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(54) WET CLEANING APPARATUS

(57) Provided is a wet cleaning apparatus (100) for cleaning a surface. The wet cleaning apparatus comprises a cleaner head (102), and a handle (148) for allowing a user to move the cleaner head on the surface. The wet cleaning apparatus further comprises a dirty liquid removal assembly (104) for removing liquid from the surface. The dirty liquid removal assembly comprises at least one volume changing element (126) manipulable to expand one or more volumes in the dirty liquid removal assembly and thereby provide an underpressure for removing the liquid from the surface. The at least one volume changing element is arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally causes manipulation of the at least one volume changing element to expand the volume(s) in the dirty liquid removal assembly. In this way, the user's exertion of force on the handle assists with removal of the liquid from the surface.

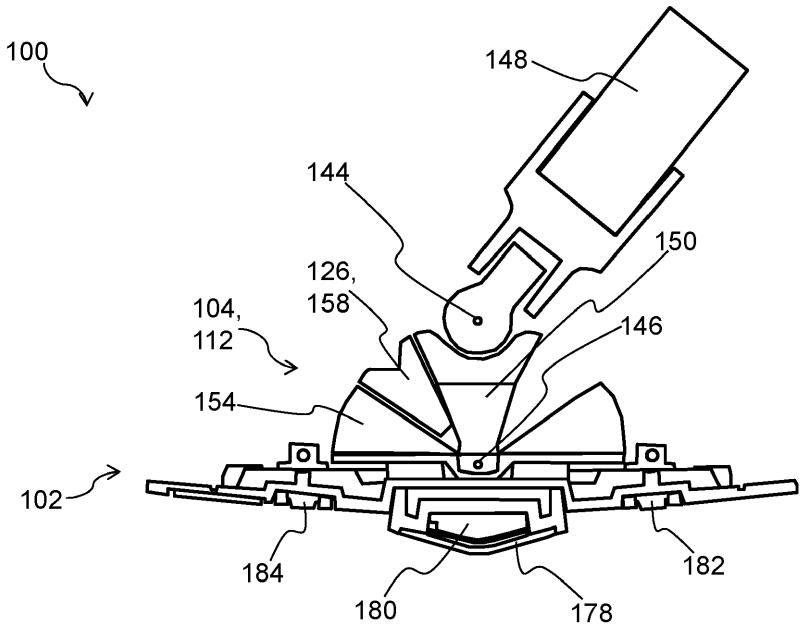

FIG. 4A

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a wet cleaning apparatus, and in particular a wet cleaning apparatus comprising a dirty liquid removal assembly for removing liquid from a surface being cleaned.

BACKGROUND OF THE INVENTION

[0002] Wet cleaning apparatuses, for example wet mopping devices, are known which remove water from a surface being cleaned. Such wet cleaning apparatuses can also apply cleaning liquid, e.g. water, to the surface, and then remove the liquid, e.g. with a suitable cloth.

[0003] Some wet cleaning apparatuses are nowadays equipped with a cleaning liquid supply that supplies cleaning liquid, e.g. clean water, to the cleaner head, in other words nozzle, or directly to the surface being cleaned. Such a cleaning liquid supply may include a manual or electric pump. In this way, the user is relieved of the burden of having to continually return to a bucket to wet a cloth with fresh cleaning liquid.

[0004] Such systems may not, however, include functionality that enables active pickup of liquid from the surface, e.g. floor.

[0005] However, such functionality, in common with the above-mentioned electric pump that may be included in the cleaning liquid supply, may render the wet cleaning apparatus more complicated and costly to manufacture. Electrical components may increase the complexity and cost of the wet cleaning apparatus, particularly in respect of regulatory requirements, such as stipulated by Ingress Protection (IPX) and International Electrotechnical Commission (IEC). These factors may drive up the factory cost price.

SUMMARY OF THE INVENTION

[0006] The invention is defined by the claims.

[0007] According to examples in accordance with an aspect of the invention, there is provided a wet cleaning apparatus for cleaning a surface, the wet cleaning apparatus comprising: a cleaner head; a handle for allowing a user to move the cleaner head on the surface; and a dirty liquid removal assembly for removing liquid from the surface, the dirty liquid removal assembly comprising at least one volume changing element manipulable to expand one or more volumes in the dirty liquid removal assembly and thereby provide an underpressure for removing the liquid from the surface, wherein the at least one volume changing element is arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally manipulates the at least one volume changing element to expand the volume(s) in the dirty liquid removal assembly.

[0008] The present disclosure is based, at least in part, on the realization that the force exerted by a user on the handle of the wet cleaning apparatus to move the cleaner head on the surface being cleaned can be additionally used to remove the liquid from the surface, and in some embodiments to deliver cleaning liquid to the surface. It is noted that the surface may, for example, be a surface of a floor, wall, window, and so on.

[0009] To this end, the dirty liquid removal assembly comprises at least one volume changing element manipulable to expand one or more volumes in the dirty liquid removal assembly and thereby provide an underpressure for removing the liquid from the surface. Moreover, the at least one volume changing element is arranged relative to, e.g. mechanically cooperates with, the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally causes manipulation of the at least one volume changing element to expand the volume(s) in the dirty liquid removal assembly.

[0010] This expansion generates the underpressure that enables the dirty liquid removal assembly to remove the liquid from the surface. Thus, the user's exertion of force on the handle assists with removal of the liquid from the surface.

[0011] An electric pump, and associated electrical components, may therefore be obviated, thereby assisting to keep cost and complexity to a minimum in terms of electrical components, as well as assisting to minimize costs associated with fulfilling regulatory requirements. The wet cleaning apparatus according to the present disclosure may nonetheless provide active liquid pickup via the dirty liquid removal assembly.

[0012] In some embodiments, the at least one volume changing element is arranged relative to, e.g. mechanically cooperates with, the handle so that force exerted on the handle by the user to push the cleaner head on the surface in a forward direction and/or to pull the cleaner head on the surface in a backward direction manipulates the at least one volume changing element to change the one or more volumes in the dirty liquid removal assembly.

[0013] For example, in a forward stroke of the cleaner head, during which the user exerts a pushing force on the handle, and/or in a backward stroke of the cleaner head, during which the user exerts a pulling force on the handle, the volume changing element(s) may be manipulated to change, including expand, the one or more volumes in the dirty liquid removal assembly.

[0014] In some embodiments, the at least one volume changing element comprises a first volume changing element manipulable to expand a first volume of the one or more volumes in the dirty liquid removal assembly when the handle is forced by the user to move the cleaner head on the surface in a first direction. In such embodiments, the at least one volume changing element may further comprise a second volume changing element manipulable to expand a second volume of the one or more volumes in the dirty liquid removal assembly when

the handle is forced by the user to move the cleaner head on the surface in a second direction opposite to the first direction.

[0015] Thus, forces applied by the user to move the cleaner head in both of the first and second directions, e.g. both forward and backward directions, may be utilized to generate the underpressure for removing the liquid from the surface being cleaned.

[0016] In some embodiments, the wet cleaning apparatus comprises a pivot assembly for pivotably coupling the handle to the cleaner head, with the at least one volume changing element being manipulable, via pivoting of the pivot assembly when the handle is forced by the user, to change the one or more volumes in the dirty liquid removal assembly. This may provide a relatively straightforwardly implementable way of employing the user's force on the handle to manipulate the volume changing element(s) and thereby control liquid removal from the surface being cleaned.

[0017] In some embodiments, the wet cleaning apparatus comprises an intermediate element between the handle and the cleaner head, with the pivot assembly comprising a first pivot between the intermediate element and the handle, and a second pivot between the intermediate element and the cleaner head. In such embodiments, the intermediate element may be moveable, via pivoting of the first pivot and the second pivot when the handle is forced by the user, to change the one or more volumes in the dirty liquid removal assembly.

[0018] Thus, the intermediate element may displace, in other words offset, the first pivot from the second pivot.

[0019] In this way, the first and second pivots may allow the force applied to the handle to be applied to manipulate the volume chaning element(s).

[0020] This may provide a convenient way of transferring force exerted by the user to move the cleaner head, e.g. in forward and/or backward directions, to manipulate the volume changing element(s).

[0021] In some embodiments, the dirty liquid removal assembly comprises a valve assembly arranged to define a one-way flow path for fluid entering and being expelled from each of the one or more volumes in the dirty liquid removal assembly. The valve assembly may facilitate repeated expansion and compression of the volume(s) of the dirty liquid removal assembly.

[0022] The valve assembly can be configured in any suitable manner provided that the valve assembly is capable of providing the one-way flow path. In some embodiments, the valve assembly comprises a pair of one-way valves, in other words a pair of check valves.

[0023] The volume changing element(s) can also be implemented in any suitable manner. In some embodiments, the dirty liquid removal assembly comprises at least one container in which at least part of said one or more volumes of the dirty liquid removal assembly is provided, with the at least one volume changing element comprising a wiper element moveable within the at least one container and arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally moves the wiper element to change, including to expand, the one or more volumes in the dirty liquid removal assembly.

[0024] Alternatively or additionally, the dirty liquid removal assembly may comprise a container in which at least part of said one or more volumes of the dirty liquid removal assembly is provided, wherein the at least one volume changing element is at least partly defined by the container being deformable. In such embodiments, the container may be arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally deforms the container to change, including to expand, the one or more volumes in the dirty liquid removal assembly.

[0025] In other words, the deformable container, e.g. bellows, may be arranged to be expanded and compressed as a consequence of the user's movement of the handle to move the cleaner head on the surface. Such a deformable container, e.g. bellows, may provide a relatively straightforward way of realizing the volume changing element(s).

[0026] In some embodiments, the wet cleaning apparatus comprises a cleaning liquid delivery assembly for delivering cleaning liquid, e.g. cleaning liquid comprising water and optionally detergent, to the surface.

[0027] Thus, the wet cleaning apparatus may be configured to remove liquid from the surface being cleaned, via operation of the dirty liquid removal assembly, as well as being configured to deliver cleaning liquid to the surface.

[0028] In some embodiments, the cleaning liquid delivery assembly includes at least one volume changing member manipulable to reduce one or more volumes in the cleaning liquid delivery assembly and thereby provide an overpressure for delivering the cleaning liquid to the surface.

[0029] In such embodiments, the at least one volume changing member may be arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface causes manipulation of the at least one volume changing member to change, including to reduce, the one or more volumes in the cleaning liquid delivery assembly. Thus, the user's exertion of force on the handle may additionally assist with delivery of the cleaning liquid to the surface.

[0030] In some embodiments, at least part of said one or more volumes in the cleaning liquid delivery assembly is provided in at least one further container, with the at least one volume changing member comprising a wiper member moveable within the at least one further container and arranged so that force exerted on the handle by the user to move the cleaner head on the surface additionally moves the wiper member to change, including to reduce, the one or more volumes in the cleaning liquid delivery assembly.

[0031] Alternatively or additionally, at least part of said one or more volumes in the cleaning liquid delivery

assembly is provided in a further container, wherein the at least one volume changing member is at least partly defined by the further container being deformable, the further container being arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally deforms the further container to change, including to reduce, the one or more volumes in the cleaning liquid delivery assembly.

[0032] In other words, the deformable further container, e.g. bellows, may be arranged to be expanded and compressed as a consequence of the user's movement of the handle to move the cleaner head on the surface. Such a deformable further container, e.g. bellows, may provide a relatively straightforward way of realizing the volume changing member(s) that assist to deliver the cleaning liquid to the surface being cleaned.

[0033] In some embodiments, the cleaning liquid delivery assembly comprises a valve system arranged to define a one-way flow path for fluid entering and being expelled from each of the one or more volumes in the cleaning liquid delivery assembly. In some embodiments, the valve system comprises a pair of one-way valves, in other words a pair of check valves. The valve system may, for example, operate similarly to the valve assembly described herein in relation to the dirty liquid removal assembly.

[0034] In some embodiments, a first total volume of said one or more volumes in the dirty liquid removal assembly is greater than a second total volume of said one or more volumes in the cleaning liquid delivery assembly. For example, the first total volume may be at least 10%, preferably at least 25%, and most preferably at least 50% greater than the second total volume.

[0035] Alternatively or additionally, the dirty liquid removal assembly and the cleaning liquid delivery assembly may be configured so that a rate of delivery of cleaning liquid to the surface by the cleaning liquid delivery assembly is less than a rate of removal of liquid from the surface by the dirty liquid removal assembly.

[0036] These measures may assist to minimize the risk of the wet cleaning apparatus causing the surface to become excessively wet.

[0037] The cleaner head may comprise at least one dirt inlet for admitting the liquid from the surface when the underpressure is provided via said manipulation of the at least one volume changing element.

[0038] In some embodiments, the at least one dirt inlet is covered by a porous material whose pores carry the liquid away from the surface to the at least one dirt inlet.

[0039] When the porous material is dry, the porous material may be regarded as being in an "air transport state" in which air is transported through each of the dry pores of the porous material. A "liquid transport state" corresponds to liquid, e.g. water, being transported through the (wetted) pores of the porous material. When there is no longer a feed of liquid to the pores, a "fluid block state" may be adopted. The "fluid block state" corresponds to the state at which the surface tension of the (residual) liquid retained in the wetted pores of the porous material prevents fluid transport through the pores. In the latter state, a surface or barrier is created at the boundary between air and liquid, e.g. water. This barrier can assist to maintain the underpressure provided by the dirty liquid removal assembly, e.g. when no flow or only relatively low flow is being generated by the dirty liquid removal assembly.

[0040] In some embodiments, the porous material is formed from a polyester and/or a polyamide. Such materials have been found to be suitably hydrophilic to enable the porous material to be adequately wetted by water, e.g. water received from the surface.

[0041] Alternatively or additionally, the porous material may comprise one or more of a woven fabric, e.g. a microfiber woven fabric, a mesh, and a perforate membrane.

[0042] More generally, the wet cleaning apparatus may comprise a wet mopping device, a window cleaner, or a sweeper. Particular mention is made of a wet mopping device.

[0043] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

FIG. 1 schematically depicts part of a wet cleaning apparatus according to a first example;
FIG. 2 schematically depicts a dirty liquid removal assembly of the wet cleaning apparatus shown in FIG. 1;
FIGs. 3A and 3B schematically depict a dirty liquid removal assembly according to another example;
FIGs. 4A to 4D schematically depict a wet cleaning apparatus according to a second example;
FIG. 5 schematically depicts fluid flow during operation of the wet cleaning apparatus shown in FIGs. 4A to 4D;
FIGs. 6A to 6C schematically depict a wet cleaning apparatus according to a third example;
FIGs. 7A to 7D schematically depict a wet cleaning apparatus according to a fourth example;
FIGs. 8A to 8D schematically depict a wet cleaning apparatus according to a fifth example;
FIG. 9 schematically depicts fluid flow during operation of the wet cleaning apparatus shown in FIGs. 8A to 8D;
FIG. 10 provides a plan view of a cleaner head of a wet cleaning apparatus according to a sixth example;
FIG. 11 provides a perspective view of a dirty liquid

removal assembly and a cleaning liquid delivery assembly according to an example; and

FIG. 12 provides a perspective view of a dirty liquid removal assembly and a cleaning liquid delivery assembly according to another example.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0045] The invention will be described with reference to the Figures.

[0046] It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

[0047] Provided is a wet cleaning apparatus for cleaning a surface. The wet cleaning apparatus comprises a cleaner head, and a handle for allowing a user to move the cleaner head on the surface. The wet cleaning apparatus further comprises a dirty liquid removal assembly for removing liquid from the surface. The dirty liquid removal assembly comprises at least one volume changing element manipulable to expand one or more volumes in the dirty liquid removal assembly and thereby provide an underpressure for removing the liquid from the surface. The at least one volume changing element is arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally causes manipulation of the at least one volume changing element to expand the volume(s) in the dirty liquid removal assembly. In this way, the user's exertion of force on the handle assists with removal of the liquid from the surface.

[0048] FIG. 1 schematically depicts part of a wet cleaning apparatus 100 according to an example. The wet cleaning apparatus 100 comprises a cleaner head 102 that is moveable over a surface during cleaning of the surface using the wet cleaning apparatus 100. The surface may, for example, be a surface of a floor, wall, window, and so on.

[0049] The wet cleaning apparatus 100 comprises a dirty liquid removal assembly 104 for removing liquid from the surface.

[0050] The wet cleaning apparatus 100 may include a dirty liquid storage container 106 in which liquid 108, e.g. dirty water, removed from the surface, via operation of the dirty liquid removal assembly 104, is collectable.

[0051] The cleaner head 102 may have at least one dirt inlet 110 for admitting the liquid from the surface to be cleaned via operation of the dirty liquid removal assembly 104.

[0052] In some embodiments, such as shown in FIG. 1, the wet cleaning apparatus 100 comprises a cleaning liquid delivery assembly 112 for delivering cleaning liquid 114, e.g. cleaning liquid 114 comprising water and optionally detergent, to the surface.

[0053] In such embodiments, the wet cleaning apparatus 100 may include a cleaning liquid storage container 116 for storing the cleaning liquid 114 prior to delivery of the cleaning liquid 114 to the surface via operation of the cleaning liquid delivery assembly 112.

[0054] The cleaner head 102 may have at least one cleaning liquid outlet 118, 120 through which the cleaning liquid 114 is deliverable from the cleaner head 102 towards the surface via operation of the cleaning liquid delivery assembly 112.

[0055] Thus, in more general terms, the wet cleaning apparatus 100 may be configured to remove liquid from the surface being cleaned, via operation of the dirty liquid removal assembly 104, as well as being configured to deliver cleaning liquid 114 to the surface.

[0056] The removal of liquid from the surface is denoted in FIG. 1 by the arrow 122 pointing towards the dirt inlet(s) 110, and the delivery of cleaning liquid 114 to the surface is denoted in FIG. 1 by the arrows 124 pointing away from the cleaning liquid outlets 118, 120.

[0057] Whilst an electric pump, e.g. an electric peristaltic pump, may in principle be included in the dirty liquid removal assembly 104 to drive liquid removal, in other words liquid extraction, from the surface, such an electric pump may have disadvantages associated with the corresponding requirement to include electrical components in the wet cleaning apparatus 100. Such electrical components can increase the complexity and cost of the wet cleaning apparatus 100, particularly considering that specific regulatory requirements may apply to wet cleaning apparatuses 100 equipped with electrical components.

[0058] The present disclosure is based, at least in part, on the realization that the force exerted by a user on a handle (not visible in FIG. 1) of the wet cleaning apparatus 100 to move the cleaner head 102 on the surface can be additionally used in removing the liquid from the surface, and in some embodiments in delivering cleaning liquid 114 to the surface.

[0059] To this end, the dirty liquid removal assembly 104 comprises at least one volume changing element 126 manipulable to expand one or more volumes in the dirty liquid removal assembly 104 and thereby provide an underpressure for removing the liquid from the surface, with the at least one volume changing element 126 being arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head 102 on the surface additionally causes manipulation of the at least one volume changing element 126 to expand the volume(s) in the dirty liquid removal assembly 104.

[0060] The arrow 128 in FIG. 1 to the right of the dirty liquid removal assembly 104 shows the direction of fluid

flow, away from the surface, upon expansion of the volume(s) in the dirty liquid removal assembly 104 and concomitant generation of the underpressure.

[0061] The liquid on the surface may accordingly be removed therefrom by being forced by the higher, atmospheric, pressure, outside the cleaner head 102 in the direction of the underpressure, in other words pressure lower than atmospheric pressure, provided by the dirty liquid removal assembly 104.

[0062] Thus, and referring now to FIG. 2, the liquid on the surface may be in fluid communication with a suction side 130 of the dirty liquid removal assembly 104.

[0063] The at least one volume changing element 126 may also be manipulable, e.g. moveable and/or deformable, to decrease the one or more volumes in the dirty liquid removal assembly 104, e.g. in a compression stroke of the dirty liquid removal assembly 104.

[0064] For example, air may be releasable from the dirty liquid removal assembly 104 in the direction denoted by the arrow 132 in FIG. 1, with a pressure side 134 (see FIG. 2) of the dirty liquid removal assembly 104 being correspondingly defined.

[0065] As best shown in FIGs. 2A, 2B, 3A and 3B, the dirty liquid removal assembly 104 may comprise a valve assembly 136, 138 arranged to define a one-way flow path for fluid entering and being expelled from each volume in the dirty liquid removal assembly 104.

[0066] The valve assembly 136, 138 can be configured in any suitable manner provided that the valve assembly 136, 138 is capable of providing the one-way flow path. In some embodiments, such as shown in FIGs. 1 to 3B, the valve assembly 136, 138 comprises a pair of one-way valves 136, 138, in other words a pair of check valves 136, 138.

[0067] The one-way valves 136, 138 can have any suitable design. In some embodiments, such as shown in FIGs. 3A and 3B, the one-way valves 136, 138 are in the form of duckbill valves.

[0068] An expansion stroke of the dirty liquid removal assembly 104 is schematically depicted in FIG. 3A. In this particular non-limiting example, the volume changing element 126 is forced in outward directions 140 to expand the volume, with the consequence that fluid flows through the valve 136 while the other valve 138 remains closed.

[0069] The compression stroke of the dirty liquid removal assembly 104 is schematically depicted in FIG. 3B. In this case, the volume changing element 126 is compressed in inward directions 142 to decrease the volume, with the consequence that fluid flows through the valve 138 while the other valve 136 remains closed.

[0070] Thus, FIGs. 3A and 3B illustrate the above-mentioned one-way flow path provided by the valve assembly 136, 138.

[0071] During cleaning, e.g. mopping, of the surface, motion resistance may mean that force is continuously required to keep the cleaner head 102 moving on the surface. Mechanical components may transfer the driving force (user input) from the handle to the volume changing element(s) 126.

[0072] In some embodiments, the volume changing element(s) 126 is or are arranged relative to the handle so that force exerted on the handle by the user to push the cleaner head 102 on the surface in a forward direction and/or to pull the cleaner head 102 on the surface in a backward direction causes manipulation of the volume changing element(s) 126 to change the volume(s) in the dirty liquid removal assembly 104.

[0073] For example, in a forward stroke of the cleaner head 102, during which the user exerts a pushing force, and/or in a backward stroke of the cleaner head 102, during which the user exerts a pulling force, the volume changing element(s) 126 may be manipulated to change the volume(s) in the dirty liquid removal assembly 104.

[0074] In such an example, back and/or forth motion of the cleaner head 102 during mopping may be able to produce an air or water flow by making use of the functional pump created by the volume changing element 126 in combination with the one-way valves 136, 138 on either side of the volume changing element 126.

[0075] The volume changing element(s) 126 can be implemented in any suitable manner. In some embodiments, the dirty liquid removal assembly 104 comprises a container in which at least part of said volume(s) of the dirty liquid removal assembly 104 is provided, with the volume changing element(s) 126 being at least partly defined by the container being deformable, in response to said movement of the handle by the user, to change the one or more volumes in the dirty liquid removal assembly 104.

[0076] In other words, the deformable container, e.g. bellows, may be arranged to be expanded and compressed as a consequence of the user's movement of the handle to move the cleaner head 102 on the surface. Such a deformable container, e.g. bellows, may provide a relatively straightforward way of realizing the volume changing element(s) 126.

[0077] The deformable container, e.g. bellows, may be expanded to provide the underpressure during the expansion stroke, and compressed during the compression stroke.

[0078] Arranging the at least one volume changing element 126 relative to the handle so that force exerted on the handle by the user to move the cleaner head 102 on the surface additionally causes manipulation of the at least one volume changing element 126 to expand the volume(s) in the dirty liquid removal assembly 104 can be implemented in any suitable manner.

[0079] In some embodiments, such as shown in FIGs. 4A to 4D, the wet cleaning apparatus 100 comprises a pivot assembly 144, 146 for pivotably coupling the handle 148 to the cleaner head 102.

[0080] In such embodiments, pivoting of the pivot assembly 144, 146 caused by the user exerting force on the handle 148 may change the one or more volumes in the dirty liquid removal assembly 104. This may provide a relatively straightforwardly implementable way of em-

ploying the user's force on the handle 148 to manipulate the volume changing element(s) 126 and thereby control liquid removal from the surface being cleaned.

[0081] In some embodiments, such as shown in FIGs. 4A to 4D, the wet cleaning apparatus 100 comprises an intermediate element 150 between the handle 148 and the cleaner head 102, with the pivot assembly 144, 146 comprising a first pivot 144 between the intermediate element 150 and the handle 148, and a second pivot 146 between the intermediate element 150 and the cleaner head 102.

[0082] In such embodiments, the intermediate element 150 may be moveable, via pivoting of the first pivot 144 and the second pivot 146 when the user exerts force on the handle 148, to change the one or more volumes in the dirty liquid removal assembly 104.

[0083] FIG. 4A shows the wet cleaning apparatus 100 at rest with no force being exerted on the intermediate element 150 via the handle 148. FIG. 4C schematically depicts a force being exerted by the user in the direction denoted by the arrow 152, e.g. to push the cleaner head 102 in a forward direction, in other words a forward stroke. As well as causing movement of the cleaner head 102 in the forward direction, the force causes manipulation of the volume changing element(s) 126, in this case to decrease the volume(s) in the dirty liquid removal assembly 104, similarly to the scenario depicted in FIG. 3B.

[0084] In particular, the force exerted by the user in the direction 152 may cause the intermediate element 150 to press into, and thereby compress, the deformable container, e.g. bellows, against a front member 154 of the cleaner head 102.

[0085] FIG. 4D schematically depicts a force being exerted by the user in the direction denoted by the arrow 156, e.g. to pull the cleaner head 102 in a backward direction, in other words a backward stroke. As well as causing movement of the cleaner head 102 in the backward direction, the force causes manipulation of the volume changing element(s) 126, in this case to increase the volume(s) in the dirty liquid removal assembly 104, similarly to the scenario depicted in FIG. 3A. This increase in volume(s) provides the underpressure for removing the liquid from the surface, as previously described.

[0086] In particular, the force exerted by the user in the direction 156 may cause the intermediate element 150 to pull the deformable container, e.g. bellows, in a direction away from the front member 154, and thereby expand the deformable container.

[0087] In some embodiments, and referring to FIGs. 4B and 5, the cleaning liquid delivery assembly 112 comprises at least one volume changing member 158 manipulable to reduce one or more volumes in the cleaning liquid delivery assembly 112 and thereby provide an overpressure for delivering the cleaning liquid 114 to the surface.

[0088] In such embodiments, the at least one volume changing member 158 may be arranged relative to the handle 148 so that force exerted on the handle 148 by the user to move the cleaner head 102 on the surface causes manipulation of the at least one volume changing member 158 to change the one or more volumes in the cleaning liquid delivery assembly 112.

[0089] In some embodiments, the volume changing member(s) 158 is or are arranged relative to the handle 148 so that force exerted on the handle 148 by the user to push the cleaner head 102 on the surface in the forward direction and/or to pull the cleaner head 102 on the surface in the backward direction causes manipulation of the volume changing member(s) 158 to change the volume(s) in the cleaning liquid delivery assembly 112.

[0090] For example, in a forward stroke of the cleaner head 102, during which the user exerts a pushing force and/or in a backward stroke of the cleaner head 102, during which the user exerts a pulling force, the volume changing member(s) 158 may be manipulated to change the one or more volumes in the cleaning liquid delivery assembly 112.

[0091] The volume changing member 158 can be implemented in any suitable manner. In some embodiments, the cleaning liquid delivery assembly 112 comprises a further container in which at least part of said volume(s) of the cleaning liquid delivery assembly 112 is provided, with the volume changing member(s) 158 being at least partly defined by the further container being deformable, in response to the user's force exerted on the handle 148, to change the one or more volumes in the cleaning liquid delivery assembly 112.

[0092] In other words, the deformable further container, e.g. bellows, may be arranged to be expanded and compressed as a consequence of the user's force on the handle 148 to move the cleaner head 102 on the surface.

[0093] Such a deformable further container, e.g. bellows, may provide a relatively straightforward way of realizing the volume changing member(s) 158.

[0094] The deformable further container, e.g. bellows, may be compressed to provide the overpressure during the compression stroke, and expanded during the expansion stroke.

[0095] The cleaning liquid delivery assembly 112 may comprise a valve system 160, 162 arranged to define a one-way flow path for fluid entering and being expelled from each of the one or more volumes in the cleaning liquid delivery assembly 112.

[0096] In some embodiments, such as shown in FIGs. 1 and 5, the valve system 160, 162 comprises a pair of one-way valves 160, 162, in other words a pair of check valves 160, 162.

[0097] The one-way valves 160, 162 can have any suitable design. In some embodiments, the one-way valves 160, 162 are in the form of duckbill valves.

[0098] The valve system 160, 162 may operate similarly to the valve assembly 136, 138 described above in relation to the dirty liquid removal assembly 104.

[0099] In some embodiments, pivoting of the pivot

assembly 144, 146 caused by exertion of force on the handle 148 by the user may change the one or more volumes in the cleaning liquid delivery assembly 112. This may provide a relatively straightforwardly implementable way of employing force exerted by the user on the handle 148 to manipulate the volume changing member(s) 158 and thereby control liquid removal from the surface being cleaned.

[0100] The intermediate element 150 may be moveable, via pivoting of the first pivot 144 and the second pivot 146 during said manipulation of the handle 148 by the user, to change the one or more volumes in the cleaning liquid delivery assembly 112.

[0101] In some embodiments, and as best shown in FIG. 4B, a volume changing element 126 and a volume changing member 158 are arranged adjacent to each other so that the volume changing element 126 and the volume changing member 158 are both manipulated by the same force exerted on the handle 148 by the user.

[0102] The volume changing element(s) 126 and the volume changing member(s) 158 may each include a deformable container, e.g. bellows, with these deformable containers being arranged adjacent to each other so that compression of one of these deformable containers as a consequence of manipulation of the handle 148 takes place while the other of these deformable containers is also compressed. This may, for example, be implemented by the force exerted by the user in the direction 152 causing the intermediate element 150 to press into, and thereby compress, each of the deformable containers against the front member 154.

[0103] In this manner, and referring to FIG. 5, compression of the deformable containers caused by exertion of force on the handle 148 by the user to push the cleaner head 102 on the surface in the forward direction, may cause delivery of the cleaning liquid 114 towards the surface (see arrows 124 and 164), while fluid, e.g. air, is released (see arrow 132) from the dirty liquid removal assembly 104.

[0104] Moreover, expansion of each of the deformable containers, e.g. during exertion of force on the handle 148 by the user to pull the cleaner head 102 on the surface in the backward direction, may generate the underpressure by which the liquid on the surface is forced into the wet cleaning apparatus 100 (see the arrows 122 and 128), while cleaning liquid 114 is displaced from the cleaning liquid storage container 116 into the cleaning liquid delivery assembly 112 (see the arrow 166). This may, for example, be implemented by the intermediate element 150 pulling each of the deformable containers in a direction away from the front member 154 so as to expand each of the deformable containers.

[0105] It is noted that the volume of this displaced cleaning liquid 114 may be replaced by air, as denoted in FIG. 5 by the arrow 168.

[0106] A challenge in terms of optimizing the wet cleaning apparatus 100 may relate to fully using the force transferrable from the handle 148 to the volume changing element(s) 126. Since the wet cleaning apparatus 100 may depend on motion resistance, the force acting on the handle 148 may typically be higher in the forward stroke of the cleaner head 102 than in the backward stroke.

[0107] In the embodiment shown in FIGs. 4A to 4D, the backward stroke is relied upon to create the underpressure. However, in this case the forward stroke is not used at all, as this is the "exhaust stroke" that lets air out of the system (see the arrow 132 in FIG. 5). In the latter, only a negligible amount of force may be needed (see the valve 138 in FIG. 3B).

[0108] For this reason, and referring now to FIGs. 6A to 6C, the wet cleaning apparatus 100 may include a biasing element 170, e.g. spring, arranged to store mechanical energy during exertion of force on the handle 148 to move the cleaner head 102 in the forward direction, with the stored mechanical energy being recovered during manipulation of the handle 148 to move the cleaner head 102 in the backward direction.

[0109] Such loading of the biasing element 170, e.g. spring, when the cleaner head 102 is moved in the forward direction may store the work, and relieve itself on the backward stroke.

[0110] The biasing element 170 can be implemented in any suitable manner. In some embodiments, such as shown in FIGs. 6A to 6C, the biasing element 170 comprises, e.g. is, a spring that connects the intermediate element 150 with a rearward portion of the cleaner head 102. Alternatively or additionally, the biasing element 170 comprises, e.g. is, a torsion spring arranged at the second pivot 146.

[0111] FIG. 6A shows the wet cleaning apparatus 100 in a neutral state, with the cleaner head 102 at rest. The biasing element 170 is pulling the intermediate element 150 to retain the volume changing element(s) 126, e.g. bellows, in a state in which the volume(s) in the dirty liquid removal assembly 104 is/are expanded. Thus, the dirty liquid removal assembly 104 may be in a suction state when the cleaner head 102 is at rest.

[0112] FIG. 6B shows a forward stroke of the cleaner head 102, with concomitant compression of the volume in the bellows and loading of the biasing element 170. FIG. 6C depicts a backward stroke of the cleaner head 102, with concomitant unloading of the biasing element 170 and implementation of a suction stroke of the dirty liquid removal assembly 104 via expansion of the volume in the bellows.

[0113] Whilst the volume changing element(s) 126 is/are arranged proximal to the front of the cleaner head 102 in the embodiment shown in FIGs. 4A to 4D and 6A to 6C, this is not intended to be limiting and other arrangements of the volume changing element(s) 126 are conceivable. In some embodiments, such as shown in FIGs. 7A to 7D, the volume changing element(s) 126 is/are arranged proximal to the back of the cleaner head 102, for example such that the intermediate element 150 presses into, and thereby compresses, the deformable container, e.g. bellows, against a rear member 172 of the cleaner

head 102 when the handle 148 is pulled backward (see FIG. 7C).

[0114] This positioning may also mean that, for example, the intermediate element 150 pulls the deformable container, e.g. bellows, in a direction away from the rear member 172, and thereby expands the deformable container, when the handle 148 is pushed forward (see FIG. 7D).

[0115] In such embodiments, the volume changing member(s) 158 of the cleaning liquid delivery assembly 112 may also be arranged, together with the volume changing element(s) 126, proximal to the back of the cleaner head 102.

[0116] In some embodiments, such as shown in FIGs. 8A to 8D, the at least one volume changing element 126 of the dirty liquid removal assembly 104 comprises a first volume changing element 126A, e.g. at least partly defined by a first deformable container, and a second volume changing element 126B, e.g. at least partly defined by a second deformable container.

[0117] In such embodiments, and referring to FIG. 8C, the first volume changing element 126A may be manipulable to expand a first volume of the one or more volumes in the dirty liquid removal assembly 104 when the handle 148 is forced by the user to move the cleaner head 102 on the surface in a first direction, e.g. while the second volume changing element 126B is manipulated to compress a second volume of the one or more volumes in the dirty liquid removal assembly 104.

[0118] The first direction may be, for example, one of the forward direction and the backward direction of the cleaner head 102 on the surface being cleaned.

[0119] Moreover, and referring now to FIG. 8D, the second volume changing element 126B may be manipulable to expand the second volume of the one or more volumes in the dirty liquid removal assembly 104 when the handle 148 is forced by the user to move the cleaner head 102 on the surface in a second direction opposite to the first direction, e.g. while the first volume changing element 126A is moved to compress the first volume.

[0120] Thus, forces applied by the user to move the cleaner head 102 in both directions, e.g. both forward and backward directions, may be utilized to generate the underpressure for removing the liquid from the surface being cleaned.

[0121] The at least one volume changing member 158 of the cleaning liquid delivery assembly 112 may comprise a first volume changing member 158A, e.g. at least partly defined by a first further deformable container, and a second volume changing member 158B, e.g. at least partly defined by a second further deformable container.

[0122] In such embodiments, and referring to FIG. 8C, the first volume changing member 158A may be manipulable to expand a first volume of the one or more volumes in the cleaning liquid delivery assembly 112 when the handle 148 is forced by the user move the cleaner head 102 on the surface in a first direction, e.g. while the second volume changing member 158B is manipulated to compress a second volume of the one or more volumes in the cleaning liquid delivery assembly 112.

[0123] Moreover, and referring to FIG. 8D, the second volume changing member 158B may be manipulable to expand the second volume of the one or more volumes in the cleaning liquid delivery assembly 112 when the handle 148 is forced by the user to move the cleaner head 102 on the surface in a second direction opposite to the first direction, e.g. while the first volume changing member 158A is manipulated to compress the first volume.

[0124] Thus, forces applied by the user to move the cleaner head 102 in both directions, e.g. both forward and backward directions, may be utilized to deliver cleaning liquid 114 to the surface being cleaned.

[0125] The flows created via forward and backward movement of the cleaner head 102 by the user's manipulation of the handle 148 may allow delivery of the cleaning liquid 114 to the surface and removal of liquid from the surface.

[0126] Referring to FIG. 9, compression of the deformable containers of the first volume changing element 126A and the first volume changing member 158A, e.g. when force is exerted on the handle 148 by the user to push the cleaner head 102 on the surface in the forward direction (see FIG. 8D), may cause delivery of the cleaning liquid 114 towards the surface (see arrows 124 and 164A), while fluid, e.g. air, is released (see arrow 132A) from the dirty liquid removal assembly 104.

[0127] At the same time, expansion of the deformable containers of the second volume changing element 126B and the second volume changing member 158B may contribute to the underpressure by which the liquid on the surface is forced into the wet cleaning apparatus 100 (see the arrows 122 and 128B), while cleaning liquid 114 is displaced from the cleaning liquid storage container 116 into the cleaning liquid delivery assembly 112 (see the arrow 166B).

[0128] This may, for example, be implemented by the intermediate element 150 pulling each of the deformable containers of the second volume changing element 126B and the second volume changing member 158B in a direction away from the rear member 172 so as to expand each of these deformable containers, while the intermediate element 150 also presses into, and thus compresses, each of the deformable containers of the first volume changing element 126A and the first volume changing member 158A.

[0129] Subsequent expansion of the deformable containers of the first volume changing element 126A and the first volume changing member 158A, e.g. when force is exerted on the handle 148 by the user to pull the cleaner head 102 on the surface in the backward direction (see FIG. 8C), may contribute to the underpressure by which the liquid on the surface is forced into the wet cleaning apparatus 100 (see the arrows 122 and 128A), while cleaning liquid 114 is displaced from the cleaning liquid storage container 116 into the cleaning liquid delivery

assembly 112 (see the arrow 166A).

[0130] At the same time, compression of the deformable containers of the second volume changing element 126B and the second volume changing member 158B may cause delivery of the cleaning liquid 114 towards the surface (see arrows 124 and 164B), while fluid, e.g. air, is released (see arrow 132B) from the dirty liquid removal assembly 104.

[0131] It is noted that FIG. 8B shows the wet cleaning apparatus 100 at rest with both volume changing element-volume changing member pairs 126A, 158A; 126B;158B, e.g. pairs of bellows, being moved to their neutral position. The latter may be achieved via a spring and/or via the intrinsic resilience of bellows.

[0132] Whilst a volume changing element 126; 126A, 126B and a volume changing member 158; 158A, 158B are arranged adjacent to each other in the embodiments shown in FIGs. 4A to 4D; 6A to 6C, 7A to 7D and 8A to 8D, this is not intended to be limiting and other arrangements of the volume changing element(s) 126; 126A, 126B and the volume changing member(s) 158; 158A, 158B are conceivable. In some embodiments, such as shown in FIG. 10, a volume changing element 126 of the dirty liquid removal assembly 104 is arranged proximal to the front of the cleaner head 102, while a volume changing member 158 of the cleaning liquid delivery assembly 112 is arranged proximal to the back of the cleaner head 102.

[0133] For example, the deformable container, e.g. bellows, of the dirty liquid removal assembly 104 may be proximal to the front of the cleaner head 102 while the further deformable container, e.g. bellows, of the cleaning liquid delivery assembly 112 may be proximal to the back of the cleaner head 102, e.g. with the intermediate element 150 being arranged in between the container and the further container so that one the deformable container and the further deformable container is compressed by the intermediate element 150 while the other is being expanded.

[0134] Alternatively, a volume changing element 126 of the dirty liquid removal assembly 104 is arranged proximal to the back of the cleaner head 102, while a volume changing member 158 of the cleaning liquid delivery assembly 112 is arranged proximal to the front of the cleaner head 102. For example, the deformable container, e.g. bellows, of the dirty liquid removal assembly 104 may be proximal to the back of the cleaner head 102 while the further deformable container, e.g. bellows, of the cleaning liquid delivery assembly 112 may be proximal to the front of the cleaner head 102.

[0135] Whilst the embodiments shown in FIGs. 2 to 4D and 6A to 8D include volume changing element(s) 126; 126A, 126B in the form of a deformable container, this is not intended to be limiting and alternative designs for the volume changing element(s) 126; 126A, 126B are conceivable. In some embodiments, and referring now to FIG. 11, the dirty liquid removal assembly 104 comprises at least one container 174A, 174B in which at least part of said one or more volumes of the dirty liquid removal assembly 104 is provided, wherein the at least one volume changing element 126; 126A, 126B each comprise, e.g. are each in the form of, a wiper element moveable within the at least one container 174A, 174B.

[0136] The wiper element may be arranged relative to the handle 148 so that force exerted on the handle 148 by the user to move the cleaner head 102 on the surface additionally moves the wiper element to change the one or more volumes in the dirty liquid removal assembly 104.

[0137] The wiper element can have any suitable design. In some embodiments, such as shown in FIG. 11, the wiper element is rotatable within the respective container 174A, 174B. In other embodiments, the wiper element may in the form of a piston or syringe. The wiper element may be moved to its neutral position by, for example, a spring coupled to the wiper element.

[0138] In some embodiments, and still referring to FIG. 11, at least part of said one or more volumes in the cleaning liquid delivery assembly 112 is provided in at least one further container 176A, 176B, and the at least one volume changing member 158; 158A, 158B each comprise a wiper member moveable within the at least one further container 176A, 176B.

[0139] The wiper member may be arranged so that force exerted on the handle 148 by the user to move the cleaner head 102 on the surface additionally moves the wiper member to change the one or more volumes in the cleaning liquid delivery assembly 112.

[0140] More generally, a first total volume of said one or more volumes in the dirty liquid removal assembly 104, when maximally expanded, may be greater than a second total volume of said one or more volumes in the cleaning liquid delivery assembly 112, when maximally expanded. For example, the first total volume may be at least 10%, preferably at least 25%, and most preferably at least 50% greater than the second total volume.

[0141] Alternatively or additionally, the dirty liquid removal assembly 104 and the cleaning liquid delivery assembly 112 may be configured so that a rate of delivery of cleaning liquid 114 to the surface by the cleaning liquid delivery assembly 112 is less than a rate of removal of liquid from the surface by the dirty liquid removal assembly 104.

[0142] These measures may assist to minimize the risk of the wet cleaning apparatus 100 causing the surface to become excessively wet.

[0143] In some embodiments, such as shown in FIGs. 4A, 4C, 4D, 6A to 6C, 7A, 7C, 7D, 8A, 8C, and 8D, the at least one dirt inlet 110 is covered by a porous material 178 whose pores carry the liquid from the surface to the at least one dirt inlet 110.

[0144] When the porous material 178 is dry, the porous material 178 may be regarded as being in an "air transport state" in which air is transported through each of the dry pores of the porous material 178. A "liquid transport state" corresponds to liquid, e.g. water, being transported through the (wetted) pores of the porous material 178. When there is no longer a feed of liquid to the pores, a

"fluid block state" may be adopted. The "fluid block state" corresponds to the state at which the surface tension of the (residual) liquid retained in the wetted pores of the porous material 178 prevents fluid transport through the pores. In the latter state, a surface or barrier is created at the boundary between air and liquid, e.g. water. This barrier can assist to maintain the underpressure provided by the dirty liquid removal assembly 104, e.g. when no flow or only relatively low flow is being generated by the dirty liquid removal assembly 104.

[0145] In some embodiments, the porous material 178 is formed from a polyester and/or a polyamide. Such materials have been found to be suitably hydrophilic to enable the porous material to be adequately wetted by water, e.g. water received from the surface.

[0146] Alternatively or additionally, the porous material 178 may comprise one or more of a woven fabric, e.g. a microfiber woven fabric, a mesh, and a perforate membrane.

[0147] In some embodiments, and still referring to FIGs. 4A, 4C, 4D, 6A to 6C, 7A, 7C, 7D, 8A, 8C, and 8D, the cleaner head 102 includes a pliable material 180 on which the porous material 178 is arranged. Deformation, e.g. resilient deformation, of such a pliable material 180 may lessen the risk of damage to the porous material 178 should, for example, a relatively hard protrusion be present on the surface to be cleaned which comes into contact with the porous material 178, or a further porous material arranged on the porous material 178. Alternatively or additionally, the pliable material 180 may assist the porous material 178 to follow any contours of the surface.

[0148] In some embodiments, the pliable material 180 comprises a curved surface on which the porous material 178 is arranged, with the porous material 178 following the curvature of the curved surface.

[0149] A liquid pick-up region of the porous material 178 may be delimited by sealing attachment of the porous material 178 around the at least one dirt inlet 110.

[0150] The sealing attachment of the porous material 178 around the dirt inlet(s), may assist to maintain an underpressure in the dirt inlet(s) 110 with or without a flow being applied by the dirty liquid removal assembly 104.

[0151] The sealing attachment can be implemented in any suitable manner, such as by gluing or welding the porous material 178 around each of the at least one dirt inlet 110, for example gluing and/or welding the porous material 178 around one or more tubes whose opening(s) define the dirt inlet(s) 110.

[0152] In some embodiments, the at least one dirt inlet 110 is defined by one or more channels extending through the pliable material 180.

[0153] In some embodiments, such as shown in FIGs. 4A, 4C, 4D, 6A to 6C, 7A, 7C, 7D, 8A, 8C, and 8D, the cleaner head 102 comprises at least one cleaning liquid distribution strip 182, 184 configured to distribute the cleaning liquid 114 delivered by the cleaning liquid delivery assembly 112 along a length of the cleaner head 102. At least some, e.g. all, of the cleaning liquid outlets 118, 120 may be included in the at least one cleaning liquid distribution strip 182, 184.

[0154] In some embodiments, the force exerted by the user is directed axially along a length of the handle 148. In such embodiments, and referring now to FIG. 12, the volume change element(s) 126; 126A, 126B, and optionally also the volume change member(s) 158; 158A, 158B, can be mounted in the handle 148.

[0155] The left hand image of FIG. 12 represents the wet cleaning apparatus 100 at rest. The middle image of FIG. 12 represents a force being exerted by the user in the direction denoted by the arrow 152, e.g. to push the cleaner head 102 in a forward direction, in other words a forward stroke. This causes reduction in the volume in the dirty liquid removal assembly 104, in this case via compression of a deformable container, e.g. bellows, arranged in the handle 148, with concomitant fluid flow to the dirty liquid storage container 106. Moreover, the forward stroke causes reduction in the volume in the cleaning liquid delivery assembly 112, in this case via compression of a further deformable container, e.g. bellows, arranged in the handle 148, with concomitant flow of the cleaning liquid 114 towards the surface, e.g. via a cleaning cloth included in or fastened to the cleaner head 102.

[0156] The right hand image of FIG. 12 represents a force being exerted by the user in the direction denoted by the arrow 156, e.g. to pull the cleaner head 102 in a backward direction, in other words a backward stroke. This causes an increase in the volume in the dirty liquid removal assembly 104, in this case via expansion of the deformable container arranged in the handle 148, with concomitant liquid flow from the surface, e.g. the cleaning cloth, into the dirty liquid removal assembly 104. Moreover, the backward stroke causes expansion in the volume in the cleaning liquid delivery assembly 112, in the case via expansion of the further deformable container arranged in the handle 148, with concomitant flow of the cleaning liquid 114 from the cleaning liquid storage container 116 into the cleaning liquid delivery assembly 112.

[0157] In summary, the present disclosure fulfils functionality provided by an electric pump assembly having an electric motor, namely moving/displacing a medium, but without requiring electrical components. This offers cost savings in terms of the parts used in the wet cleaning apparatus 100 but also in respect of regulatory requirements, such as Ingress Protection (IPX) and International Electrotechnical Commission (IEC). In spite of not requiring electrical components, the wet cleaning apparatus 100 may still be able to extract/remove, and in some embodiments feed/deliver, liquid during operation.

[0158] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an"

does not exclude a plurality.

[0159] The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0160] If the term "adapted to" is used in the claims or description, it is noted the term "adapted to" is intended to be equivalent to the term "configured to".

[0161] Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A wet cleaning apparatus (100) for cleaning a surface, the wet cleaning apparatus comprising:

   a cleaner head (102);
   a handle (148) for allowing a user to move the cleaner head on the surface; and
   a dirty liquid removal assembly (104) for removing liquid from the surface, the dirty liquid removal assembly comprising at least one volume changing element (126; 126A, 126B) manipulable to expand one or more volumes in the dirty liquid removal assembly and thereby provide an underpressure for removing the liquid from the surface, wherein the at least one volume changing element is arranged relative to the handle so that force exerted on the handle by the user to move the cleaner head on the surface additionally manipulates the at least one volume changing element to expand the volume(s) in the dirty liquid removal assembly.

2. The wet cleaning apparatus (100) according to claim 1, wherein the at least one volume changing element (126; 126A, 126B) is arranged relative to the handle (148) so that force exerted on the handle by the user to push the cleaner head (102) on the surface in a forward direction and/or to pull the cleaner head on the surface in a backward direction manipulates the at least one volume changing element to change the volume(s) in the dirty liquid removal assembly.

3. The wet cleaning apparatus (100) according to claim 1 or claim 2, wherein the at least one volume changing element (126; 126A, 126B) comprises:

   a first volume changing element (126A) manipulable to expand a first volume of the one or more volumes in the dirty liquid removal assembly (104) when the handle (148) is forced by the user to move the cleaner head (102) on the surface in a first direction; and
   a second volume changing element (126B) manipulable to expand a second volume of the one or more volumes in the dirty liquid removal assembly when the handle is forced by the user to move the cleaner head on the surface in a second direction opposite to the first direction.

4. The wet cleaning apparatus (100) according to any one of claims 1 to 3, comprising a pivot assembly (144, 146) for pivotably coupling the handle (148) to the cleaner head (102), the at least one volume changing element being manipulable, via pivoting of the pivot assembly when the handle is forced by the user, to change the volume(s) in the dirty liquid removal assembly (104).

5. The wet cleaning apparatus (100) according to claim 4, comprising an intermediate element (150) between the handle (148) and the cleaner head (102), the pivot assembly (144, 146) comprising a first pivot (144) between the intermediate element and the handle, and a second pivot (146) between the intermediate element and the cleaner head, the intermediate element being moveable, via pivoting of the first pivot and the second pivot when the handle is forced by the user, to change the volume(s) in the dirty liquid removal assembly (104).

6. The wet cleaning apparatus (100) according to any one of claims 1 to 5, wherein the dirty liquid removal assembly (104) comprises a valve assembly (136, 138; 136A, 136B, 138A, 138B) arranged to define a one-way flow path for fluid entering and being expelled from each of the one or more volumes in the dirty liquid removal assembly.

7. The wet cleaning apparatus (100) according to any one of claims 1 to 6, wherein the dirty liquid removal assembly (104) comprises at least one container (174A, 174B) in which at least part of said one or more volumes of the dirty liquid removal assembly is provided, the at least one volume changing element (126; 126A, 126B) comprising a wiper element moveable within the at least one container and arranged relative to the handle (148) so that force exerted on the handle by the user to move the cleaner head on the surface additionally moves the wiper element to change the volume(s) in the dirty liquid removal assembly.

8. The wet cleaning apparatus (100) according to any one of claims 1 to 7, wherein the dirty liquid removal assembly (104) comprises a container in which at least part of said one or more volumes of the dirty liquid removal assembly is provided, wherein the at least one volume changing element (126; 126A, 126B) is at least partly defined by the container being deformable, the container being arranged relative to the handle (148) so that force exerted on the handle by the user to move the cleaner head on the surface additionally deforms the container to change the

volume(s) in the dirty liquid removal assembly.

9. The wet cleaning apparatus (100) according to any one of claims 1 to 8, comprising a cleaning liquid delivery assembly (112) that includes at least one volume changing member (158; 158A, 158B) manipulable to reduce one or more volumes in the cleaning liquid delivery assembly and thereby provide an overpressure for delivering the cleaning liquid to the surface.

10. The wet cleaning apparatus (100) according to claim 9, wherein the at least one volume changing member (158; 158A, 158B) is arranged relative to the handle (148) so that force exerted on the handle by the user to move the cleaner head (102) on the surface manipulates the at least one volume changing member to change the volume(s) in the cleaning liquid delivery assembly (112).

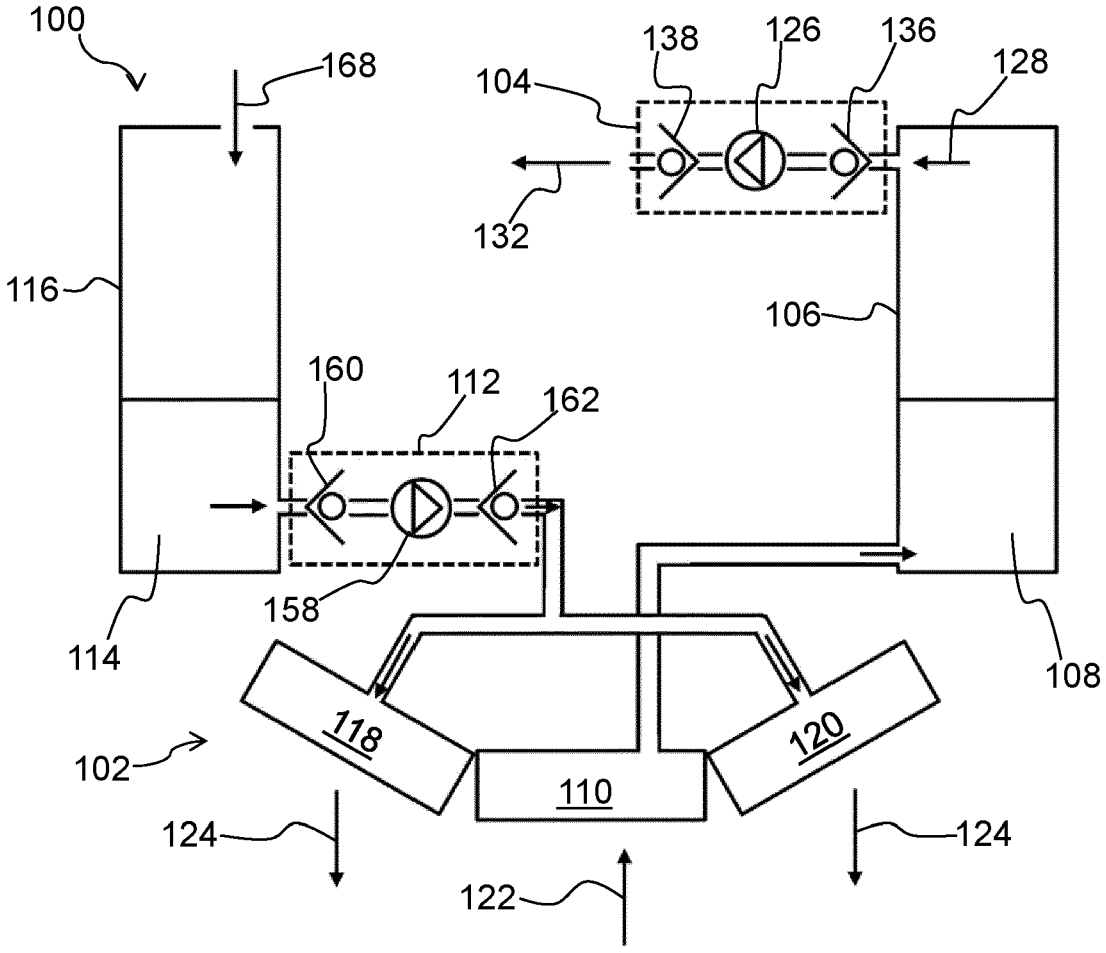
11. The wet cleaning apparatus (100) according to claim 9 or claim 10, wherein at least part of said one or more volumes in the cleaning liquid delivery assembly (112) is provided in at least one further container (176A, 176B), the at least one volume changing member (158; 158A, 158B) comprising a wiper member moveable within the at least one further container and arranged so that force exerted on the handle (148) by the user to move the cleaner head (102) on the surface additionally moves the wiper member to change the volume(s) in the cleaning liquid delivery assembly.

12. The wet cleaning apparatus (100) according to any one of claims 9 to 11, wherein at least part of said one or more volumes in the cleaning liquid delivery assembly (112) is provided in a further container, wherein the at least one volume changing member (158; 158A, 158B) is at least partly defined by the further container being deformable, the further container being arranged relative to the handle (148) so that force exerted on the handle by the user to move the cleaner head (102) on the surface additionally deforms the further container to change the volume(s) in the cleaning liquid delivery assembly.

13. The wet cleaning apparatus (100) according to any one of claims 9 to 12, wherein the cleaning liquid delivery assembly (112) comprises a valve system (160, 162; 160A, 160B, 162A, 162B) arranged to define a one-way flow path for fluid entering and being expelled from each of the one or more volumes in the cleaning liquid delivery assembly.

14. The wet cleaning apparatus (100) according to any one of claims 9 to 13, wherein a first total volume of said one or more volumes in the dirty liquid removal assembly (104) is greater than a second total volume of said one or more volumes in the cleaning liquid delivery assembly (112).

15. The wet cleaning apparatus (100) according to any one of claims 1 to 14, wherein the cleaner head (102) comprises at least one dirt inlet (110) for admitting the liquid from the surface when said underpressure is provided via said manipulation of the at least one volume changing element (126; 126A, 126B), the at least one dirt inlet being covered by a porous material (178) whose pores carry the liquid away from the surface to the at least one dirt inlet.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168
104
138
126
136
128
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116
106
160
112
162
158
114
108
118
120
102
110
124
124
122

FIG. 1

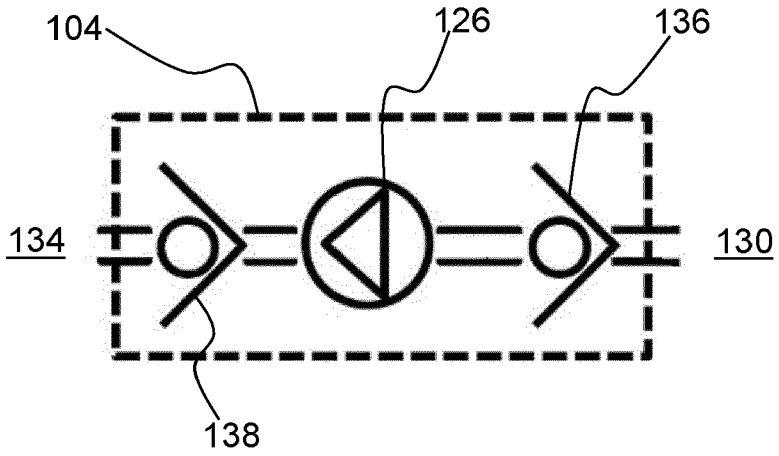

104
126
136
134
130
138

FIG. 2

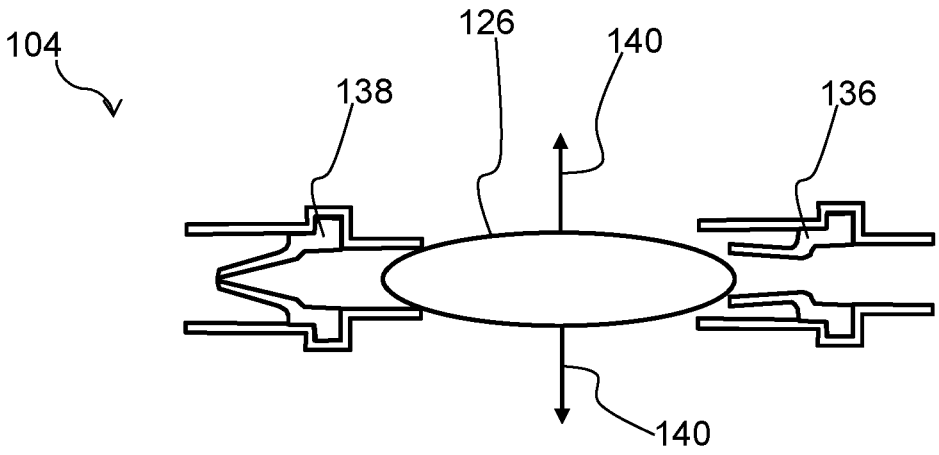


FIG. 3A

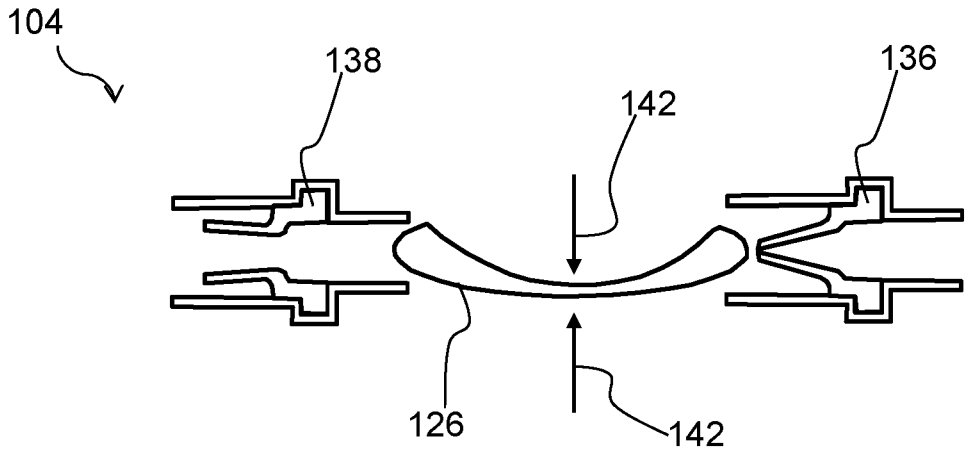
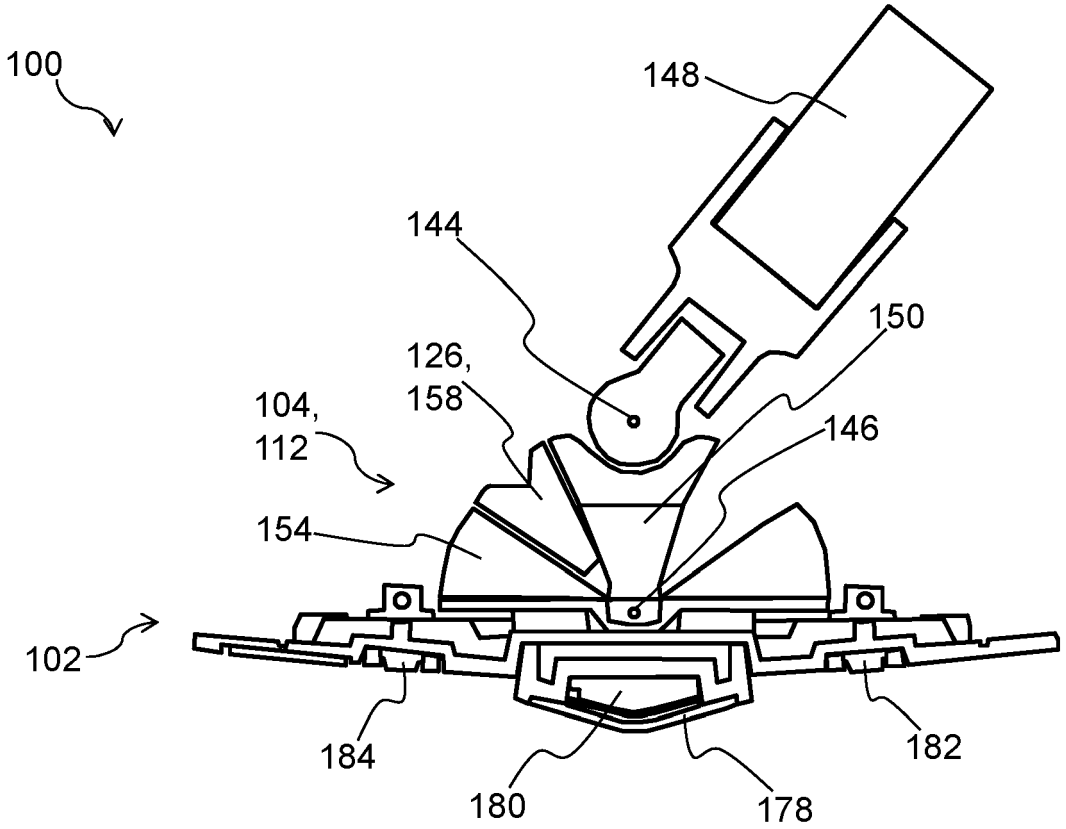


FIG. 3B


100
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150
126,
158
104,
112
146
154
102
184
180
178
182

FIG. 4A

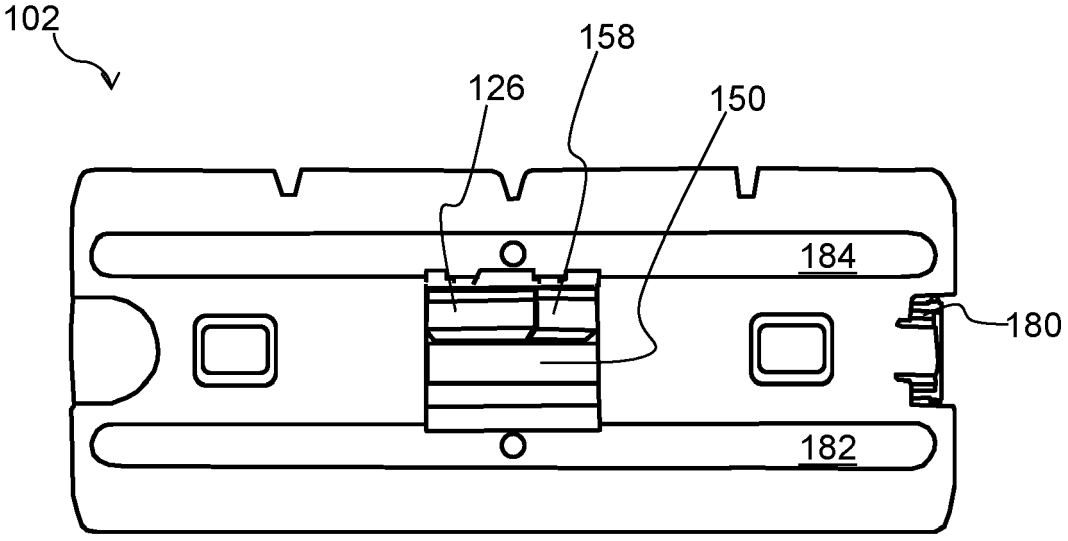
102
158
126
150
184
180
182

FIG. 4B

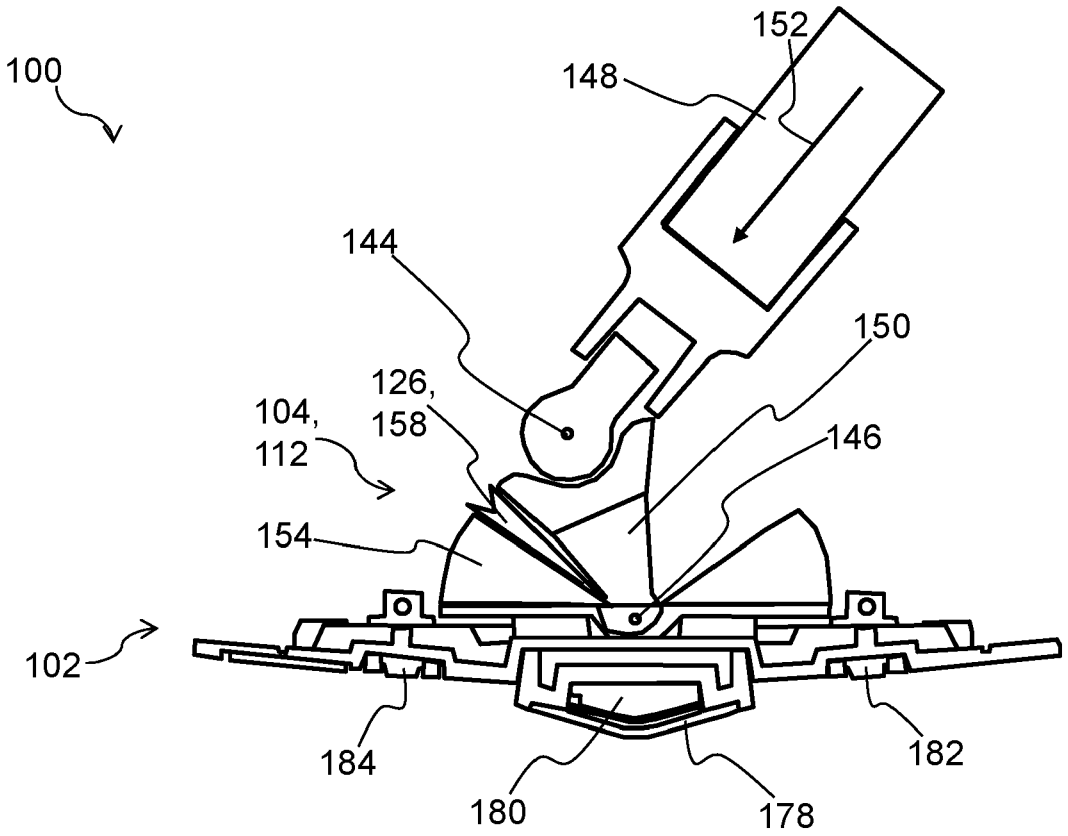

FIG. 4C

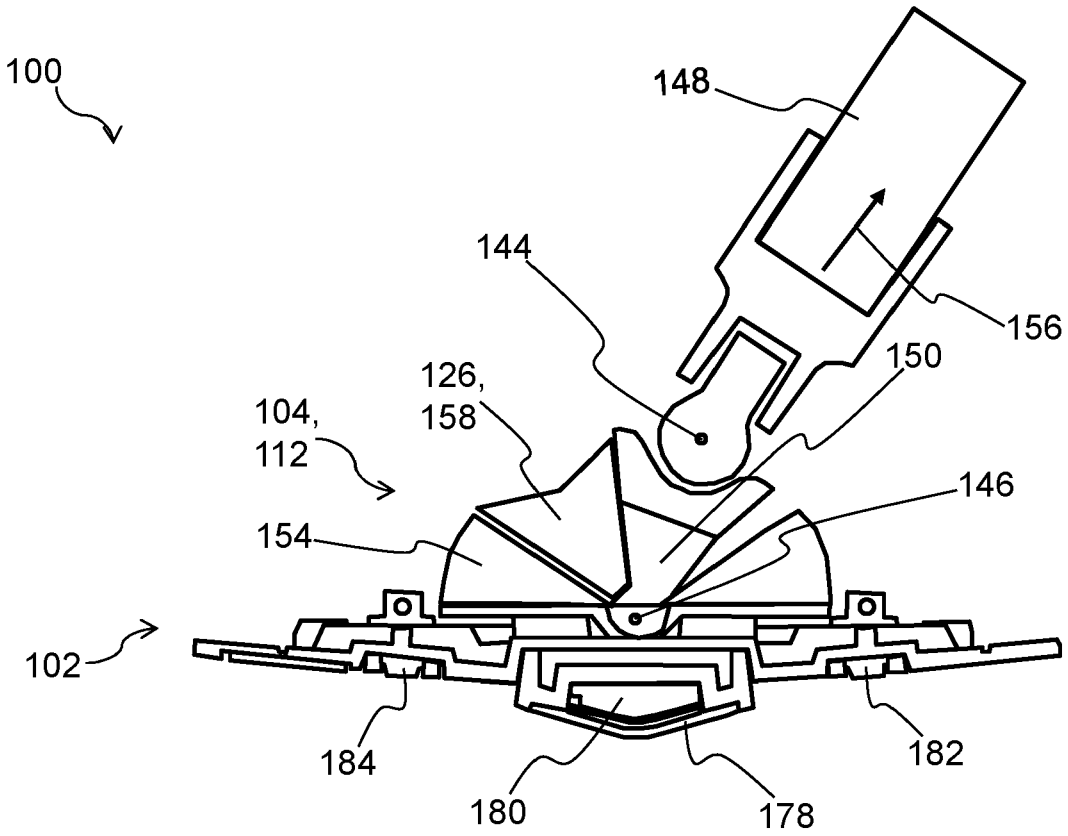

FIG. 4D

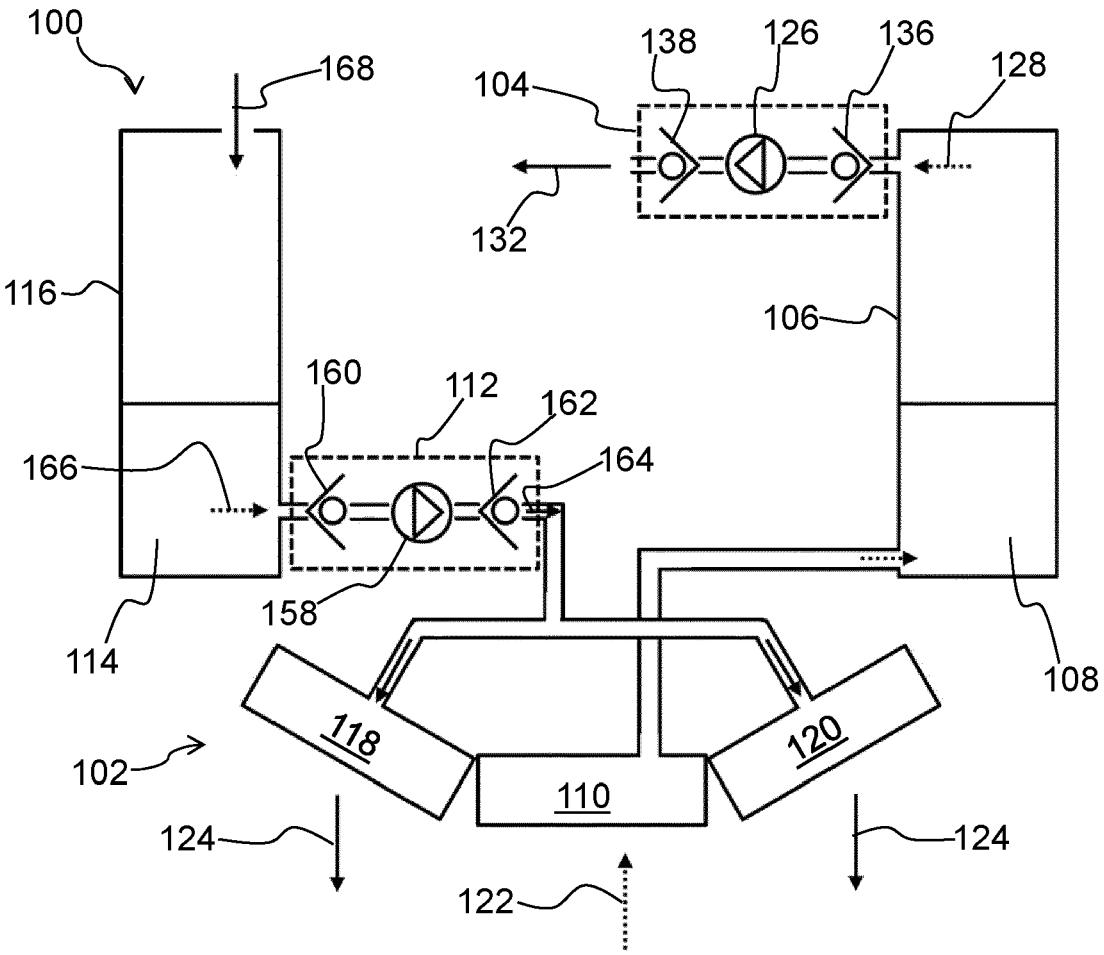
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FIG. 5

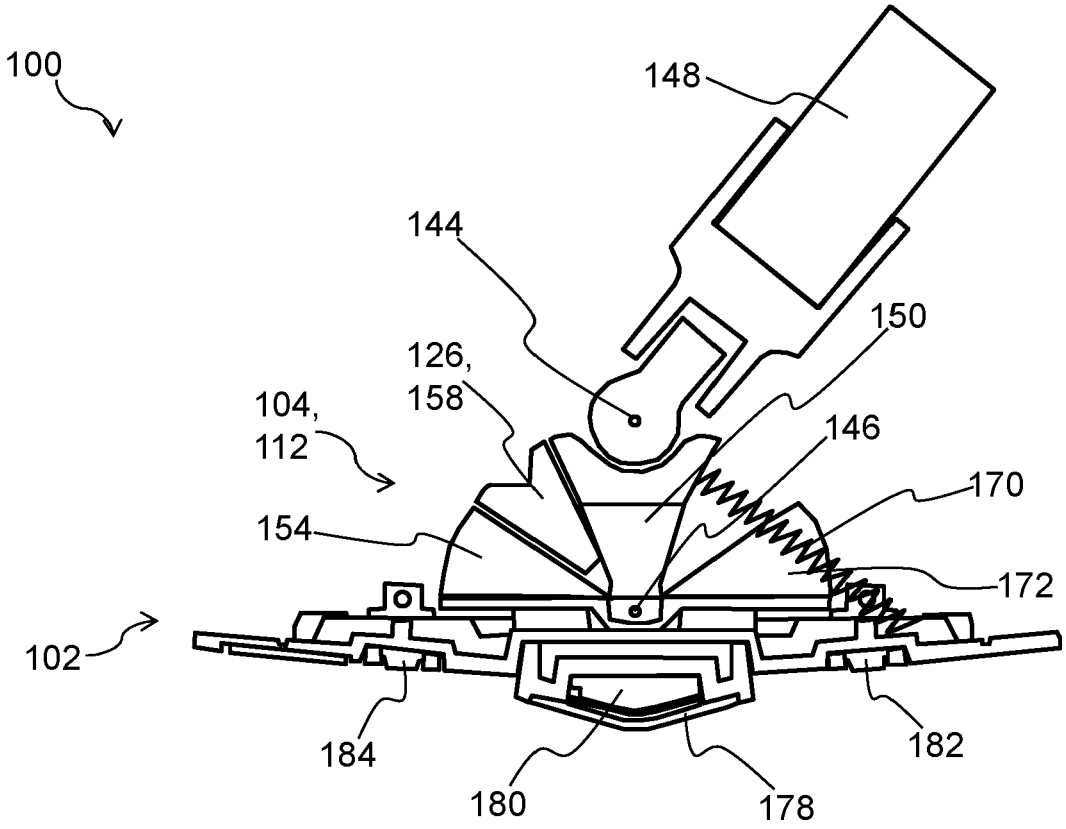
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FIG. 6A

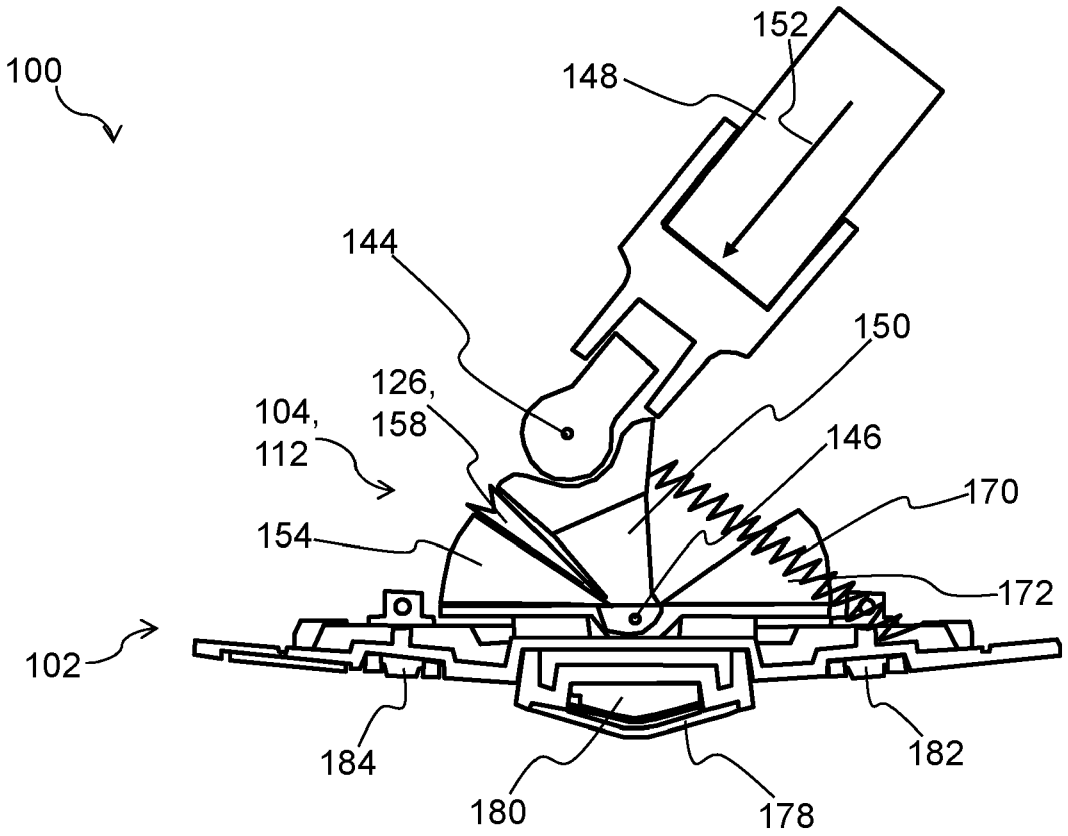
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FIG. 6B

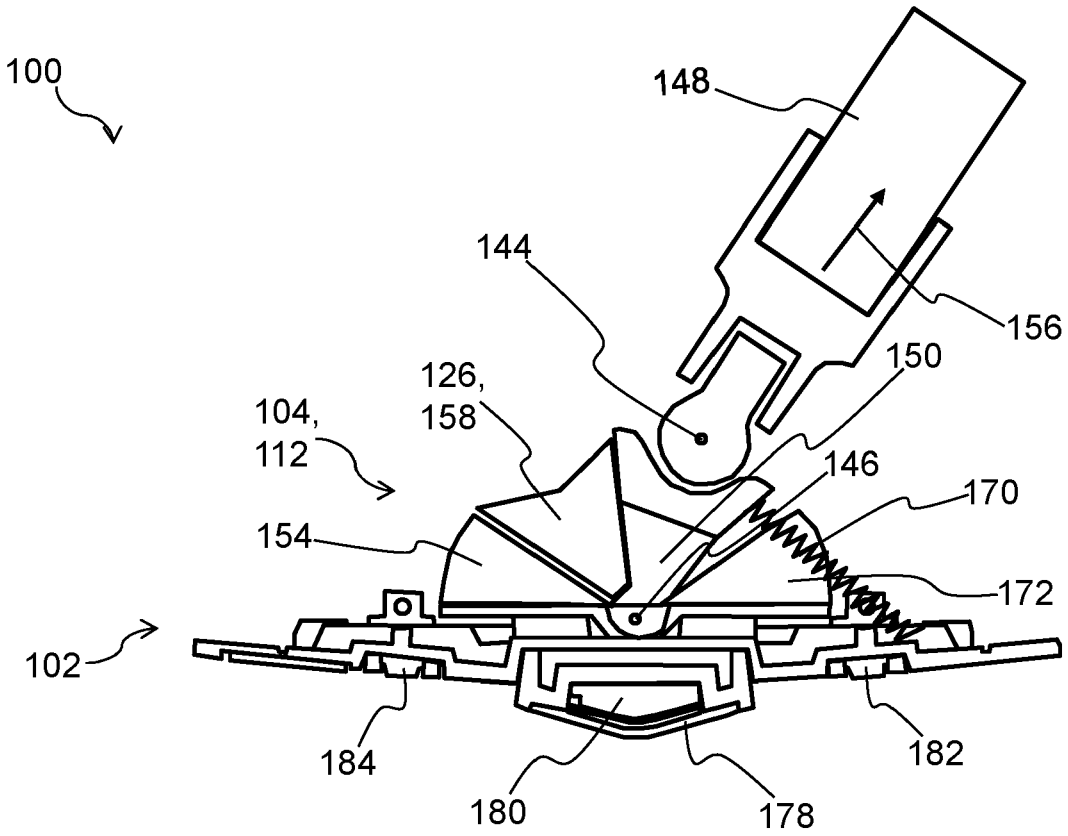
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FIG. 6C

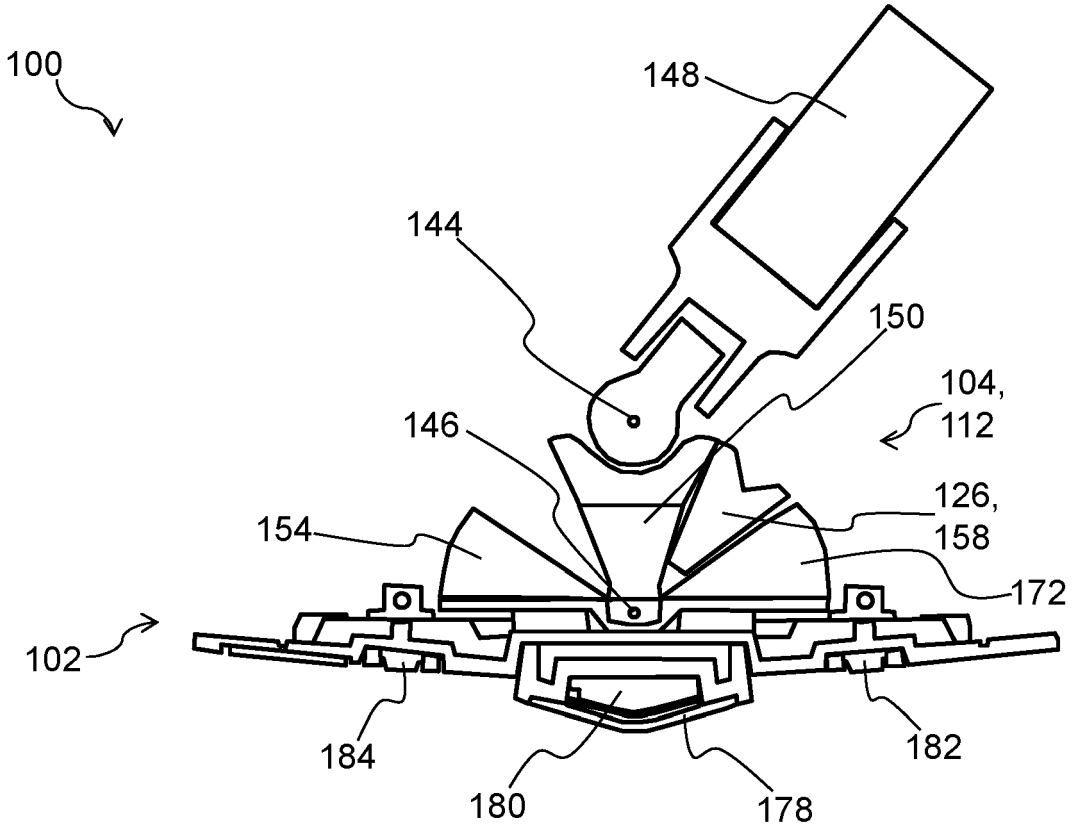
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FIG. 7A

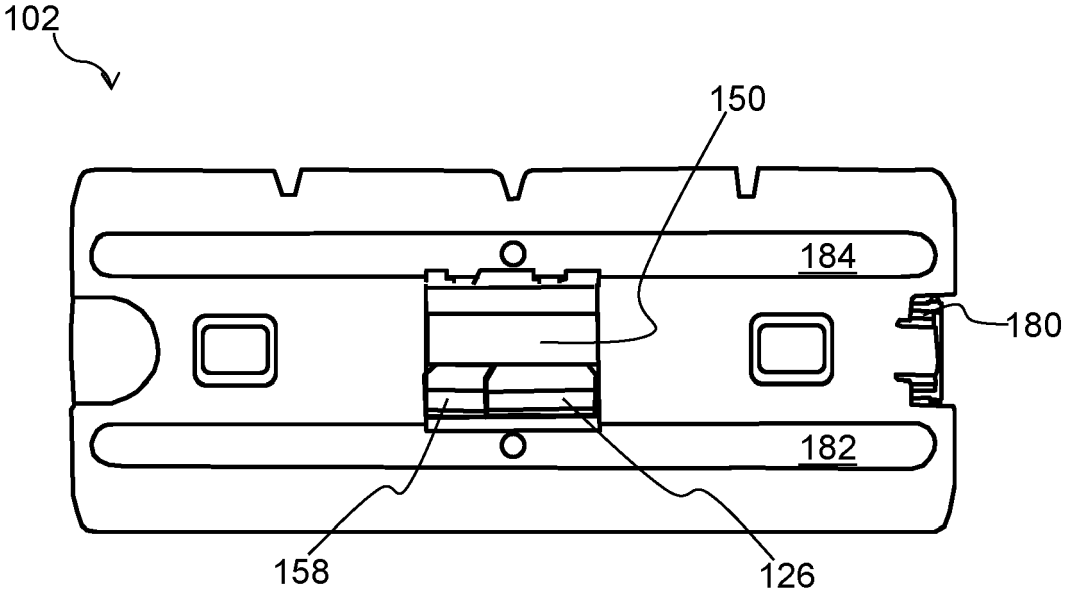
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FIG. 7B

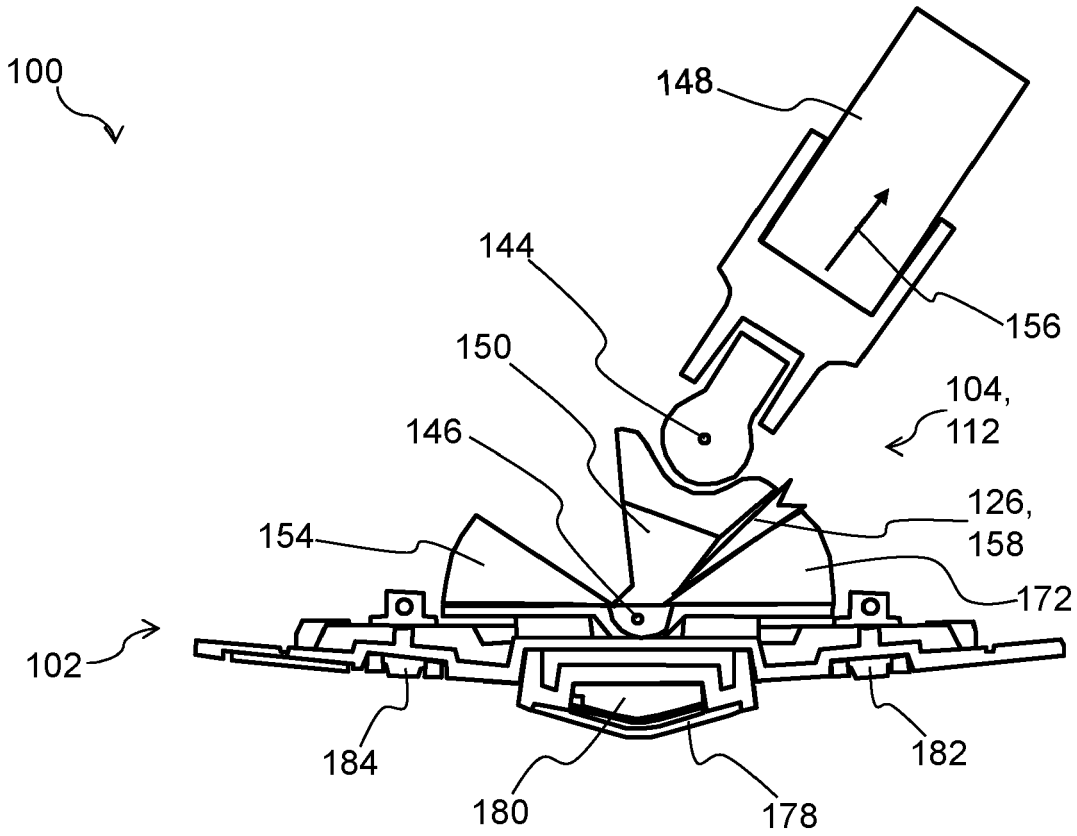
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FIG. 7C

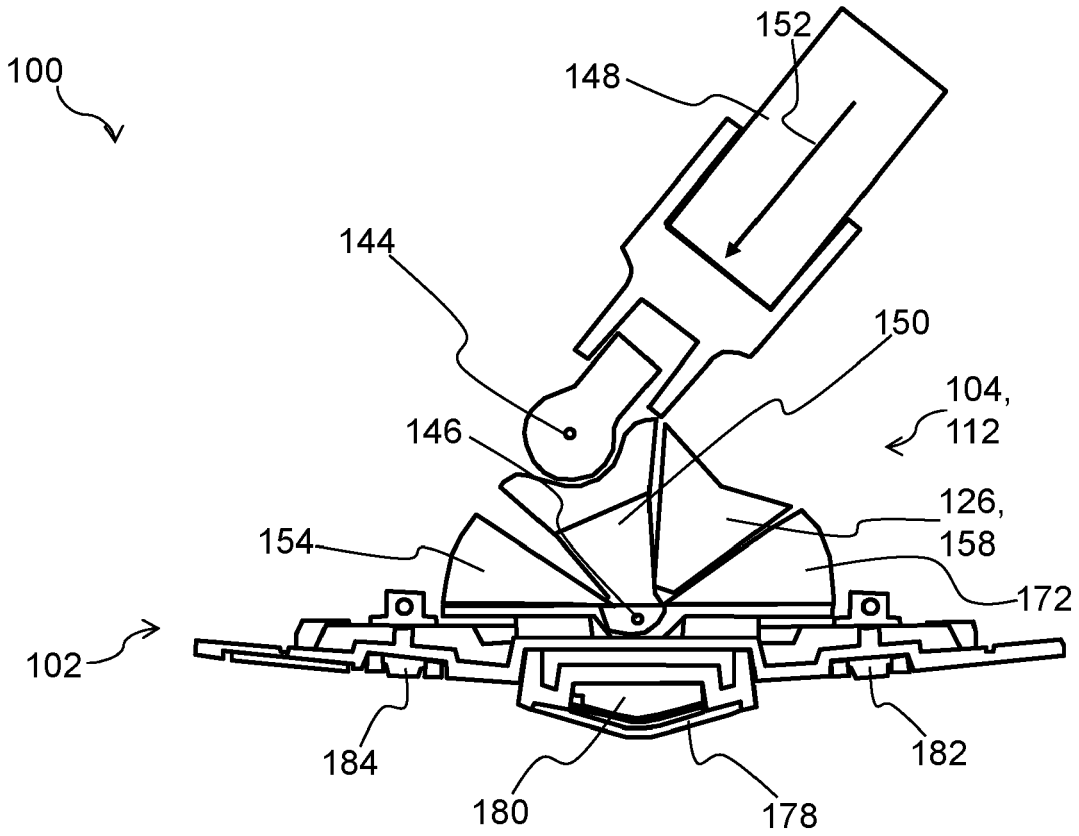
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FIG. 7D

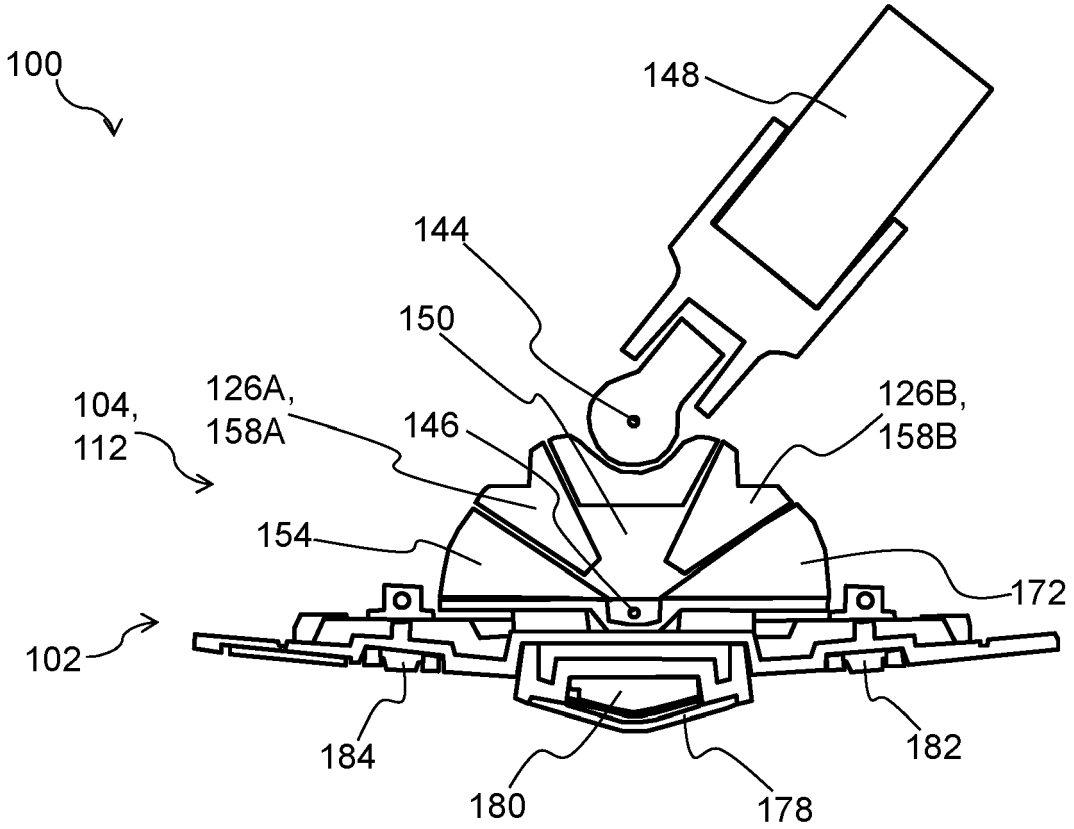
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FIG. 8A

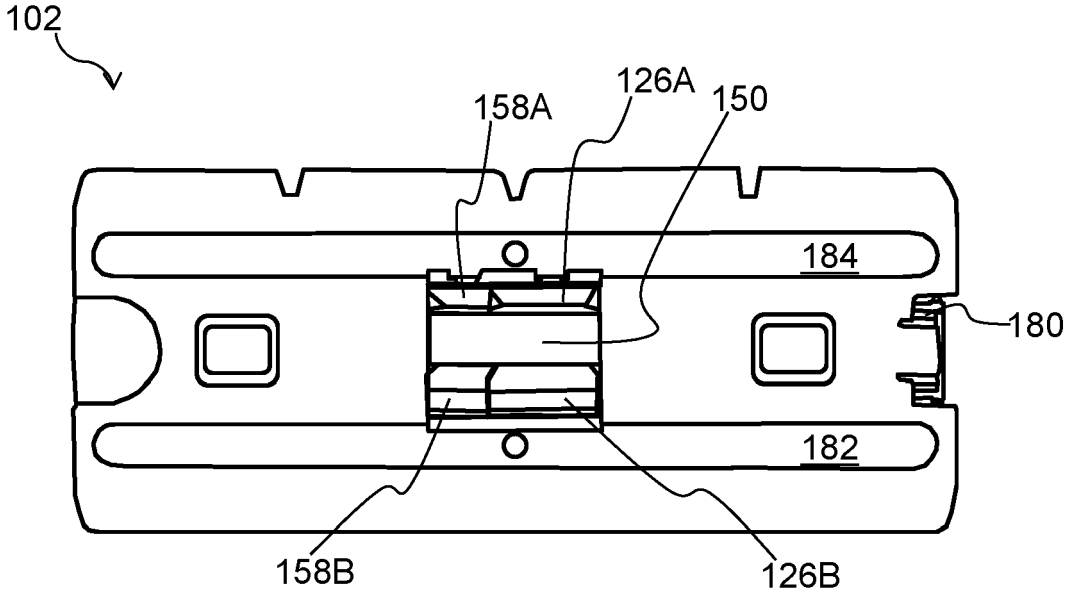
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FIG. 8B

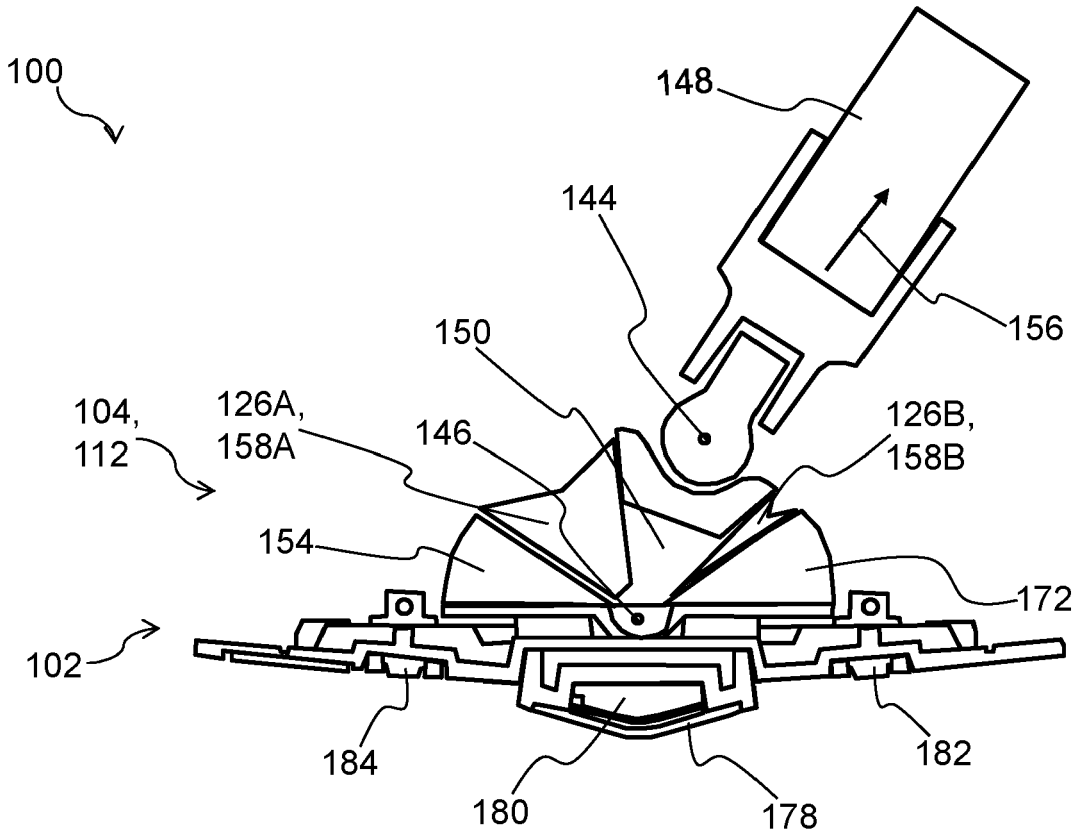
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FIG. 8C

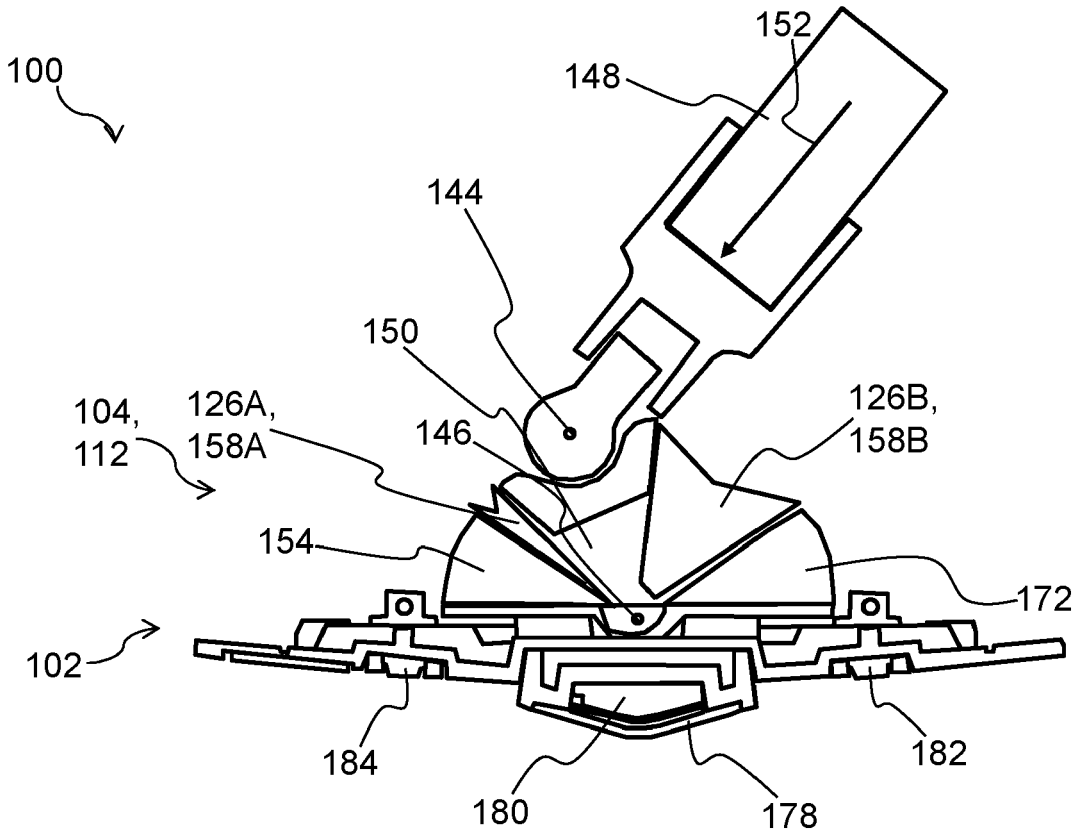
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FIG. 8D

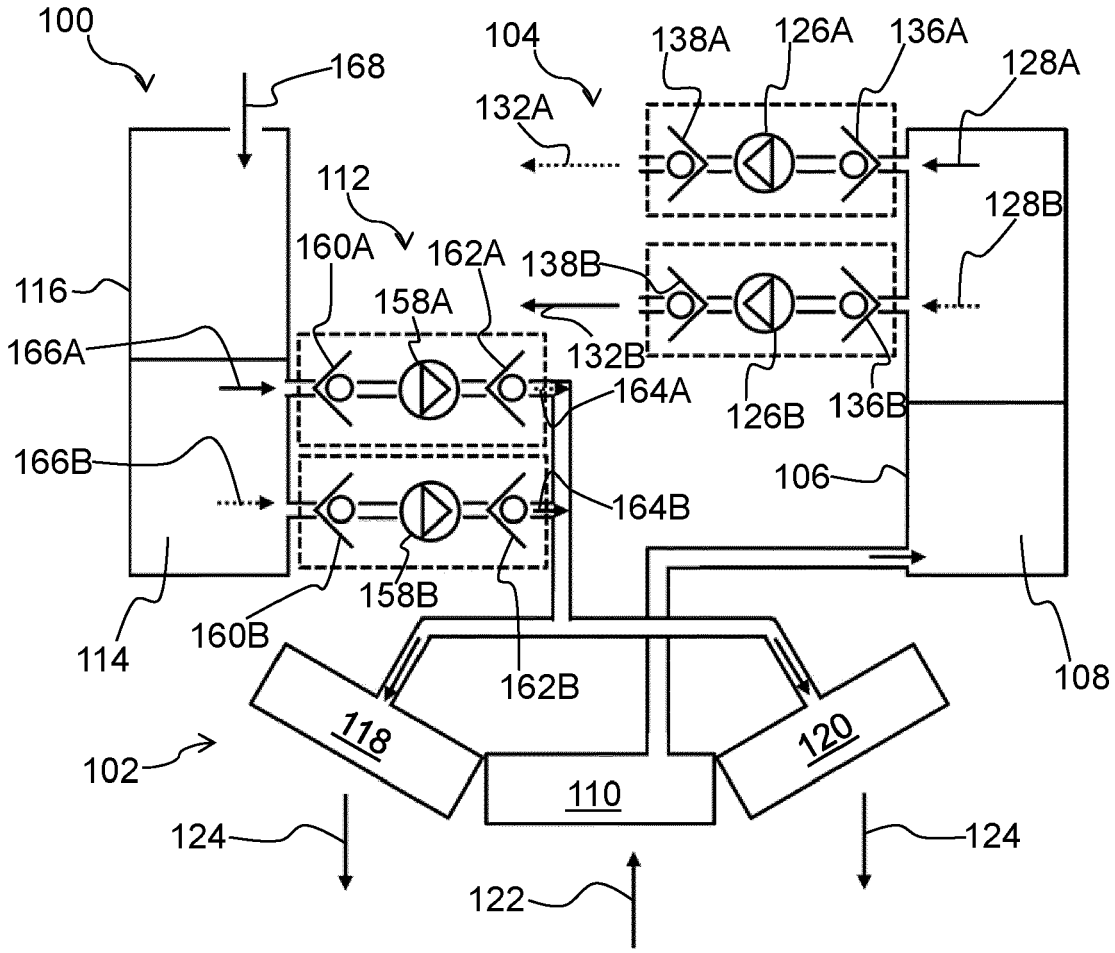
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FIG. 9

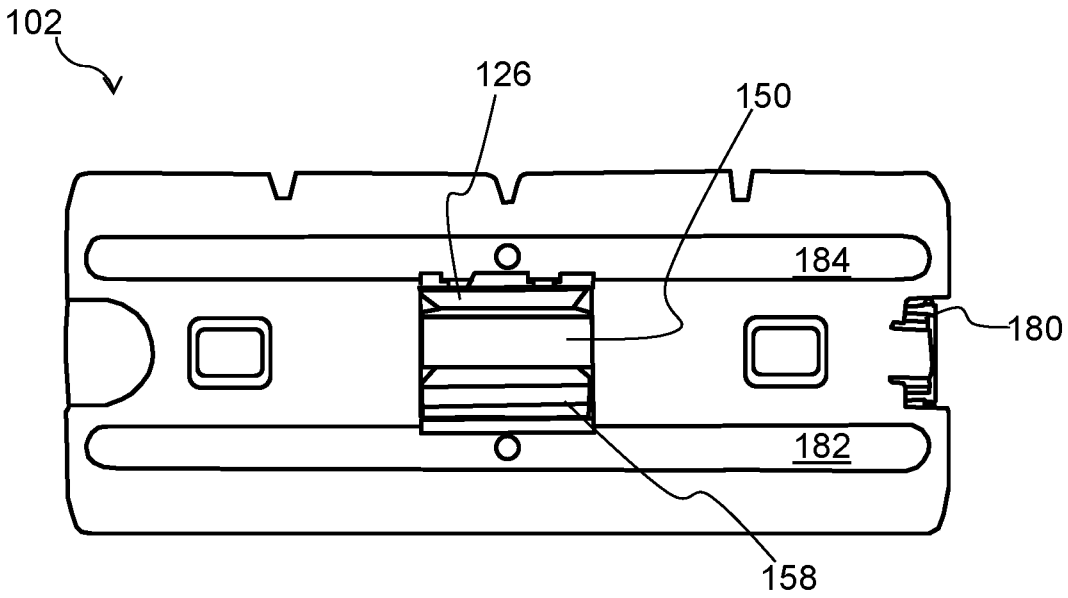

FIG. 10

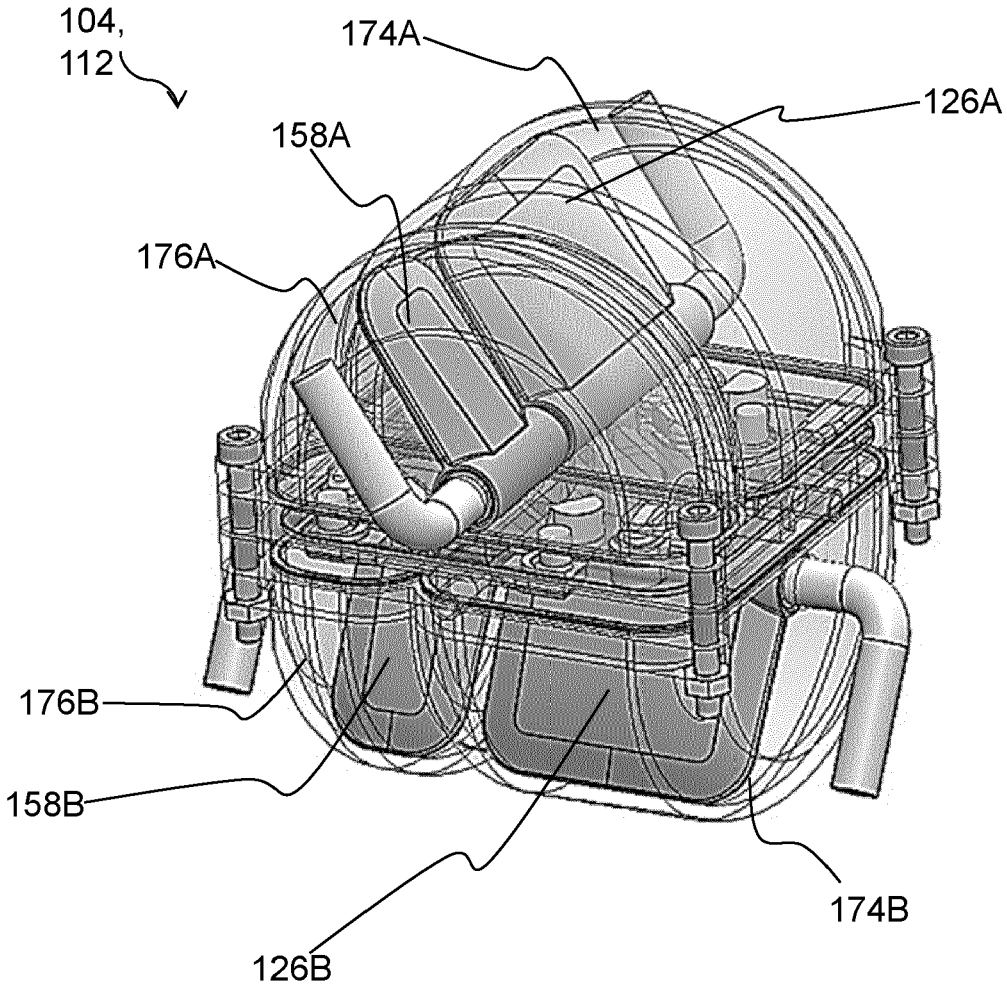

FIG. 11

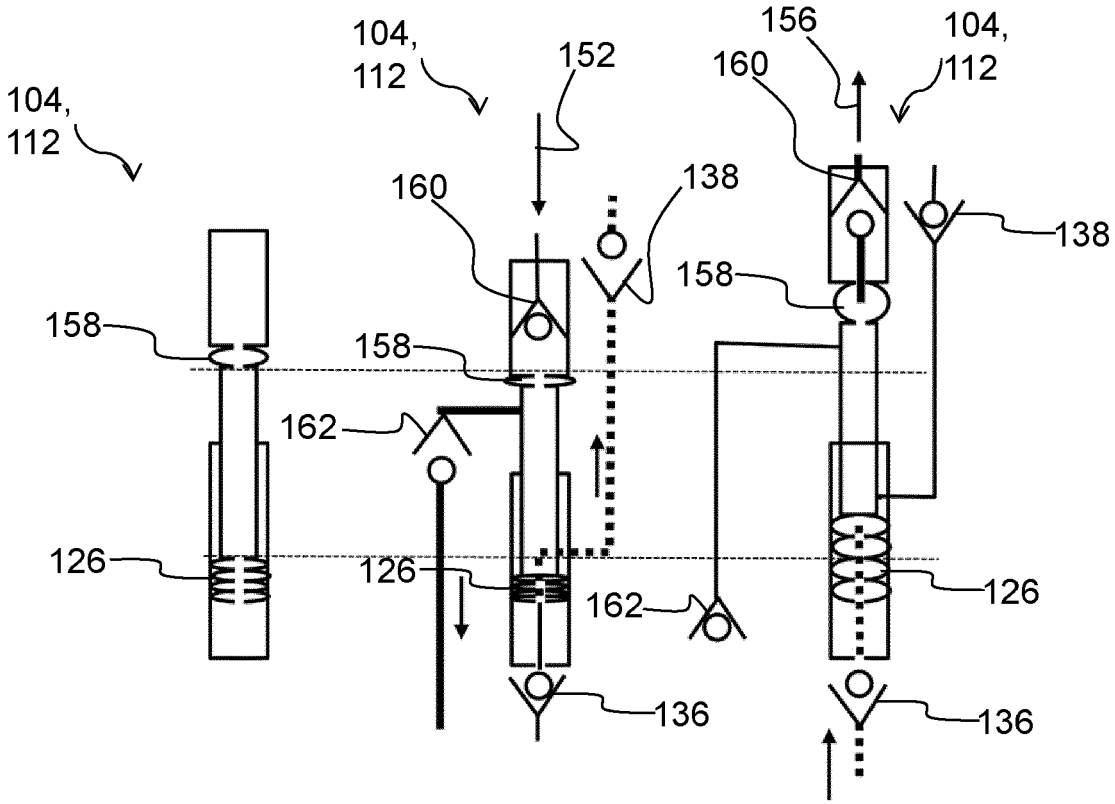
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FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 0944

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 May 2024	Trimarchi, Roberto

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