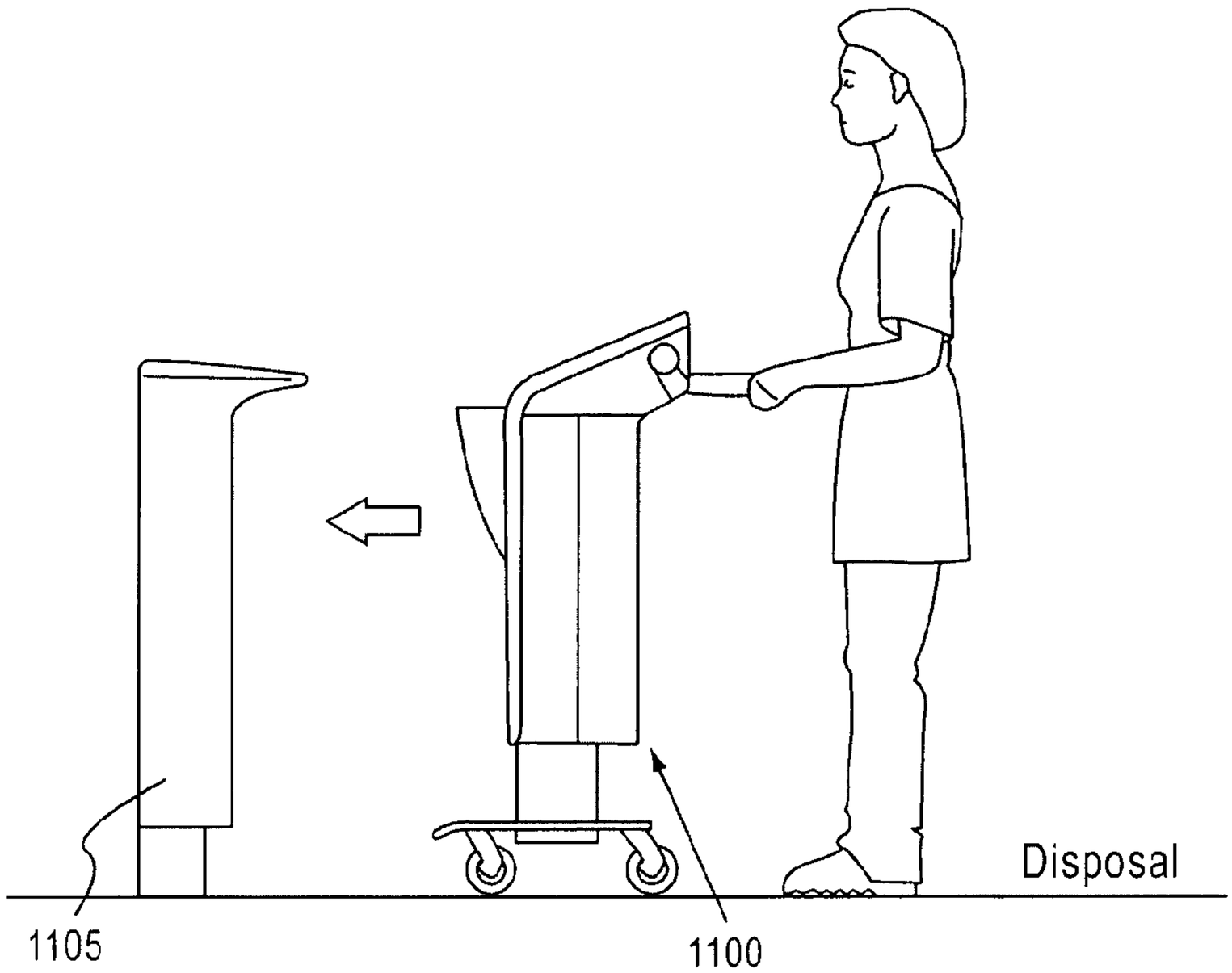


Fig.57

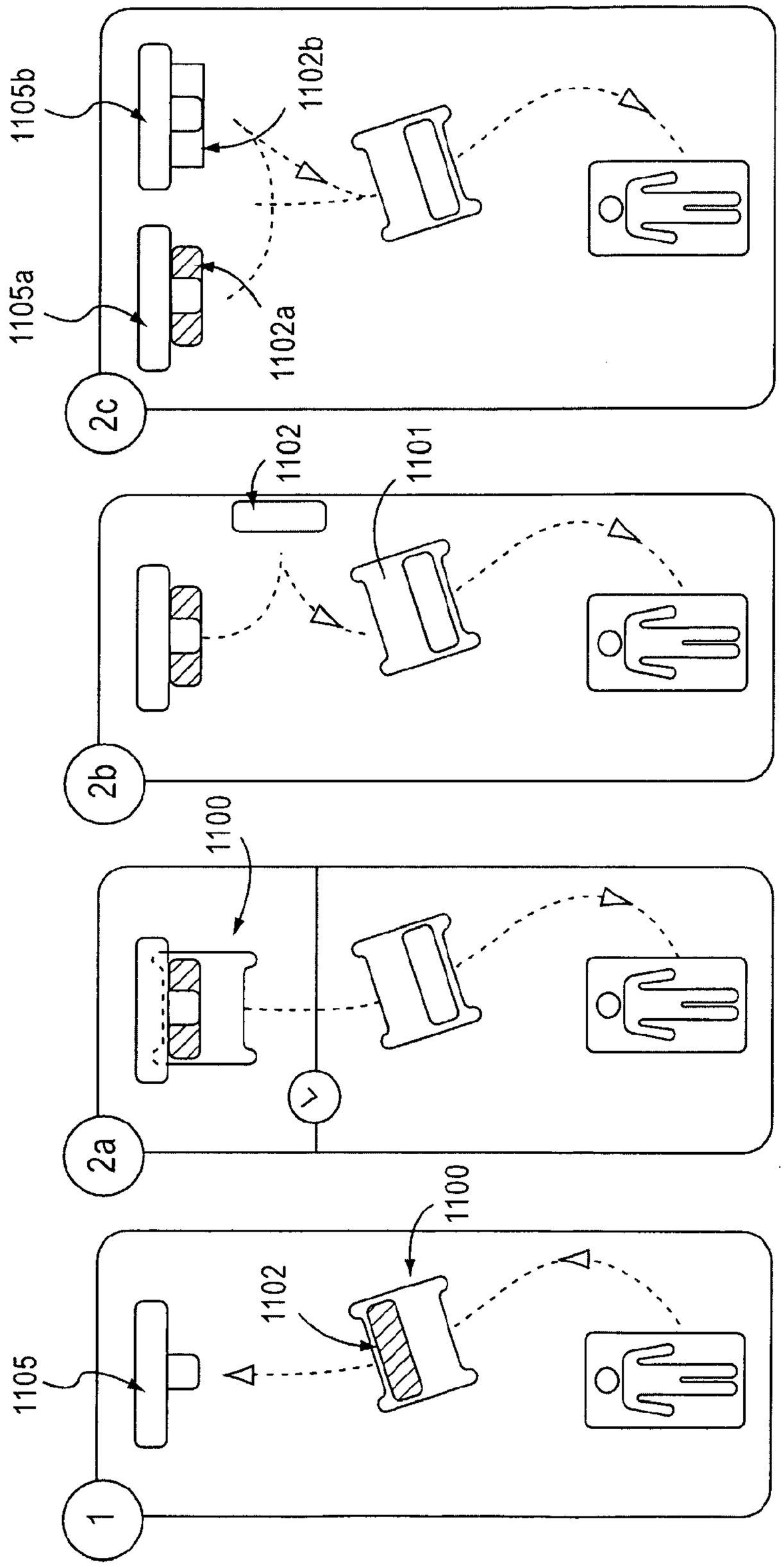

1105b
1102b
1105a
1102a
2c
1102
1101
2b
1100
2a
1100
1102
1105
1

Fig.58

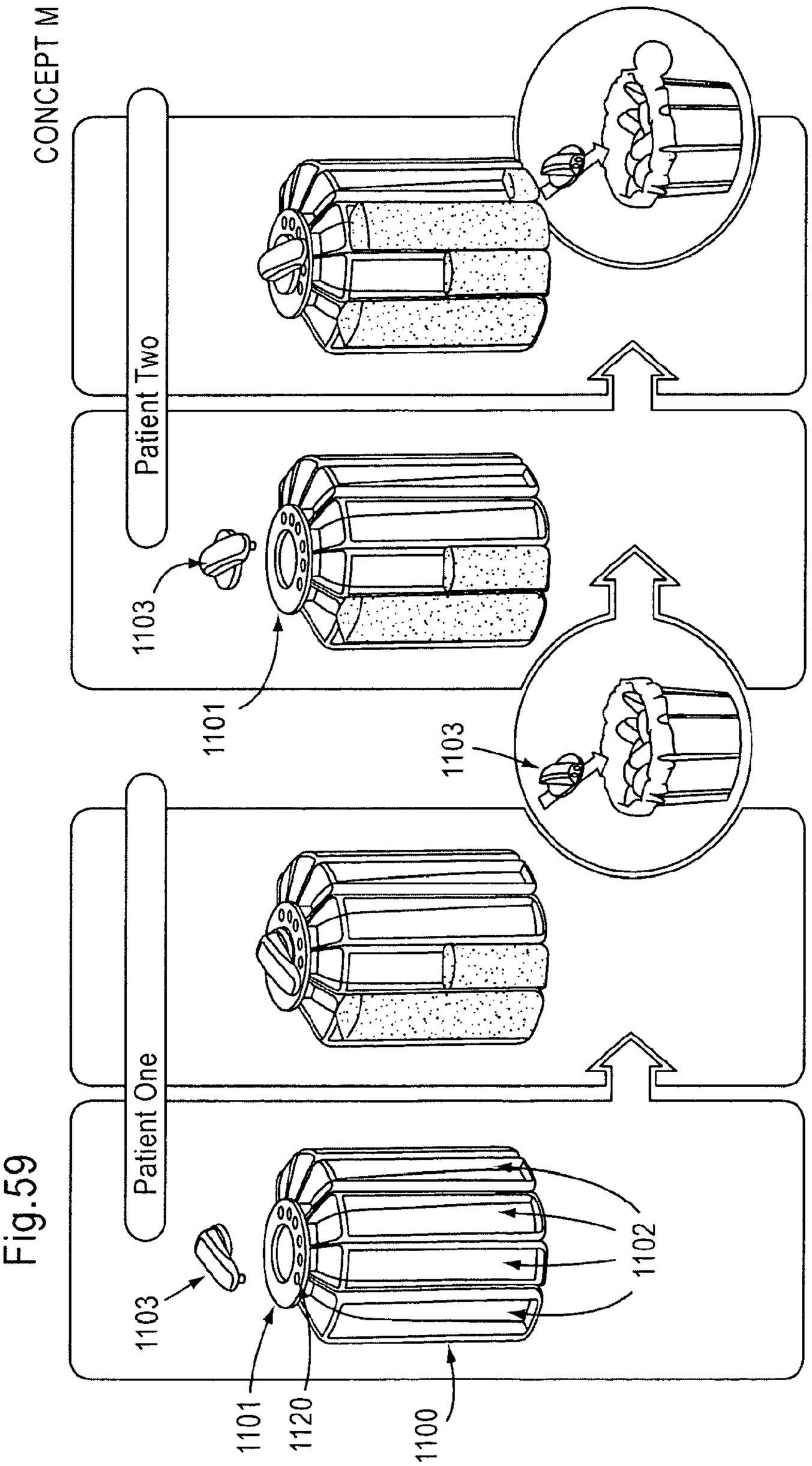

CONCEPT M
Patient Two
1103
1101
1103
Patient One
1103
1102
1101
1120
1100

Fig.59

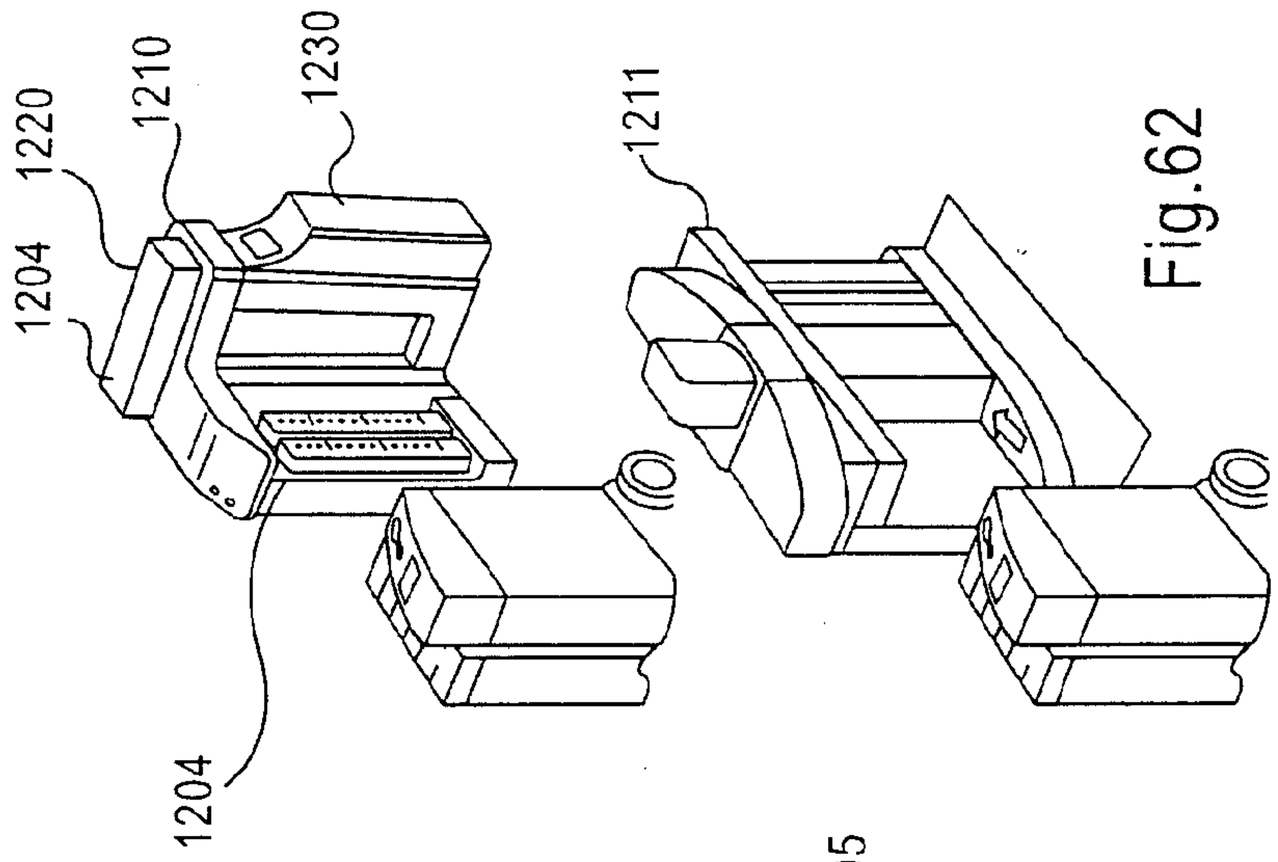


Fig.62

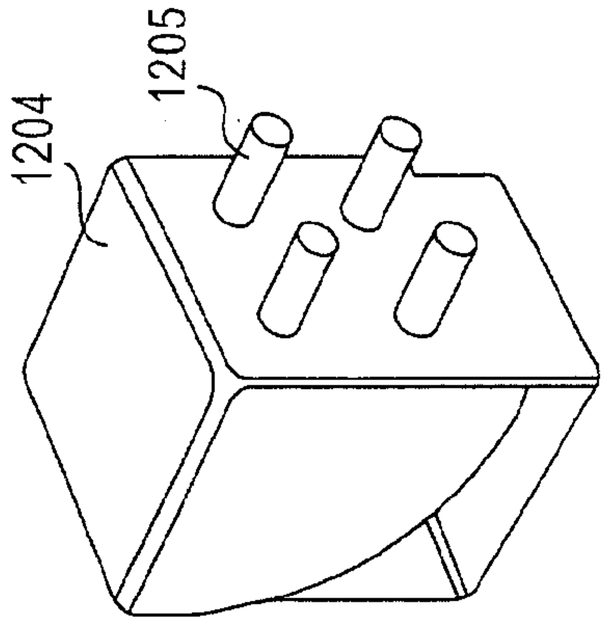


Fig.61

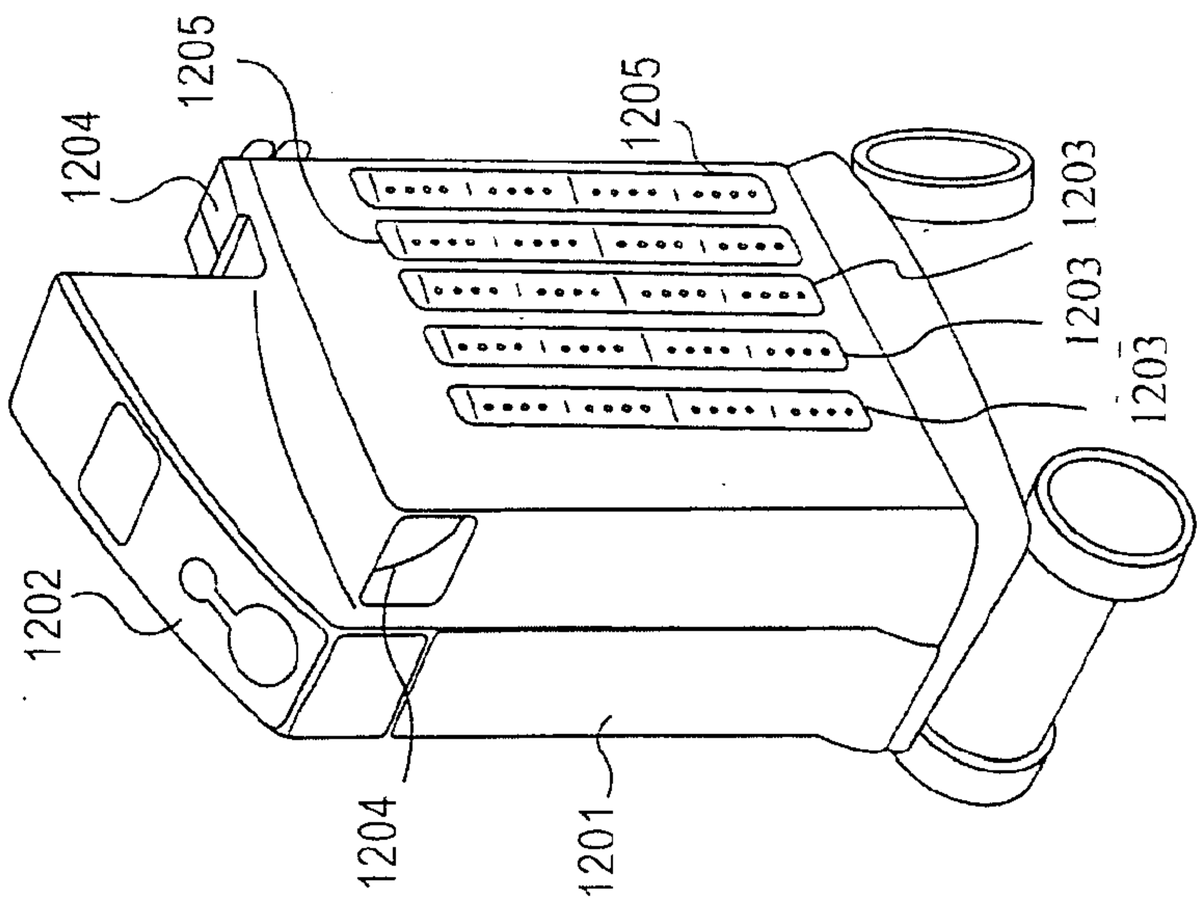


Fig.60

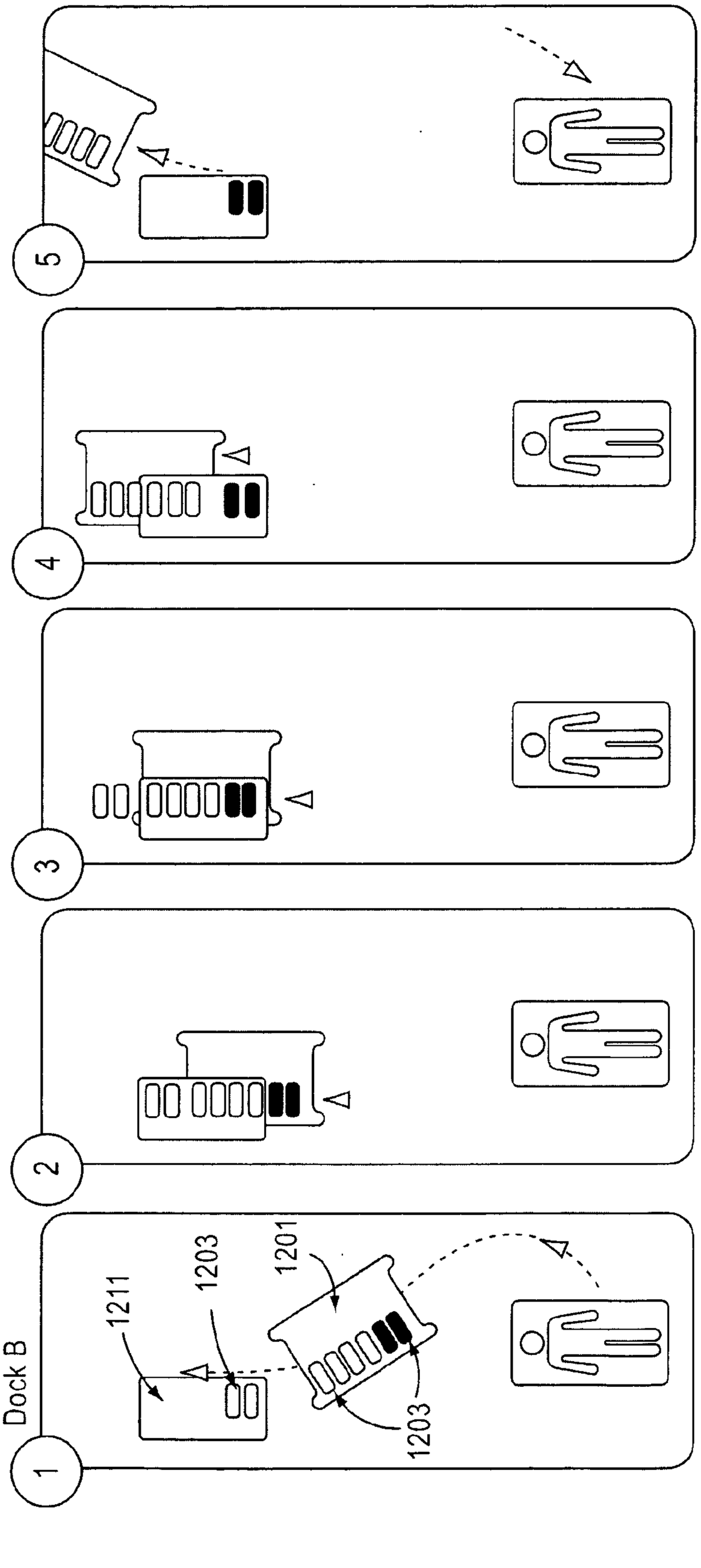


Fig.63

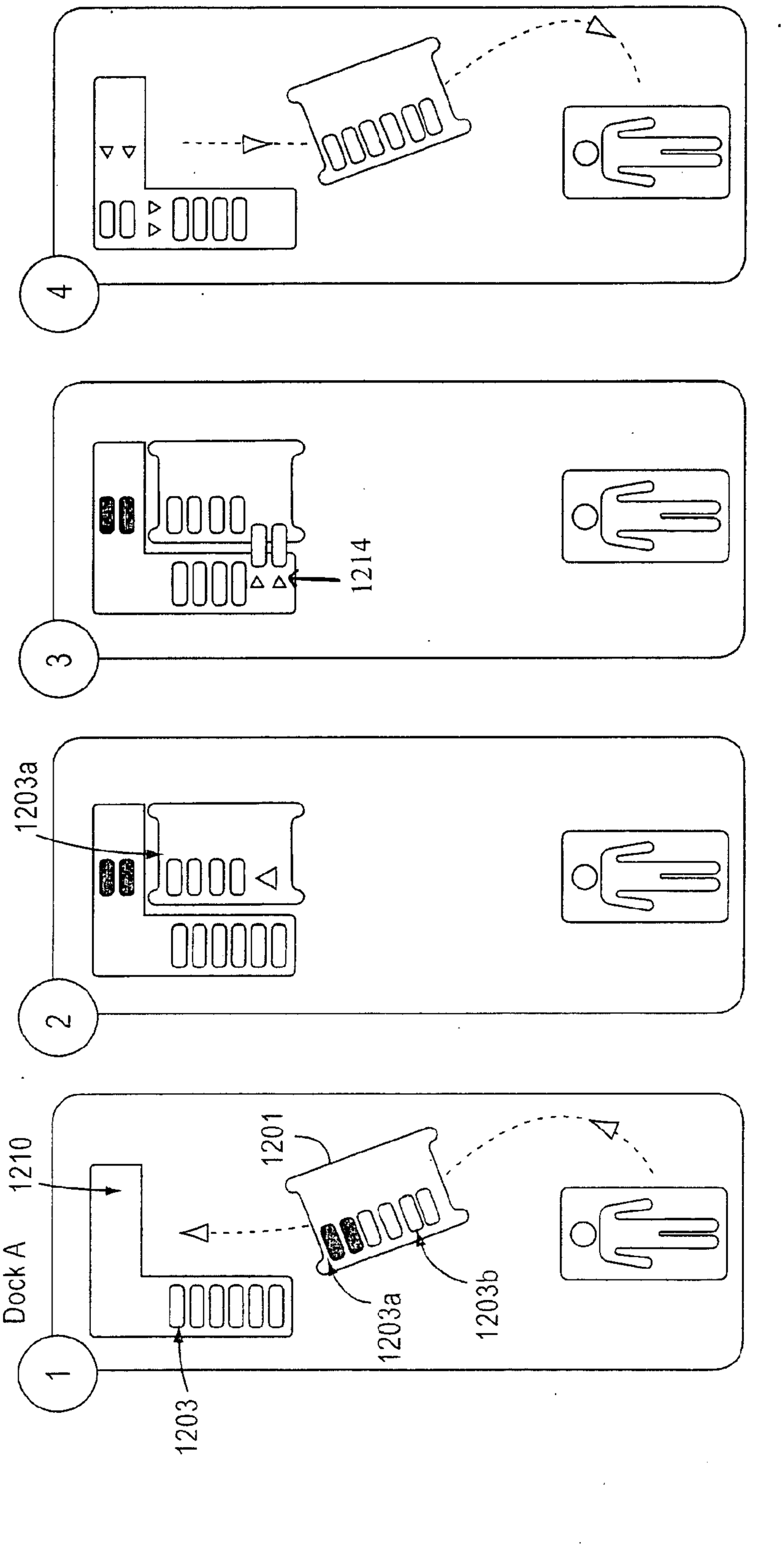


Fig.64

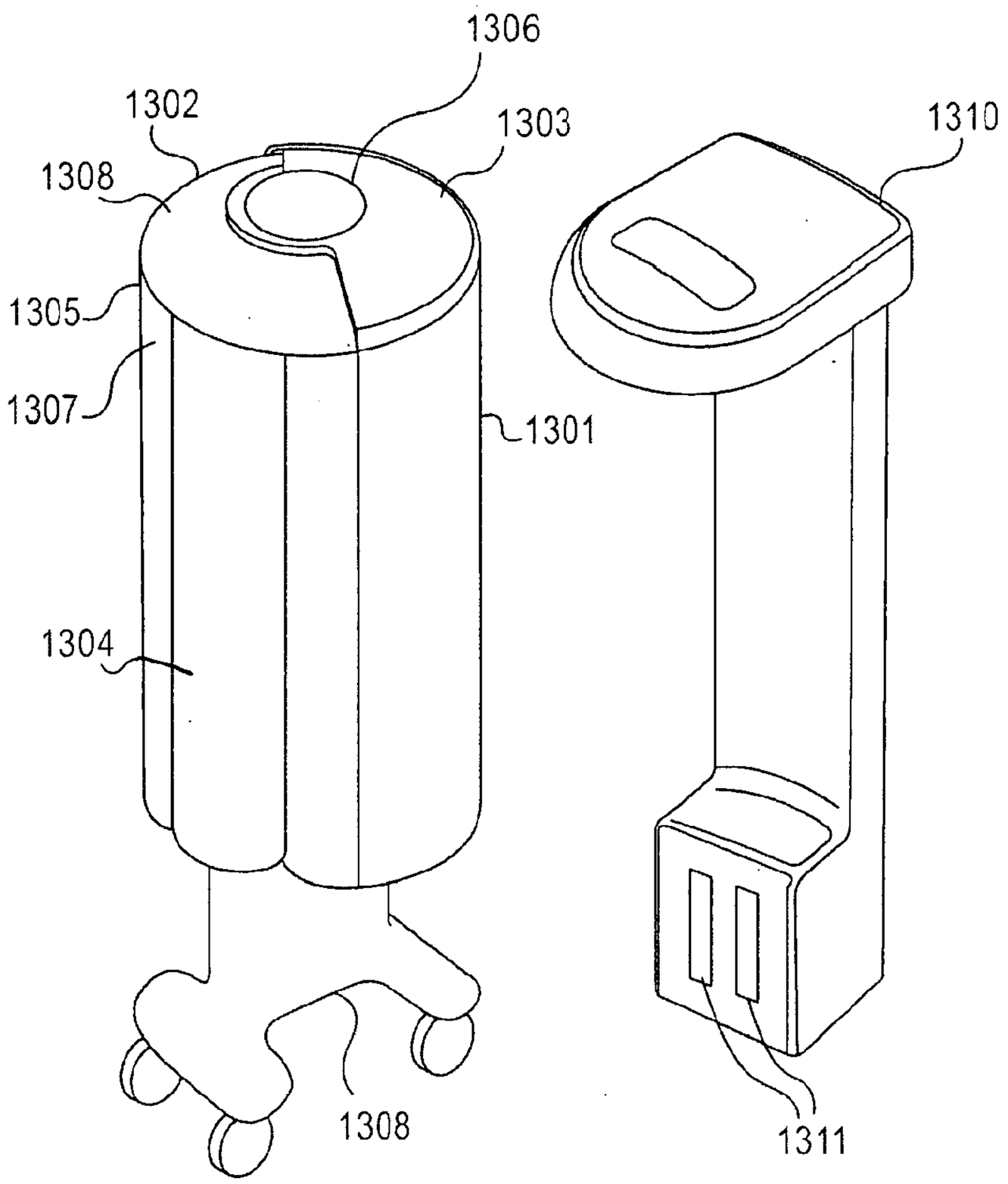
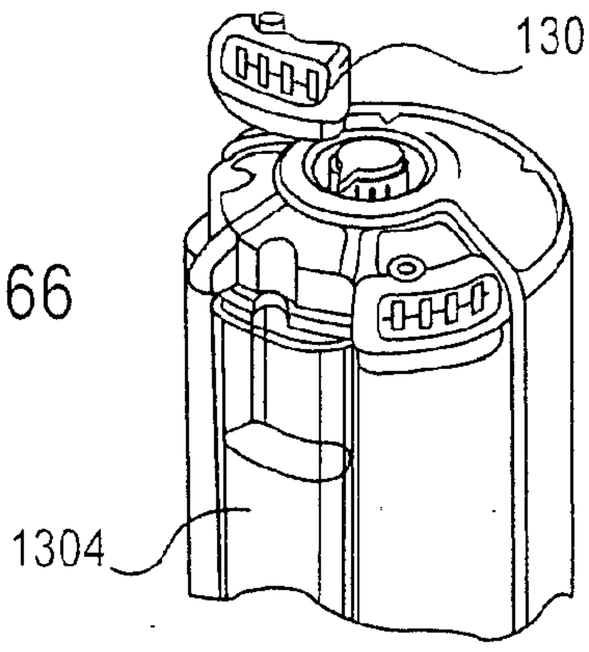

1306
1302
1303
1310
1308
1305
1307
1301
1304
1308
1311

Fig.65

Fig.66


1305
1304

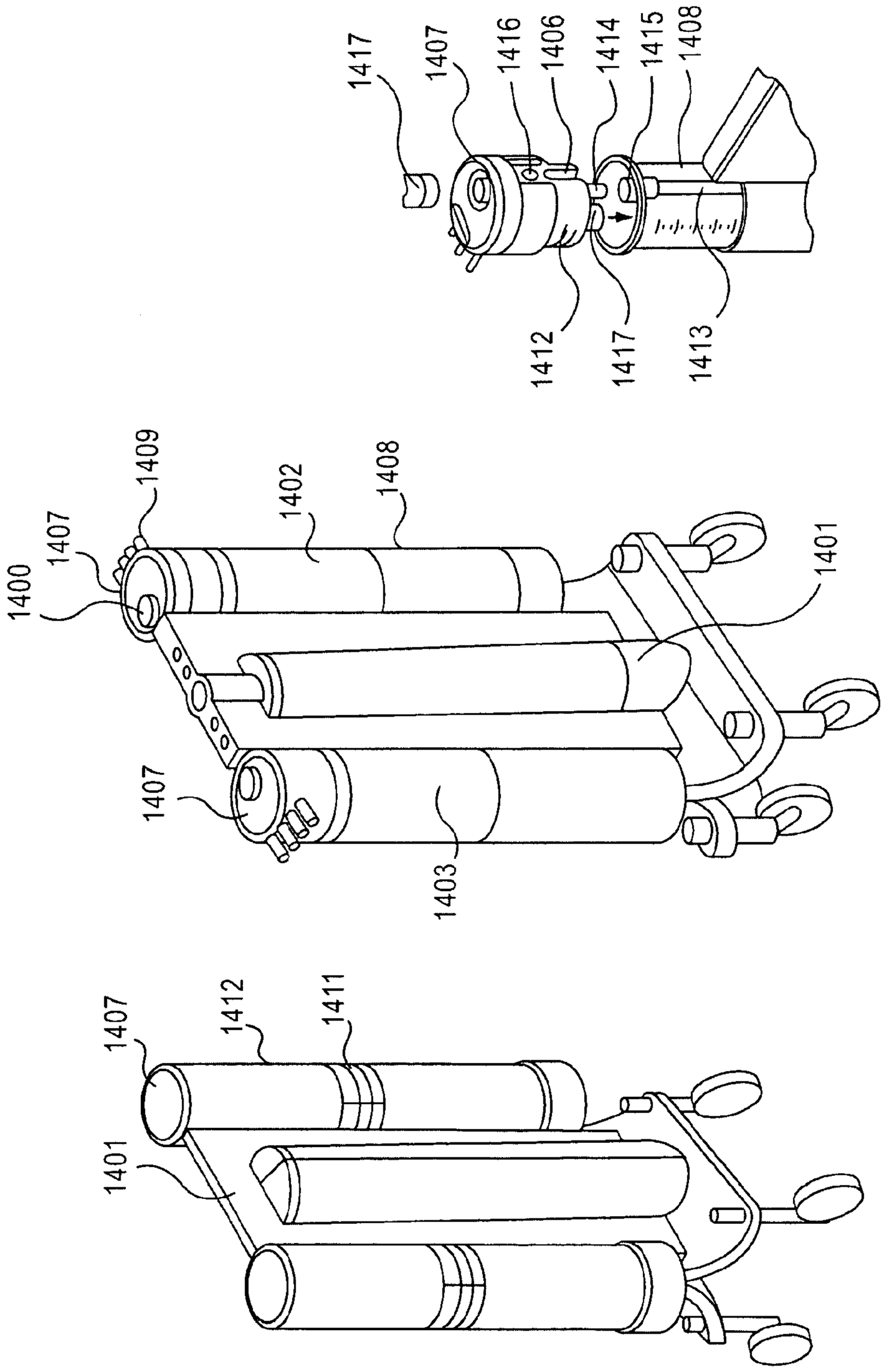


Fig.69

Fig.68

Fig.67

Fig.70

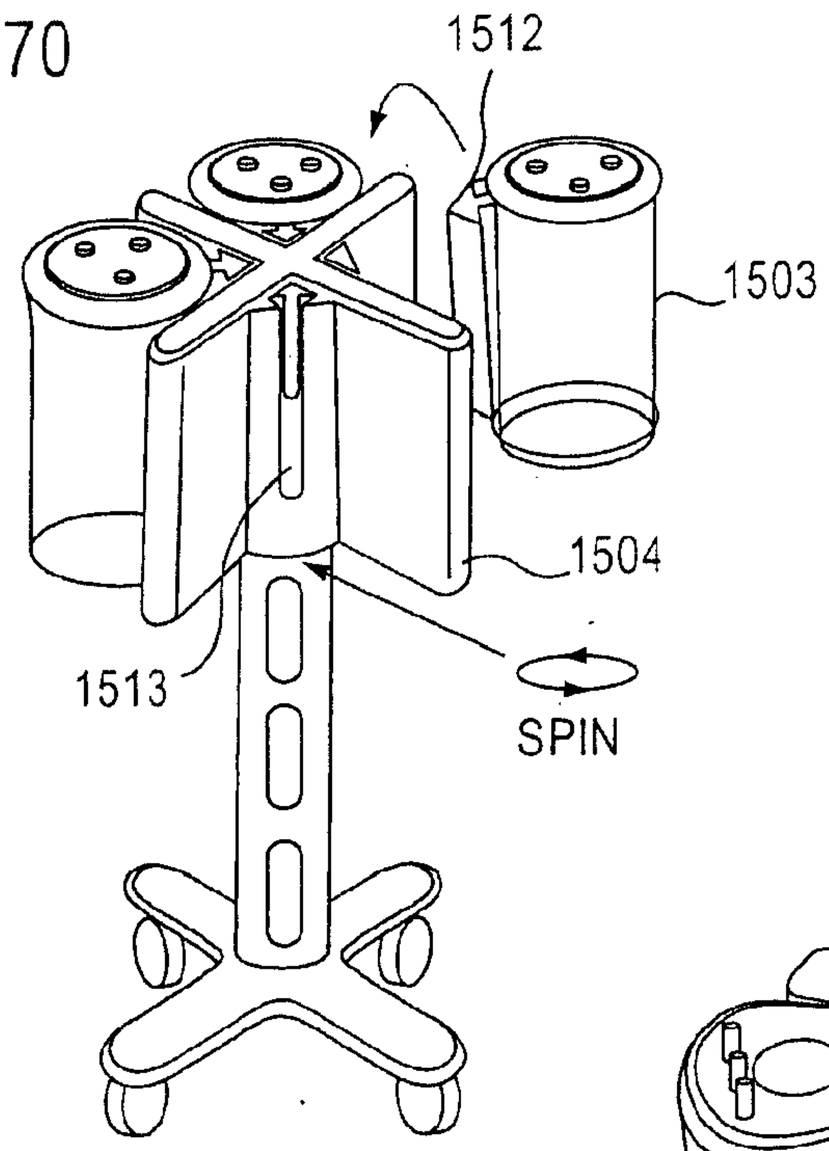
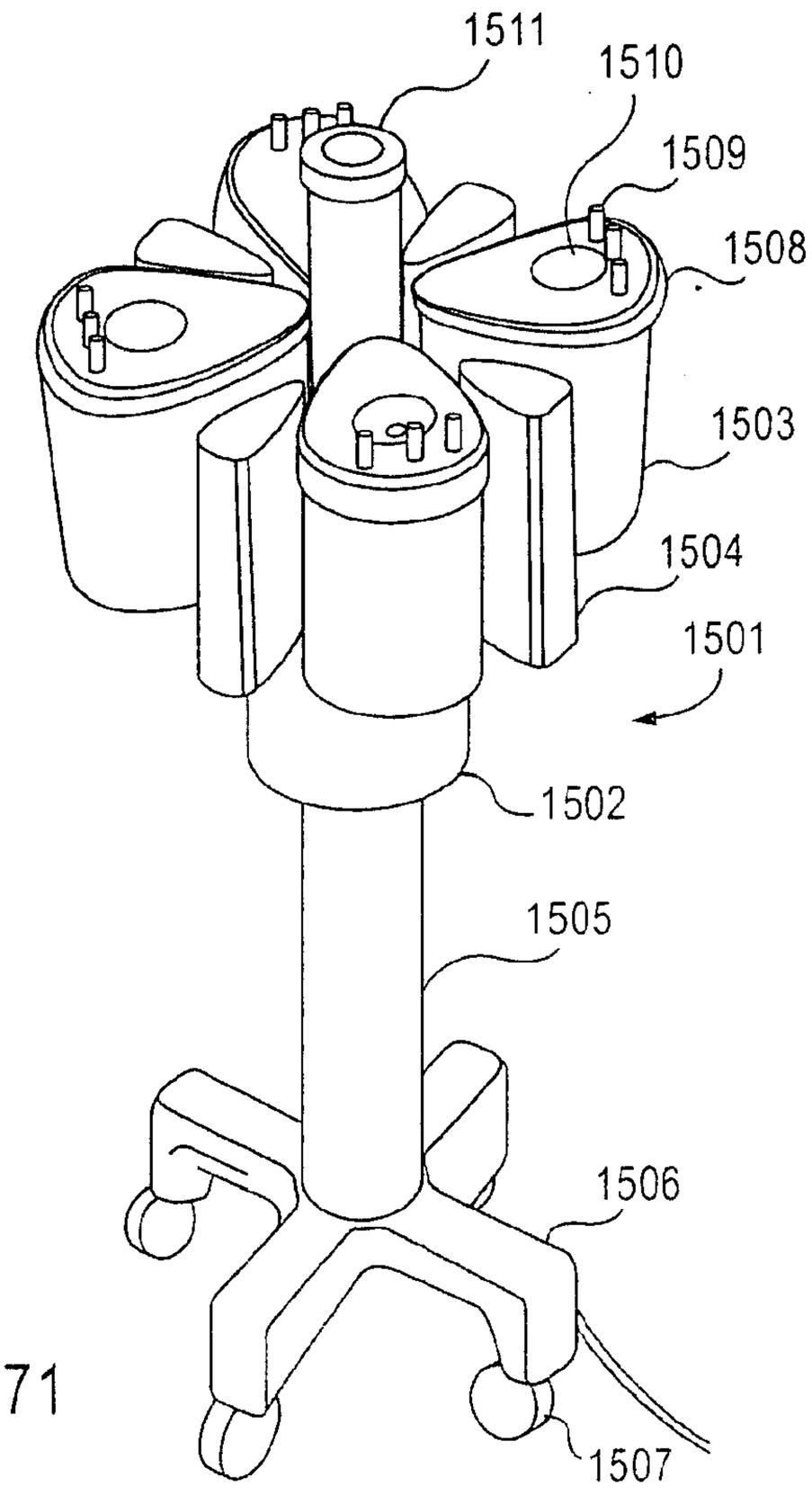
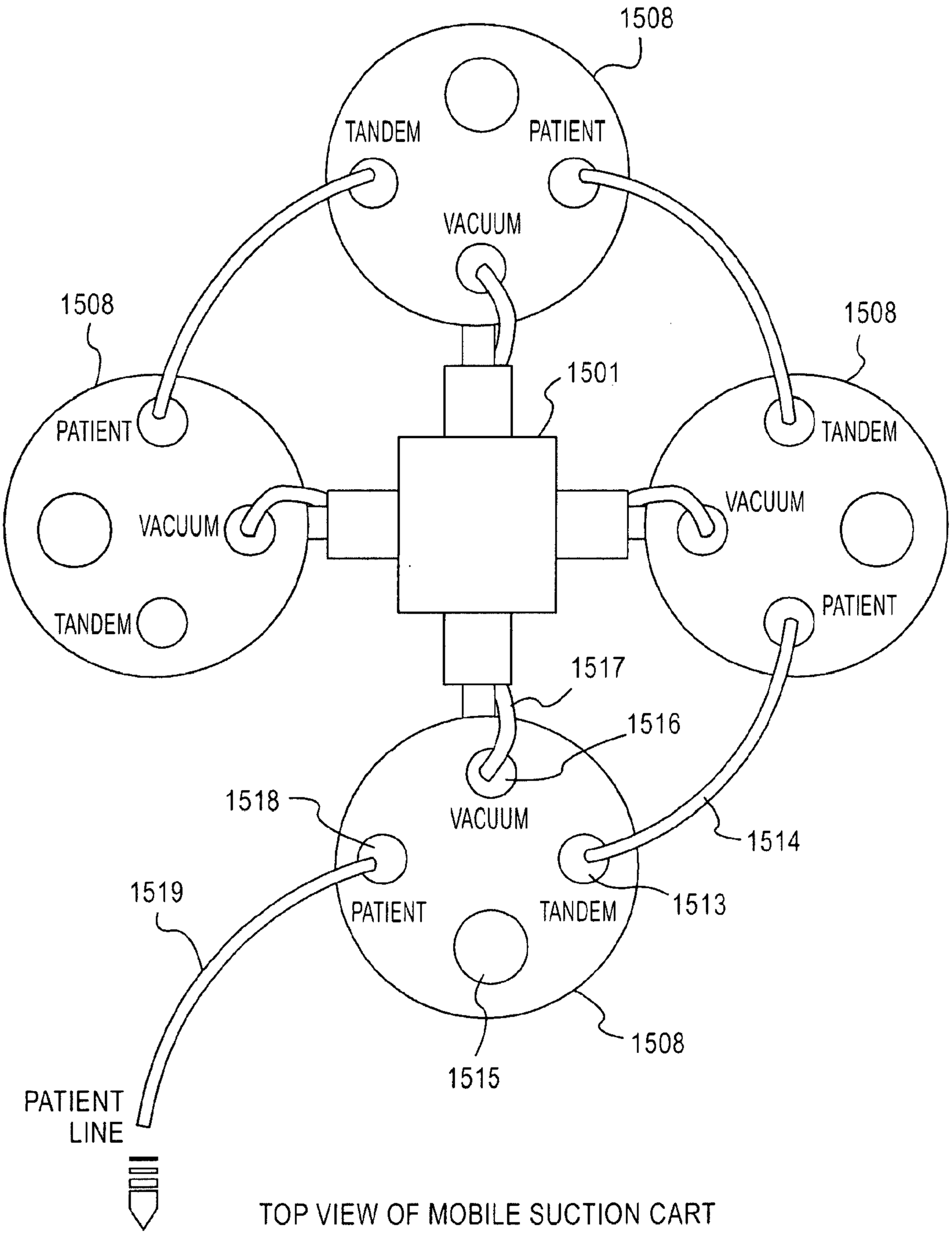

1512
1503
1504
1513
SPIN

Fig.71


1511
1510
1509
1508
1503
1504
1501
1502
1505
1506
1507



TOP VIEW OF MOBILE SUCTION CART

Fig.71(a)

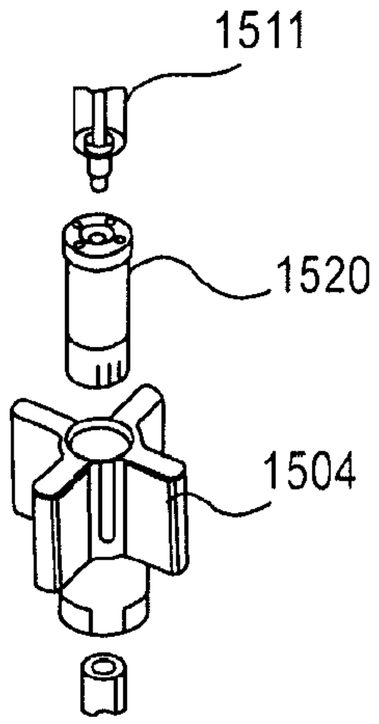


Fig.72

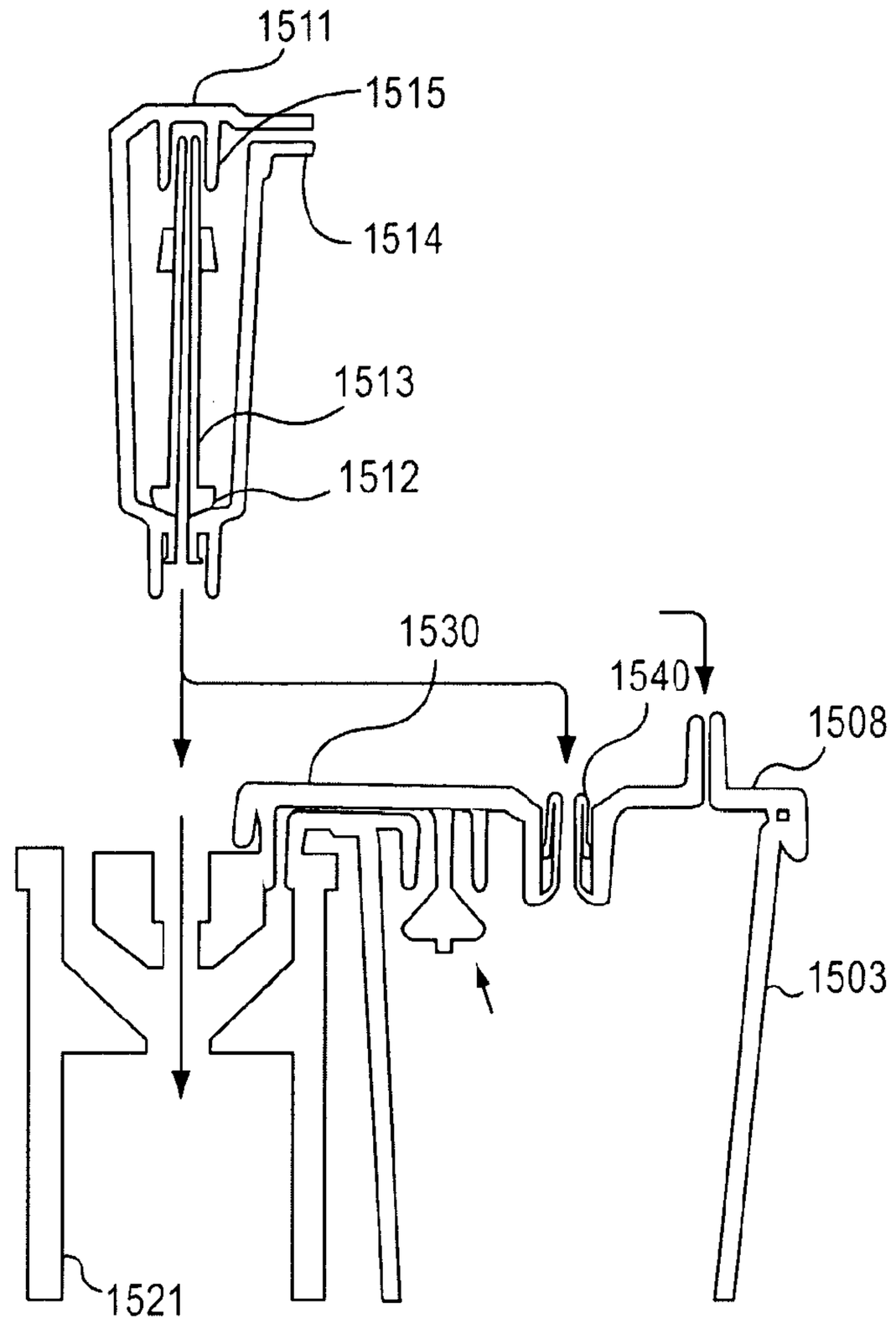


Fig.73

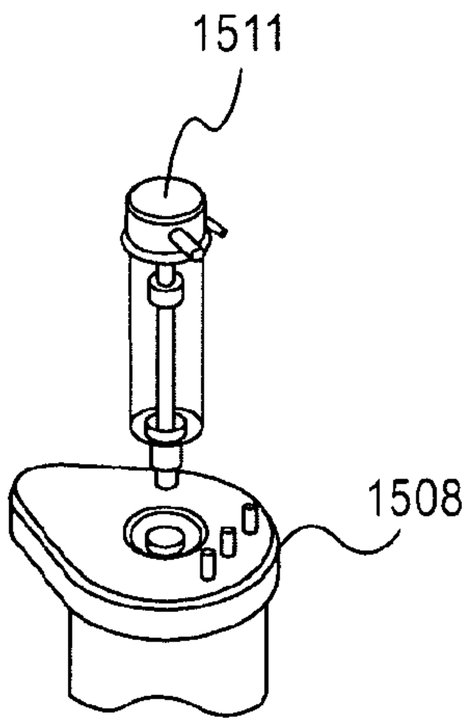


Fig.74

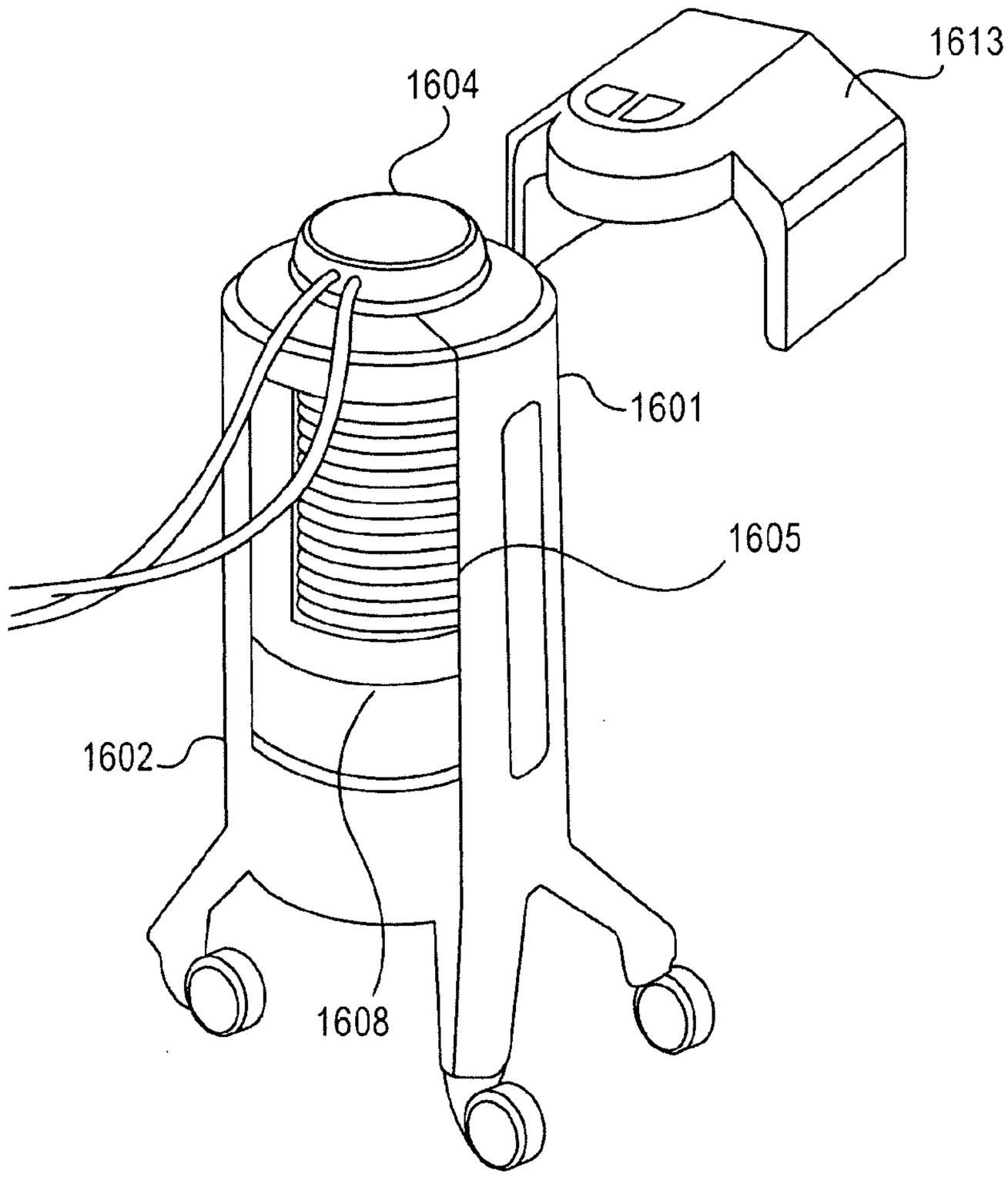


Fig.75

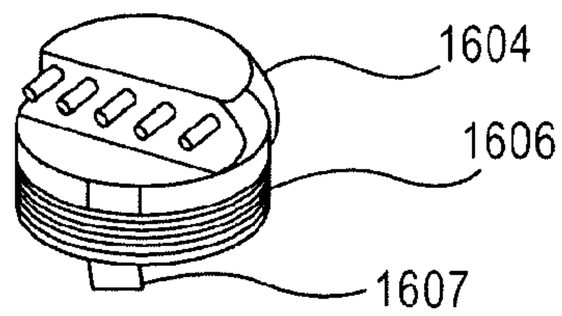
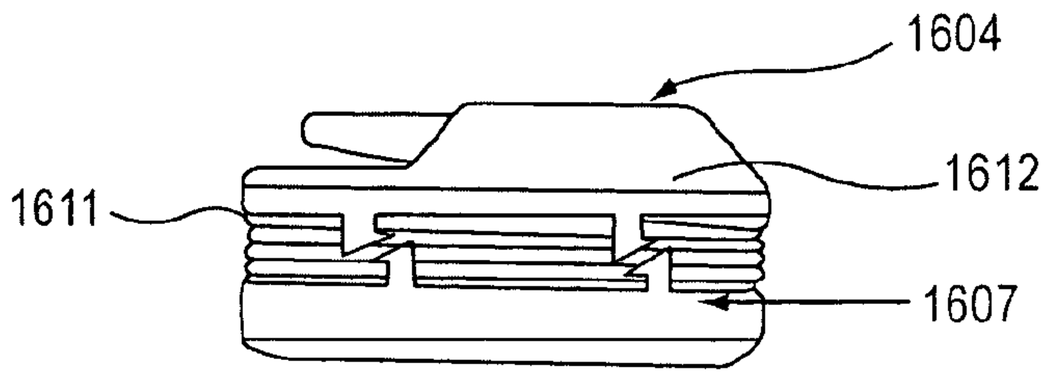


Fig.76



disposable unlocked to start

Fig.77(a)

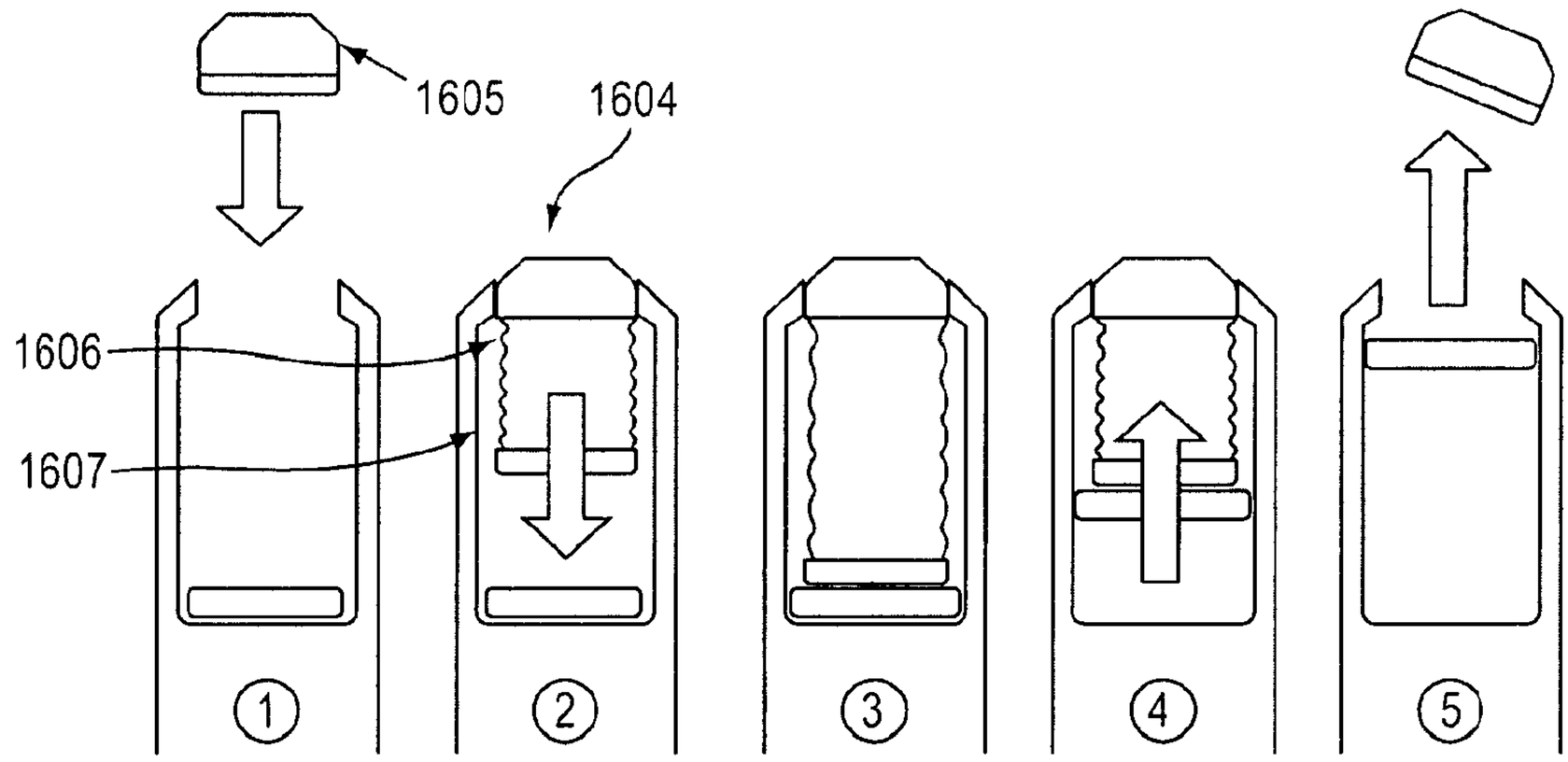
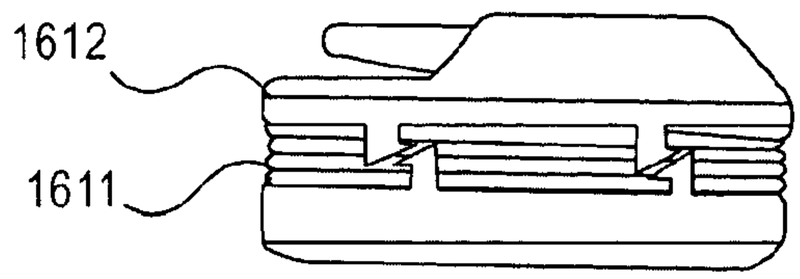


Fig.77(b)



disposable locks to disposable

FIG.77(c)

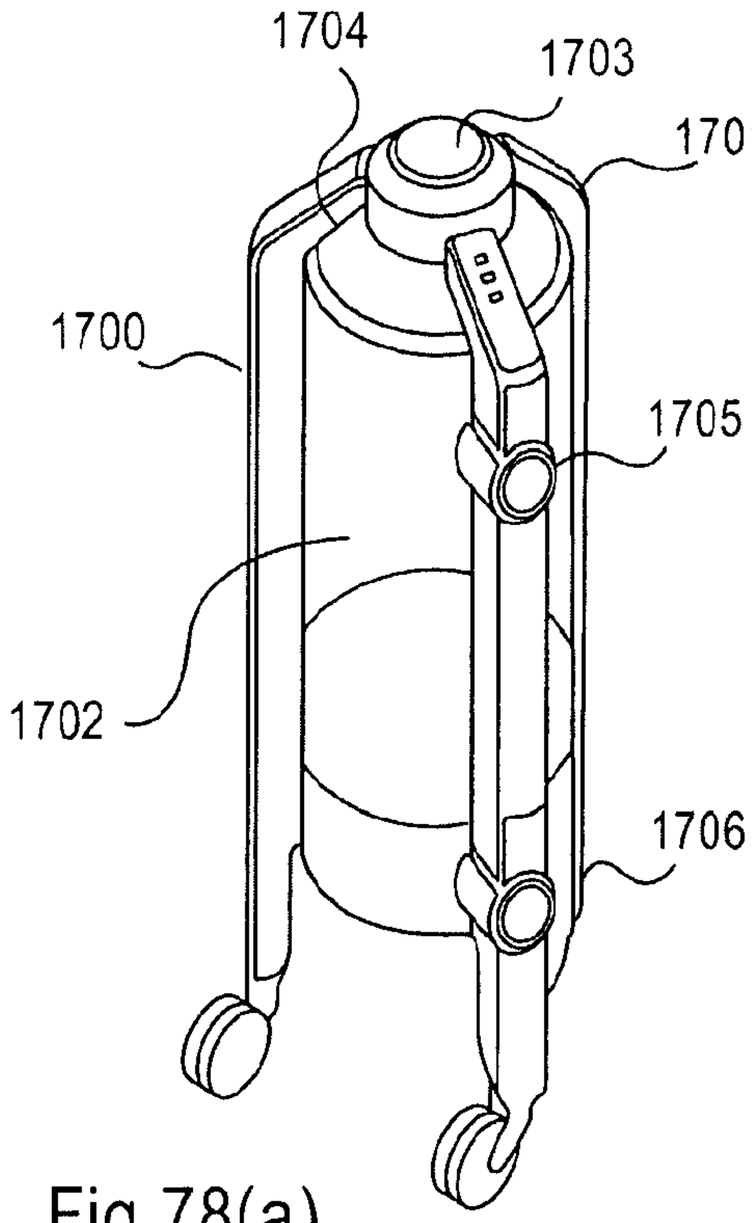


Fig.78(a)

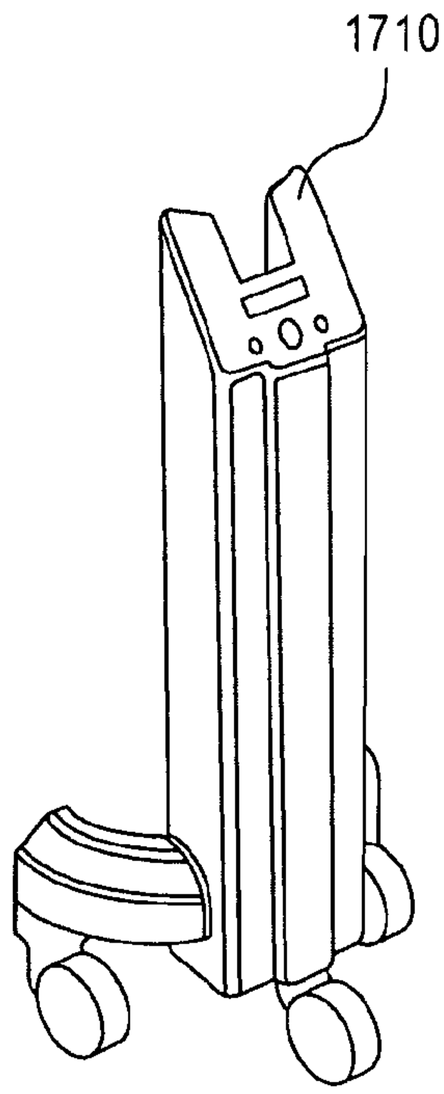


Fig.79(a)

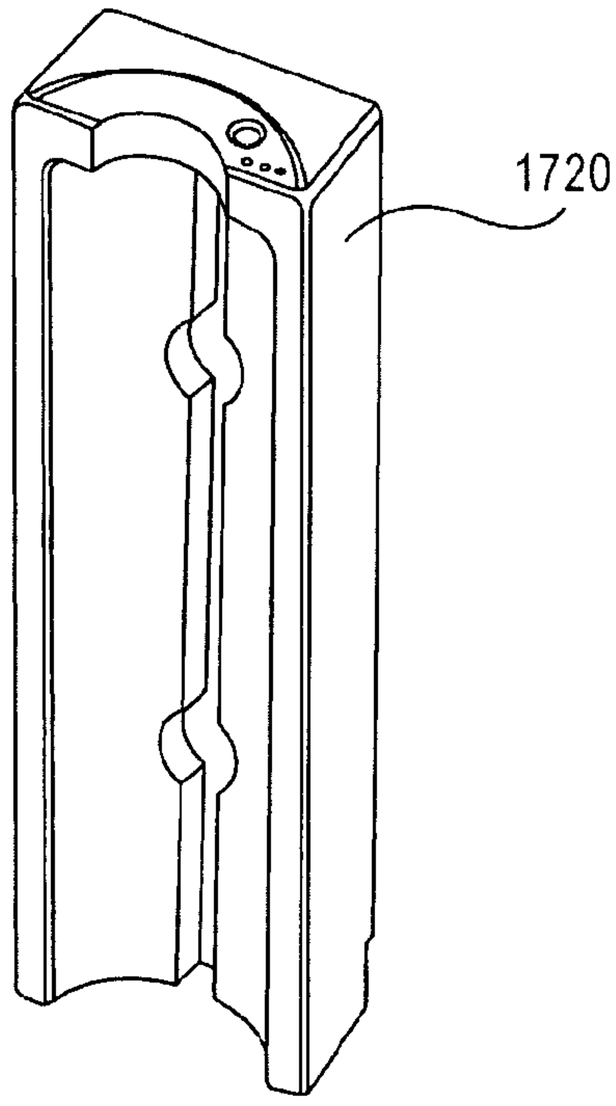


Fig.79(b)

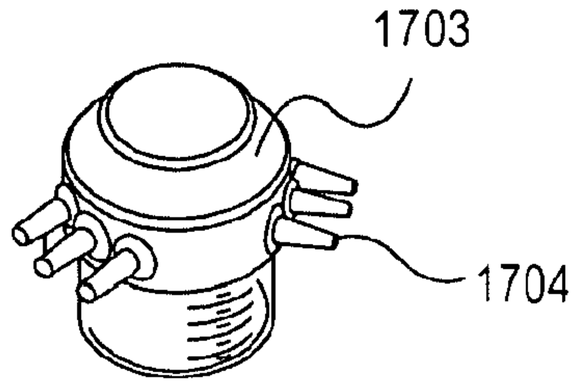


Fig.80

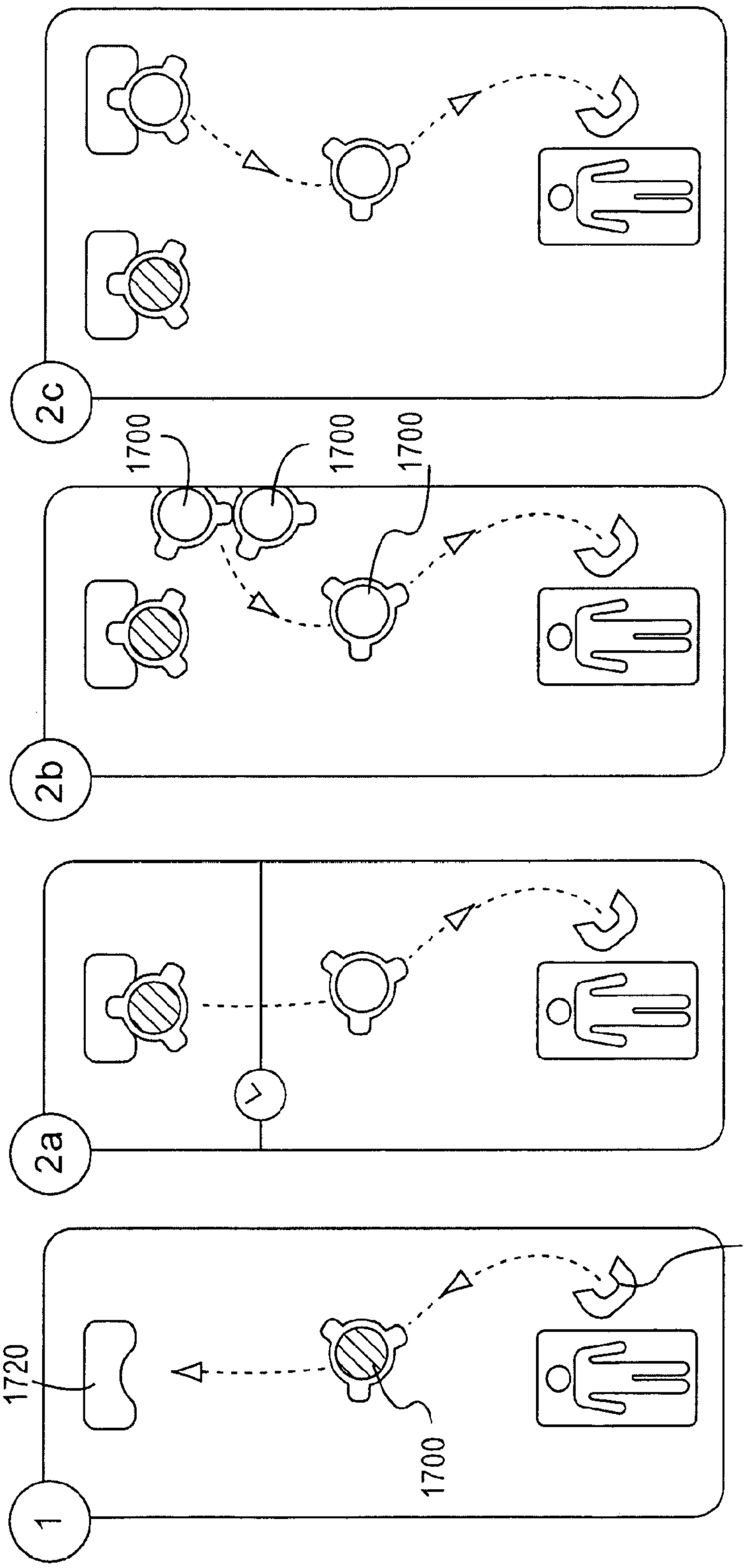


Fig.81

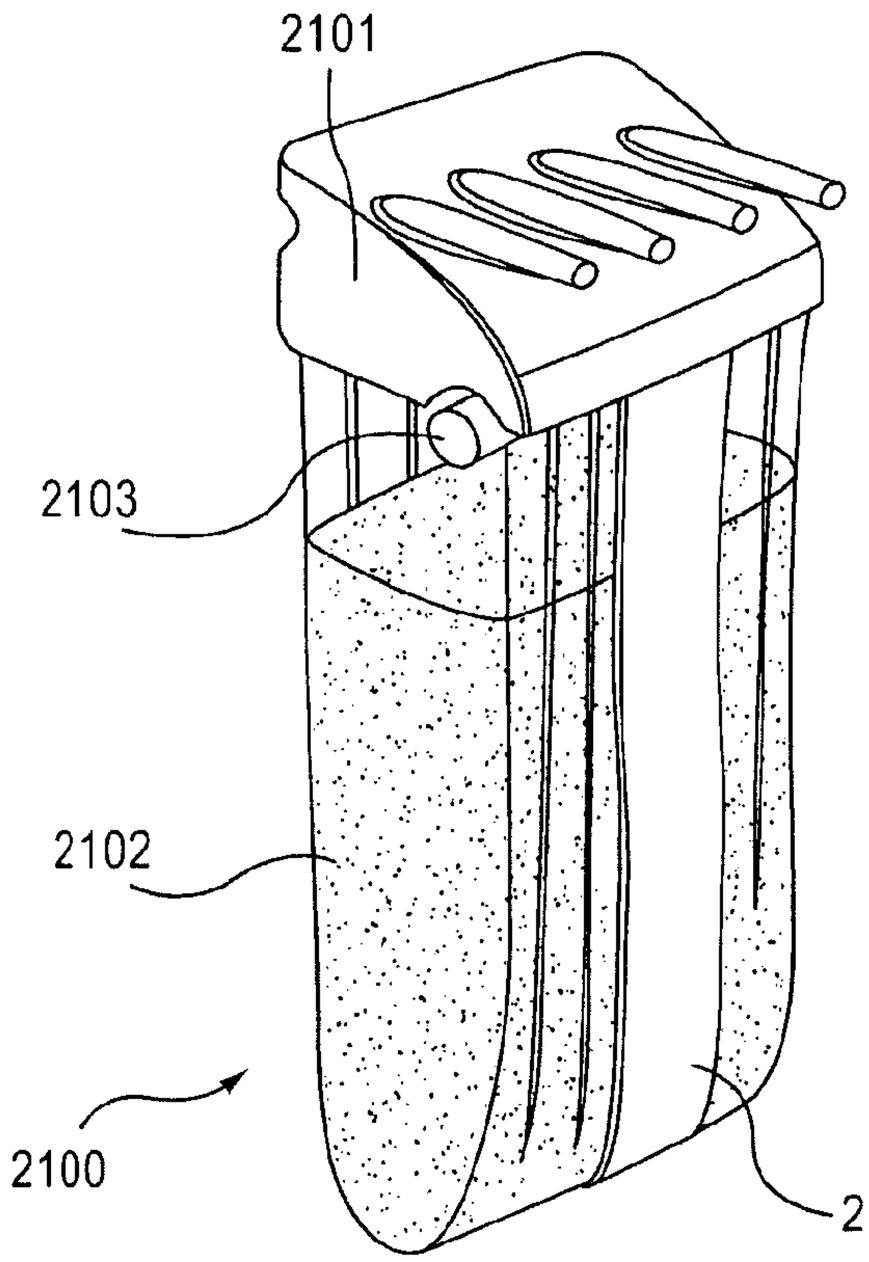


Fig.82(a)

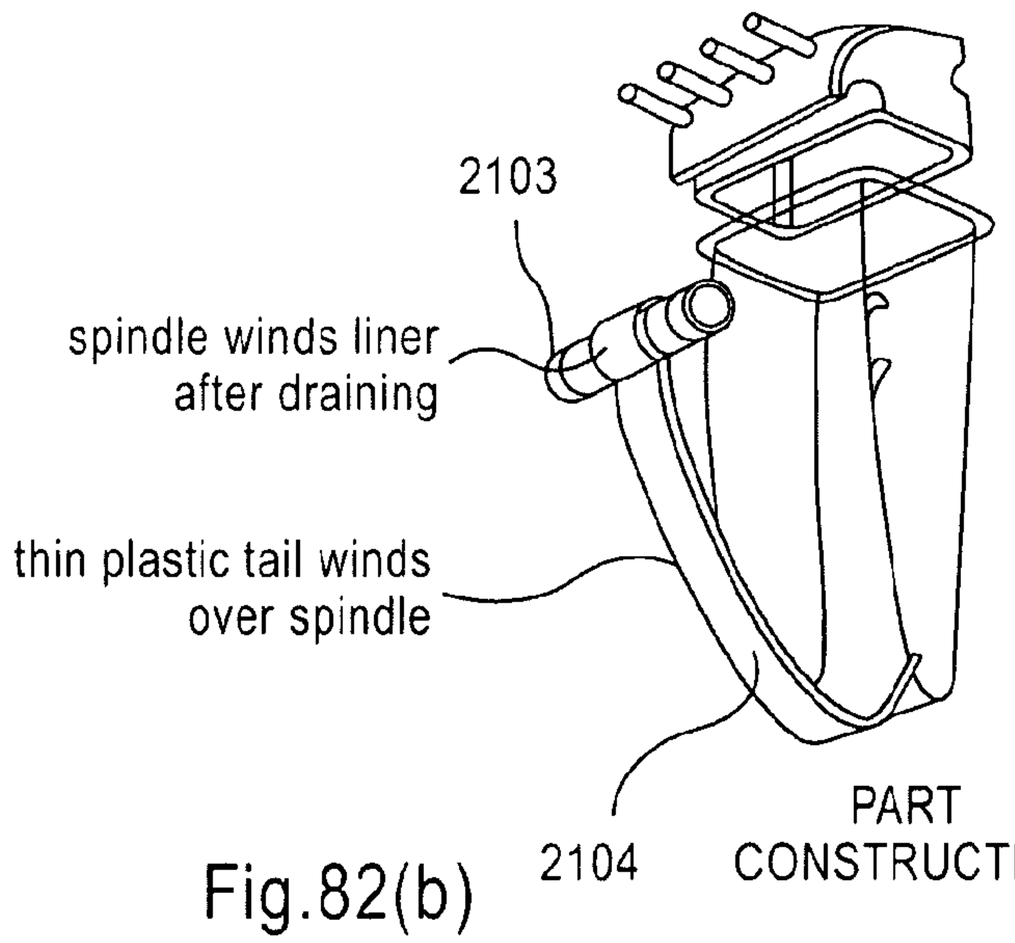


Fig.82(b)

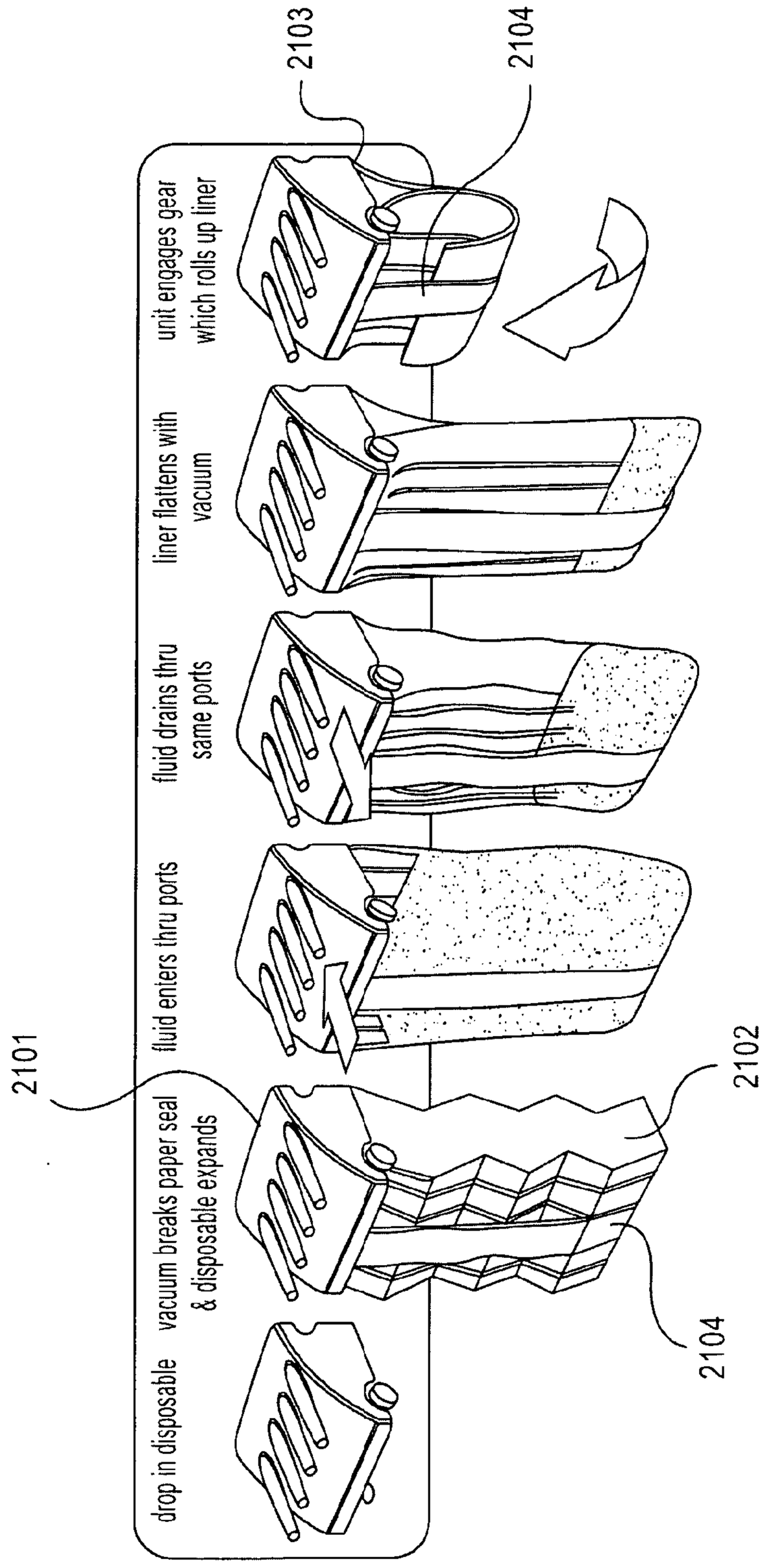

2103
2104
unit engages gear which rolls up liner
liner flattens with vacuum
fluid drains thru same ports
fluid enters thru ports
2101
vacuum breaks paper seal & disposable expands
2102
drop in disposable
2104

Fig.82(c)

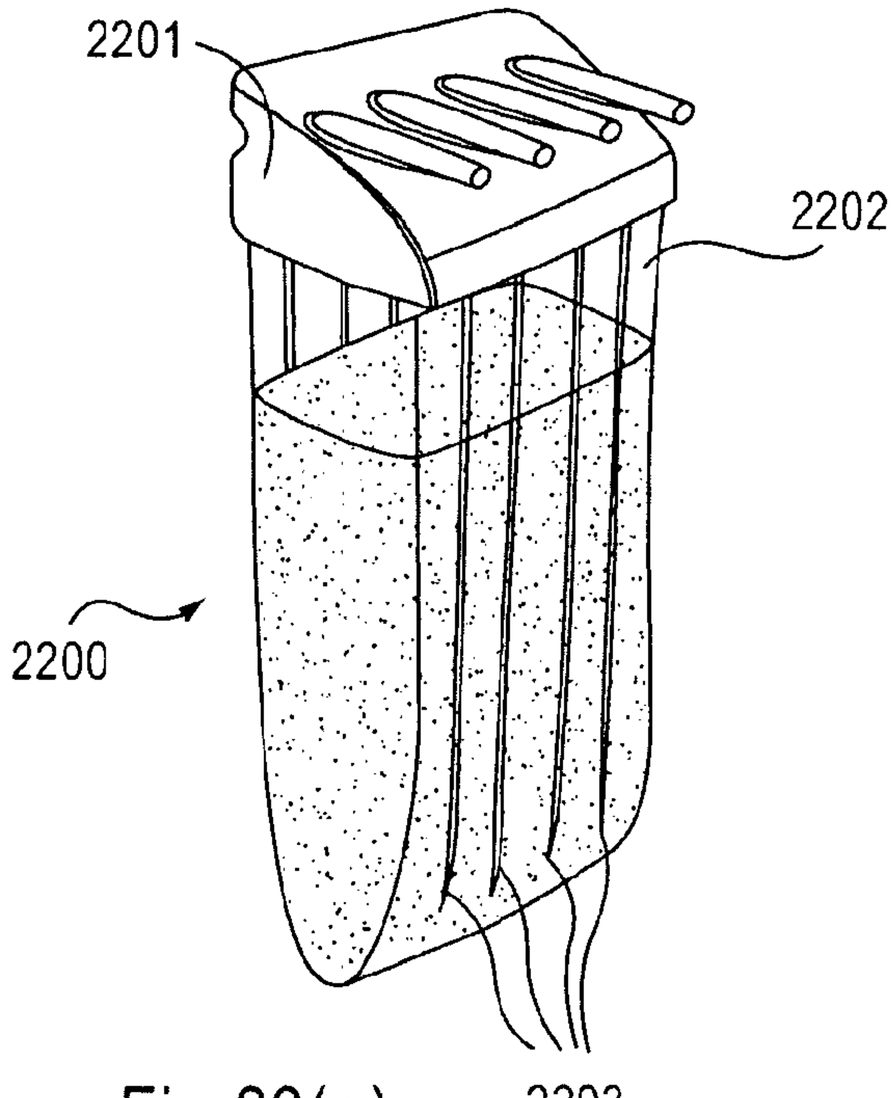


Fig.83(a)

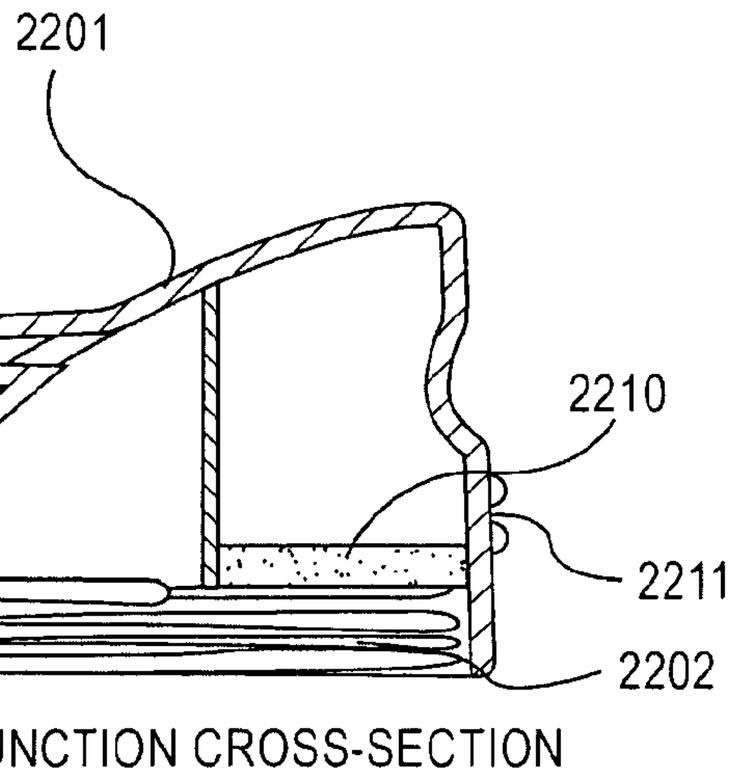


Fig.83(b)

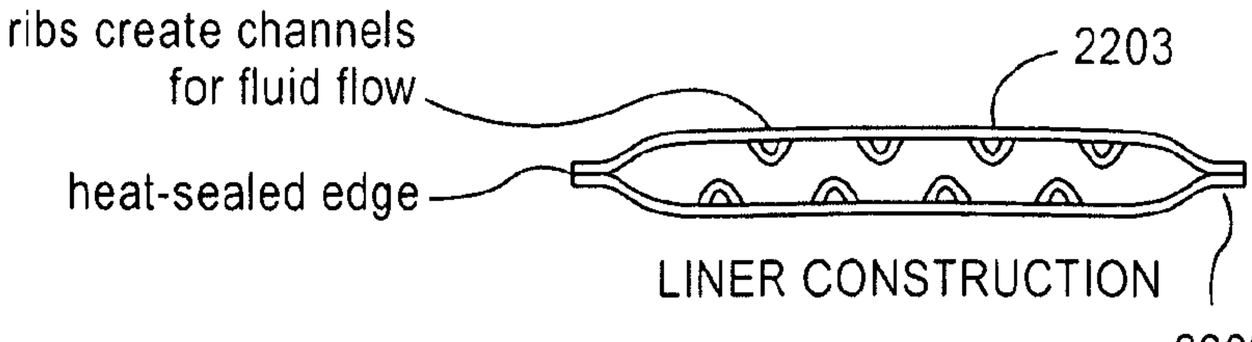


Fig.84

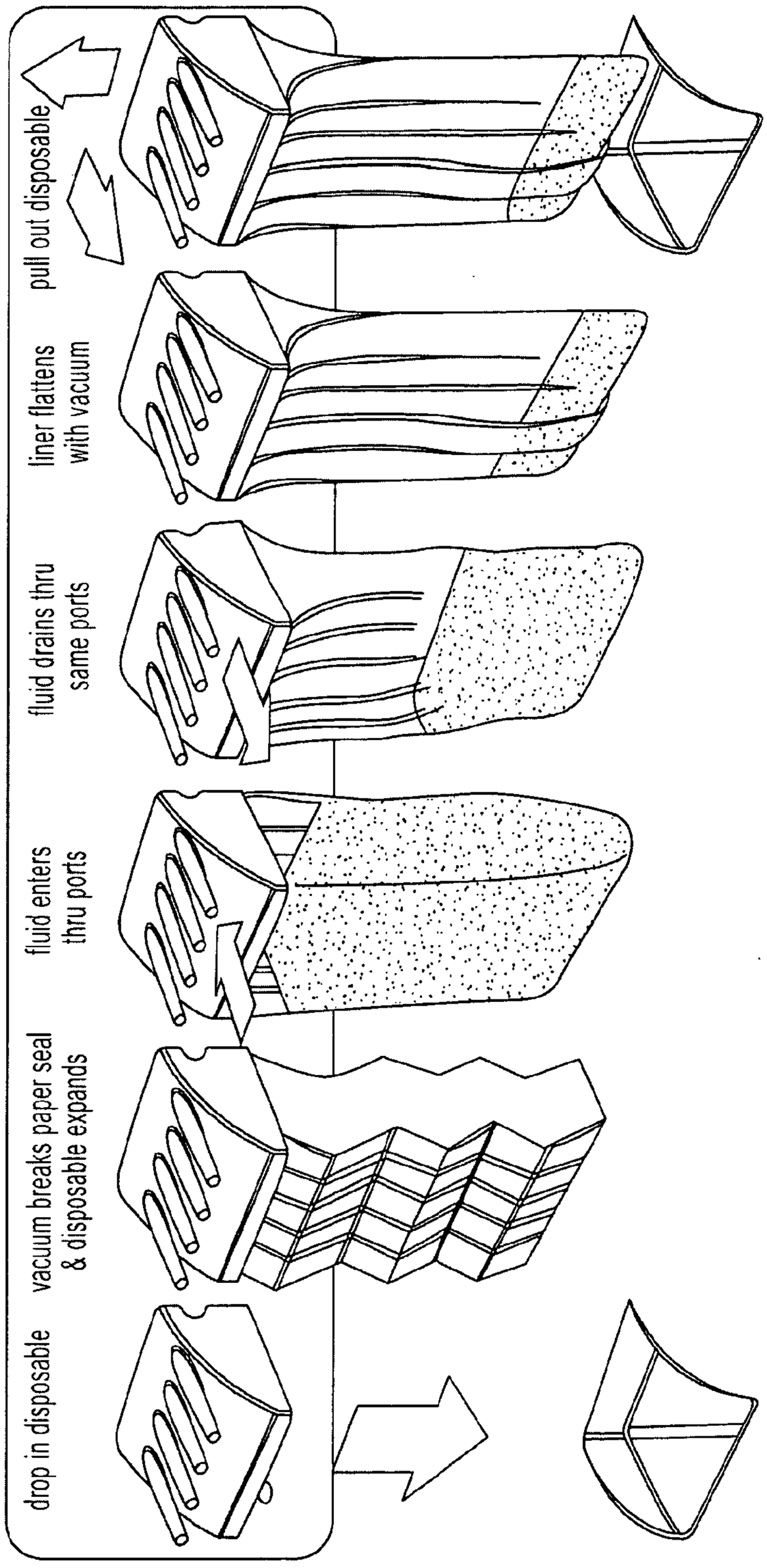

pull out disposable
liner flattens with vacuum
fluid drains thru same ports
vacuum breaks paper seal & disposable expands
fluid enters thru ports
drop in disposable

Fig.85

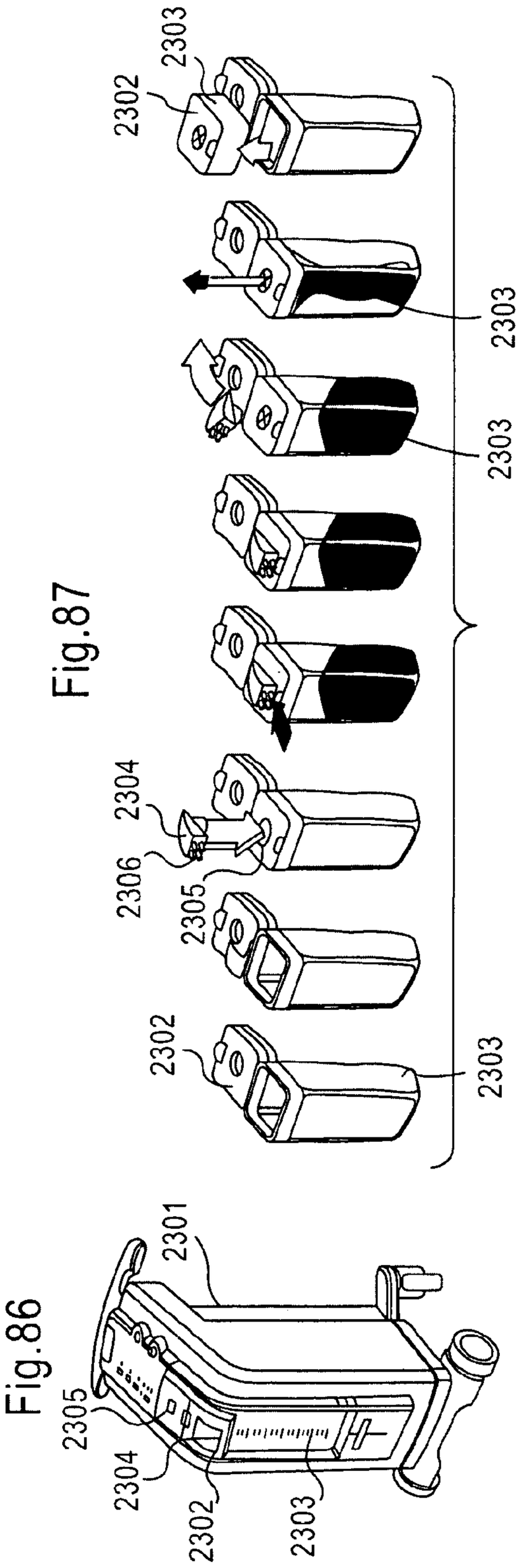


Fig.87

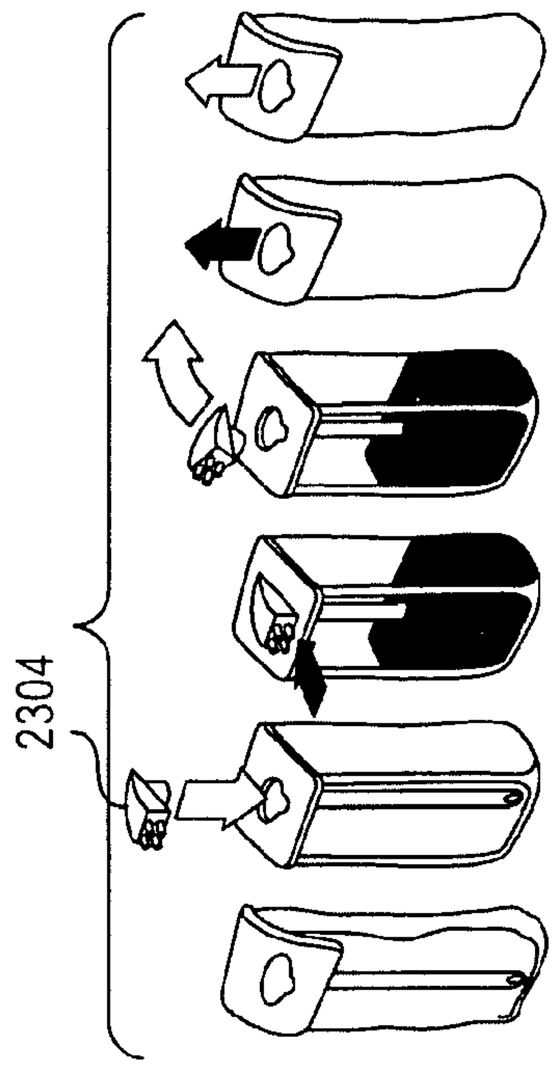


Fig.88(c)

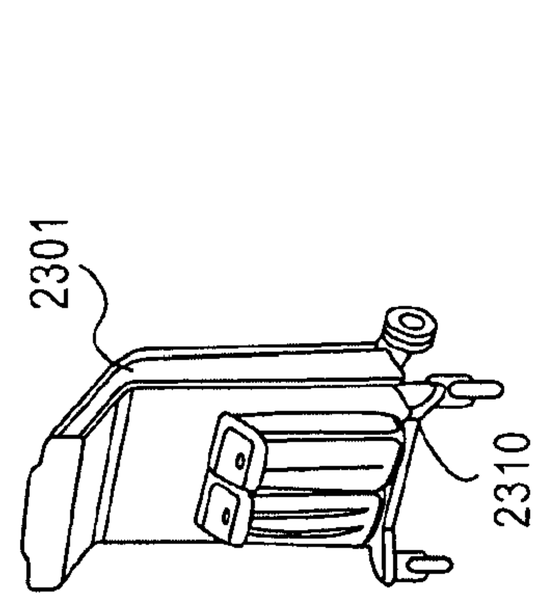


Fig.88(b)

Fig.86

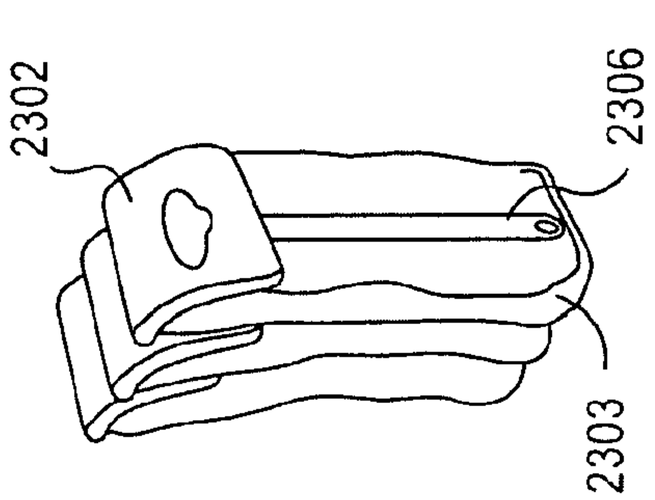


Fig.88(a)

Fig.89(a)

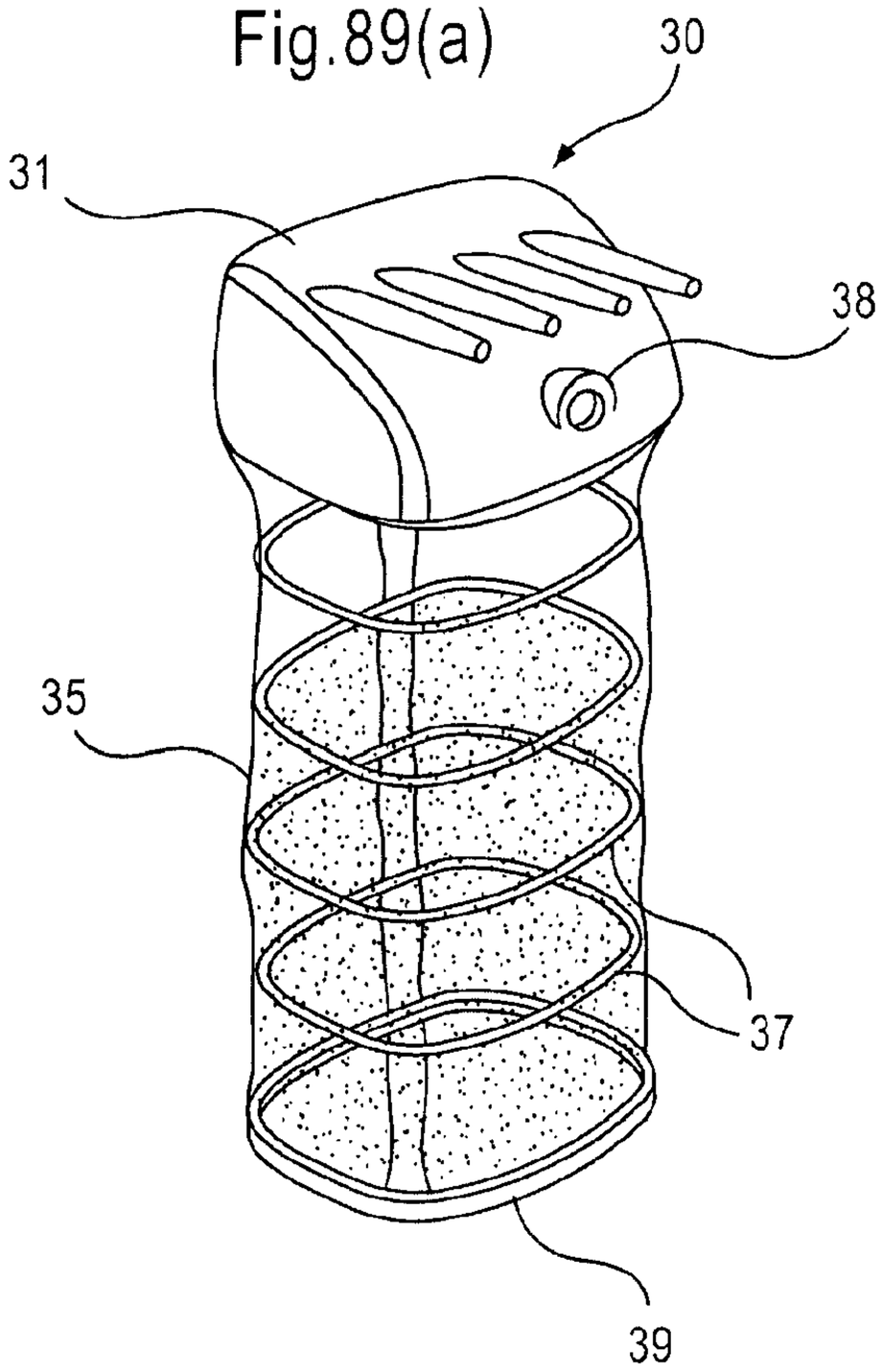
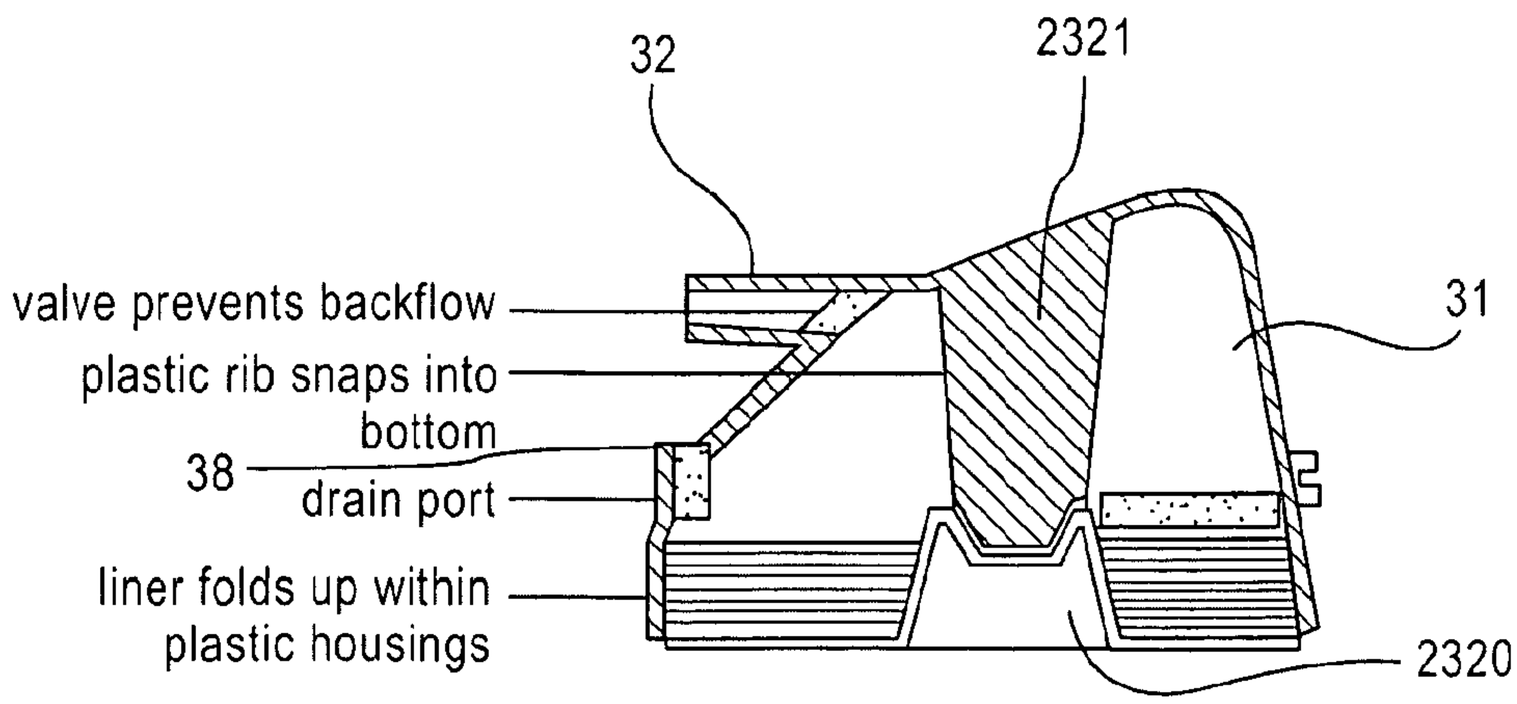


Fig.89(b)



TUBE JUNCTION CROSS-SECTION

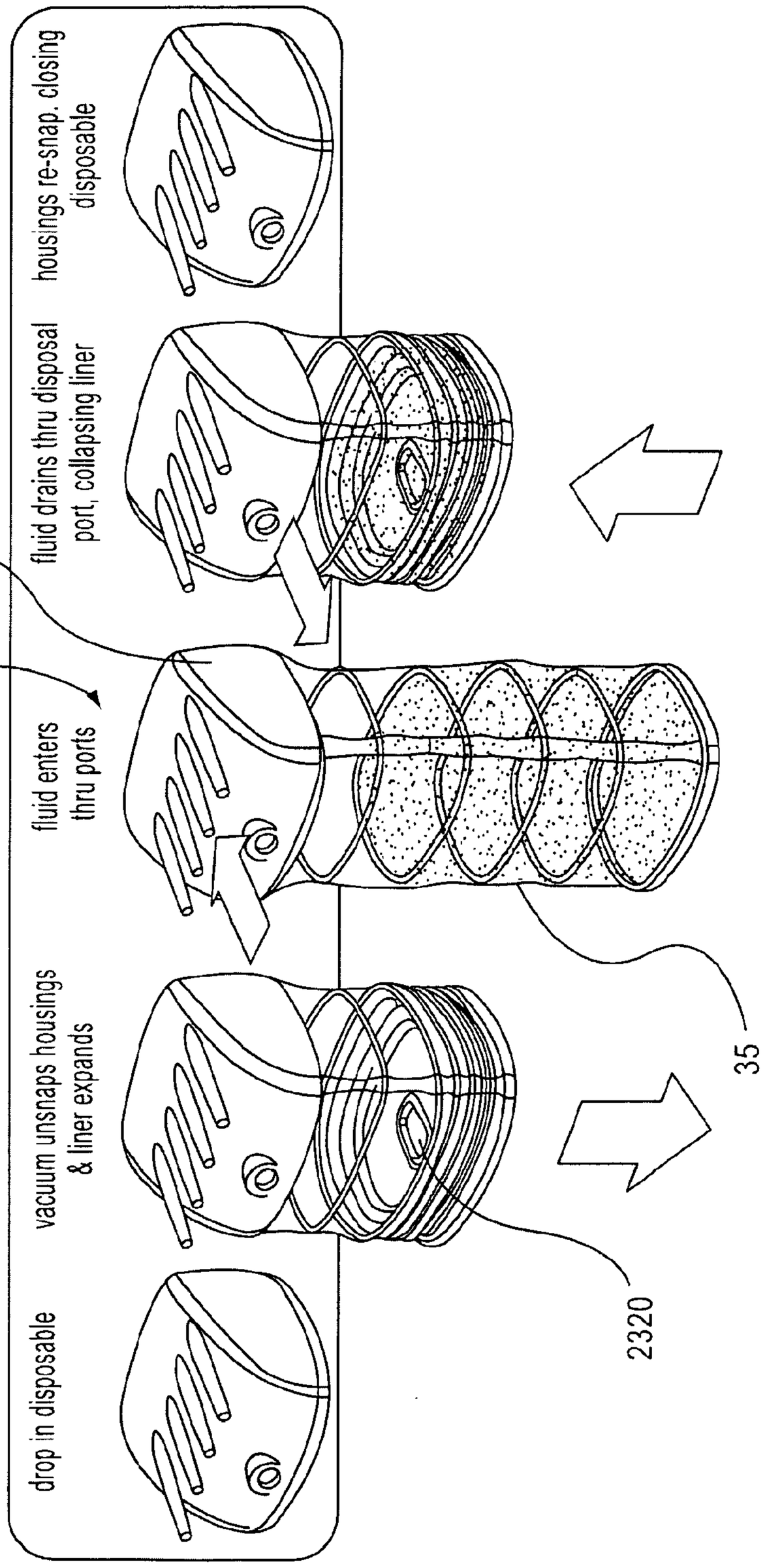

drop in disposable housings re-snap. closing disposable
fluid drains thru disposal port, collapsing liner
vacuum unsnaps housings & liner expands
fluid enters thru ports
31
30
35
2320
20

Fig.89(c)

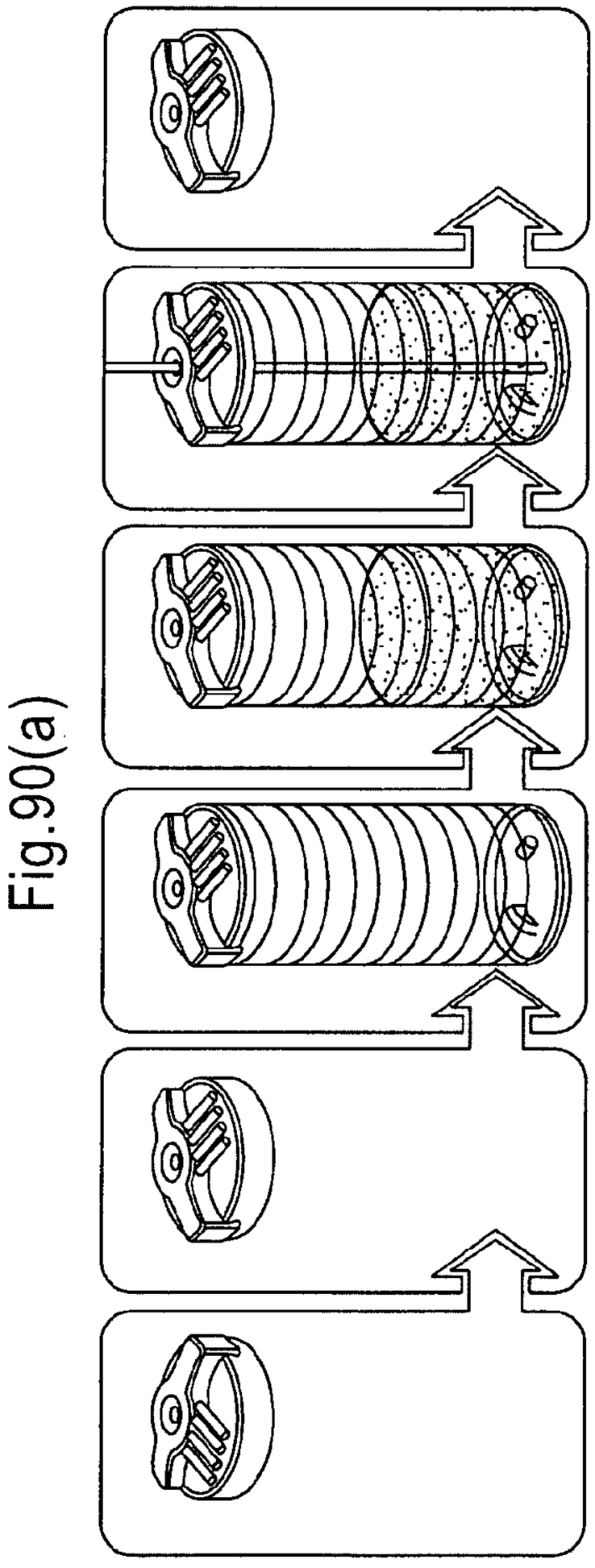


Fig.90(a)

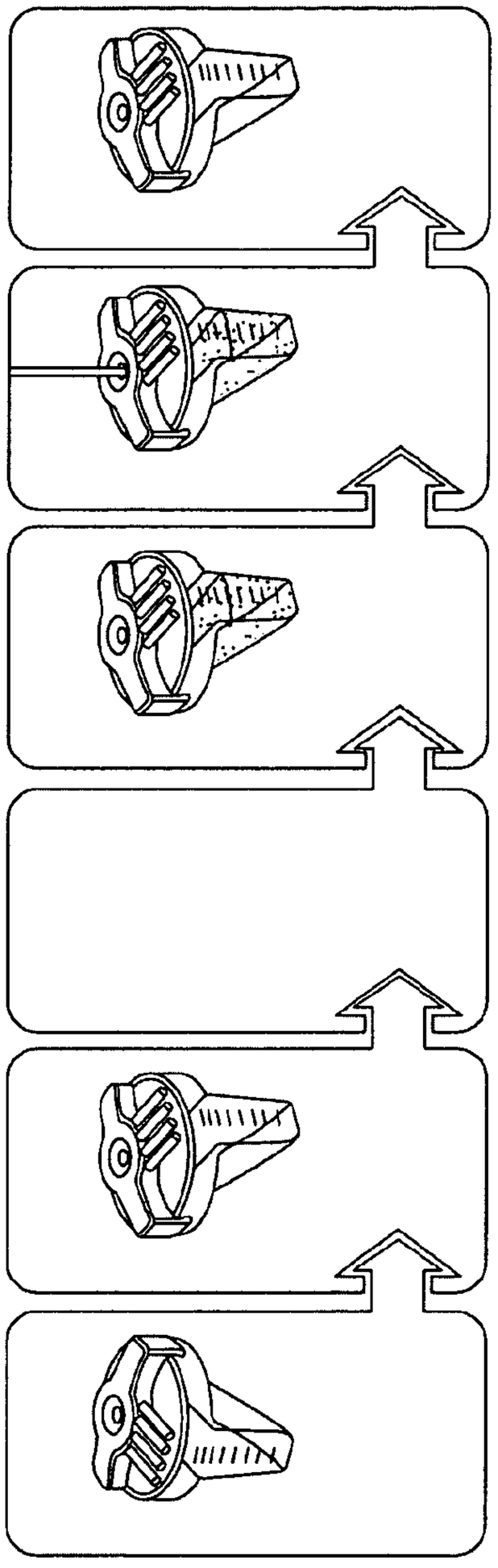


Fig.90(b)

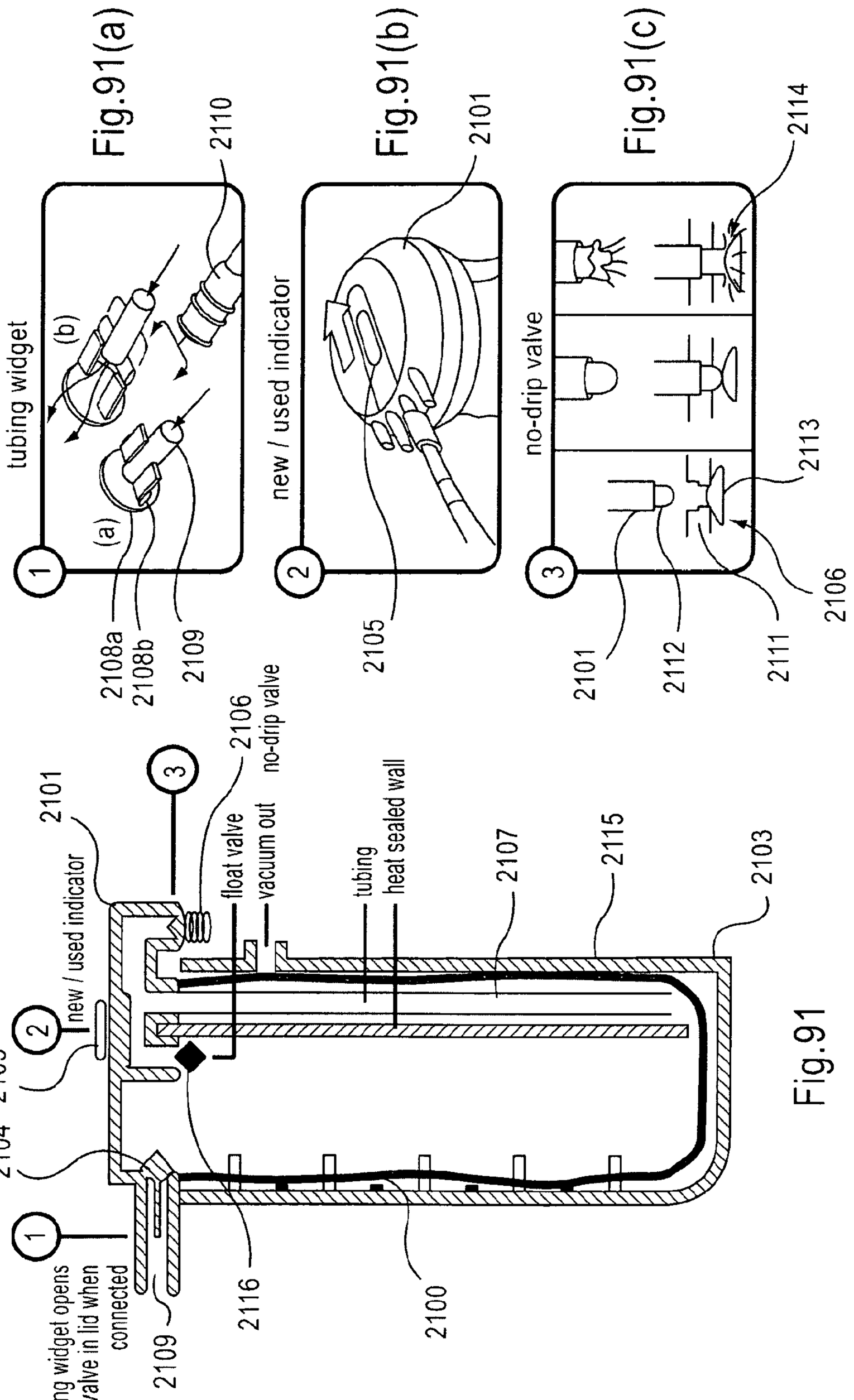

Fig.91(a)
tubing widget
(b)
(a)
2110
2108a
2108b
2109
Fig.91(b)
new / used indicator
2101
2105
Fig.91(c)
no-drip valve
2114
2101
2112
2113
2111
2106
1
2
3
tubing widget opens in-valve in lid when connected
2109
2104
2105
2101
new / used indicator
float valve
vacuum out
no-drip
tubing
heat sealed wall
2107
2115
2103
2116
2100

Fig.91

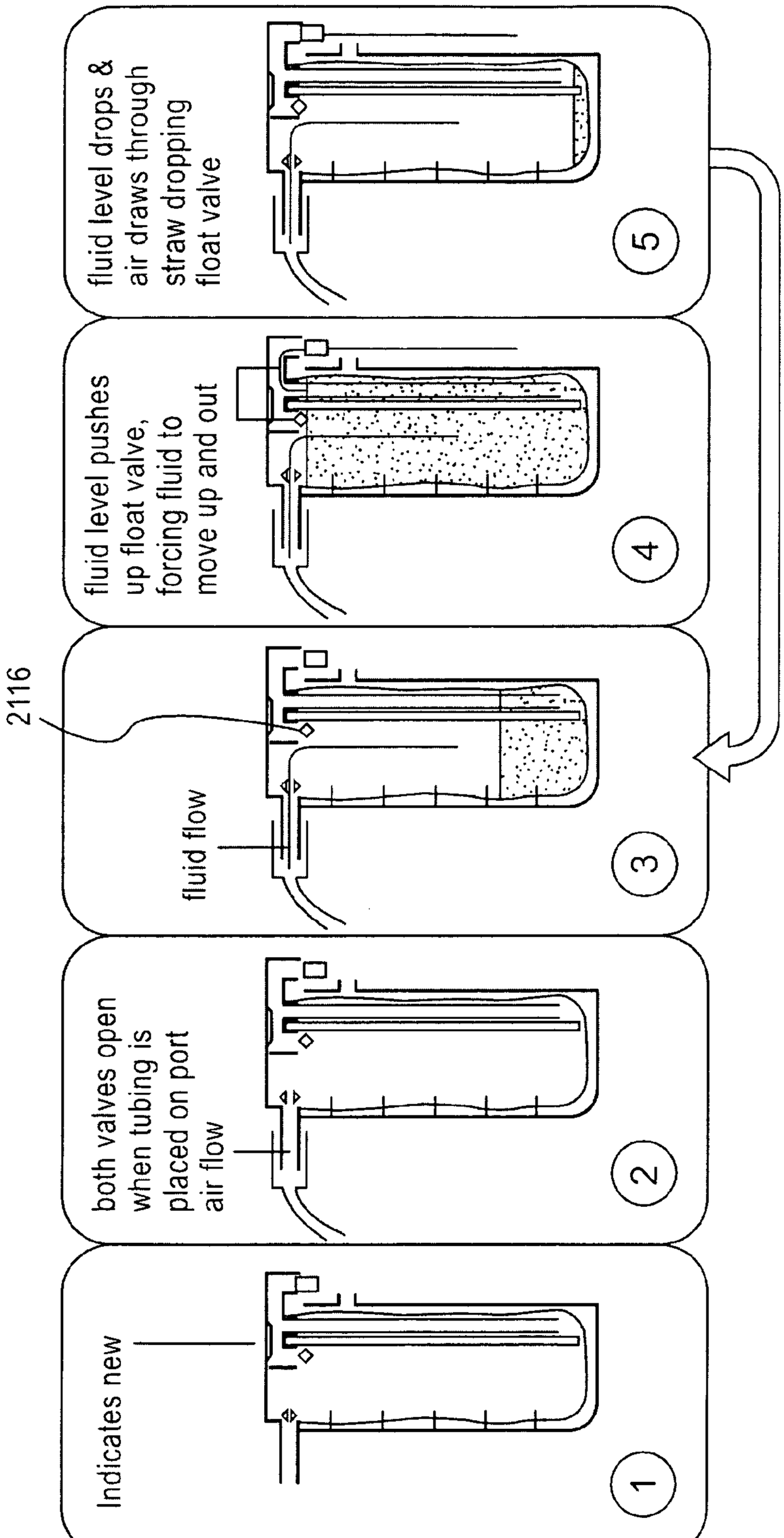

fluid level drops & air draws through straw dropping float valve
5
fluid level pushes up float valve, forcing fluid to move up and out
4
2116
fluid flow
3
both valves open when tubing is placed on port air flow
2
Indicates new
1

Fig.92

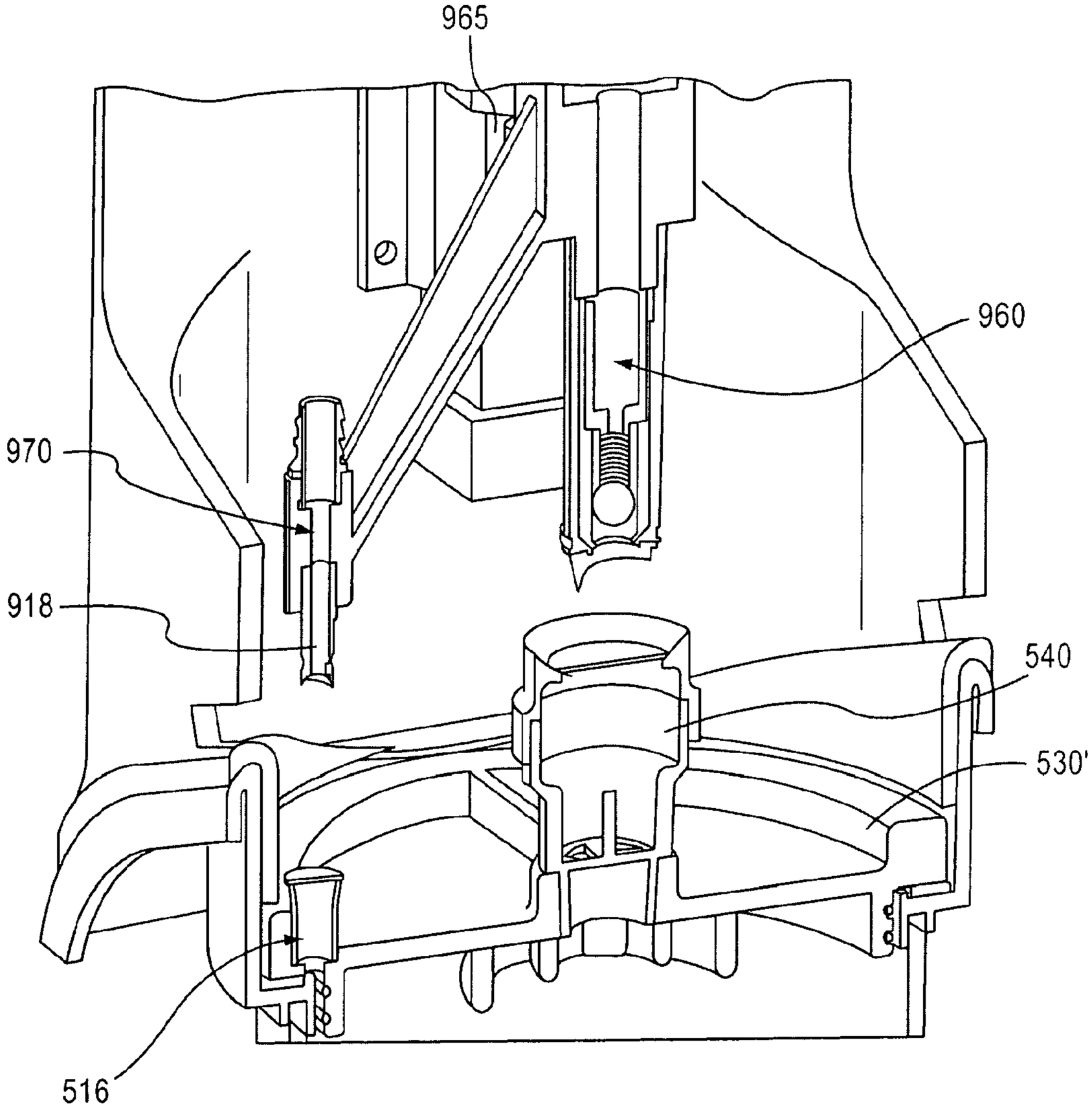


Fig.93

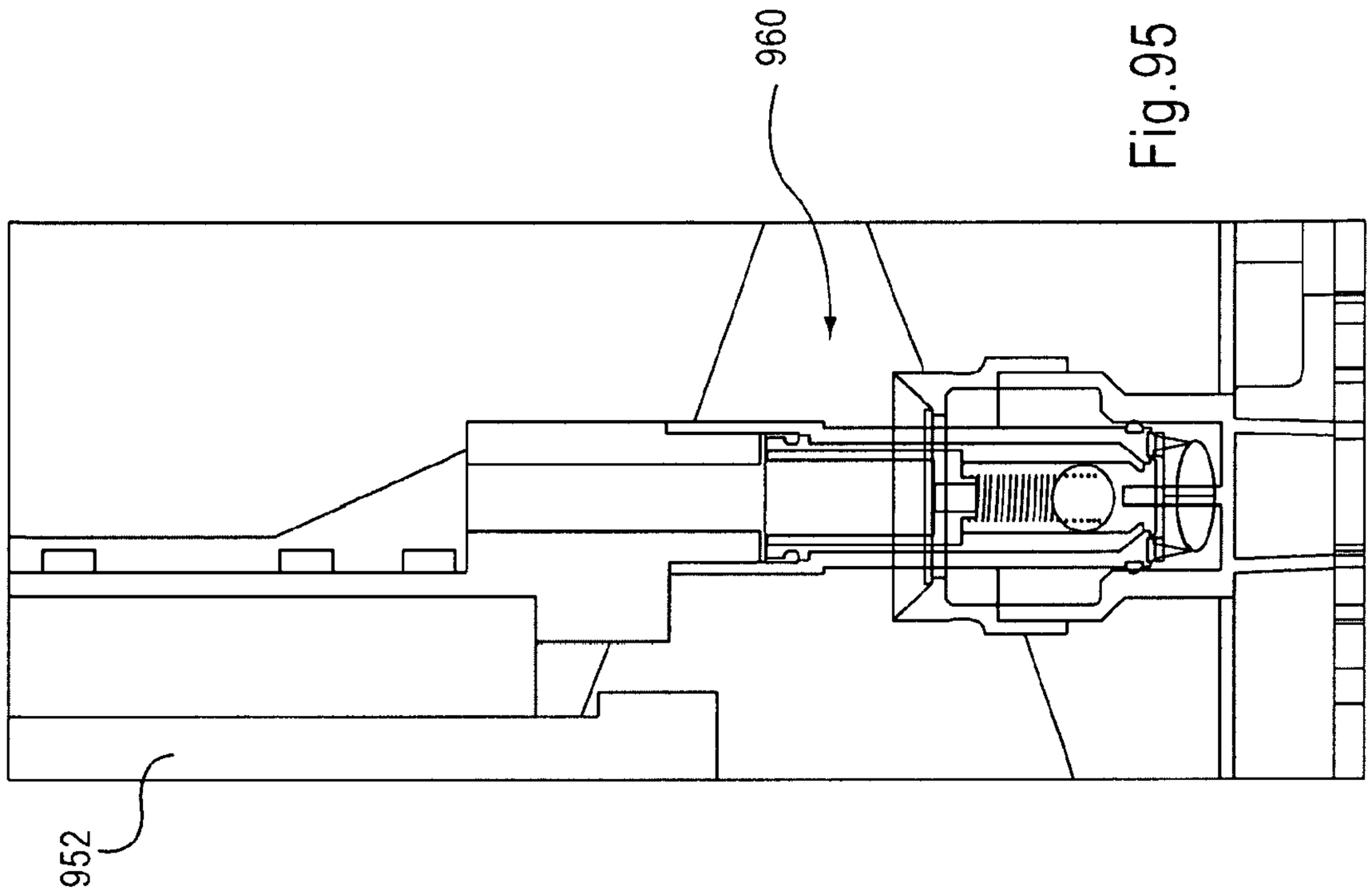


Fig.95

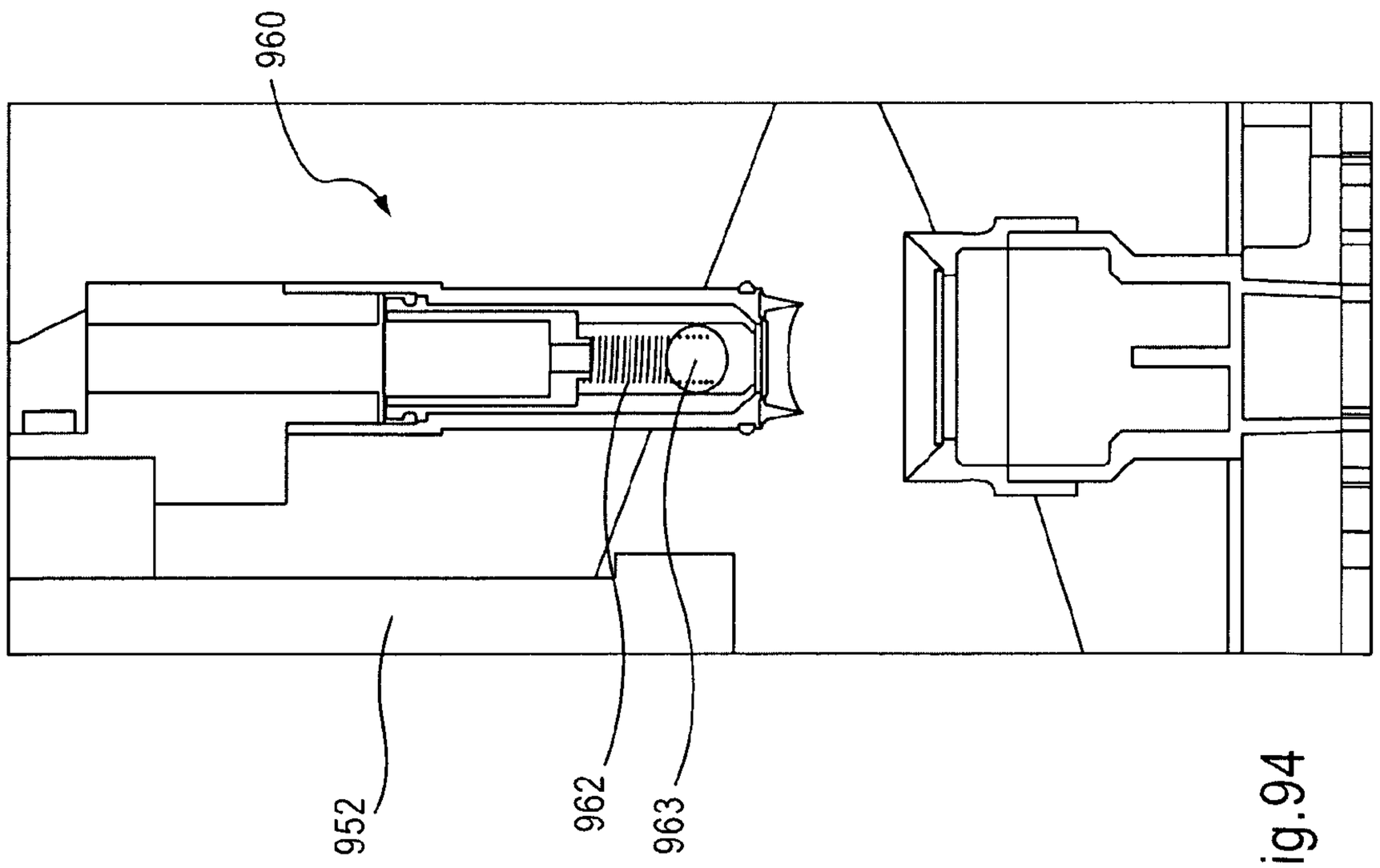


Fig.94

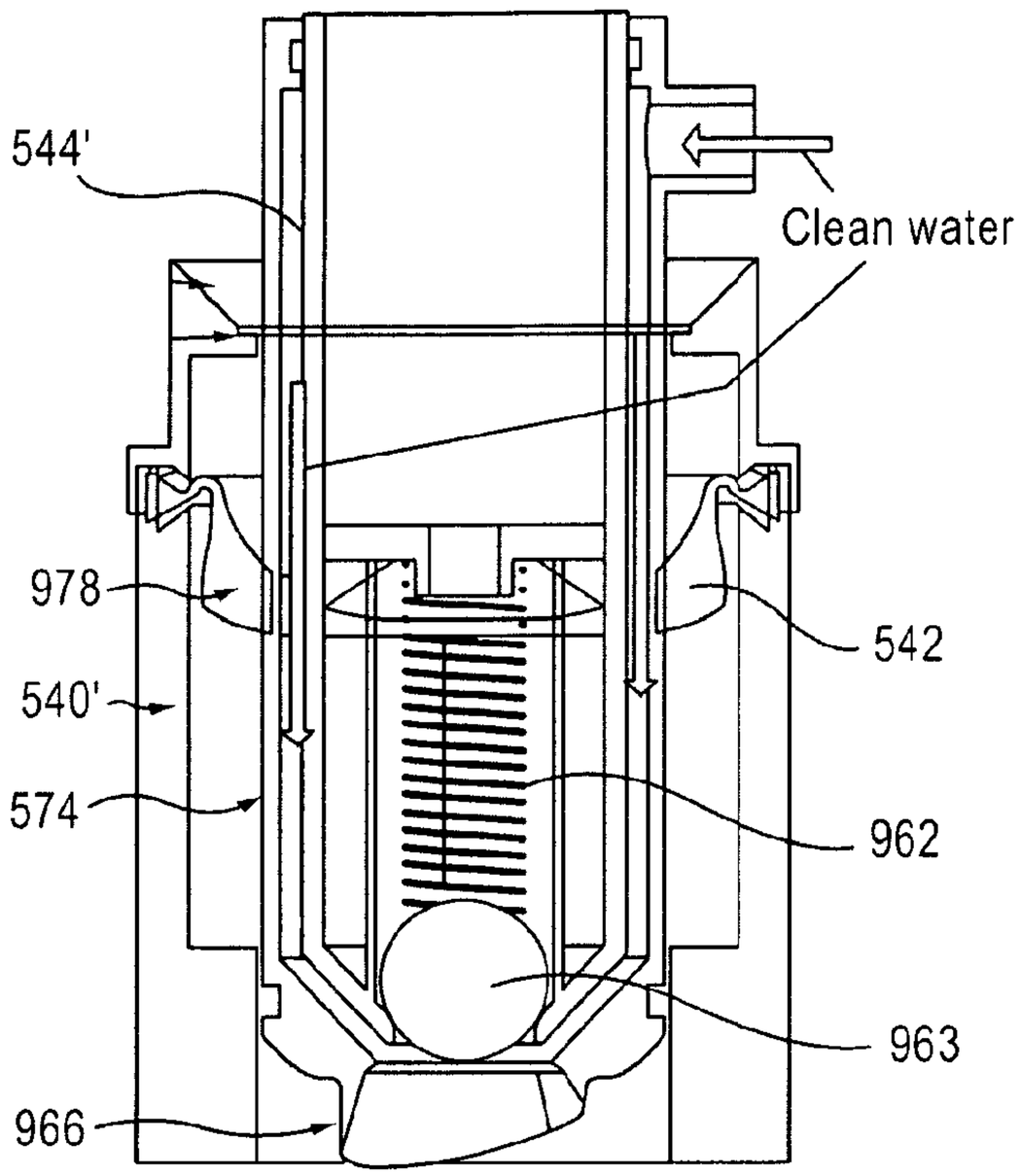

544'
Clean water
978
542
540'
574
962
963
966

Fig.96

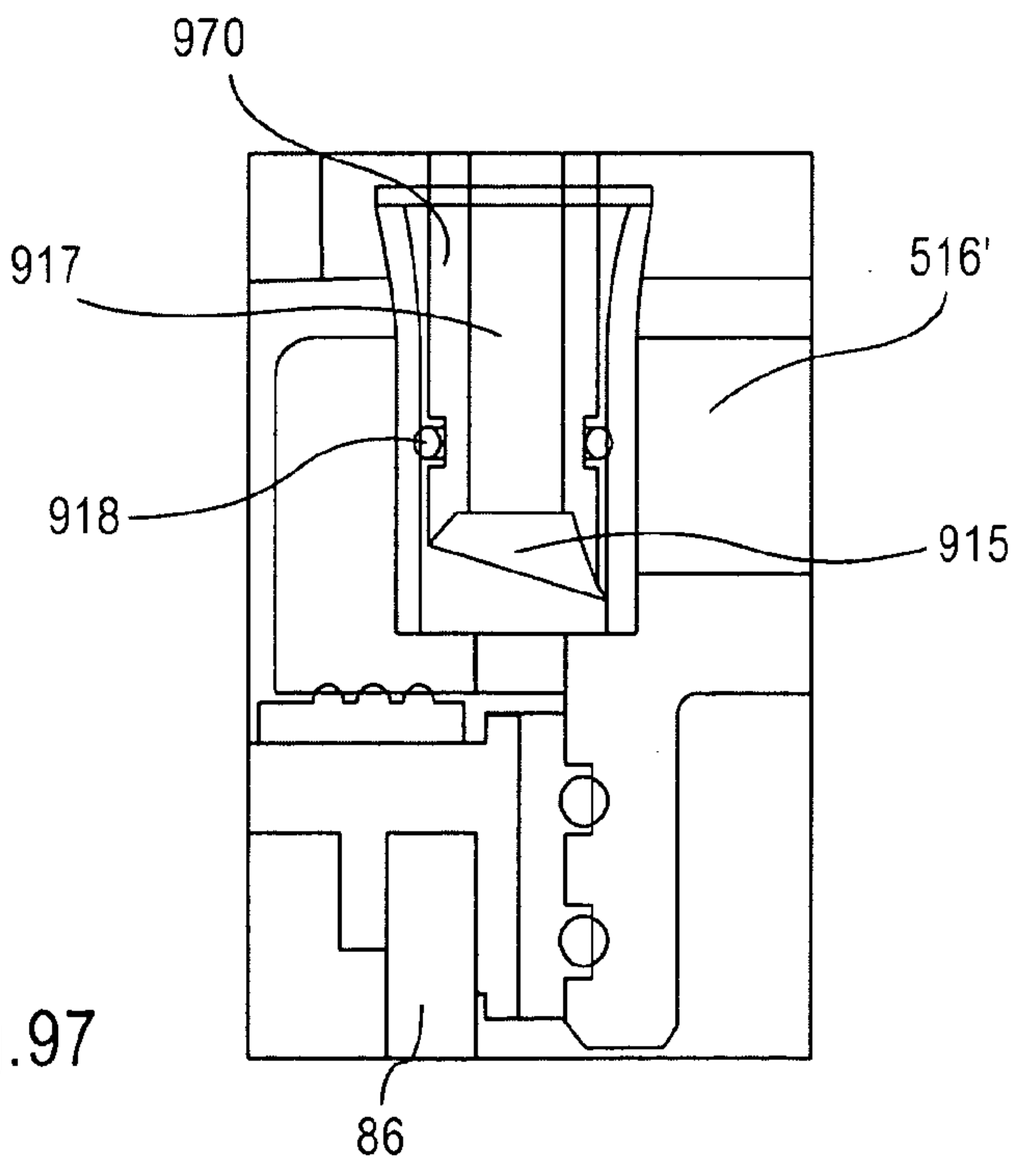

970
917
516'
918
915
86

Fig.97

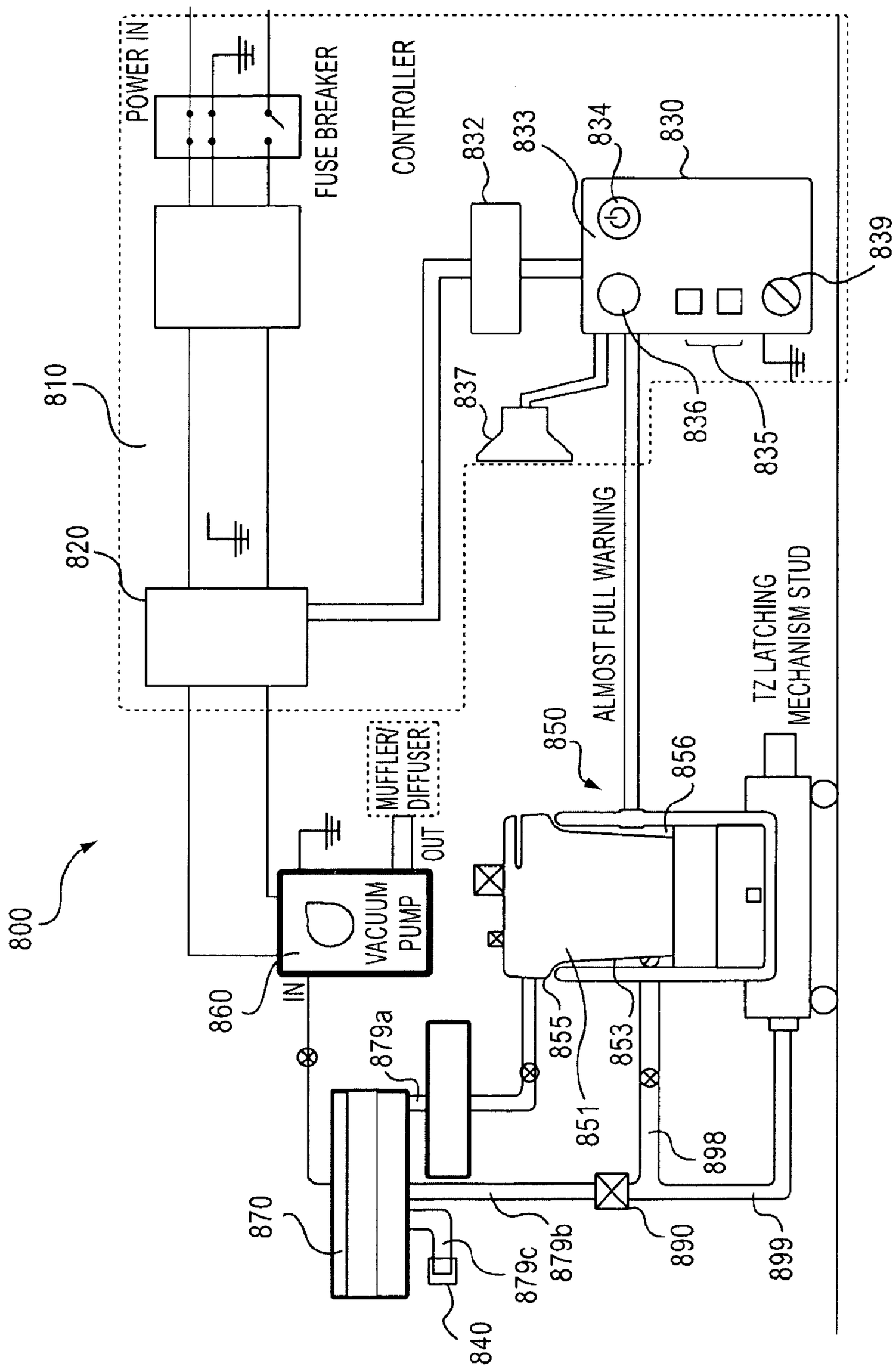

POWER IN
FUSE BREAKER
CONTROLLER
832
833
834
830
839
810
820
837
836
835
FULL WARNING
TZ LATCHING MECHANISM STUD
850
ALMOST FU
856
MUFFLER/ DIFFUSER
OUT
800
VACUUM PUMP
860
IN
879a
855
853
851
898
870
879c
879b
890
899
840

Fig.98

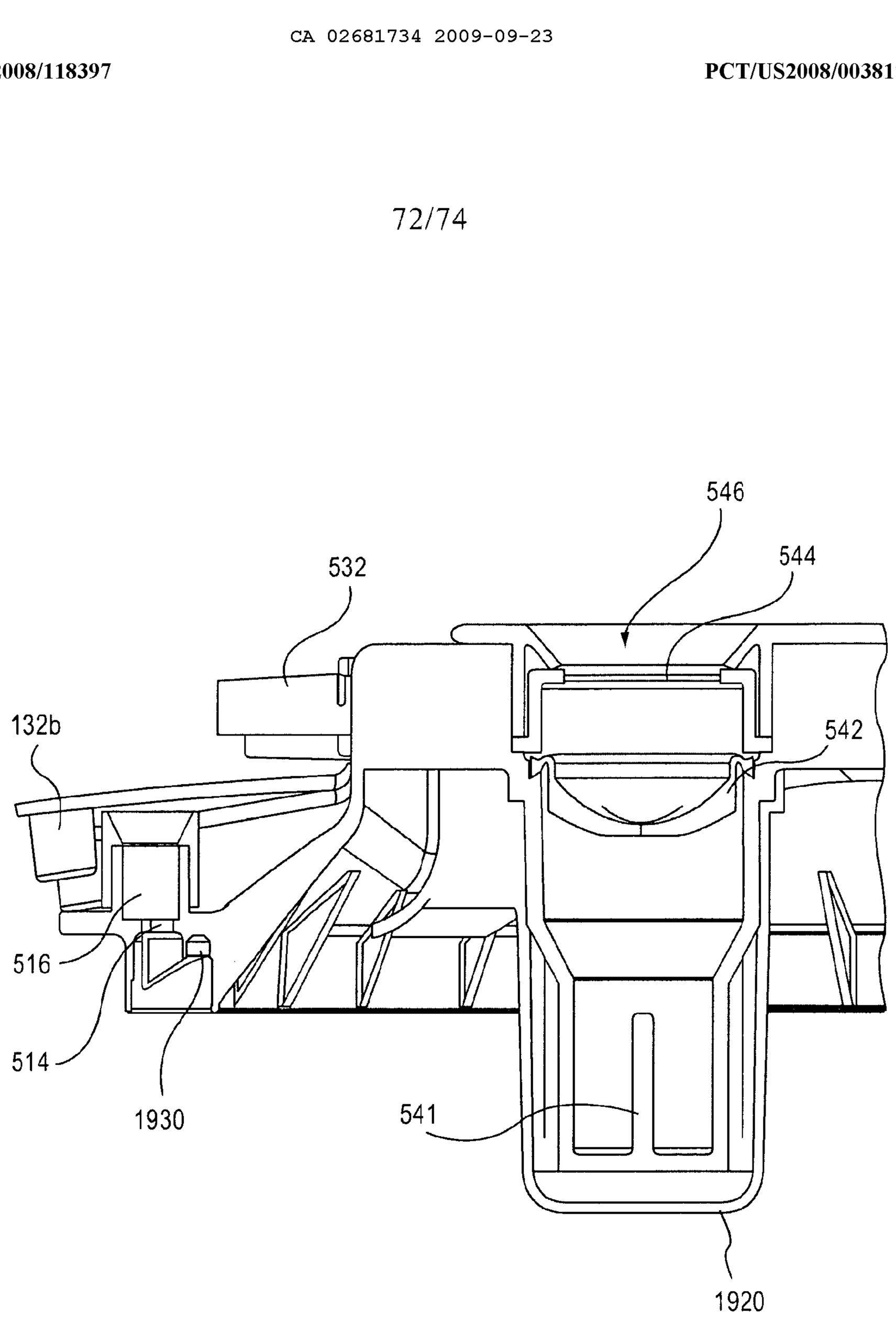


Fig.99

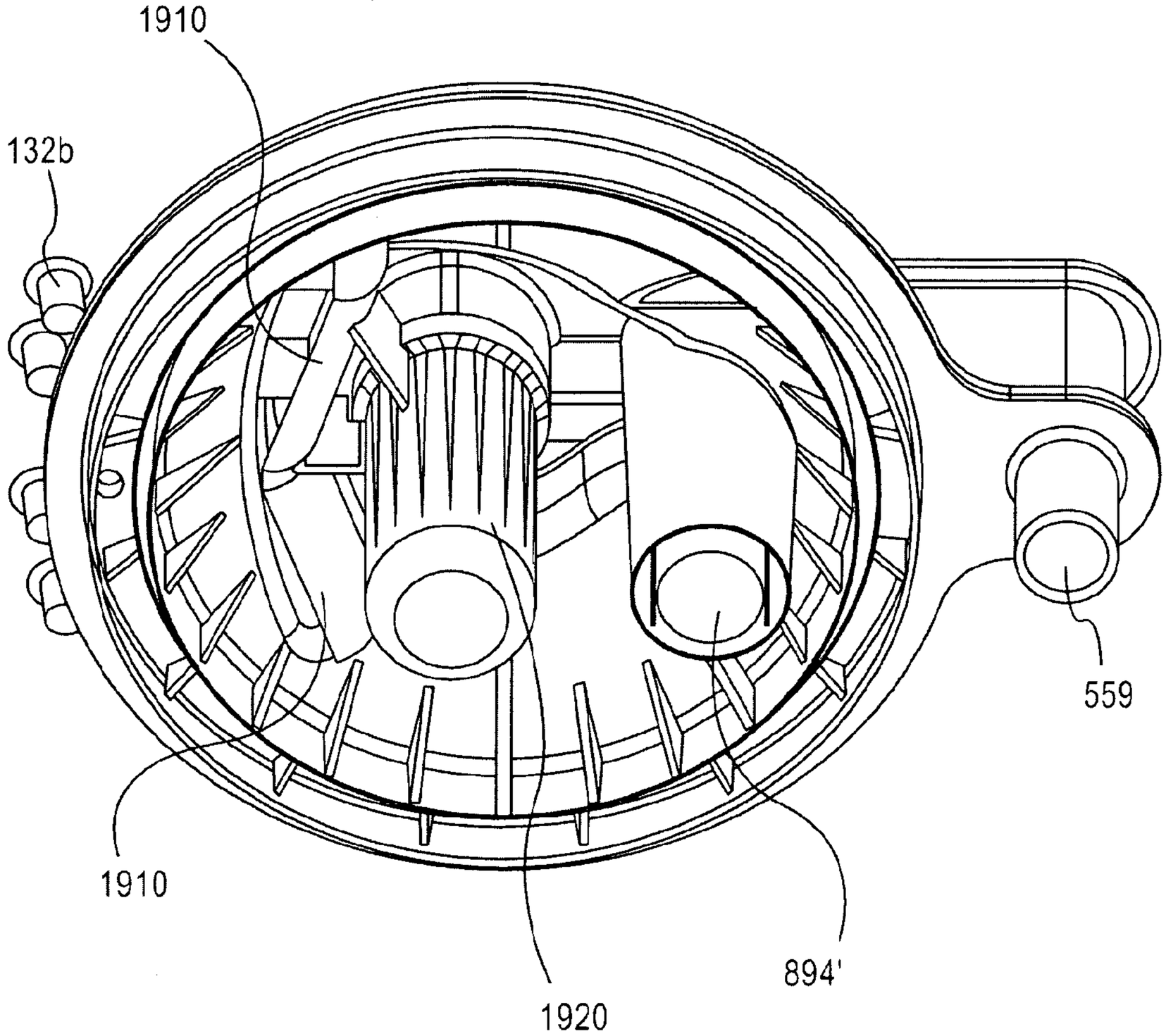


Fig.100

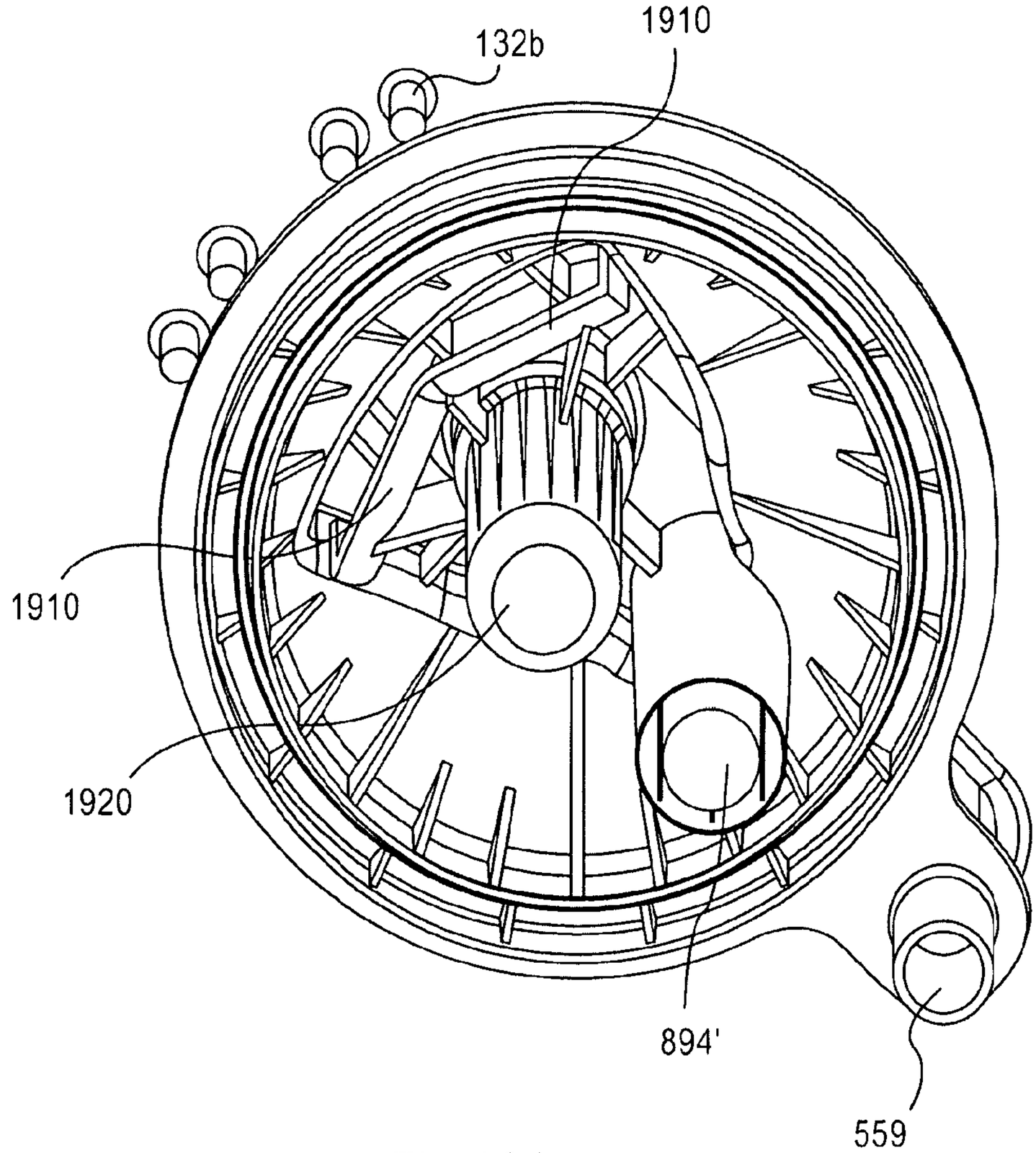
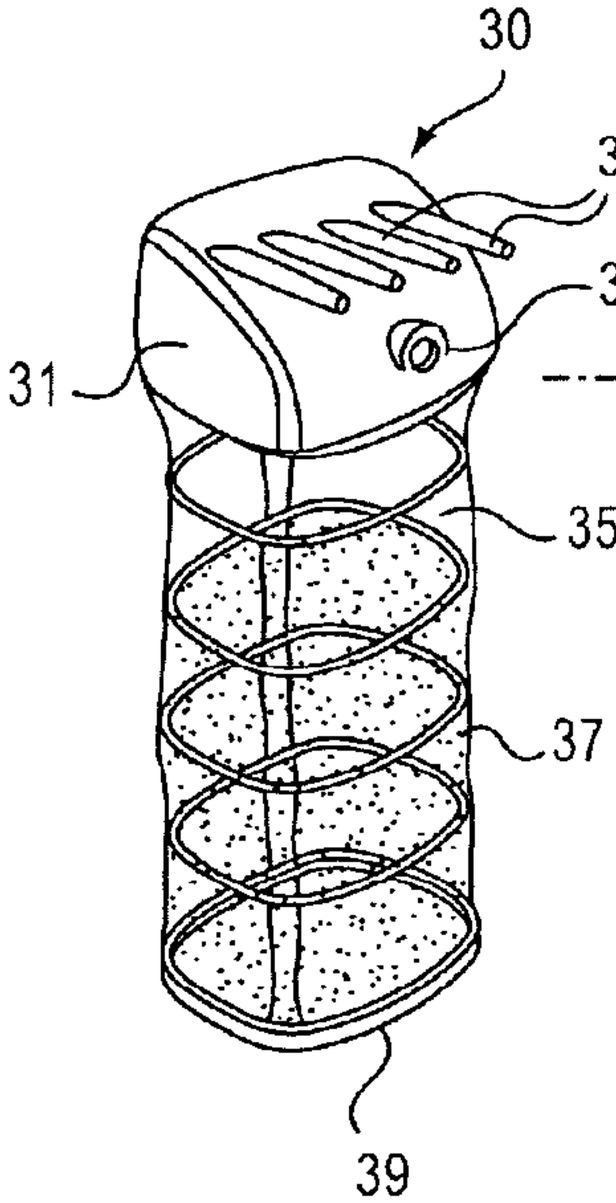
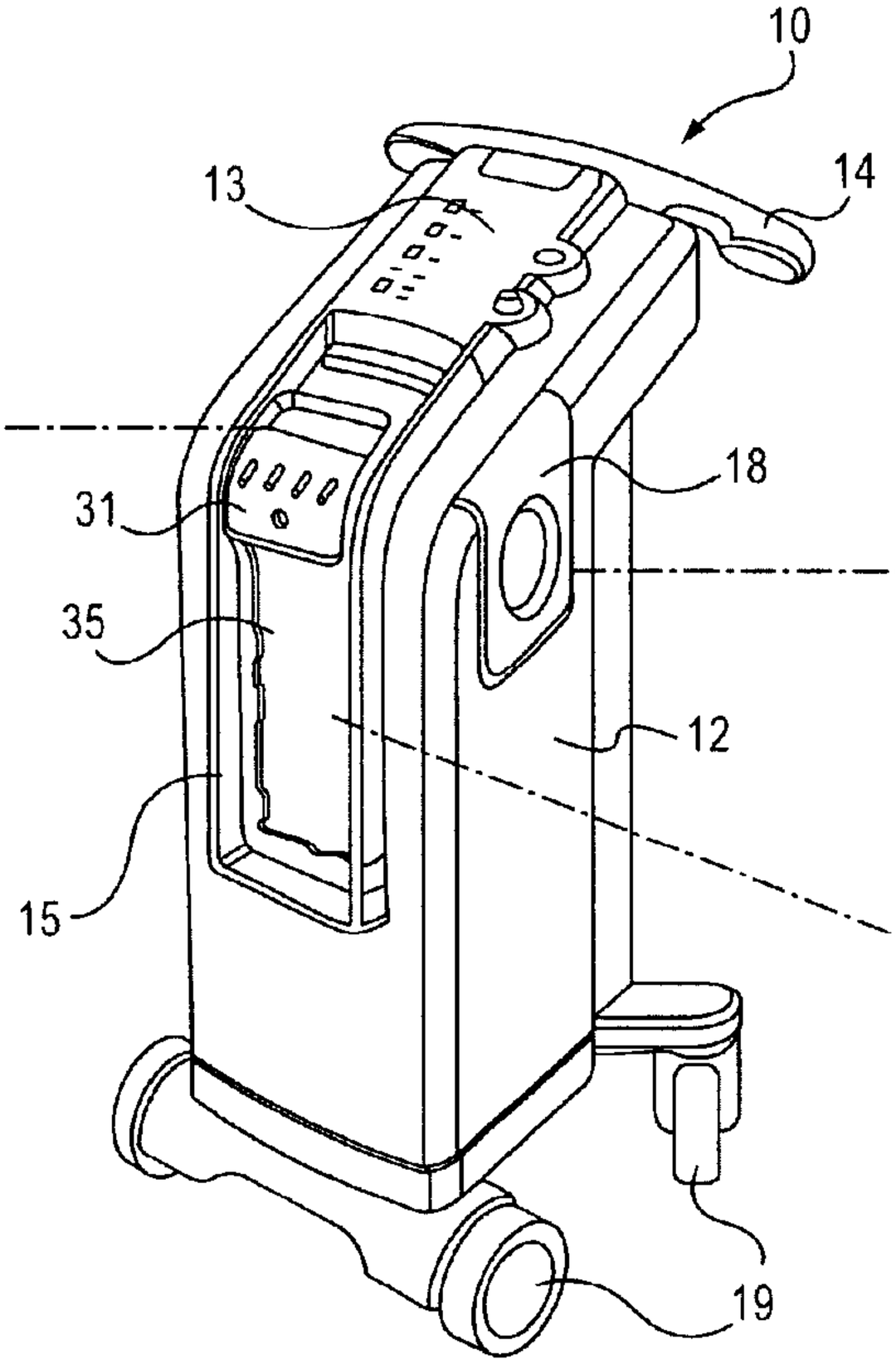
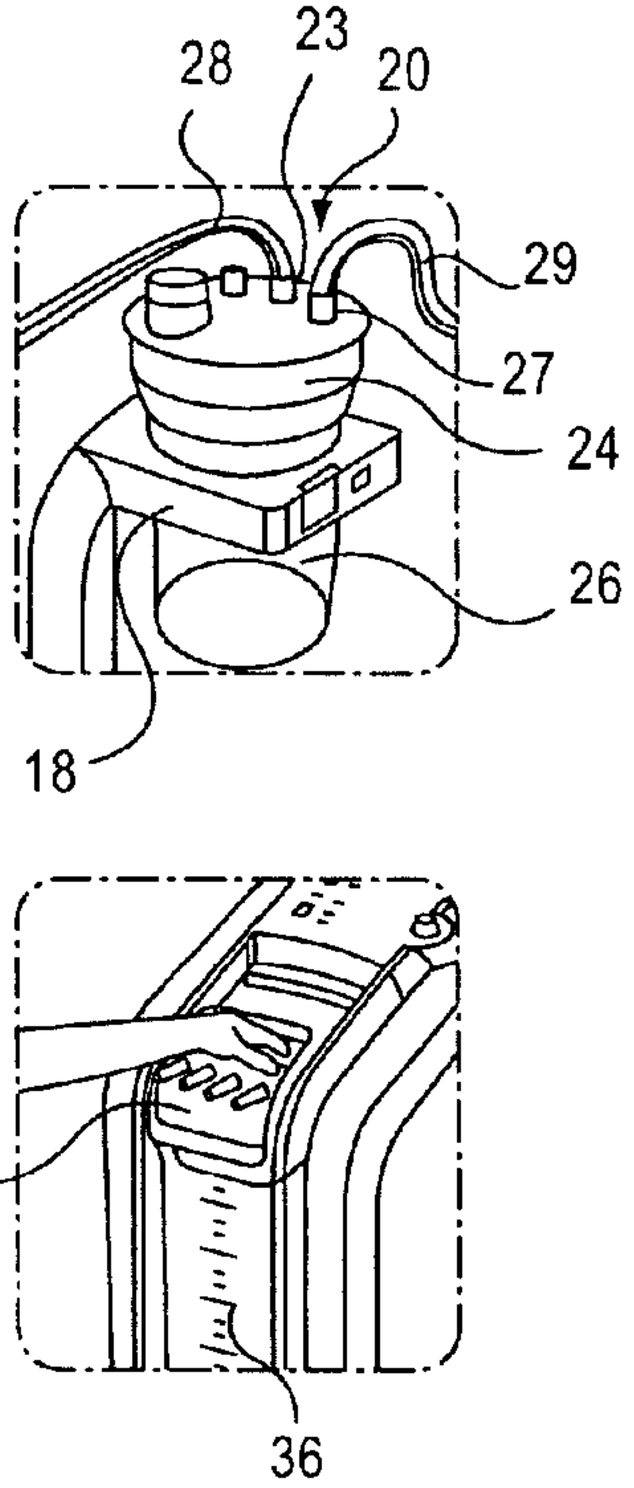


Fig.101


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