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(71) Applicant (*for all designated States except US*): **COLOPLAST A/S** [DK/DK]; Holtedam 1, DK-3050 Humlebæk (DK).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **BUDIG, Klaus** [DK/DK]; Lærkevej 13, DK-3650 Ølstykke (DK). **JEPSEN, Erik Lund** [DK/DK]; Bringekrogen 38, DK-3500 Værløse (DK).

(74) Agent: **INSPICOS A/S**; P.O. Box 45, Kogle Allé 2, DK-2970 Hørsholm (DK).

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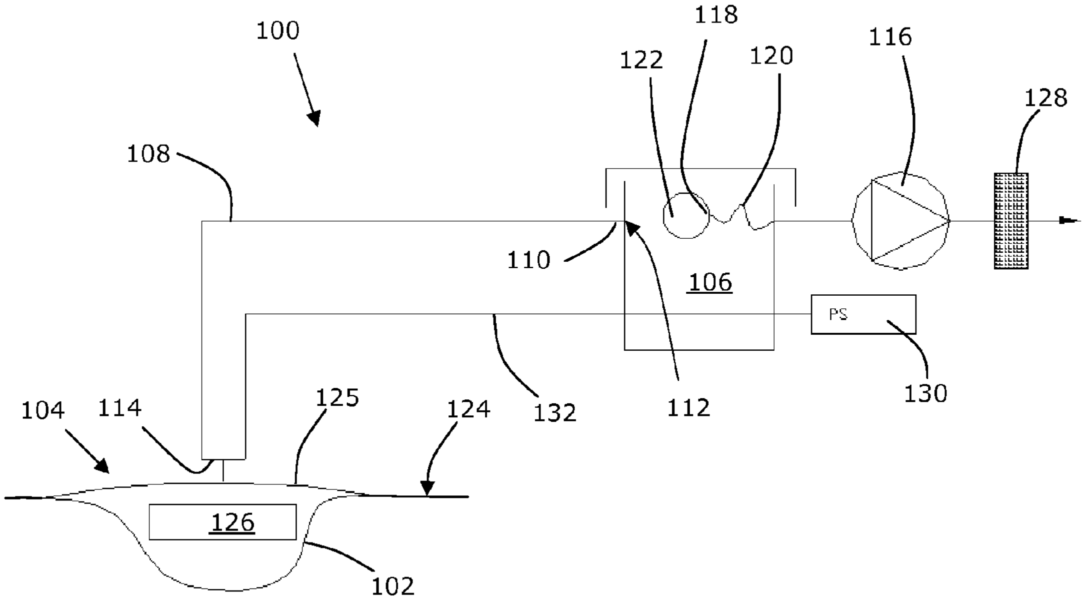

Fig. 1

(57) Abstract: A wound treatment device for applying a reduced pressure to a wound site, the wound treatment device comprises a wound bandage fluidly connected to a canister and a vacuum source for sucking liquids from the wound site into the canister. The wound treatment device comprises an outlet arrangement defining an outlet of the canister, at least a part of the outlet arrangement being movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet.

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A WOUND TREATMENT DEVICE

FIELD OF THE INVENTION

The present invention relates to a wound treatment device for applying a reduced pressure to a wound site such that liquids from the wound site are collected in a canister of the wound treatment device. In particular the present invention relates to a wound treatment device wherein the canister comprises an outlet and means for preventing any liquids present in the canister from entering the outlet.

BACKGROUND OF THE INVENTION

In order to improve wound healing it is advantageous to apply a reduced pressure to a wound to be healed. Accordingly, wound treatment devices for applying vacuum to a wound site have been developed. Such devices often comprise a canister for collecting liquids sucked from the wound site. Most canisters comprise an outlet allowing air to be evacuated from the canister. It is generally desirable to ensure that the liquids remain in the canister and to ensure that such liquids are not expelled to the surroundings, as such liquids may contain viruses and bacteria.

EP 0 865 304 discloses a portable wound treatment apparatus comprising a canister fluidly connected to a wound site by means of a tube. Suction is applied to the wound site via the canister by means of a tube connected to a pump and an outlet of the canister. A filter is placed at or close to the outlet to prevent liquid or solid particles from entering the tube connected to the pump.

US 2005/0261642 discloses a wound treatment device comprising a container with a shutoff mechanism with a float valve assembly in the form of a ball which is held and suspended in a cage positioned below a valve seat disposed within the opening at the top of the container below a second port that will float upon the exudate and will be lifted against the valve seat as the container fills with exudate.

One disadvantage of the invention according to US 2005/0261642 is that for most orientations of the container, the shutoff mechanism will not shutoff, as the ball will not float into a position in which it blocks the second port.

Accordingly, it is an object of an embodiment of the present invention to provide an outlet arrangement which for any position of the canister, prevents liquid from entering the outlet arrangement.

Moreover, it is an object of an embodiment of the present invention to provide an alternative to known solutions.

DESCRIPTION OF THE INVENTION

The present invention relates to a wound treatment device for applying a reduced pressure to a wound site, the wound treatment device comprising:

- a wound bandage adapted to cover a wound such that an airtight seal is provided in the area of the wound site,

- a canister for collecting liquid sucked from the wound site, the canister defining an inlet and at least one outlet for evacuating air from the canister,

- a drainage conduit interconnecting the wound bandage and the inlet of the canister,

- a vacuum source for providing a reduced pressure, the vacuum source being arranged such with respect to the drainage conduit and/or the canister that operation of the vacuum source causes liquids to be sucked from the wound site and to flow into the canister via the inlet, and

wherein the wound treatment device comprises an outlet arrangement defining the outlet(s), at least a part of the outlet arrangement being movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet(s).

In one embodiment at least one of the outlet(s) is movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet. In one embodiment, the outlet arrangement comprises one outlet which is movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet.

In the context of the present invention, the term "outlet" shall designate at least the passage/hole into which a fluid may flow into. In some embodiments, the outlets also designate the elements/structures which define the hole/"entrance" of the outlet. As an example, the end hole in a hose is an outlet, but in some embodiments, the end part of the hose which define the outlet/hole/"entrance" shall also be called the outlet. This is especially the case when in this application it is stated that the outlet comprises buoyancy means.

In one embodiment, at least a part of the outlet arrangement is movable within the canister, such that for any position of the canister, one or more of the outlet(s) is/are positioned above any liquid in the canister whereby liquid cannot enter said one or more outlet(s).

The drainage conduit of the wound treatment device may be defined by a tube. In one embodiment the tube is transparent so as to allow a user to visually determine the content of the tube, e.g. determine whether the tube contains liquids, gasses or is occluded.

In one embodiment the wound bandage and/or the drainage tube (conduit) may comprise means for detachably connecting the wound bandage to the drainage tube such that the drainage tube is fluidly connected to the wound bandage. As an example the wound bandage and the drainage tube (conduit) may be connected to each other by means of an interference fit.

In another embodiment the wound bandage is permanently connected to the drainage tube e.g. by means of glue or welding.

The wound bandage may comprise a sealing layer such as a film or a foil, for covering the wound site so as to allow a substantially airtight seal to be provided in the area of the wound. In one embodiment, the substantially airtight seal is impermeable to air but permeable to vapour. In another embodiment, the substantially air tight seal is impermeable to both air and vapour. In order to provide the substantially airtight seal, sealing means may be provided in a rim portion of the sealing layer, such as an adhesive for adhering the sealing layer to the skin of a user. Alternatively, or as a supplement, a sealing tape may be used to attach the sealing layer to the skin of the user.

The wound treatment device may comprise a wound contacting element such as a wound dressing member, adapted to be interposed between the sealing layer and the wound site so as to prevent the sealing layer from contacting the wound and so as to allow a vacuum to be applied to the whole area of the wound. Furthermore, the wound bandage may comprise a connector for connecting the wound bandage to the drainage conduit and/or a venting conduit for venting the wound bandage and/or the drainage conduit.

In order to provide a vacuum in the area of the wound, the wound treatment device comprises a vacuum source such as a pump. The pump may comprise a pump head operated by a motor which may be connected to the pump head via an eccentric. In another embodiment, the wound treatment device is adapted to be connected to a central vacuum source such as a central vacuum source in a hospital e.g. of the kind which is accessible in most hospital bed rooms/patient suits.

The wound bandage is fluidly connected to a canister for collecting liquids from the wound site. The canister defines an inlet to which the drainage conduit is fluidly connected and one or more outlets.

The vacuum source, which is adapted to provide a reduced pressure, is arranged such with respect to the drainage conduit and/or the canister that operation of the vacuum source causes liquids to be sucked from the wound site and to flow into the canister via the inlet.

In one embodiment, the vacuum source is interposed between a first and a second part of the drainage conduit, such that the wound bandage and the first part of the drainage conduit are provided upstream relative to the vacuum source, and such that the canister and the second part of the drainage conduit are provided downstream relative to the vacuum source. In the latter embodiment, the vacuum source is adapted to pump both liquids and gasses sucked from the wound site.

In another embodiment, the vacuum source is provided downstream the canister by being fluidly connected to one or more outlets of the canister. As the outlets comprises buoyancy means for preventing liquids present in the canister from being sucked into the outlet, the vacuum source need only be adapted to be brought into contact with gasses and not necessarily liquids.

The outlet arrangement may comprise buoyancy means for elevating the outlet(s) to a position above any liquid present in the canister, so as to prevent any liquid present in the canister from entering the outlet. In order to allow the buoyancy means to float on the surface of a liquid present in the canister, the buoyancy means may have a lower density than liquids in the canister. In one embodiment, the buoyancy means comprises one or more air pockets adapted to provide at least a part of the buoyancy. As an example the buoyancy means may comprise closed-cell foam or natural or artificial cork.

In one embodiment, at least one of the outlets of the canister is defined by an outlet tube extending into the canister. The outlet tube may define the buoyancy means or the buoyancy means may be attached to the outlet tube. In one embodiment, the buoyancy means may be defined on an outer surface of the outlet tube. As an example the buoyancy means may define a passage into which the outlet tube may be inserted in order to attach the buoyancy means to the outlet tube. Alternatively, or as a supplement, the buoyancy means may be attached e.g. adhered, to the outer surface of the outlet tube. Alternatively, or as a supplement, the buoyancy means may be defined in at least a part of a sidewall of the outlet tube. As an example at least a part of the sidewall of the outlet tube may comprise one or more air pockets for increasing the buoyancy of said part of the outlet tube.

In cases wherein the buoyancy means is attached to or integrated with the outlet tube, one or more passages may be defined in the buoyancy means. The passages may be fluidly connected to the outlet of the outlet tube and the number of and the position of the passages on the buoyancy means may be chosen such that for any or most positions of the buoyancy means air/gasses present in the canister may be evacuated through the outlet of the outlet tube.

In order to allow the buoyancy means to elevate the outlet(s) to a position above any liquids present in the canister, the outlet tube may be flexible, e.g. by having thin walls. Alternatively, or as a supplement, the outlet tube may comprise one or more bellows section(s) for increasing the flexibility of the outlet tube.

It will be appreciated, that if the wound treatment device is un-intentionally shaken e.g. as it hits a floor or a table by accident, liquids in the canister may due to ripples/waves flow into the outlet. Accordingly, the outlet may comprise a membrane which is impermeable to liquids and permeable to gasses. It will be appreciated that due to the buoyancy means, the membrane will only be brought into contact with the liquid by accident, and is thus not permanently contacting the liquid. Accordingly, the risk of occlusion of the membrane is low compared to conventional wound treatment devices.

In one embodiment, a plurality of outlet arrangements are defined in the canister, each of which is adapted to evacuate air from the canister and to prevent any liquid present in the canister from entering its outlet. One or more of the outlets may comprise buoyancy means for elevating the respective outlet above the surface of liquid present in the canister. In the latter case the outlets may be defined by an outlet tube as is described above.

Alternatively, or as a supplement, the outlets may be fixed in predetermined positions and each comprise a valve arrangement for preventing liquid from flowing into the outlet. In embodiments with outlets fixed in predetermined positions, the outlets may be spaced apart such that for any position of the canister, at least one outlet is positioned above liquid present in the canister. The valve arrangements may each comprise a valve element arranged such with respect to the respective outlet, that the outlet is blocked by the valve element when liquid is present in the area of the outlet. In one case the effect is achieved by providing a valve element which has a higher density or buoyancy than the liquid present in the canister and by arranging the valve element such that presence of liquid causes the element due to its buoyancy to block the outlet and thus prevent liquid from entering the outlet.

In the alternative, the density of the valve element may be higher than or equal to the density of the liquid present in the canister, whereby presence of liquid causes the element to be forced downwards relative to the liquid surface and into a position wherein the outlet is blocked.

As the drainage conduit may be occluded by semi-solid matter, the wound treatment device may comprise a venting conduit fluidly connected to the wound bandage and/or the drainage conduit. This venting conduit may be used to vent the wound bandage and/or the drainage conduit such that matter stock in the drainage conduit may be forced into the canister due to a pressure difference upstream and downstream the matter, i.e. a higher pressure upstream and a lower pressure downstream. Moreover, the wound treatment device may comprise a venting valve arranged to control supply of air for venting via the venting conduit. In one embodiment the venting conduit defines an outlet in the canister for evacuating air from the canister and into the venting conduit.

DESCRIPTION OF THE FIGURES

Figs. 1-5 disclose embodiments of the wound treatment device,

Figs. 6-11 disclose embodiments of the outlet tube and the corresponding buoyancy element, and

Figs. 12 and 13 disclose embodiments comprising a plurality of outlets spaced apart at different positions of the canister.

Fig. 1 discloses a wound treatment device 100 for applying a reduced pressure to a wound site 102. The wound treatment device 100 comprises a wound bandage 104 adapted to cover a wound such that a substantially airtight seal is provided in the area of the wound site. The wound bandage 104 may be sealed to the skin of a user by means of a substantially airtight film (not shown) or by means of a substantially airtight adhesive (not shown) provided at a rim portion of the wound bandage 104. In order to collect liquids from the wound site 102 a canister 106 is fluidly connected to the wound bandage 104 by means of a drainage conduit 108. A first end 110 of the drainage conduit 108 is fluidly connected to an inlet 112 of the canister 106 and a second end 114 is fluidly connected to the wound bandage 104. A vacuum source 116 is arranged to provide a reduced pressure by means of which wound liquids such as pus, discharged from the wound site may be sucked into the canister as the vacuum source 116 evacuates air from the canister via an outlet 118. In order to prevent that the outlet 118 is occluded by any liquid present in the canister 106, the canister 106 comprises an outlet tube 120 which extends into the canister 106 and defines buoyancy means 122 which is arranged such with respect to the outlet 118, that if liquid is present in the canister 106, the outlet 118 is elevated to a position above the "water level" of the liquid. This prevents the liquid from being sucked into the outlet and further into the vacuum source 116. Accordingly, liquids are collected in the canister 106 and the vacuum source 116 (e.g. an electrical pump) is prevented from being damaged. It will be appreciated that in order to suck liquid from the wound site 102 and into the canister 106 by means of the pump, the drainage conduit 108, the canister 106 and the outlet tube 120, must be substantially airtight, such that a vacuum generated by the vacuum source 116 causes liquids at the wound site 102 to be initially sucked into the drainage conduit 108 and subsequently into the canister 106 via the inlet 112. Different embodiments of the outlet tube 120 and the buoyancy means 122 described in further detail in relation to Figs. 6-11.

In order to seal the wound bandage 104 to the skin 124 of the patient the wound bandage 104 may comprise a sealing film 125 which is may be adhered to the skin 124 as described above. Prior to sealing the sealing film 125 to the skin 124, a wound dressing member 126 may be placed in the wound so as to prevent the sealing film 125 from collapsing and being sucked into contact with the wound site 102 when a vacuum is applied to the wound bandage 104. The wound dressing member 126 may form a plurality of passages (not shown) allowing wound liquids to be sucked from the wound. It will be appreciated that if a wound dressing member 126 is not interposed between the sealing film 125 and the wound site 102, application of the vacuum may cause the film 125 to be sucked onto the wound such that it prevents wound liquids from being sucked away from the wound. Moreover it will be appreciated, that the wound dressing member may take any form suitable for spacing the sealing film 125 from the wound site 102, so as to prevent the sealing film 125 from collapsing and being sucked into contact with the wound site 102.

As bacteria and viruses may be air born, the wound treatment device 100 may comprise a filter 128 for preventing such bacteria and viruses form being emitted to the surroundings. In the embodiment of Fig. 1 the filter 128 is positioned downstream relative to the vacuum source 116 and the canister 106. However as it is described below, the filter may be positioned downstream the canister 106 and upstream the vacuum source 116.

The vacuum source 116 may be operated such that a predetermined pressure is maintained at the wound site 102. Accordingly, a pressure sensor 130 may be provided so as to enable a controller (not shown) to monitor the pressure at the wound site 102. The pressure sensor 130 is fluidly connected to the wound site 102 via an additional conduit 132 which, in the embodiment of Fig. 1, is coupled to the drainage conduit 108. It will be appreciated that due to the additional conduit 132, the pressure detected by the pressure sensor 130 is substantially identical to the pressure at the wound site 102. However, the provision of a additional conduit 132 enables incorporation of the pressure sensor 130 into the wound treatment device 100. This provides a simple device which may be installed and operated by connecting only two conduits – namely the drainage conduit 108 and the additional conduit 132. In the embodiments of Fig. 1-3 the additional conduit 132 extends through the canister 106. However, it will be appreciated that this is not essential for the operation of the wound treatment device 100.

It will be readily realised that the length of the outlet tube 120 should be chosen so as to allow the buoyancy means 122 elevate the outlet 118 above the liquid level for any positions of the canister 106. At the same time, the outlet tube 120 must be short enough to allow the outlet tube 120 and the buoyancy means 122 to move inside the canister 106 in response to the movements and/or movements of the canister 106.

The wound treatment device 100 of Fig. 2 is substantially identical to the wound treatment device 100 of Fig. 1 and identical reference numbers refer to identical elements/features. In Fig. 2 the vacuum source 116 is inserted into the drainage conduit 108, such that a first part 108' of the drainage conduit 108 is provided upstream the vacuum source 116 and downstream the wound bandage 104, and such that a second part 108'' of the drainage conduit 108 is provided downstream the vacuum source 116 and upstream the canister 106. Due to the different position of the vacuum source 116, liquids sucked from the wound site 102 flow through the vacuum source 116 in order to flow into the canister 106. Accordingly, the vacuum source 116 of Fig. 2 must be adapted to allow liquid to flow through the vacuum source 116 during normal operation of the device. In contrast hereto, the vacuum source 116 of Fig. 1 need not be liquid tight and adapted to allow liquids to flow through the vacuum source 116 as the buoyancy means 122 is adapted to prevent liquids from entering the outlet 118.

Due to the different configuration of the wound treatment device 100 of Fig. 2, liquid sucked from the wound site is not sucked into the canister 106 but rather pushed/pumped into the canister 106. As a consequence, the canister 106 of Fig. 2 need not be airtight so as to be able to maintain a vacuum inside the canister 106 as is the case with the canister 106 of Fig. 1.

The wound treatment device 100 of Fig. 3 is similar to that of Fig. 1, but differs in that the position of the vacuum source 116 and the filter 128 are reversed such that the vacuum source 116 is positioned downstream relative to the filter 128. Thus, in order to maintain the vacuum needed to suck liquids from the wound site 102, the filter 128 must be substantially airtight, as is described in relation to the drainage conduit 108, the canister 106 and the outlet tube 120 in relation to Fig. 1.

In Fig. 4 the additional conduit 132 has been dispensed with and the pressure sensor 130 is connected to the tube 134 interconnecting the filter 128 and the vacuum source 116. It will be appreciated, that such a configuration increases the requirements for airtightness of the elements positioned upstream the pressure sensor 130, as any pressure loss will cause the pressure sensor 130 to measure an incorrect pressure, i.e. a pressure which is different than the pressure at the wound site 102. It will be appreciated, that the pressure sensor 130 may be positioned at any other position along drainage conduit 108, the canister 106 or the outlet tube 120. However, if the pressure sensor 130 is positioned along the drainage conduit 108 or in the canister 106, the pressure sensor 130 must be water proof such that liquids sucked from the wound site 102 will not damage the pressure sensor 130, when such liquids contact the sensor 130.

In embodiment of Fig. 5 the additional conduit 132 is used to vent the wound bandage 104 and/or the drainage conduit 108, by allowing air/gasses in the canister 106 to be re-circulated into the drainage conduit 108 and/or the wound bandage 104. An advantage of such venting is, that matter in the drainage conduit 108 which occludes the drainage conduit 108 may be forced into the canister as re-circulation of air causes the pressure upstream such an occlusion to be higher than the pressure downstream such an occlusion. The pressure difference will cause the occluded matter in the direction of the canister and eventually clear the drainage conduit 108. In order to control the venting process a regulator 136 is incorporated into the additional conduit 132. The regulator 136 is adapted to allow air/gasses to flow into the additional conduit 132 if the pressure downstream the regulator 136 is below a predetermined threshold, i.e. if the vacuum at the wound site 102 and/or the drainage conduit 108 is too low. As the air supplied through the additional conduit 132 is used to prevent occlusion of the drainage conduit 108, it is desirable that liquids or matter which can potentially occlude the additional conduit 132 or the drainage conduit 108 is prevented from flowing into the outlet 118' defined by the additional conduit 132. Accordingly, a buoyancy means 122' is provided at the end of the additional conduit 132 which is thus adapted to elevate the outlet 118' above the level of any liquid/matter contained in the canister 106.

In Fig. 5 the outlet 118 is not defined by an outlet tube 120 comprising a buoyancy means 122 as is described in relation to Figs. 1-4, however it will be appreciated that such an outlet tube 120 and such a buoyancy means 122 may be provided. In one embodiment both outlets 118,118' use the same buoyancy means 122 to ensure that the outlets 118,118' are elevated to a position above the liquid level in the canister 106. In the embodiment of Fig. 5, the regulator 136 is provided inside the canister 106, but the skilled person will readily realise that it may be positioned outside the canister 106.

Figs. 6-11 disclose different embodiments of the outlet tube 120 and the buoyancy means 122. In Figs. 6-8 and 10-11 the outlet tube 120 is illustrated in a bended configuration and in each drawing the left part is a front elevational view and the right part is a cross-section extending into the front elevational view of the left part. In Fig. 6 the buoyancy means 122 is defined by a cylindrical element which is attached to the outlet tube 120, e.g. by forcing the outlet tube 120 into the passage of the cylindrical element. The buoyancy means 122 is positioned in the vicinity of the outlet 118 so as to ensure that the outlet is elevated above any liquid present in the canister 106. In Fig. 7 the buoyancy means 122 is spherically shaped and defines a passage for receiving the outlet tube 120. In order to allow air to flow into the outlet 118, for any position of the outlet tube 120, a plurality of flow passages 138 are defined in the buoyancy means 122 of Fig. 8. In the case of Fig. 8, eight flow passages are defined.

In Fig. 9 the outlet tube 120 defines a bellows section 140 which is adapted to enhance the flexibility of the tube 120 such that the stiffness of the tube 120 does not prevent the buoyancy means 122 from floating on the surface of any liquid present in the canister. It will be appreciated, that the flexibility may be achieved in other ways such as providing a outlet tube 120 made from an extremely flexible material or by be providing an outlet tube 120 with very thin walls. Moreover, it will be appreciated that the bellows may be used in connection with the outlet tubes 120 of Figs. 6-8 and 10-11 in order to achieve the desired flexibility of the outlet tube 120. In Fig. 10 the buoyancy means 122 is provided as air pockets 142 in a part of the outlet tube 120. In one embodiment the outlet tube 120 is made form a closed-cell foam which defines the air pockets 142.

In the embodiment of Fig. 10, the air pockets 142 are defined in a zone close to the outlet 118, however in other embodiments, the air pockets 142 are provided along the entire length of the outlet tube 120.

In Fig. 11 the buoyancy means 122 forms an integral part of the outlet tube 120. Such a tube/buoyancy means may be produced by welding the tube 120 and the buoyancy means 122 together or by moulding the two members as one monolithic element.

Fig. 12 discloses a canister 106 according to the invention, in which four outlets 118 are defined. The outlets 118 are positioned in different ends of the canister 106, such that for any position of the canister 106, one or more of the outlets 118 is/are positioned above the surface 144 of the liquid 146 such that air may be evacuated/sucked from the canister 106 via the outlets 118, which are not covered by the liquid 146. Each of the outlets comprises a valve means 148 which is adapted to prevent liquid 146 from flowing into the outlet 118 when the outlet is positioned below the surface 144 of the liquid 146. In the embodiment of Fig. 12 the valve means 148 comprises a valve element 150 in the form of a spherical element, which is arranged such with respect to the outlet 118, that if the outlet 118 is positioned in a liquid 146, the liquid forces the valve element 150 into a locking position in which the valve element 150 blocks the outlet 118, whereby the liquid 146 is prevented from flowing into the outlet 118. The two outlets 118' in the bottom of the drawing are surrounded by the liquid 146 and are thus shown in the locking position, whereas the outlets 118'' in the upper part of the drawing are elevated above the surface 144 and are thus shown in the open position in which air may flow into the outlets 118''. It will be appreciated, that if the canister is tilted 90 degrees the upper right outlet 118' will be covered by the liquid 146 whereby valve element 150 will prevent liquid from flowing into the outlet 118''. At the same time, the lower left outlet 118' will no longer be covered by the liquid 146 and air will be free to flow into the outlet as the valve element 150 will move into its open position.

From Fig. 12 it will be appreciated that the outlets 118,118',118'' advantageously may be positioned in opposite corners in order to allow air to be evacuated from the canister 106 for any position thereof and for most levels of liquid. However, it will be appreciated that none of the outlets will be open for passage of air if the canister 106 is completely filled with liquid such that all the outlets are positioned in their locking position.

Fig. 13 illustrates a canister 106 in which the outlets 118 are positioned in opposite corners of the canister 106, whereby one or more of the outlets 118 are not covered by liquid 146 for any position of the canister 106. Four different positions of the canister 106 are illustrated by in Fig. 13. In the upper most canister 106t, the outlets 118a,118b are not covered by the liquid 146, and, thus, allow air to be evacuated from the canister. However, the two remaining outlets 118c,118d are covered by the liquid 146 whereby their valve elements (not illustrated) prevent liquid from flowing into the outlet as is described in relation to Fig. 12. The right canister 106r is tilted 90 degrees relative to the top canister 106t whereby the outlet 118b is covered by liquid 146 which causes its valve element to block the outlet 118b and prevent liquid 146 from flowing into the outlet 118b, at the same time the outlet 118d is positioned above the liquid 146 which causes the outlet 118d to open and allow air to pass into the outlet. In the bottom, the canister 106b is tilted 90 degrees relative to the right canister 106r whereby the outlet 118c is opened and the outlet 118a is closed for passage of the liquid 146. The left canister 106l is tilted further 90 degrees whereby the outlets 118b,118c are open and the outlets 118a,118d are closed.

For some positions of the canister 106 and some levels of the liquid 146 more than two outlets may be open for passage of air. If little liquid is collected in the canister, only one outlet 118 may be covered by the liquid 146. This is the case if any of the canisters 116 of Fig. 13 are tilted only 45 degrees. As an example the upper canister 106t may be tilted 45 degrees clockwise, whereby only the outlet 118c will be covered by liquid 146 if only little liquid is collected in the canister 106t.

However, in other cases less than two outlets may be open for passage of air. This will e.g. be the case if the upper canister 106t is tilted 45 degrees clockwise and a large amount of liquid is collected in the canister 106t.

CLAIMS

1. A wound treatment device for applying a reduced pressure to a wound site, the wound treatment device comprising:

- a wound bandage adapted to cover a wound such that a substantially airtight seal is provided in the area of the wound site,

- a canister for collecting liquid sucked from the wound site, the canister defining an inlet and at least one outlet for evacuating air from the canister,

- a drainage conduit interconnecting the wound bandage and the inlet of the canister,

- a vacuum source for providing a reduced pressure, the vacuum source being arranged such with respect to the drainage conduit and/or the canister that operation of the vacuum source causes liquids to be sucked from the wound site and to flow into the canister via the inlet, and

wherein the wound treatment device comprises an outlet arrangement defining the outlet(s), at least a part of the outlet arrangement being movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet(s).

2. A wound treatment device according to claim 1, wherein at least one of the outlet(s) is movable within the canister in response to liquid present in the canister so as to prevent said liquid from entering the outlet.

3. A wound treatment device according to claim 1 or 2, wherein at least a part of the outlet arrangement is movable within the canister, such that for any position of the canister, one or more of the outlet(s) is/are positioned above any liquid in the canister whereby said liquid cannot enter said one or more outlet(s).

4. A wound treatment device according to any of the preceding claims , wherein the outlet arrangement device comprises buoyancy means for elevating the outlet(s) to a position above any liquid present in the canister.

5. A wound treatment device according to claim 4, wherein the outlet arrangement comprises an outlet tube extending into the canister, and wherein the outlet tube comprises the buoyancy means.

6. A wound treatment device according to claim 5, wherein the buoyancy means is defined on an outer surface of the outlet tube.

7. A wound treatment device according to any of claims 5 or 6, wherein the buoyancy means is defined in at least a part of a sidewall of the outlet tube.

8. A wound treatment device according to any of claims 5-7, wherein the buoyancy means defines a plurality of passages each of which is fluidly connected to outlet.

9. A wound treatment device according to any of clams 5-8, wherein the outlet tube comprises a bellows section for increasing the flexibility of the outlet tube.

10. A wound treatment device according to any of the preceding claims, wherein the outlet comprises a membrane which is impermeable to liquids and permeable to gasses.

11. A wound treatment device according to any of the preceding claims, wherein a plurality of outlet arrangements are defined in the canister, each of which is adapted to evacuate air from the canister and to prevent any liquid present in the canister from entering its outlet.

12. A wound treatment device according to claim 11, wherein the outlet arrangements are spaced apart such that for any position of the canister at least one outlet is positioned above any liquid present in the canister.

13. A wound treatment device according to any of the preceding claims, wherein at least one of the outlet arrangements comprises a valve arrangement comprising a valve element arranged such with respect to the outlet of the outlet arrangement that the outlet is blocked by the valve element when liquid is present in the area of said outlet.

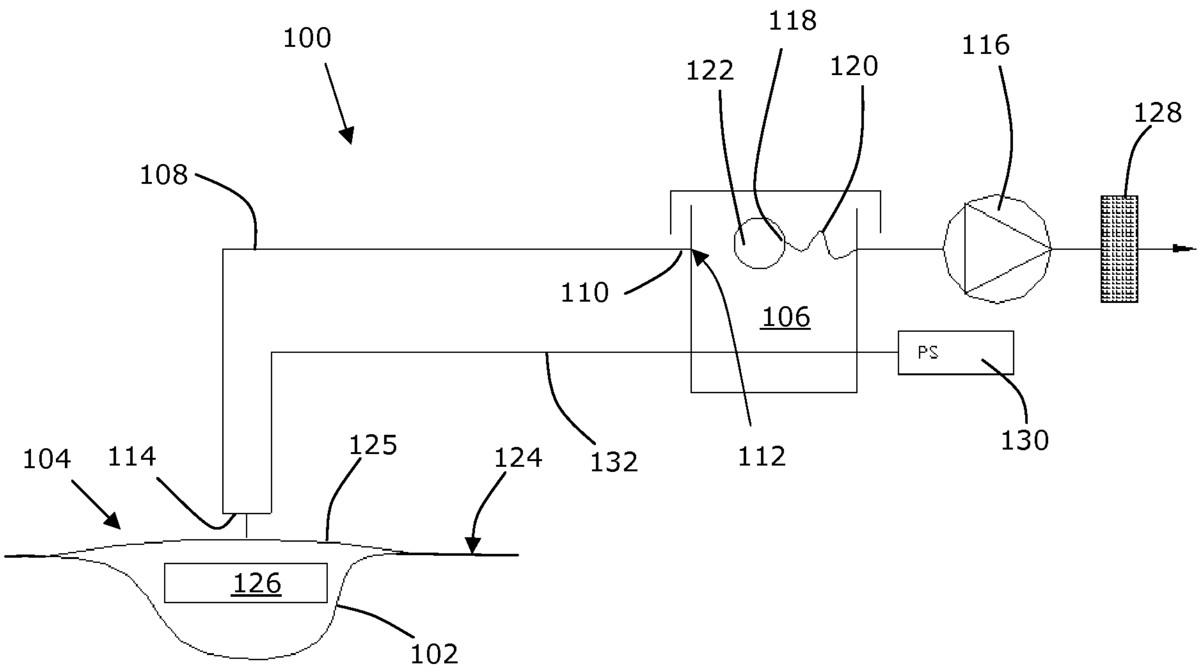
14. A wound treatment device according to claim 13, wherein the density of the valve element is higher than or equal to the density of the liquid present in the canister.

15. A wound treatment device according to any of the preceding claims, wherein the vacuum source is provided upstream relative to the inlet of the canister.

16. A wound treatment device according to any of the preceding claims, wherein the vacuum source is provided downstream relative to the inlet and/or the outlet of the canister.

17. A wound treatment device according to any of the preceding claims, further comprising a venting conduit fluidly connected to the wound bandage and/or the drainage conduit so as to allow the wound bandage and/or the drainage conduit to be vented and wherein a venting valve is arranged to control supply of air for venting via the venting conduit.

18. A wound treatment device according to claim 17, wherein the venting conduit defines an outlet in the canister for evacuating air from the canister and into the venting conduit.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112
114
104
125
124
126
102
106
118
122
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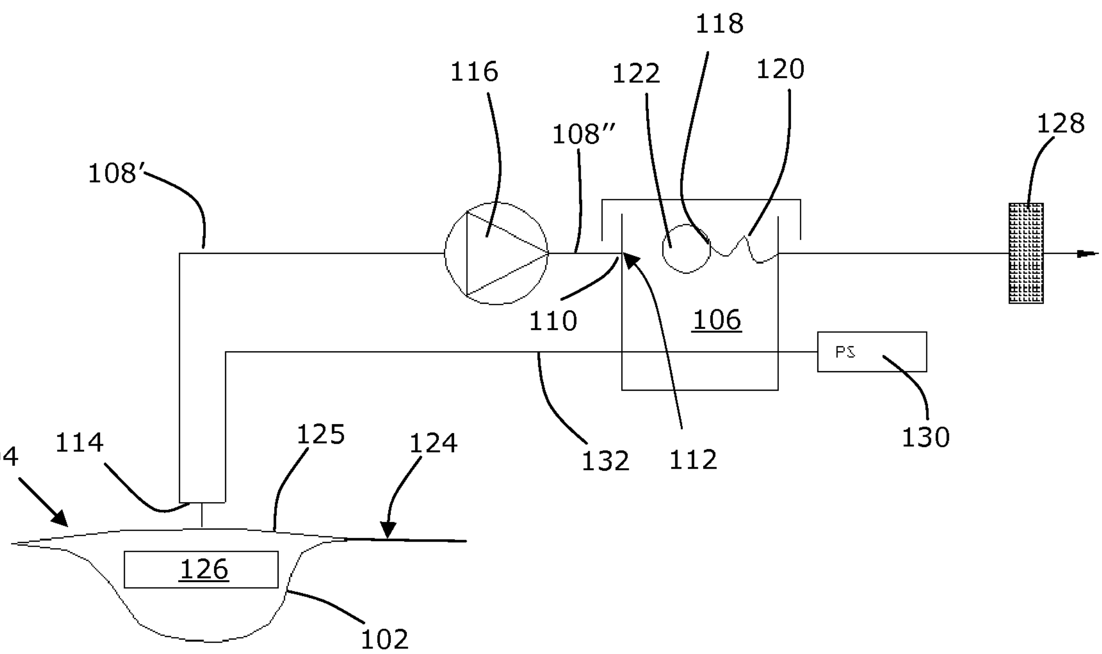
116
128
PS
130
132

Fig. 1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106
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PS
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132

Fig. 2

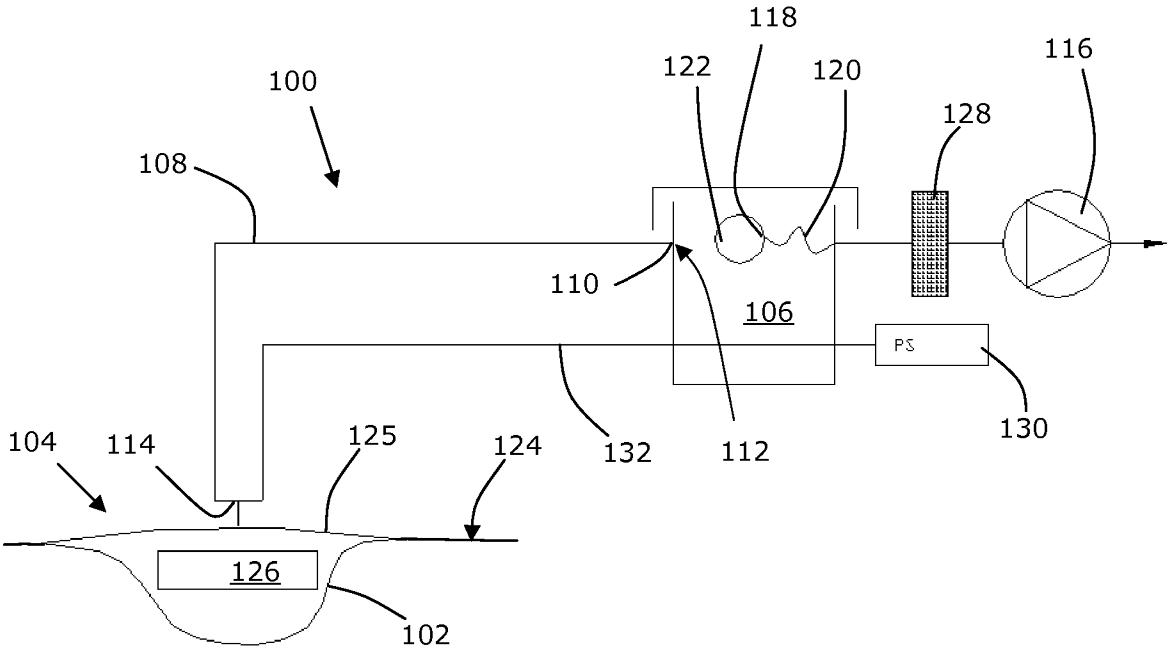
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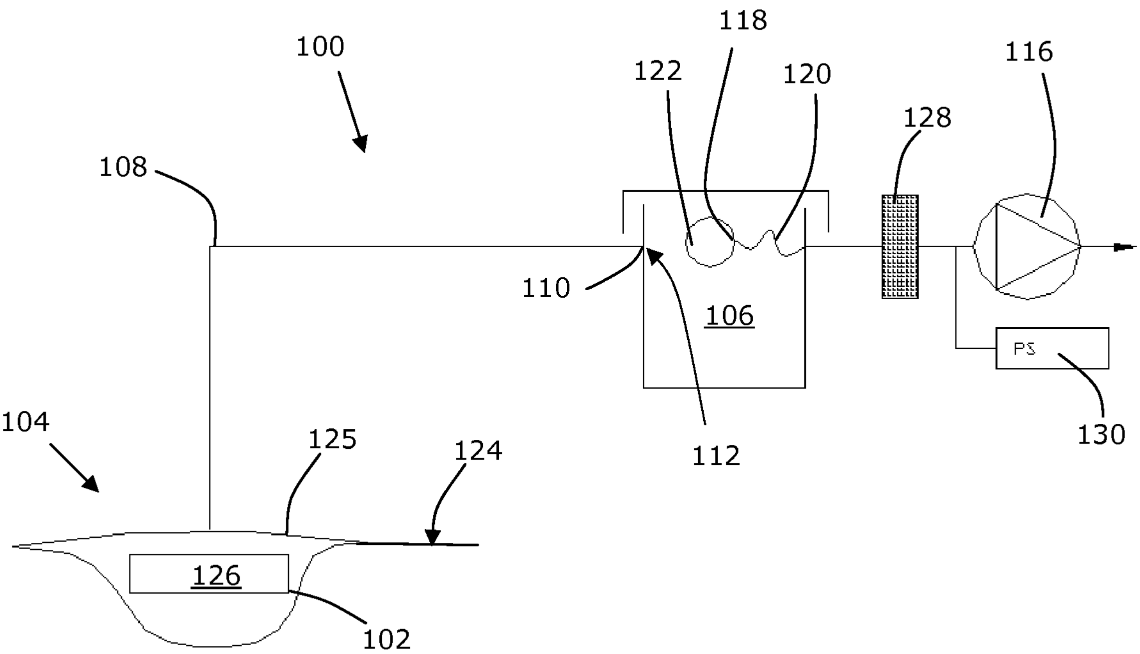
Fig. 3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PS
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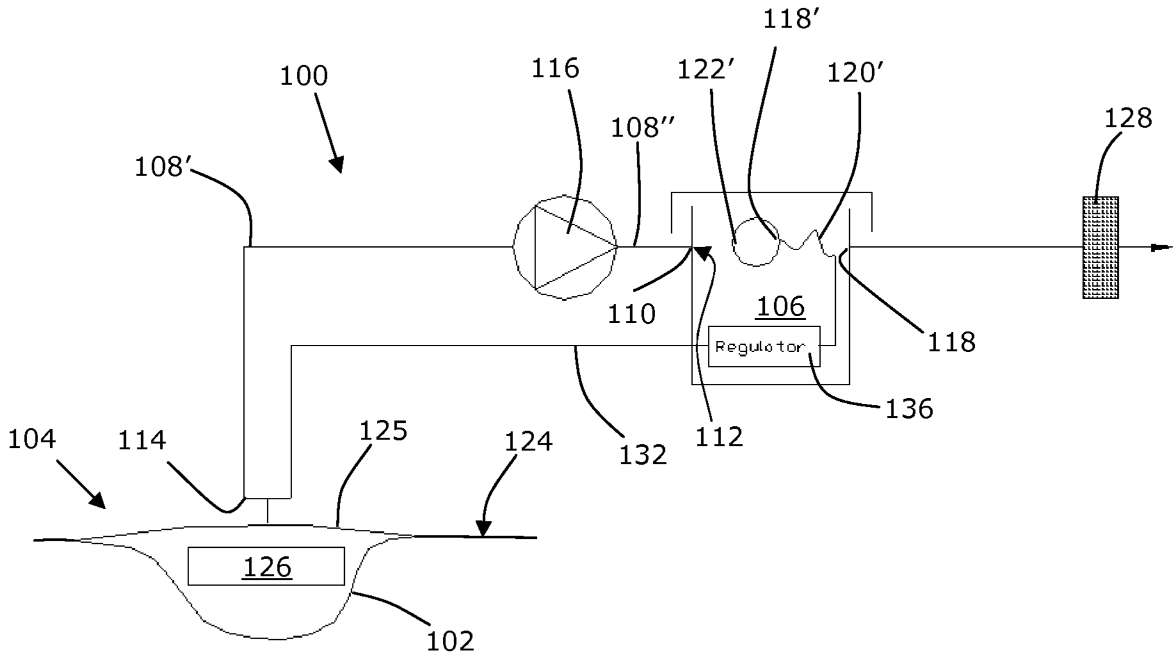
Fig. 4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Regulator
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102

Fig. 5

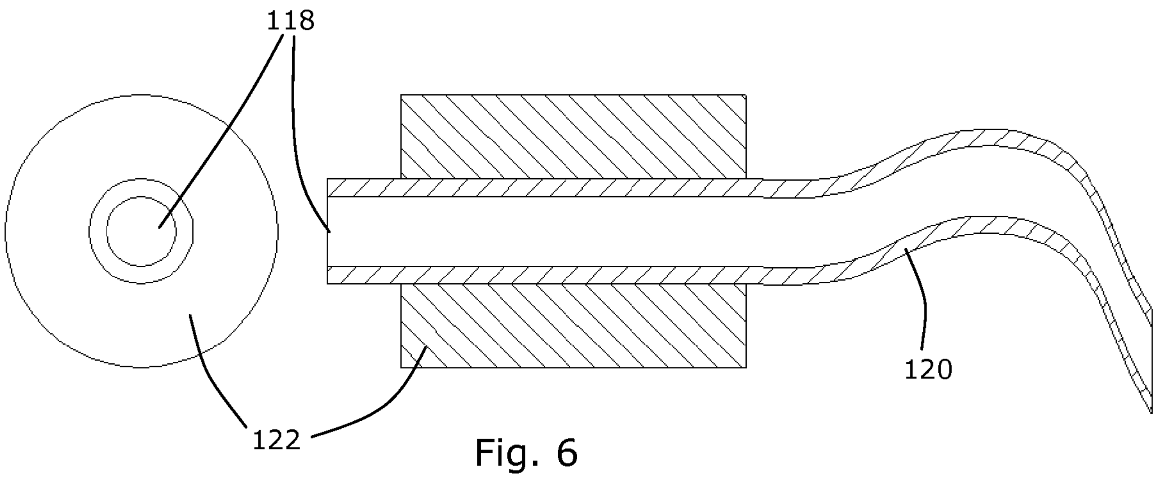


Fig. 6

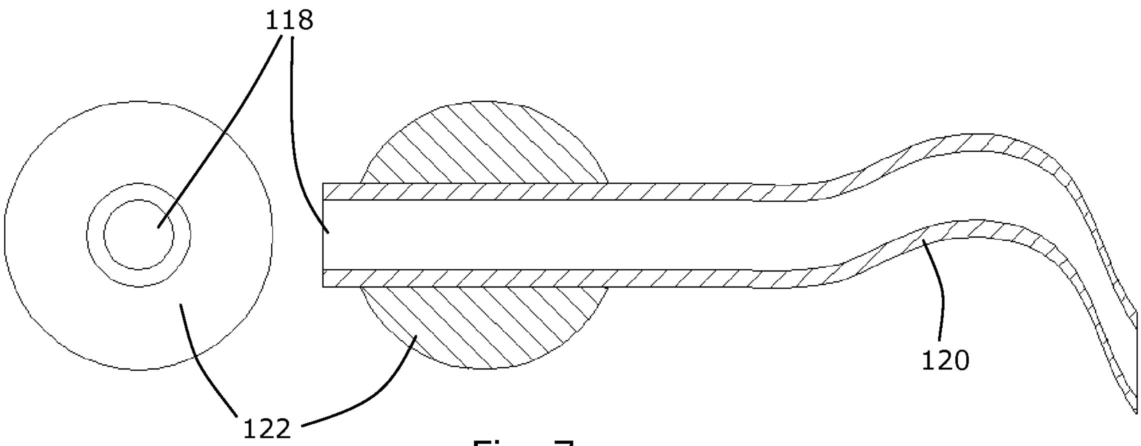


Fig. 7

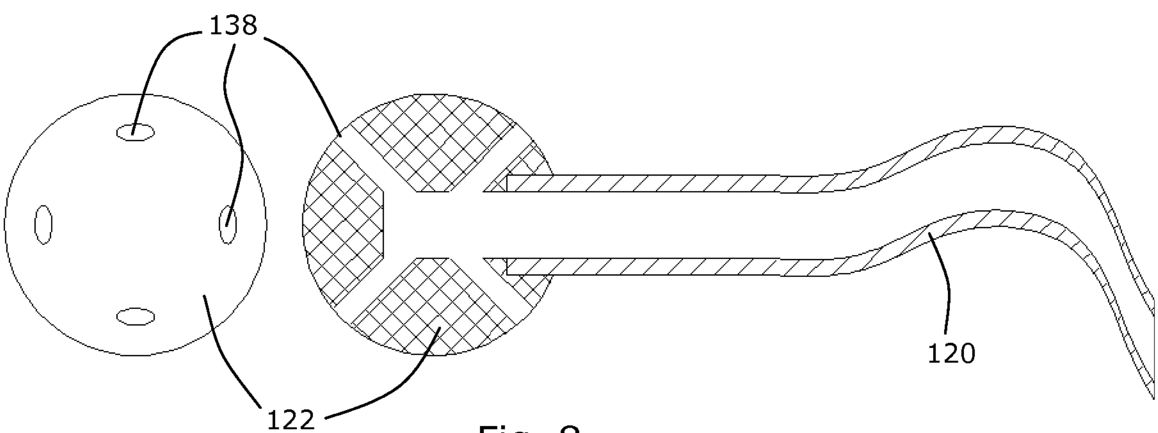


Fig. 8

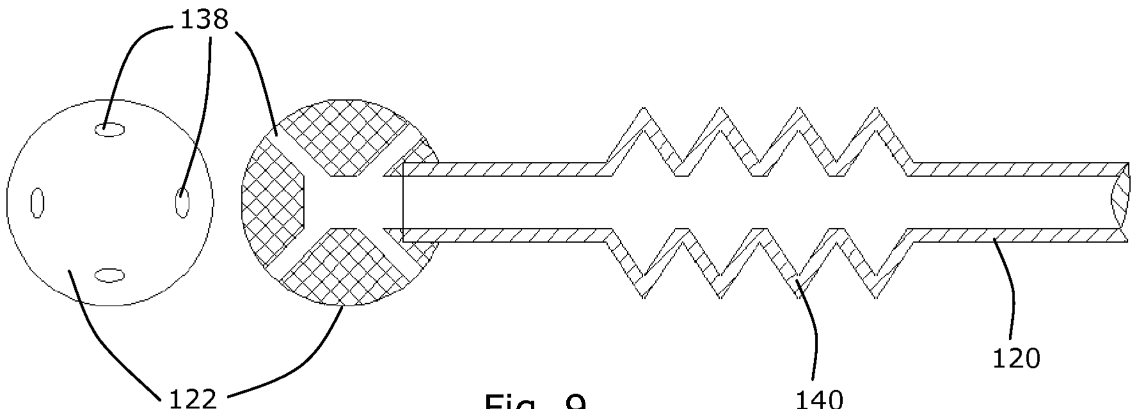


Fig. 9

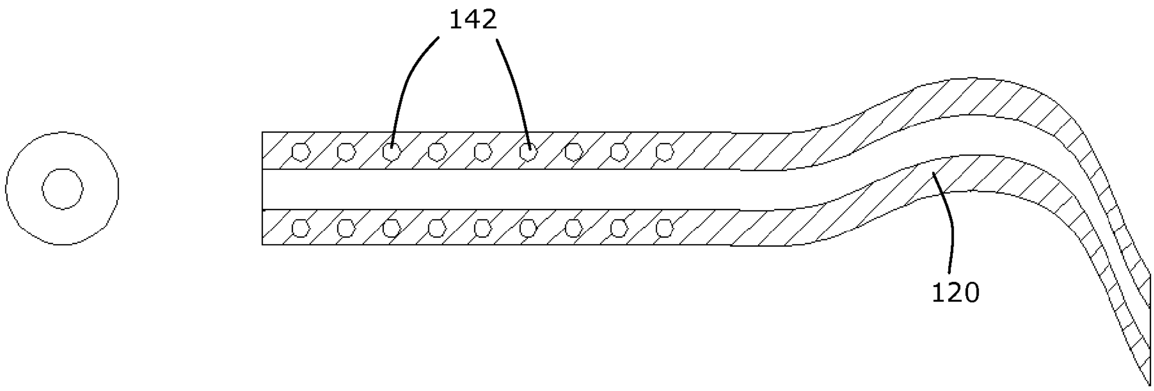


Fig. 10

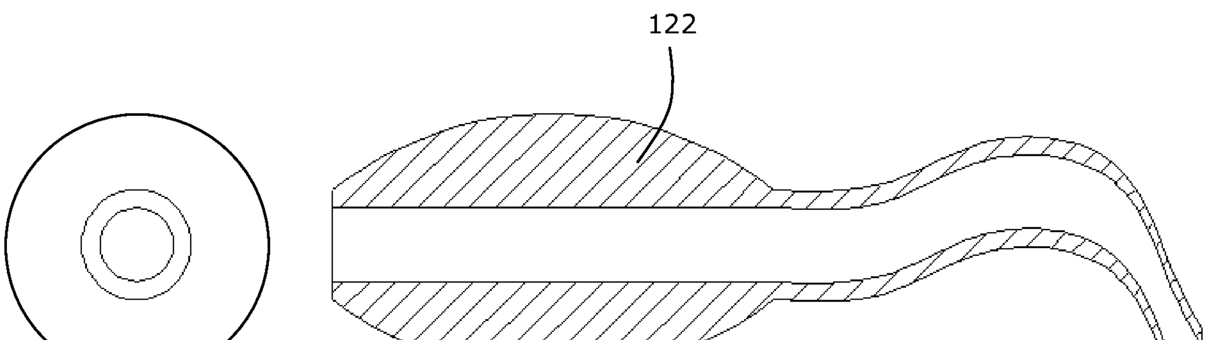


Fig. 11

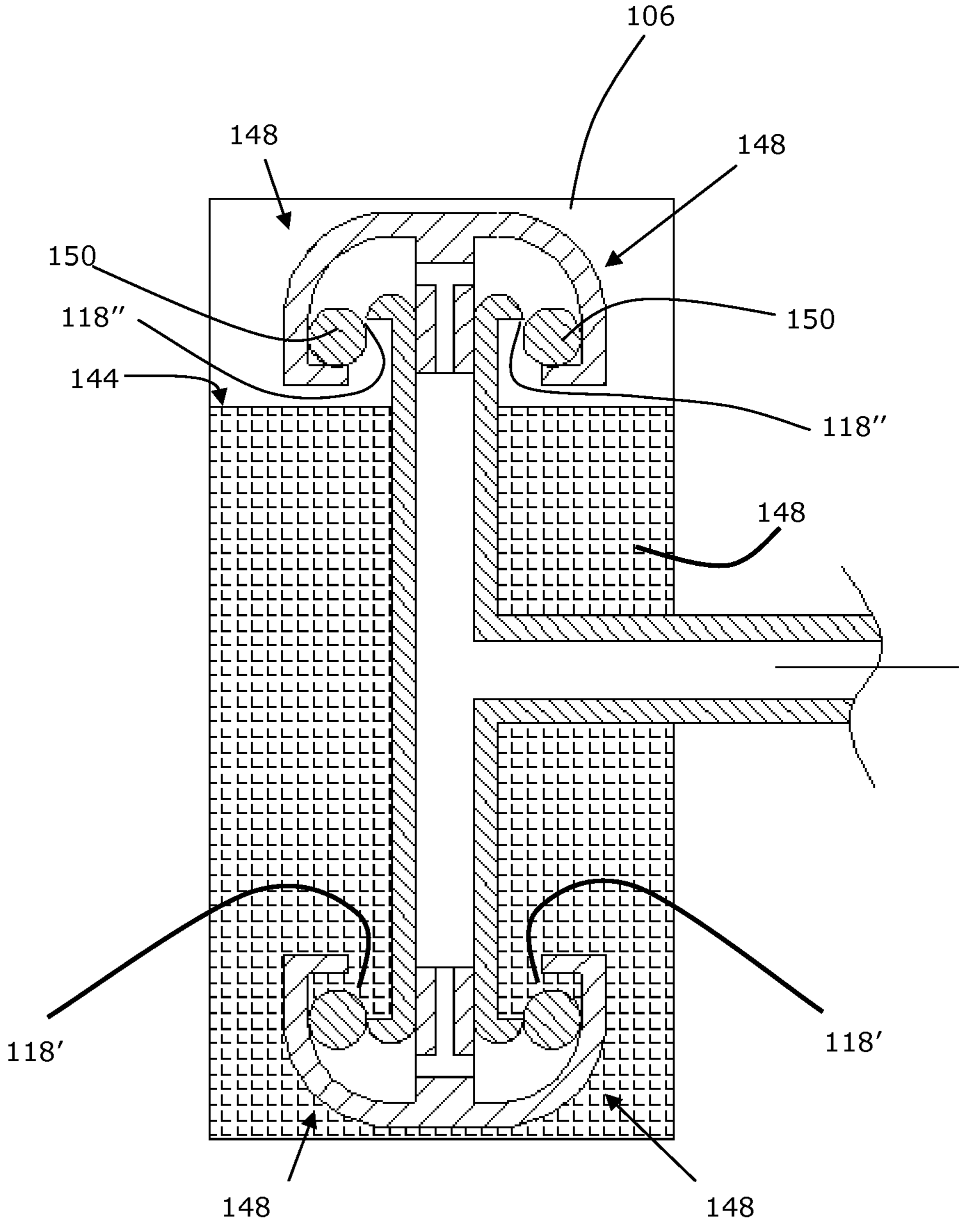
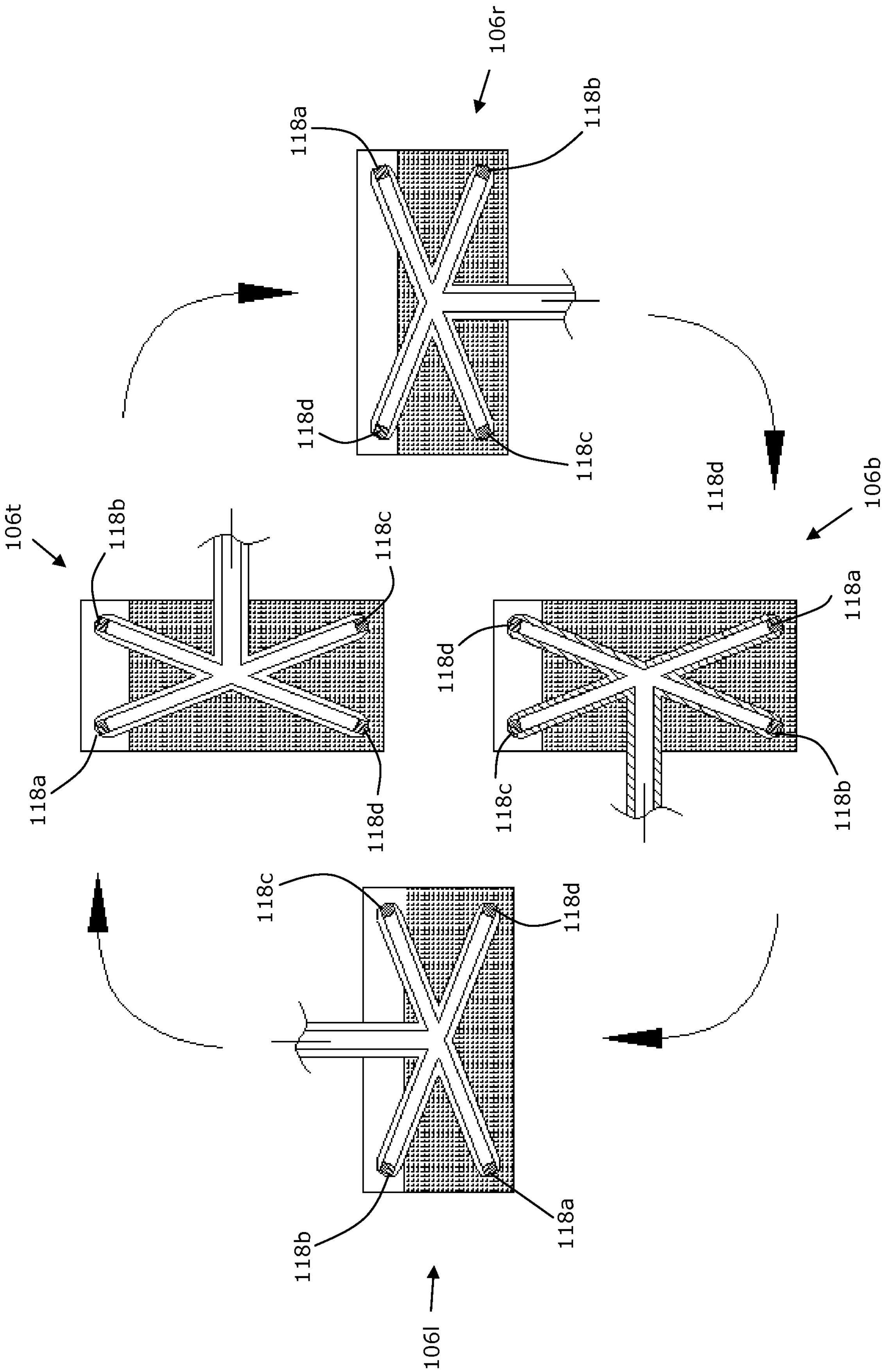


Fig. 12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118b
118a
106l

Fig. 13