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(54) TANK FOR A MODULAR HYDRAULIC POWER UNIT AND MODULAR HYDRAULIC POWER UNIT COMPRISING THE SAME

TANK FÜR EIN MODULARES HYDRAULIKAGGREGAT UND MODULARES HYDRAULIKAGGREGAT DAMIT

RÉSERVOIR POUR UNE UNITÉ DE PUISSANCE HYDRAULIQUE MODULAIRE ET UNITÉ DE PUISSANCE HYDRAULIQUE MODULAIRE LE COMPRENANT

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(56) References cited:
WO-A1-2018/041606
WO-A2-2011/149949
DE-A1-102013 101 869

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of tanks for a modular hydraulic power unit. Furthermore, the present invention relates to the technical fields of modular hydraulic power units comprising such tanks.

PRIOR ART

[0002] In order to reduce a production time and improve a time to market, in the last years hydraulic power modules and supporting frames have been standardized and a variation of options has been pre-defined. This modular approach complies with the the most ISO standards and fits to Industry 4.0 with a complete set of condition monitoring options.

[0003] In this regard, by standardizing the individual elements of a hydraulic power unit as well as the subframes on which the elements are mounted together on modules, significant time and cost reductions can be realized. In this way, hydraulic power unit assemblies with an installed power ranging from 350 to 6000kW can be delivered to the market faster, while at the same time meeting a high quality standard.

[0004] However, the design of tanks for Large Hydraulic Power Units (with an oil reservoir capacity greater than 2500 oil) should be optimized in floor space, amount of connections and flow.

[0005] In this regard, even if said hydraulic power units can be installed very quickly, there are still some drawbacks in the efficiency, which have to be overcome. One of the main drawbacks, which has been found in the actual modular hydraulic power unit by the inventor of the present invention, is the relative high amount of air in the oil contained inside the tank.

[0006] WO 2011/149949 A2 discloses a fluid storage tank for removing entrained air from fluid stored within and passing through the fluid storage tank.

[0007] The problem to be solved is thus the realization of a tank for a modular hydraulic power unit, which at the same time enables the realization of a compact modular hydraulic power unit and also effectively enables to reduce the amount of air dissolved in the fluid, like oil, which is contained in the tank.

[0008] In particular, the problem to be solved is how to create a standard tank with minimal variants and with a scaling capacity from 2500 l up to 30000 or more l with limited floor space and flow optimized micro intelligence.

SUMMARY

[0009] The present invention is based on the idea of deflecting the flow of fluid at the inside of the tanks so as to create an ascending-descending flow, which enables to effectively reduce the amount of air dissolved in the fluid, while at the same time an effective compactness of the tank of the modular hydraulic power unit is maintained.

[0010] In this invention the term "tank" is used to describe a volume configured to store an amount of liquid, like oil. Therefore, in this invention the term "tank" is a synonym of reservoir.

[0011] In this invention with the term "inclined surface" it is meant that the surface has a leaning or slope. For example both a plain surface having a constant inclination angle and a curvature having an inclined angle, which varies with the position are meant.

[0012] In this invention with prism it is meant a solid with bases that are polygons and the sides are flat surfaces. Therefore, even a cylinder falls in said definition since a cylinder is a prism with an infinite number of faces.

[0013] According to the present invention, a tank for a modular hydraulic power unit for the supply of a pressurized fluid is provided, wherein said tank extending primarily along a vertical direction; said tank being provided with a first opening which is positioned at an upper portion of said tank and through which a fluid can be introduced into said tank; said tank further comprising a conduit having a first and a second end portion, wherein said first end portion is attached to said first opening and wherein said second end portion is positioned at a central portion of said tank so as to convey said fluid coming from said first opening to a central portion of said tank; wherein said second end portion of said conduit is configured so as to release the fluid coming from said first opening along a direction substantially perpendicular to said vertical direction of said tank; wherein said tank comprises at least one inclined surfaces, which faces said second end portion of said conduit and which is inclined with respect to said vertical direction of said tank so as to deflect the flow of fluid coming from said second end portion of said conduit toward an upper portion of said tank. This embodiment enables to deflect the flow of fluid at the inside of the tanks so as to create an ascending-descending flow, which enables to effectively increase the length of the oil flow path inside the tank, and to obtain a high oil flow path even with a small volume of the tank. In that way it is effectively possible to reduce the amount of air dissolved in the fluid, while at the same time an effective compactness of the tank of the modular hydraulic power unit is maintained. With the term inclined surface both a constant slope and a continuous/discontinuous varying slope are covered.

[0014] According to an embodiment of the present invention, a distance between said first opening and said central portion measured along an axis parallel to said vertical direction is at least 1/2 of a vertical extension of said tank, preferably greater than 3/5 of the vertical extension of said tank, more preferably greater than 2/3 of the vertical extension of said tank, more preferably greater than 4/5 of the vertical extension of said tank. Said embodiment enables to use the vertical extension of the tank to effectively increase the oil flow path.

[0015] According to an embodiment of the present in-

vention, said conduit extends along said vertical direction of said tank. Said feature enables to obtain a symmetrical tank since the conduit can be preferably positioned along the axis of said tank.

[0016] According to an embodiment of the present invention, said tank comprises two of said inclined surfaces, which are provided on opposite sides of said tank. In that way it is effectively possible to use an element, for example a diffusor, which comprises an inlet and two outlet sections, which are positioned on opposite sides in order to face each of said inclined walls, in order to effectively use the all volume of the tank for the internal flow path of oil.

[0017] According to an embodiment of the present invention, said conduit comprises a diffusor which is positioned at said second end portion and is configured to change a direction of the fluid coming from said first end portion so as to introduce said fluid into said tank along a direction substantially perpendicular to said vertical direction of said tank.

[0018] According to an embodiment of the present invention, a tilt angle of said at least one inclined surface with respect to said vertical direction of said tank is comprised between 20° and 45°, preferably between 22° and 35°, still more preferably equal to 25°.

[0019] According to the present invention, a lower portion of said tank, which is positioned below, preferably directly below, said inclined surface is substantially a lower prism, wherein said lower prism is elongated along said vertical direction, wherein at least one side of said lower prism is provided with a second opening, wherein connecting means are provided at said second opening so as to protrude externally to said tank, wherein said connecting means are configured to enable the fluid connection of the internal volume of said tank with another tank having analogous characteristics.

[0020] According to an embodiment of the present invention, said second opening is provided on a lateral side of said lower prism at which said inclined surface is provided. Said feature effectively enables to effectively reduce the dimensions of the HPU since the tanks can be installed next to each other without a large distance between these.

[0021] According to an embodiment of the present invention, said lower prism is provided with two of said second opening, which are provided on opposite sides of said lower prism.

[0022] According to an embodiment of the present invention, said inclined surface is a lateral wall of said tank. Said characteristic is very advantageous since it effectively enables to use a lateral wall of the tank in order to deflect the flow and no additional element is required.

[0023] According to an embodiment of the present invention, an upper portion, which is preferably directly above said inclined lateral wall, of said tank is substantially an upper prism, wherein the upper prism is elongated along said vertical direction and wherein the conduit extends preferably along a central axis of said upper prism, wherein said at least one inclined lateral wall is positioned at a lower portion of said upper prism so as to reduce a section of said tank taken along a plane which is perpendicular to said vertical direction.

[0024] According to an embodiment of the present invention a modular hydraulic power unit for the supply of a pressurized fluid comprising a plurality of tanks according to the invention connected with each other is provided, wherein each of the tank is provided with a third opening, which is provided at a lower portion of said tank, wherein a pump is provided at said third opening so as to supply the fluid contained in said tank in form of pressurized fluid to an external user. Preferably the third opening is positioned on a wall of the tank on which no lateral inclined walls are provided. Preferably there are two third openings positioned on two lateral walls of the tank, whereineach of the third openings is positioned on a wall of the tank on which no lateral inclined walls are provided.

[0025] According to an embodiment of the modular hydraulic power unit of the invention, a first and a second pipe are provided into said second opening so as to pass through said tanks, wherein each of the pipe is provided with a plurality of holes so as to enable a fluid to pass therethrough.

[0026] According to an embodiment of the present modular hydraulic power unit of the invention, said first and said second pipe comprises a plurality of sub-pipes positioned next to each other and wherein an end portion of a sub-pipe is preferably in direct contact with an end portion of another sub-pipe. This solution enables to facilitate the transport and installation of the components of the hydraulic power unit since no transportation and installation of long pipes is requested. Additionally, due to the fact that the first and the second pipe pass through the tanks, there is no necessity to provide sealing means between the end portions of the sub-pipes. In that way an easy connection of the sub-pipes and therefore of the tanks is effectively reached without high effort.

[0027] According to an embodiment of the present modular hydraulic power unit of the invention, said modular hydraulic power unit further comprises a filtering and/or cooling system for filtering and/or cooling the fluid passing therethrough, wherein said first pipe is connected to an inlet of said filtering and/or cooling system so as to provide fluid coming from said tanks and flowing through said plurality of holes of said first pipe to said filtering and/or cooling system and wherein said second pipe is connected to an outlet of said filtering and/or cooling system so as to reintroduce the cooled and/or filtered fluid into each of the tanks through said plurality of holes of said second pipe.

[0028] According to an embodiment of the present modular hydraulic power unit of the invention, said modular hydraulic power unit further comprises an input/output interface which is connected to one of the connecting means of a tank, wherein said input/output interface has a substantially hollow cylindrical shape main body closed

at the end portions thereof and having two conduits which extends parallel to an axis of the main body, wherein said two conduits of said input/output interface provides two openings on a base of the main body which faces said connecting means of said tank, wherein said two conduits comprise an inlet and an outlet conduit, wherein said inlet conduit is directly connected with said first pipe and wherein said outlet conduit is directly connected with said second pipe, wherein said input/output interface further comprises dividing means which divides the internal volume of the hollow main body of said input/output interface into a first and a second chamber, wherein said inlet conduit is provided with openings so as to be fluidically in contact with said first chamber, wherein said outlet conduit is provided with openings so as to be fluidically in contact with said second chamber.

[0029] According to an embodiment of the present modular hydraulic power unit of the invention, said filtering and/or cooling system is configured to create and overpressure in said second chamber and an underpressure in said firs chamber. In that way it is effectively possible to provide an internal circulation flow of oil, in order to filter and/or cool the oil contained in the tanks.

[0030] According to an embodiment of the present modular hydraulic power unit of the invention, said first chamber is positioned between said second chamber and said connecting means of said tank and wherein said modular hydraulic power unit is preferably further provided with a pump for sucking fluid from said first chamber and for conveying said fluid through said filtering and/or cooling system.

BRIEF DESCRIPTION OF THE FIGURES

[0031] The present invention is described with reference to the enclosed figures wherein the same reference numbers refer to the same parts and/or to similar parts and/or to corresponding parts of the system. In the figures:

Figure 1 schematically shows a three dimensional view of a modular hydraulic power unit according to an embodiment of the present invention;

Figure 2 shows a three-dimensional frontal cross section taken along a plane x-z of Figure 1 of three tanks connected in series according to a preferred embodiment of the present invention;

Figure 3 shows a two-dimensional cross section taken along the plane x-z of Figure 1 of the three tanks connected in series of Figure 2, wherein the arrows describe the flow of the fluid inside said tanks;

Figure 4 shows in details a three dimensional view of a tank in a modular hydraulic power unit according to an embodiment of the present invention;

Figure 5 shows a three-dimensional cross section taken along a plane y-z of Figure 4 of a tank provided with two main pumps according to a preferred embodiment of the present invention;

Figure 6 shows a two-dimensional view of the cross section along the plane y-z of Figure 5.

DETAILED DESCRIPTION

[0032] In the following, the present invention is described with reference to particular embodiments as shown in the enclosed figures. Nevertheless, the present invention is not limited to the particular embodiments described in the following detailed description and shown in the figures, but rather the embodiments described simply exemplify several aspects of the present invention, the scope of which is defined by the claims.

[0033] Further modifications and variations of the present invention will be clear for the person skilled in the art. The present description is thus to be considered as including all said modifications and/or variations of the present invention, the scope of which is defined by the claims.

[0034] Figure 1 shows a three dimensional view of a modular hydraulic power unit 1000 (from now on simply called modular HPU or only HPU). The modular HPU is configured to supply a compressed fluid, normally oil, to a user and to receive the expanded oil again, after said fluid has been used by the user for any scope.

[0035] In this regard, even if in the present invention the wording "oil" is sometime used for describing an example of fluid, which can be used in the main embodiment of the invention, any other type of fluid know from the state of the art, which can be used as hydraulic working fluid, can be used

As shown in the figure, the HPU 1000 comprises a plurality of tanks 100 connected with each other and which are connected with a set of pumps (which will be shown with more details in the following figures).

[0036] Figure 2 shows a three-dimensional frontal cross section taken along a plane x-z of Figure 1. In particular, figure 2 shows three tanks 100 connected in series according to a preferred embodiment of the present invention.

[0037] Each of the tanks 100 extends primarily along a vertical direction D1 (which coincides with the z direction of figure 1).

[0038] Each of the tanks 100 is provided with a first opening 101 which is positioned at an upper portion of the tank 100 and through which, as will be clearer with the prosecution of the disclosure, oil can be introduced into the tank 100. In the particular embodiment described in the figures the first opening 101 is positioned on a top surface of the tank 100. However, said feature is not essential for this invention. The first opening 100 could also be positioned on a lateral upper portion of the tank 100.

[0039] A conduit 102 extends from the first opening 101 to a central portion of the tank 100. As shown in the figure, the conduit 102 is a straight conduit extending along the axis of the tank 100, which is parallel to the vertical direction D1. Therefore, the conduit 102 comprises a first end portion 102a, which is positioned at said

first opening, and a second end portion 102b, which is positioned at a central portion of the tank 100. With the wording "central portion" it is meant an internal portion of the tank 102 which has a significant distance from the external walls of the tank 102.

[0040] In particular, a distance between the first opening 101 and the central portion of the tank 100 where the second end portion 102b is positioned, measured along an axis parallel to the vertical direction D1, is at least 1/2 of a vertical extension of the tank 100, preferably greater than 2/3 of the vertical extension of the tank 100.

[0041] The conduit 102 at its second end portion 102b comprises a diffusor 102c, which is configured to change the direction of the flow of oil coming from the first opening 101 between a substantially vertical direction (upstream of the diffusor 102c) to a substantially horizontal direction, which is substantially perpendicular to the vertical direction D1 of the tank 100 (downstream of the diffusor 102c). The form of the diffusor 102c is not restricted to a particular form and could also be replaced by a curvature of the conduit 102, which would reach the same scope.

[0042] The tank 100 comprises two inclined walls 103, which face the second end portion 102a of the conduit 102 and which are inclined with respect to the vertical direction D1 of the tank 100 so as to deflect the flow of oil coming from the second end portion 102b of the conduit 102 toward an upper portion of the tank 100. The two inclined surfaces 103 are provided on opposite sides of the tank 100.

[0043] A tilt angle of the inclined walls 103 of the tank 100 with respect to the vertical direction D1 of the tank is comprised between 20° and 45°, preferably between 22° and 35°, still more preferably equal to 25°

An upper portion 104 of the tank 100, which is directly above the inclined lateral walls 103 of the tank 100, is substantially an upper prism, for example an upper rectangular prism or a cylinder. The prism 104 is elongated along the vertical direction D1 and the inclined lateral walls are positioned on two opposite sides of the lower portion of the prism 104 so as to reduce a section of the tank 100 taken along a plane which is perpendicular to the vertical direction D1.

[0044] A lower portion 105 of the tank 100, which is positioned directly below the inclined lateral walls 103, is substantially a lower prism, for example a lower rectangular prism or a cylinder. The prism 105 is elongated along the vertical direction D1.

[0045] One side of the lower prism 105 is provided with two second openings 106, which are positioned on two opposite sides of the lower prism 105, which correspond to the sides on which the inclined lateral walls 103 are provided.

[0046] Connecting means 108 are provided at the two second openings 106 so as to protrude externally to the tank 100. The connecting means 108 comprises a tubular portion 108a positioned at the second openings 106 and a flange portion 108b, which is positioned at a distal end portion of the connecting means 108 with respect to the two second openings 106.

[0047] The connecting means 108 of each tank 100 are connected with connecting means 108 of another tank 108, by means of the flange portions 108b thereof and, as will be clearer explained in the prosecution of the disclosure, are configured to enable the fluid connection of the internal volume of each of the tanks 100 with the other tanks 100, in order to maintain the same level of oil inside the tank 100. It is clear that the connecting means 108 of the tanks 100 positioned on the left-hand side and on the right-hand side of figure 2 have a different function and in some cases could be also omitted. For example, the connecting means 108 on the left hand side of figure 2 are connected with a cooling and/or filtering system.

[0048] The connecting means 108 can be represented by widely known large flanges, whose pattern is assigned according to DIN EN 1092-1, by circular flanges for pipes, valves, fittings and accessories.

[0049] Furthermore, in the example shown in the figure, the tank 100 is provided with two third openings 107, which are positioned one above the other, and which are normally used for connecting the tank with one or more pumps 81, 82 (shown in figure 5) for the supply of pressurized oil to an external user.

[0050] As shown in the figure, a first pipe 30 and a second pipe 31 pass through the second openings 107 of the tank 100 and the connecting means 108. Each of the pipe is provided with a plurality of holes, which enable a fluid connection of the internal portion of the pipes with the oil contained in the tank 100. As can be seen, for structural reasons the conduit 102 is attached to a lateral surface of the first pipe 31, so as to stabilize and to reduce oscillations of the conduit 102. Furthermore, the conduit 102 at a portion lower than the diffusor 102c is closed. Therefore, even if the conduit 102 seems to extend to the first pipe 31, the portion comprised between the diffusor 102 and the first pipe 31 is closed, so that the all amount of oil coming from the pipe 102 is caused to flow directly through the diffusor 102c.

[0051] These pipes 30, 31 can be used to convey the fluid contained in the tank 100 to a filtering and/or cooling system 50 and to convey the fluid back to the tanks.

[0052] The first and the second pipes 31, 32 are preferably composed by a plurality of sub-pipes, each extending between the two connecting means 108 of each tank 100. This solution enables to facilitate the transport and installation of the components of the HPU 1000 since no transportation and installation of long external pipes is requested. External leakage points are herewith minimalized. Additionally, due to the low overpressure and underpressure in the first and the second pipes 31, 32 (which will be described more in details in the prosecution of the description) and due to the specific closed configuration of the HPU (the connection of the sub-pipes surrounded by oil of the tank 100), there is no necessity to provide sealing means between the end portions of the sub-pipes. In that way an easy connection of the sub-

pipes and therefore of the tanks is effectively reached.

[0053] By looking at figure 2, the connecting means 108 are positioned at the left-hand side and are connected to an input/output interface 400, which is configured to connect the connecting means of the tank 100 with the filtering and/or cooling system 50.

[0054] The input/output interface 400 has a substantially hollow cylindrical shape main body 401 closed at the end portions 402a, 402b thereof and having two conduits 403, 404, which extends parallel to the axis of the main body 401.

[0055] The two conduits 403, 404 of the input/output interface 400 provides two openings on the first end portion 402a of the main body 401, which faces the connecting means 108 of the tank 100. The two conduits 403, 404 comprise an inlet conduit 403 and an outlet conduit 404, wherein the inlet conduit 403 is directly connected with the first pipe 30 and wherein the outlet conduit 401 is directly connected with the second pipe 31,

[0056] The input/output interface 400 further comprises dividing means 405, which divides the internal volume of the hollow volume of the input/output interface 400 into a first chamber 406 and a second chamber 407. In particular, the dividing means 405 is represented by a plate having two holes, which enable the inlet and outlet conduit to pass therethrough and at the same time to maintain a sealing between the first and the second chamber 406, 407.

[0057] The inlet conduit 403 is provided with openings 408, so as to be fluidically in contact with the first chamber 406. Furthermore, the outlet conduit 404 is provided also with openings 409 so as to be fluidically in contact with the second chamber 407. In the particular example shown in the figure, both the openings 408 and 409 of the inlet and outlet conduit respectively are two, which extends along an axial direction of the conduit.

[0058] The first chamber 406 is positioned between the second chamber 407 and the connecting means 108 of the tank 100.

[0059] The first chamber 406 is provided with a lateral opening 406a, which enables to fluidically connect the first chamber with the filtering and/or cooling system 50 described above. Therefore, the first chamber 406 has the function of an oil supply means for the filtering and/or cooling system 50. In particular the opening 406a of the first chamber 406 is provided with connecting means 410, which protrudes outwards from the first chamber 406 and are attached to a pump (not shown) for sucking fluid from the first chamber 406 through the opening 406a and to convey the fluid through the filtering and/or cooling system 50.

[0060] Differently, the second chamber 407 has the function of collecting oil coming from the filtering and/or cooling system 50 and to deliver said oil to the outlet conduit 404.

[0061] Furthermore, as shown in figure 1, and as will be clearer by looking at figure 3, it is possible to use the first and the second chamber 406 and 407 also for another block of tanks 100, which are positioned on the left-hand side of figure 2. In this way, the oil will reach the first chamber 406 both from the left and from the right hand side of figure 2.

[0062] In the following, with reference to figure 3 the internal flow of fluid inside the modular HPU 1000 is described.

[0063] As described above, the return oil, coming from an external user, is introduced into the modular HPU 1000 through the first opening 101. The oil flows from the top of the tank 100 along the vertical direction D1 through the conduit 102.

[0064] The return oil is introduced inside of the tank 100 by means of the diffusor 102c, which is positioned at the second end portion 102b of the conduit 102. This diffusor 102c faces the inclined lateral walls 103 and is configured to release the oil flow along a direction substantially perpendicular to the vertical direction D1. This will result in a deflection of the oil flow inside the tank 100.

[0065] In particular, by means of the inclined walls 103 the oil is deflected from a direction substantially perpendicular to the vertical direction D1 to a direction substantially parallel to the vertical direction D1. In that way the oil is returned toward an upper portion of the tank 100 (see the arrows in the figure). The upwards flow of the return oil effectively decreases the amount of air in the oil, and, therefore, effectively provides a degassing process of the oil.

[0066] The oil, which is highly degassed as it has reached the top portion of the tank 100 will flow from topside to the bottom of the tank 100 where it will flow, due to a slight vacuum pressure, in the first pipe 31 through the holes of the first pipe 31. The slight vacuum pressure is due to a pump (not shown), which is attached at the opening 406a of the first chamber 406. Said pump is normally driven by an electromotor.

[0067] In order to condition the hydraulic oil, the filtering and/or cooling system 50 comprises a low pressure pump with electromotor, a low pressure and high volume filter.

[0068] The oil than, due to the slight vacuum pressure applied in the first pipe 31, flows through the first pipe 31 to the first chamber 406. Then, the oil is introduced through the opening 406a of the first chamber 406 to the filtering and/or cooling system 50.

[0069] Furthermore, in the particular embodiment shown in the figure, as can be also seen from figure 1, the first and the second chambers 406 and 407 are used as first and the second chambers 406 and 407 for another block of tanks 100, which are positioned on the left-hand side of figure 3. In this way, the oil will reach the first chamber both from the left and from the right hand side of figure 3, as shown by the arrows. Additionally, the oil will be conveyed both toward the right and to the left of the second chamber 407.

[0070] Then, the cooled and/or filtered oil is reintroduced in each of the tanks 100 passing through the second chamber 407 by means of the second pipe 32, and in particular through the holes of the second pipe 32. In

particular, the flowing of the oil through the second pipe 32 is guaranteed by a slight overpressure provided on the oil by means of the pump described above, which is positioned upstream of the filtering and/or cooling system 50.

[0071] Figure 4 shows in details a three dimensional external view of a single tank 100 in a modular hydraulic power unit 1000. The tank 100, as can be more clearly seen in the three-dimensional cross section of figure 5, is provided with a pumping system 80 comprising two pumps 81, 82 driven by an electric motor 83, which are positioned at the third openings 107 of the tank 100.

[0072] The two pumps 81, 82 are positioned one above the other, and are configured to supply pressurized oil to an external user. A leakage channel 84 connects a leakage port of the pumps with the first pipe 31.

[0073] By looking at figure 5 and at the two-dimensional view thereof shown in figure 6, it is possible to see that the pumps 81, 82 are connected to the third openings (107) by means of straight horizontal tubes 85 and a flange portion 86, which is attached to said third openings 107. The flange portion 107 has a particular form, which is eccentric. In that way, it is possible to install any type of pump 81, 82 and to adapt the system to the dimension of the particular dimensions of the pumps chosen by means of an eccentric flange, as the one described in the present invention.

[0074] While the present invention has been described with reference to the embodiments described above, it is clear for the skilled person that it is possible to realize several modifications, variations and improvements of the embodiments in the light of the teaching described above and without departing from the scope of protection of the invention as defined by the claims.

[0075] For example, even if the conduit 102 has been described to be parallel to the vertical direction D1 of the tank 100, said conduit could have a different shape, which substantially enable to provide oil coming from the first opening 101 to a lower portion of the tank 100.

[0076] Even if in the disclosure the tank 100 has been described to comprise at least one inclined lateral wall for deflecting the flow of oil coming from the second end portion 102a of the conduit 102, it is also possible to substitute the described inclined lateral wall of the tank 100 with one or more additional inclined surfaces, which are fixed to the tank and which face he second end portion 102a of the conduit 102 and are inclined with respect to the vertical direction D1 of the tank 100, in order to reach the same scope of the inclined lateral walls of the tank 100.

[0077] Additionally, even if figure 2 shows three tanks 100 connected in series it is possible to increase or decrease the number of tanks in series connected with each other.

[0078] Furthermore, even if in the disclosure it has been described that the tank 100 is provided with two third openings 107, which are positioned one above the other, it is possible also to provide the third openings on two opposite sides of the tank or one next to the other. Another possibility is also represented by providing the tank 100 with only one third opening 107 or with a higher number of third openings 107.

[0079] In addition, those areas in which it is believed that those of ordinary skill in the art are familiar, have not been described herein in order not to unnecessarily obscure the invention described.

[0080] Accordingly, the invention is not to be limited by the specific illustrative embodiments, but only by the scope of the appended claims.

REFERENCE SIGNS

[0081] In the figures, each feature is indicated as follows:

1000:	Modular hydraulic power unit;
31:	First pipe;
32:	Second pipe;
50:	Filtering and/or cooling system;
80:	Pumping system;
81, 82:	Pumps;
83:	Electric motor;
84:	Leakage channel;
85:	Horizontal tube;
86:	Flange portion;
100:	Tank;
101:	First opening;
102:	Conduit;
102a:	First end portion of the conduit;
102b:	Second end portion of the conduit;
102c:	Diffusor;
103:	Inclined surfaces (inclined lateral walls);
104:	Upper portion of the tank;
105:	Lower portion of the tank;
106:	Second opening;
107:	Third opening;
108:	Connecting means;
400:	Input/output interface;
401:	Main body;
402a, 402b:	End portions of the input/output interface;
403:	Inlet conduit of the input/output interface;
404:	Outlet conduit of the input/output interface;
405:	Dividing means;
406:	First chamber;
406a:	Opening of the first chamber;
407:	Second chamber;
408:	Openings of the first chamber;
409:	Openings of the second chamber;
410:	Connecting means;

Claims

1. Tank (100) for a modular hydraulic power unit (1000)

for the supply of a pressurized fluid;

said tank (100) extending primarily along a vertical direction (D1);
said tank (100) being provided with a first opening (101) which is positioned at an upper portion of said tank (100) and through which a fluid can be introduced into said tank (100);
said tank (100) further comprising a conduit (102) having a first and a second end portion (102a, 102b), wherein said first end portion (102a) is attached to said first opening (101) and wherein said second end portion (102b) is positioned at a central portion of said tank (100) so as to convey said fluid coming from said first opening (101) to a central portion of said tank (100);
wherein said second end portion (102b) of said conduit (102) is configured so as to release the fluid coming from said first opening (101) along a direction substantially perpendicular to said vertical direction (D1) of said tank (100);
wherein said tank (100) comprises at least one inclined surfaces (103), which faces said second end portion (102b) of said conduit (102) and which is inclined with respect to said vertical direction (D1) of said tank (100) so as to deflect the flow of fluid coming from said second end portion of said conduit (102) toward an upper portion of said tank (100), wherein a lower portion (105) of said tank, which is positioned below, preferably directly below, said inclined surface (103) is substantially a lower prism, wherein said lower prism is elongated along said vertical direction (D1), wherein at least one side of said lower prism is provided with a second opening (106), wherein connecting means (108) are provided at said second opening (106) so as to protrude externally to said tank (100), wherein said connecting means (108) are configured to enable the fluid connection of the internal volume of said tank (100) with another tank (100) having analogous characteristics.

2. Tank (100) according to claim 1, wherein a distance between said first opening (101) and said central portion measured along an axis parallel to said vertical direction (D1) is at least 1/2 of a vertical extension of said tank (100), preferably greater than 2/3 of the vertical extension of said tank (100).

3. Tank (100) according to any of claims 1 or 2, wherein said conduit (102) extends along said vertical direction (D1) of said tank (100).

4. Tank (100) according to any of claims 1 to 3, wherein said tank (100) comprises two of said inclined surfaces (103), which are provided on opposite sides of said tank (100).

5. Tank (100) according to any of claims 1 to 4, wherein said conduit (102) comprises a diffusor (102c) which is positioned at said second end portion (102b) and is configured to change a direction of the fluid coming from said first end portion (102a) so as to introduce said fluid into said tank (100) along a direction substantially perpendicular to said vertical direction (D1) of said tank (100).

6. Tank (100) according to claim 1, wherein said second opening (106) is provided on a lateral side of said lower prism (105) at which said inclined surface (103) is provided.

7. Tank (100) according to any of claims 1, wherein said lower prism (105) is provided with two of said second opening (106), which are provided on opposite sides of said lower prism (105).

8. Tank (100) according to any of claims 1 to 6, wherein said inclined surface (103) is a lateral wall of said tank (100).

9. Tank (100) according to claim 8, wherein an upper portion (104), which is preferably directly above said inclined lateral wall (103), of said tank (100) is substantially an upper prism, wherein the upper prism is elongated along said vertical direction (D1) and wherein the conduit (102) extends preferably along a central axis of said upper prism, wherein said at least one inclined lateral wall (103) is positioned at a lower portion of said upper prism so as to reduce a section of said tank (100) taken along a plane which is perpendicular to said vertical direction (D1).

10. Modular hydraulic power unit (1000) for the supply of a pressurized fluid comprising a plurality of tanks (100) according to any of claims 1 to 9 connected with each other, wherein each of the tank (100) is provided with a third opening (107), which is provided at a lower portion (105) of said tank (100), wherein a pump (81, 82) is provided at said third opening (107) so as to supply the fluid contained in said tank (100) in form of pressurized fluid to an external user.

11. Modular hydraulic power unit (1000) according to claim 10 when dependent from claim 6, wherein a first and a second pipe (31, 32) are provided into said second opening (106) so as to pass through said tanks (100), wherein each of the pipe (31, 32) is provided with a plurality of holes so as to enable a fluid to pass therethrough.

12. Modular hydraulic power unit (1000) according to claim 11, wherein said first and said second pipe (31, 32) comprises a plurality of sub-pipes positioned

next to each other and wherein an end portion of a sub-pipe is preferably in direct contact with an end portion of another sub-pipe.

13. Modular hydraulic power unit (1000) according to any of claims 11 or 12, further comprising a filtering and/or cooling system (50) for filtering and/or cooling the fluid passing therethrough, wherein said first pipe (31) is connected to an inlet of said filtering and/or cooling system so as to provide fluid coming from said tanks (100) and flowing through said plurality of holes of said first pipe (31) to said filtering and/or cooling system (50) and wherein said second pipe (32) is connected to an outlet of said filtering and/or cooling system (50) so as to reintroduce the cooled and/or filtered fluid into each of the tanks (100) through said plurality of holes of said second pipe (32).

14. Modular hydraulic power unit (1000) according to claim 13,

wherein said modular hydraulic power unit (1000) further comprises an input/output interface (400) which is connected to one of the connecting means (108) of a tank (100), wherein said input/output interface (400) has a substantially hollow cylindrical shape main body (401) closed at the end portions (402a, 402b) thereof and having two conduits (403, 404) which extends parallel to an axis of the main body,
wherein said two conduits (403, 404) of said input/output interface (400) provides two openings on a base of the main body (401) which faces said connecting means (108) of said tank (100),
wherein said two conduits (403, 404) comprise an inlet and an outlet conduit (403, 404), wherein said inlet conduit (403) is directly connected with said first pipe (31) and wherein said outlet conduit (404) is directly connected with said second pipe (32),
wherein said input/output interface (400) further comprises dividing means (405) which divides the internal volume of the hollow main body (401) of said input/output interface (400) into a first and a second chamber (406, 407),
wherein said inlet conduit (403) is provided with openings (408) so as to be fluidically in contact with said first chamber (406);
wherein said outlet conduit (404) is provided with openings (409) so as to be fluidically in contact with said second chamber (407).

15. Modular hydraulic power unit (1000) according to claim 14 wherein said filtering and/or cooling system (50) is configured to create and overpressure in said second chamber (407) and an underpressure in said firs chamber (406).

Patentansprüche

1. Tank (100) für ein modulares Hydraulikaggregat (1000) zum Zuführen eines druckbeaufschlagten Fluids; wobei sich der Tank (100) primär entlang einer vertikalen Richtung (D1) erstreckt;

wobei der Tank (100) mit einer ersten Öffnung (101) versehen ist, die an einem oberen Abschnitt des Tanks (100) positioniert ist und durch die ein Fluid in den Tank (100) eingebracht werden kann;
wobei der Tank (100) ferner eine Leitung (102) umfasst, die einen ersten und einen zweiten Endabschnitt (102a, 102b) aufweist, wobei der erste Endabschnitt (102a) an der ersten Öffnung (101) angebracht ist und wobei der zweite Endabschnitt (102b) an einem mittleren Abschnitt des Tanks (100) positioniert ist, so dass das aus der ersten Öffnung (101) kommende Fluid zu einem mittleren Abschnitt des Tanks (100) geleitet wird;
wobei der zweite Endabschnitt (102b) der Leitung (102) derart ausgestaltet ist, dass das aus der ersten Öffnung (101) kommende Fluid entlang einer Richtung im Wesentlichen senkrecht zur vertikalen Richtung (D1) des Tanks (100) abgegeben wird;
wobei der Tank (100) mindestens eine geneigte Fläche (103) umfasst, die dem zweiten Endabschnitt (102b) der Leitung (102) zugewandt ist und die in Bezug zur vertikalen Richtung (D1) des Tanks (100) derart geneigt ist, dass der aus dem zweiten Endabschnitt der Leitung (102) kommende Fluidstrom hin zu einem oberen Abschnitt des Tanks (100) umgelenkt wird, wobei ein unterer Abschnitt (105) des Tanks, der unterhalb, vorzugsweise direkt unterhalb, der geneigten Fläche (103) positioniert ist, im Wesentlichen ein unteres Prisma ist, wobei das untere Prisma entlang der vertikalen Richtung (D1) länglich ist, wobei mindestens eine Seite des unteren Prismas mit einer zweiten Öffnung (106) versehen ist, wobei Verbindungsmittel (108) an der zweiten Öffnung (106) derart bereitgestellt sind, dass sie extern zu dem Tank (100) hervorragen, wobei die Verbindungsmittel (108) dazu ausgestaltet sind, die Fluidverbindung des Innenvolumens des Tanks (100) mit einem anderen Tank (100) mit analogen Eigenschaften zu ermöglichen.

2. Tank (100) nach Anspruch 1, wobei ein Abstand zwischen der ersten Öffnung (101) und dem mittleren Abschnitt, gemessen entlang einer Achse parallel

zur vertikalen Richtung (D1) mindestens 1/2 einer vertikalen Erstreckung des Tanks (100), vorzugsweise mehr als 2/3 der vertikalen Erstreckung des Tanks (100), beträgt.

3. Tank (100) nach einem der Ansprüche 1 oder 2, wobei sich die Leitung (102) entlang der vertikalen Richtung (D1) des Tanks (100) erstreckt.

4. Tank (100) nach einem der Ansprüche 1 bis 3, wobei der Tank (100) zwei der geneigten Flächen (103) umfasst, die auf gegenüberliegenden Seiten des Tanks (100) bereitgestellt sind.

5. Tank (100) nach einem der Ansprüche 1 bis 4, wobei die Leitung (102) einen Diffusor (102c) umfasst, der an dem zweiten Endabschnitt (102b) positioniert und dazu ausgestaltet ist, eine Richtung des aus dem ersten Endabschnitt (102a) kommenden Fluids derart zu ändern, dass das Fluid entlang einer Richtung im Wesentlichen senkrecht zur vertikalen Richtung (D1) des Tanks (100) in den Tank (100) eingebracht wird.

6. Tank (100) nach Anspruch 1, wobei die zweite Öffnung (106) auf einer lateralen Seite des unteren Prismas (105) bereitgestellt ist, an der die geneigte Fläche (103) bereitgestellt ist.

7. Tank (100) nach einem der Ansprüche 1, wobei das untere Prisma (105) mit zwei der zweiten Öffnung (106) versehen ist, die auf gegenüberliegenden Seiten des unteren Prismas (105) bereitgestellt sind.

8. Tank (100) nach einem der Ansprüche 1 bis 6, wobei die geneigte Fläche (103) eine laterale Wand des Tanks (100) ist.

9. Tank (100) nach Anspruch 8, wobei ein oberer Abschnitt (104), der sich vorzugsweise direkt über der geneigten lateralen Wand (103) befindet, des Tanks (100) im Wesentlichen ein oberes Prisma ist, wobei das obere Prisma entlang der vertikalen Richtung (D1) länglich ist und wobei sich die Leitung (102) vorzugsweise entlang einer Mittelachse des oberen Prismas erstreckt, wobei die mindestens eine geneigte laterale Wand (103) an einem unteren Abschnitt des oberen Prismas derart positioniert ist, dass ein entlang einer Ebene, die senkrecht zur vertikalen Richtung (D1) ist, vorgenommener Profilschnitt des Tanks (100) reduziert ist.

10. Modulares Hydraulikaggregat (1000) zum Zuführen eines druckbeaufschlagten Fluids, umfassend eine Mehrzahl von Tanks (100) nach einem der Ansprüche 1 bis 9, die miteinander verbunden sind, wobei jeder des Tanks (100) mit einer dritten Öffnung (107) versehen ist, die an einem unteren Abschnitt (105) des Tanks (100) bereitgestellt ist, wobei eine Pumpe (81, 82) an der dritten Öffnung (107) bereitgestellt ist, um das in dem Tank (100) enthaltene Fluid in Form von druckbeaufschlagtem Fluid einem externen Benutzer zuzuführen.

11. Modulares Hydraulikaggregat (1000) nach Anspruch 10, wenn abhängig von Anspruch 6, wobei ein erstes und ein zweites Rohr (31, 32) in der zweiten Öffnung (106) derart bereitgestellt sind, dass sie durch die Tanks (100) verlaufen, wobei jedes des Rohrs (31, 32) mit einer Mehrzahl von Löchern versehen ist, um zu ermöglichen, dass ein Fluid dort hindurch passiert.

12. Modulares Hydraulikaggregat (1000) nach Anspruch 11, wobei das erste und das zweite Rohr (31, 32) eine Mehrzahl von Teilrohren umfasst, die nebeneinander positioniert sind, und wobei sich ein Endabschnitt eines Teilrohrs vorzugsweise in direktem Kontakt mit einem Endabschnitt eines anderen Teilrohrs befindet.

13. Modulares Hydraulikaggregat (1000) nach einem der Ansprüche 11 oder 12, ferner umfassend ein Filterungs- und/oder Kühlsystem (50) zum Filtern und/oder Kühlen des dort hindurch passierenden Fluids, wobei das erste Rohr (31) mit einem Einlass des Filterungs- und/oder Kühlsystems derart verbunden ist, dass aus den Tanks (100) kommendes und durch die Mehrzahl von Löchern des ersten Rohrs (31) strömendes Fluid zu dem Filterungs- und/oder Kühlsystem (50) bereitgestellt wird, und wobei das zweite Rohr (32) mit einem Auslass des Filterungs- und/oder Kühlsystems (50) derart verbunden ist, dass das gekühlte und/oder gefilterte Fluid durch die Mehrzahl von Löchern des zweiten Rohrs (32) in jeden der Tanks (100) wieder eingebracht wird.

14. Modulares Hydraulikaggregat (1000) nach Anspruch 13,

wobei das modulare Hydraulikaggregat (1000) ferner eine Eingabe-/Ausgabeschnittstelle (400) umfasst, die mit einem der Verbindungsmittel (108) eines Tanks (100) verbunden ist, wobei die Eingabe-/Ausgabeschnittstelle (400) einen Hauptkörper (401) mit im Wesentlichen hohler zylindrischer Form aufweist, der an den Endabschnitten (402a, 402b) davon geschlossen ist und zwei Leitungen (403, 404) aufweist, die sich parallel zu einer Achse des Hauptkörpers erstrecken,
wobei die zwei Leitungen (403, 404) der Eingabe-/Ausgabeschnittstelle (400) zwei Öffnungen an einer Basis des Hauptkörpers (401) bereitstellen, die den Verbindungsmitteln (108) des

Tanks (100) zugewandt sind,
wobei die zwei Leitungen (403, 404) eine Einlass- und eine Auslassleitung (403, 404) umfassen, wobei die Einlassleitung (403) direkt mit dem ersten Rohr (31) verbunden ist und wobei die Auslassleitung (404) direkt mit dem zweiten Rohr (32) verbunden ist,
wobei die Eingabe-/Ausgabeschnittstelle (400) ferner ein Teilungsmittel (405) umfasst, das das Innenvolumen des hohlen Hauptkörpers (401) der Eingabe-/Ausgabeschnittstelle (400) in eine erste und eine zweite Kammer (406, 407) teilt,
wobei die Einlassleitung (403) mit Öffnungen (408) versehen ist, um strömungstechnisch in Kontakt mit der ersten Kammer (406) zu sein;
wobei die Auslassleitung (404) mit Öffnungen (409) versehen ist, um strömungstechnisch in Kontakt mit der zweiten Kammer (407) zu sein.

15. Modulares Hydraulikaggregat (1000) nach Anspruch 14, wobei das Filterungs- und/oder Kühlsystem (50) dazu ausgestaltet ist, einen Überdruck in der zweiten Kammer (407) und einen Unterdruck in der ersten Kammer (406) zu erzeugen.

Revendications

1. Réservoir (100) pour une unité de puissance hydraulique modulaire (1000) pour l'alimentation d'un fluide sous pression ; ledit réservoir (100) s'étendant principalement dans une direction verticale (D1) ;

ledit réservoir (100) étant muni d'une première ouverture (101) qui est positionnée au niveau d'une partie supérieure dudit réservoir (100) et à travers laquelle un fluide peut être introduit dans ledit réservoir (100) ;
ledit réservoir (100) comprenant en outre un conduit (102) ayant une première et une seconde partie d'extrémité (102a, 102b), dans lequel ladite première partie d'extrémité (102a) est fixée à ladite première ouverture (101) et dans lequel ladite seconde partie d'extrémité (102b) est positionnée au niveau d'une partie centrale dudit réservoir (100) de façon à transporter ledit fluide provenant de ladite première ouverture (101) vers une partie centrale dudit réservoir (100) ;
dans lequel ladite seconde partie d'extrémité (102b) dudit conduit (102) est conçue de façon à libérer le fluide provenant de ladite première ouverture (101) dans une direction sensiblement perpendiculaire à ladite direction verticale (D1) dudit réservoir (100) ;
dans lequel ledit réservoir (100) comprend au moins une surface inclinée (103), qui fait face à ladite seconde partie d'extrémité (102b) dudit conduit (102) et qui est inclinée par rapport à ladite direction verticale (D1) dudit réservoir (100) de façon à dévier l'écoulement de fluide provenant de ladite seconde partie d'extrémité dudit conduit (102) en direction d'une partie supérieure dudit réservoir (100), dans lequel une partie inférieure (105) dudit réservoir, qui est positionnée sous, de préférence directement en dessous, de ladite surface inclinée (103) est sensiblement un prisme inférieur, dans lequel ledit prisme inférieur est allongé dans ladite direction verticale (D1), dans lequel au moins un côté dudit prisme inférieur est muni d'une deuxième ouverture (106), dans lequel des moyens de liaison (108) sont placés au niveau de ladite deuxième ouverture (106) de façon à faire saillie à l'extérieur dudit réservoir (100), dans lequel lesdits moyens de liaison (108) sont conçus pour permettre la liaison fluidique du volume interne dudit réservoir (100) avec un autre réservoir (100) présentant des caractéristiques analogues.

2. Réservoir (100) selon la revendication 1, dans lequel une distance entre ladite première ouverture (101) et ladite partie centrale mesurée le long d'un axe parallèle à ladite direction verticale (D1) est égale à au moins la moitié d'une extension verticale dudit réservoir (100), de préférence est supérieure aux deux tiers de l'extension verticale dudit réservoir (100).

3. Réservoir (100) selon l'une quelconque des revendications 1 ou 2, dans lequel ledit conduit (102) s'étend dans ladite direction verticale (D1) dudit réservoir (100).

4. Réservoir (100) selon l'une quelconque des revendications 1 à 3, dans lequel ledit réservoir (100) comprend deux desdites surfaces inclinées (103), qui sont placées sur des côtés opposés dudit réservoir (100).

5. Réservoir (100) selon l'une quelconque des revendications 1 à 4, dans lequel ledit conduit (102) comprend un diffuseur (102c) qui est positionné au niveau de ladite seconde partie d'extrémité (102b) et est conçu pour modifier une direction du fluide provenant de ladite première partie d'extrémité (102a) de façon à introduire le fluide dans ledit réservoir (100) dans une direction sensiblement perpendiculaire à ladite direction verticale (D1) dudit réservoir (100).

6. Réservoir (100) selon la revendication 1, dans lequel ladite deuxième ouverture (106) est placée sur un côté latéral dudit prisme inférieur (105) sur lequel ladite surface inclinée (103) est placée.

7. Réservoir (100) selon la revendication 1, dans lequel ledit prisme inférieur (105) est muni de deux desdites secondes ouvertures (106), qui sont placées sur des côtés opposés dudit prisme inférieur (105).

8. Réservoir (100) selon l'une quelconque des revendications 1 à 6, dans lequel ladite surface inclinée (103) est une paroi latérale dudit réservoir (100).

9. Réservoir (100) selon la revendication 8, dans lequel une partie supérieure (104), qui est de préférence placée directement au-dessus de ladite paroi latérale inclinée (103) dudit réservoir (100), est sensiblement un prisme supérieur, dans lequel le prisme supérieur est allongé dans ladite direction verticale (D1) et dans lequel le conduit (102) s'étend de préférence le long d'un axe central dudit prisme supérieur, dans lequel ladite au moins une paroi latérale inclinée (103) est positionnée au niveau d'une partie inférieure dudit prisme supérieur de façon à réduire une section dudit réservoir (100) prise dans un plan qui est perpendiculaire à ladite direction verticale (D1).

10. Unité de puissance hydraulique modulaire (1000) pour l'alimentation d'un fluide sous pression, comprenant une pluralité de réservoirs (100) selon l'une quelconque des revendications 1 à 9 reliés les uns aux autres, dans laquelle chacun des réservoirs (100) est muni d'une troisième ouverture (107), qui est placée au niveau d'une partie inférieure (105) dudit réservoir (100), dans laquelle une pompe (81, 82) est placée au niveau de ladite troisième ouverture (107) de façon à fournir le fluide contenu dans ledit réservoir (100) sous la forme de fluide sous pression à un utilisateur externe.

11. Unité de puissance hydraulique modulaire (1000) selon la revendication 10 lorsqu'elle dépend de la revendication 6, dans laquelle un premier et un second tuyau (31, 32) sont placés dans ladite deuxième ouverture (106) de façon à passer à travers lesdits réservoirs (100), dans laquelle chacun des tuyaux (31, 32) est muni d'une pluralité de trous de façon à permettre le passage d'un fluide à travers.

12. Unité de puissance hydraulique modulaire (1000) selon la revendication 11, dans laquelle lesdits premier et second tuyaux (31, 32) comprennent une pluralité de sous-tuyaux positionnés à côté les uns des autres et dans laquelle une partie d'extrémité d'un sous-tuyau est de préférence en contact direct avec une partie d'extrémité d'un autre sous-tuyau.

13. Unité de puissance hydraulique modulaire (1000) selon l'une quelconque des revendications 11 ou 12, comprenant en outre un système de filtrage et/ou de refroidissement (50) destiné à filtrer et/ou refroidir le fluide passant à travers, dans laquelle ledit premier tuyau (31) est relié à une entrée dudit système de filtrage et/ou de refroidissement de façon à fournir le fluide provenant desdits réservoirs (100) et circulant à travers ladite pluralité de trous dudit premier tuyau (31) audit système de filtrage et/ou de refroidissement (50) et dans laquelle ledit second tuyau (32) est relié à une sortie dudit système de filtrage et/ou de refroidissement (50) de façon à réintroduire le fluide refroidi et/ou filtré dans chacun des réservoirs (100) par l'intermédiaire de ladite pluralité de trous dudit second tuyau (32).

14. Unité de puissance hydraulique modulaire (1000) selon la revendication 13,

dans laquelle ladite unité de puissance hydraulique modulaire (1000) comprend en outre une interface d'entrée/sortie (400) qui est reliée à l'un des moyens de liaison (108) d'un réservoir (100), dans laquelle ladite interface d'entrée/sortie (400) possède un corps principal de forme cylindrique sensiblement creux (401) fermé au niveau de ses parties d'extrémité (402a, 402b) et ayant deux conduits (403, 404) qui s'étendent parallèlement à un axe du corps principal,
dans laquelle lesdits deux conduits (403, 404) de ladite interface d'entrée/sortie (400) fournissent deux ouvertures sur une base du corps principal (401) qui fait face auxdits moyens de liaison (108) dudit réservoir (100),
dans laquelle lesdits deux conduits (403, 404) comprennent un conduit d'entrée et un conduit de sortie (403, 404), dans laquelle ledit conduit d'entrée (403) est directement relié audit premier tuyau (31) et dans laquelle ledit conduit de sortie (404) est directement relié audit second tuyau (32),
dans laquelle ladite interface d'entrée/sortie (400) comprend en outre des moyens de division (405) qui divisent le volume interne du corps principal creux (401) de ladite interface d'entrée/sortie (400) en une première et une seconde chambre (406, 407),
dans laquelle ledit conduit d'entrée (403) est muni d'ouvertures (408) de façon à être en contact fluidique avec ladite première chambre (406) ;
dans laquelle ledit conduit de sortie (404) est muni d'ouvertures (409) de façon à être en contact fluidique avec ladite seconde chambre (407).

15. Unité de puissance hydraulique modulaire (1000) selon la revendication 14, dans laquelle ledit système de filtrage et/ou de refroidissement (50) est conçu pour créer une surpression dans ladite seconde chambre (407) et une sous-pression dans ladite pre-

mière chambre (406).

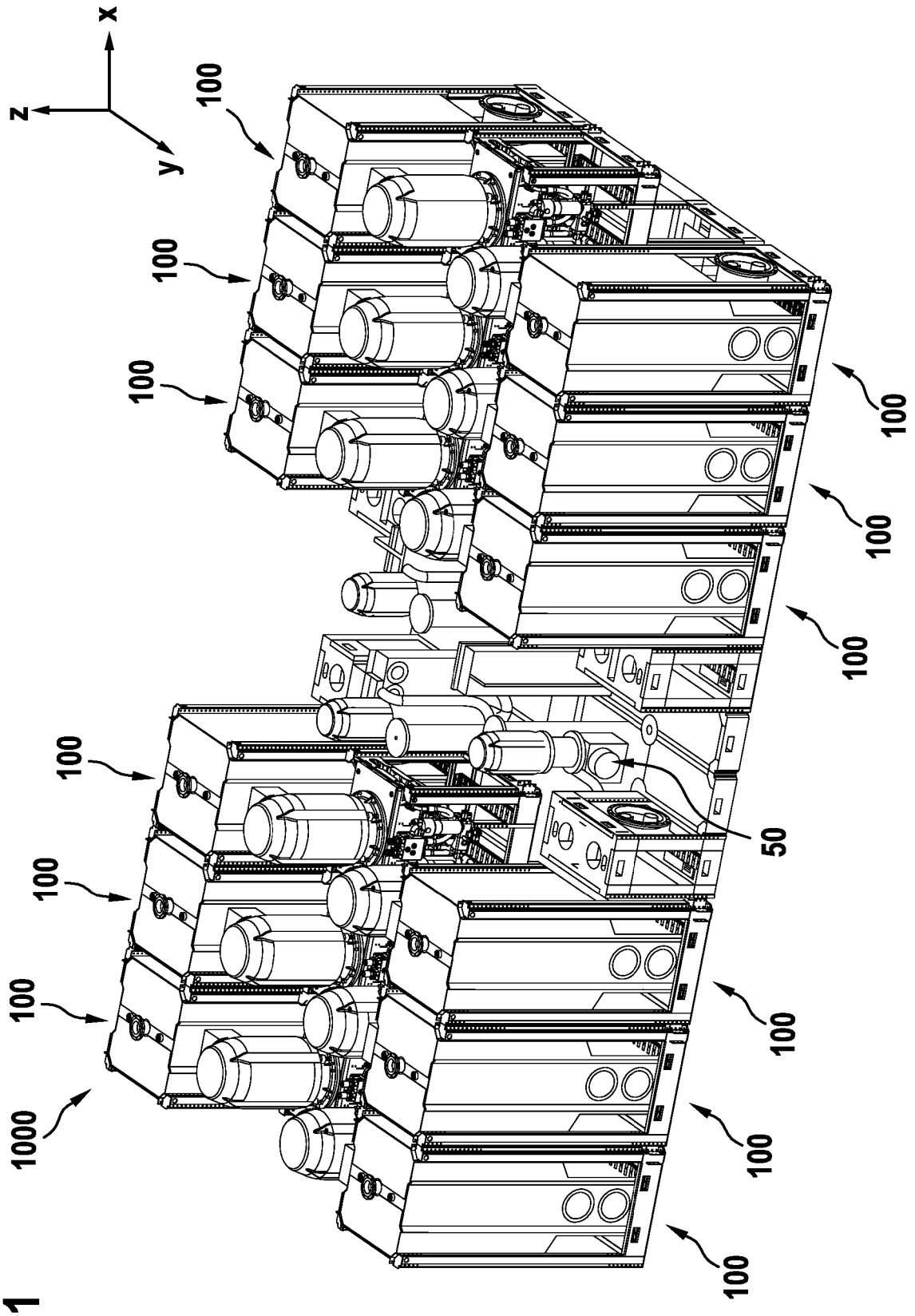
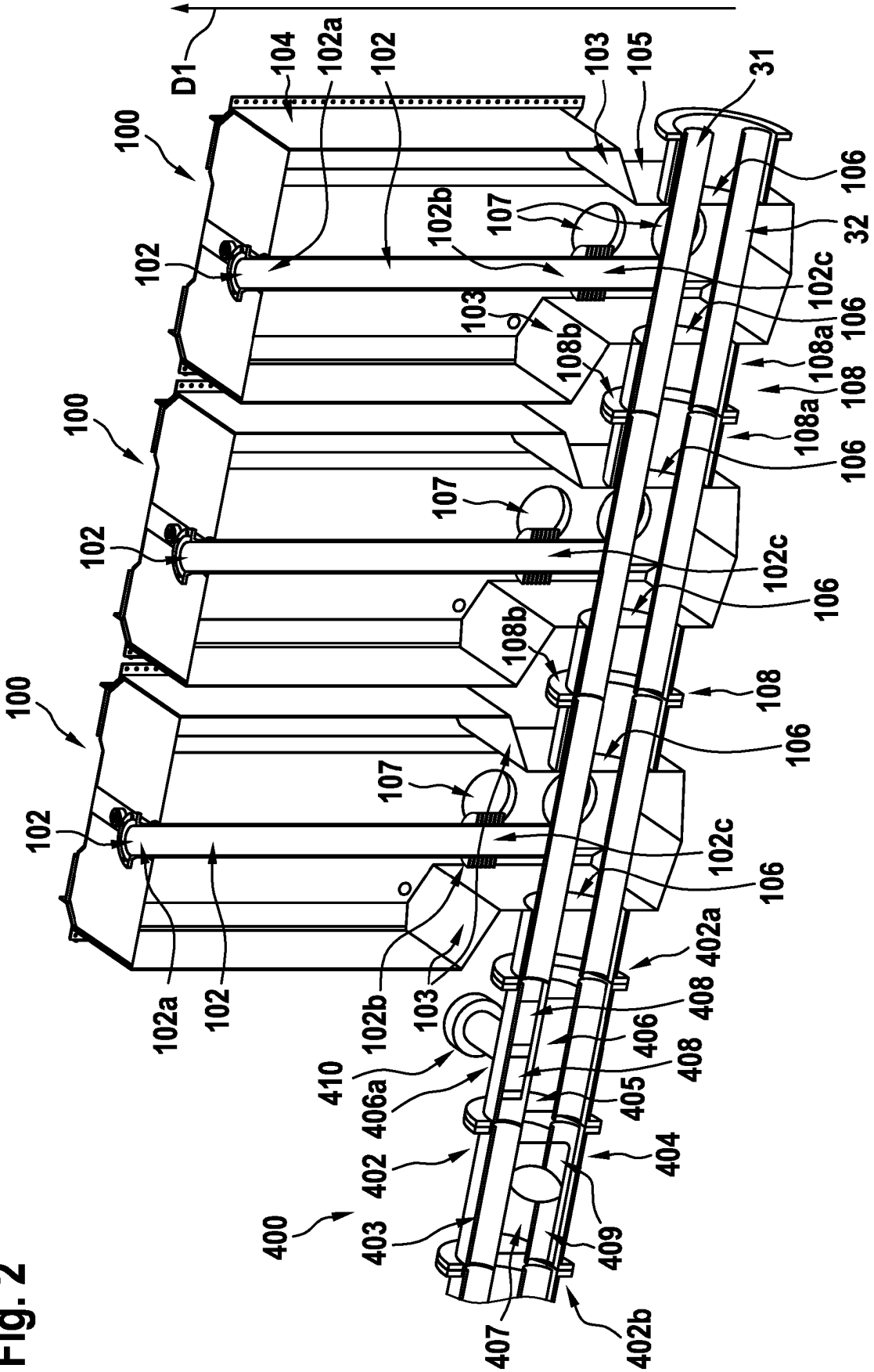


Fig. 1


D1
104
102a
102
103
105
31
100
106
102b
107
32
102
102c
103
106
108b
108a
108
100
107
102
102c
106
108b
108
100
106
107
102
102c
106
102a
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405
402
404
400
403
409
407
402b

Fig. 2

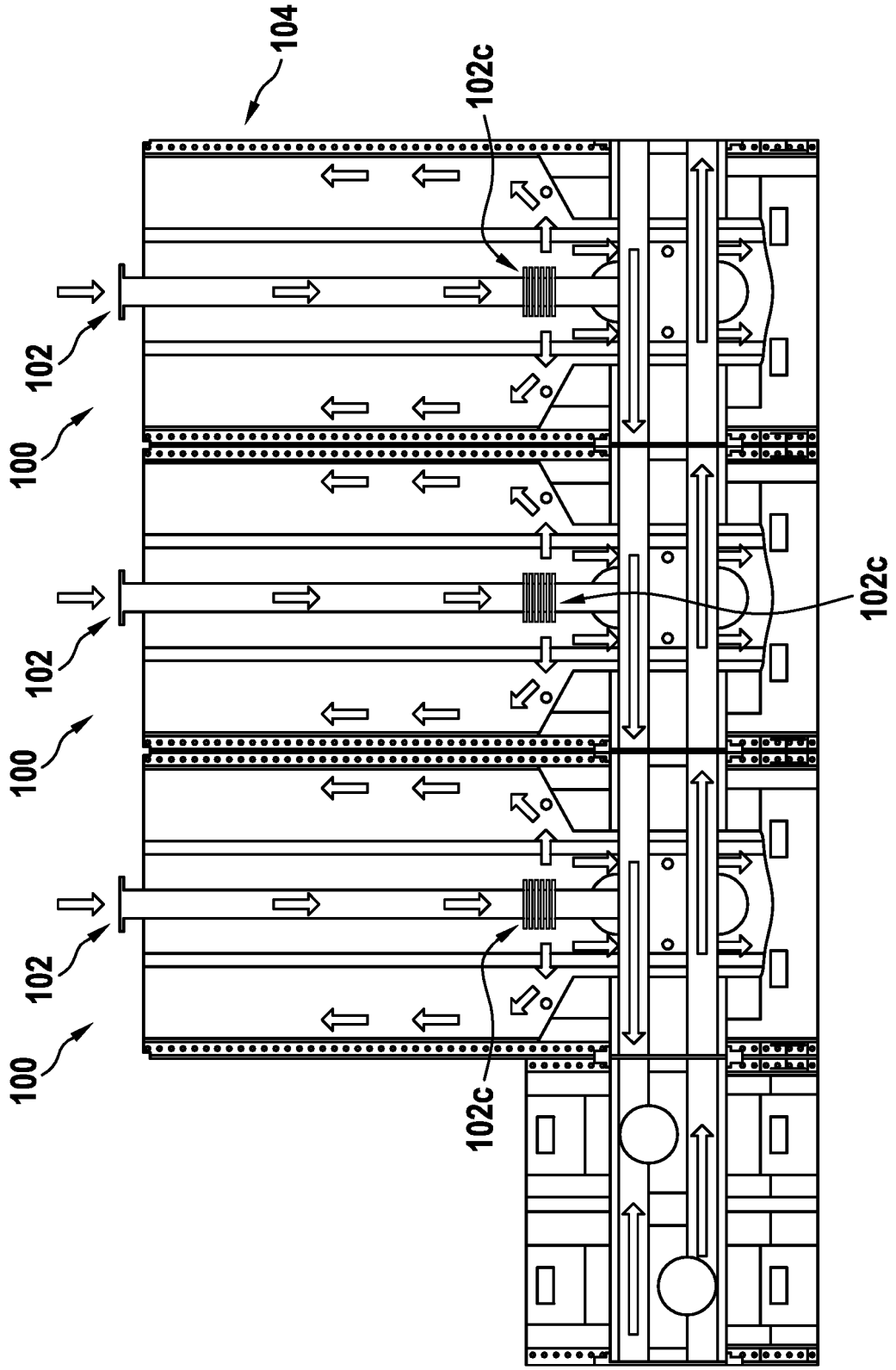


Fig. 3

Fig. 4

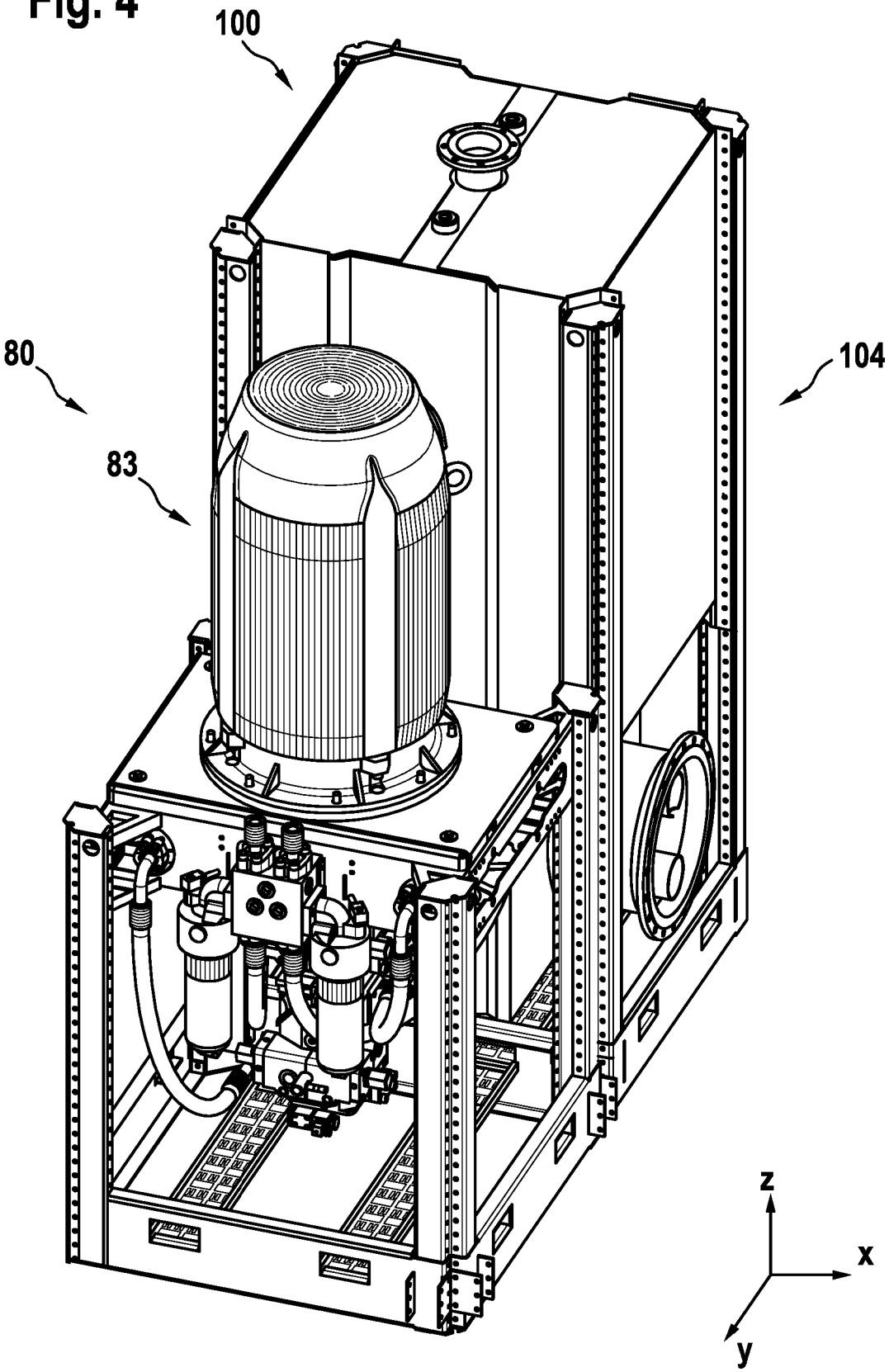


Fig. 5

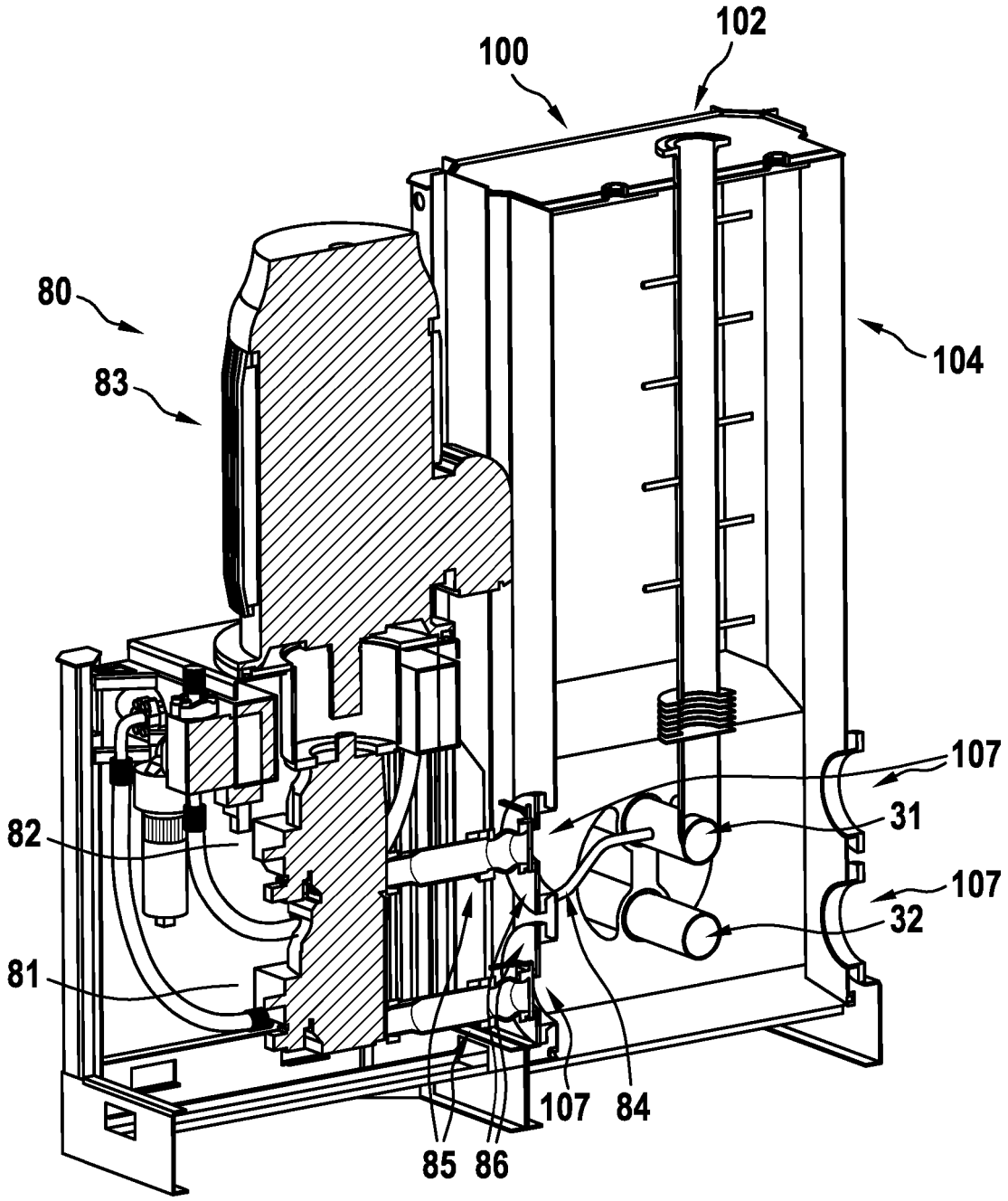
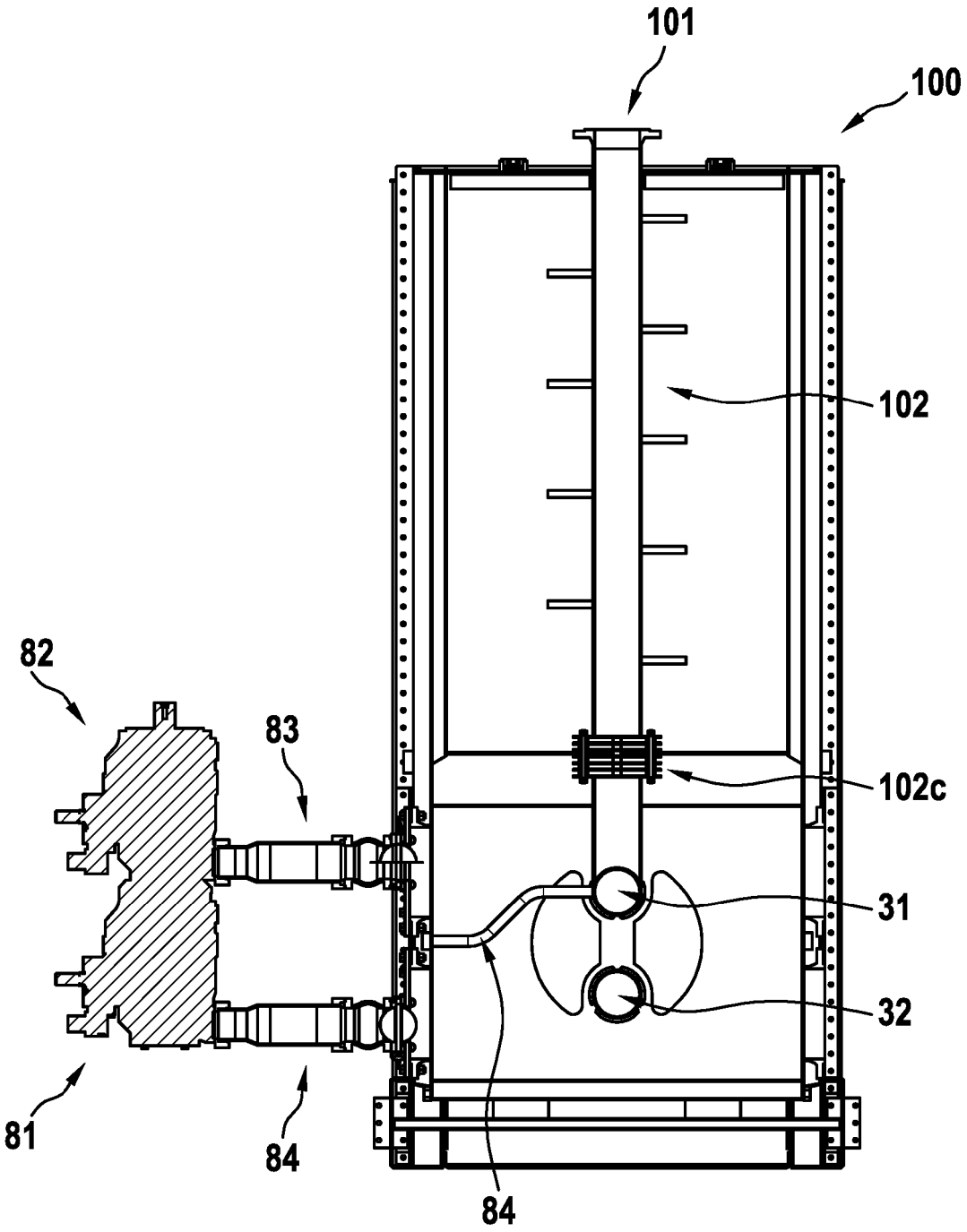


Fig. 6



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Patent documents cited in the description

- WO 2011149949 A2 **[0006]**