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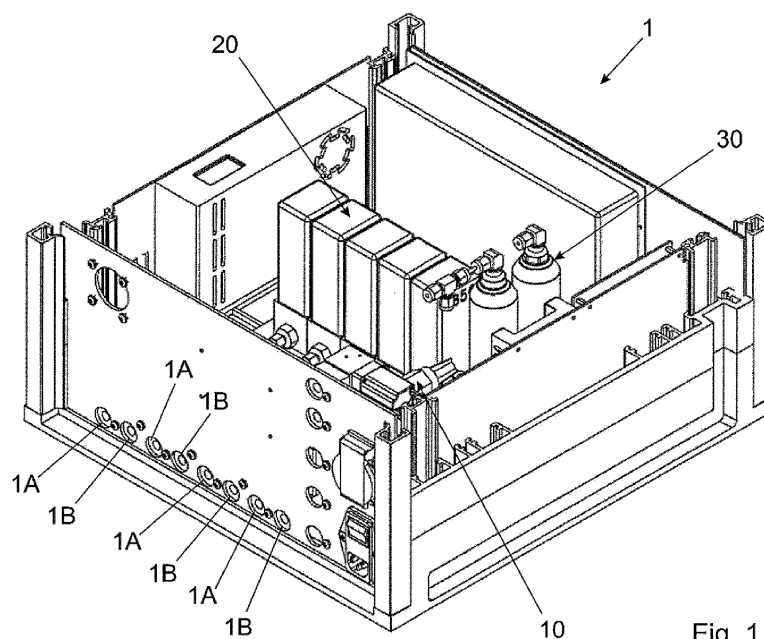
BA ME• **De Miguel Sanz, Sergio****08733 El Pla del Penedès (ES)**• **De La Orza Tortosa, Joaquín José****08013 Barcelona (ES)**• **Gimenéz Font, Humbert****08140 Caldes de Montbui (ES)**(71) Applicant: **Gometrics S.L.****08184 Palau-Solita i Plegamans (ES)**(74) Representative: **Davila Baz, Angel et al****Clarke, Modet & Co.****C/ Goya, 11****28012 Madrid (ES)**

(72) Inventors:

• **Casanovas Gesalí, Joan****08010 Barcelona (ES)**(54) **Gas mixer**

(57) Gas mixer that comprises one or more feed modules (10) connectable to the supply sources of a first and of a second inlet gas, wherein each feed module (10) is designed to supply a feed gas selectable among the first and the second inlet gas towards a flow regulator (20). Said feed module (10) comprises a selecting body (11) that receives the first and the second inlet gas, and that has an internal circuit (100) designed to carry the

selected gas towards an outlet channel (2); a first solenoid valve (12A) connected to the internal circuit (100) to open or close the path of the first inlet gas towards the outlet channel (2); and a second solenoid valve (12B) connected to the internal circuit (100) to open or close the path of the second inlet gas towards the outlet channel (2).

**Fig. 1****EP 2 740 528 A1**

Description

Object of the invention

[0001] The present invention relates to a gas mixer for industrial processes and research activities for use in laboratories in general, especially designed for the preparation of mixtures of gas (binary, ternary, quaternary, etc.), and the generation of atmospheres with a desired proportion of gases. The instrument is conceived for the analysis and characterization of gas sensors and transmitters; verification and calibration of gas analyzers; and research on growth in plant or cell cultures, among other uses.

Background of the invention

[0002] There are processes both within the industry as well as in laboratories, in which the manipulation of gases is required. One of the most common operations is the dilution or mixing of two or more inlet gases. In order to carry out these operations, the industries or laboratories are equipped with various more or less complex devices or facilities which allow for the manipulation of these gases.

[0003] Among the more sophisticated devices, are the electronic mixers, which are highly compact and manageable, although they pose certain prominently significant problems such as those mentioned below.

[0004] In one aspect, the fact that they are so compact limits considerably, due to lack of space, the number of inlets for feed gases; the usual number being between two and four gases in total that can remain permanently connected, and thus, arranged on the device. In this regard, there are some known solutions that have allowed to slightly increase said number of inlets, by means of incorporating one or more feed modules each of which are connectable to supply sources of a first and of a second inlet gas. Each feed module is designed to supply a feed gas selectable among the first and the second inlet gas towards a flow regulator, in such a way that the number of gases available to be controlled is multiplied. However, each one of these modules is formed by a hydraulic (or pneumatic) circuit in which, normally a three-way valve is connected by means of the appropriate conduits, to two inlet channels and one outlet channel. Any regulatory and/or control element for the pressure of inlet and/or outlet gases that any one of these modules may require, should be connected to said circuit by means of the appropriate conduits. Therefore, these basic solutions require a considerable space in order to accommodate the elements and conduits that form the hydraulic or pneumatic circuit of each feed module, which at the same time, increases the risk of breakdown and the presence of leaks, due to the high number of connections.

[0005] Another significant problem that these types of equipment have is the cleaning of the circuit. In order to achieve reliable results, after each mixing process, the

user should inactivate the circuit, without a solution in which the equipment itself integrates a specific cleaning outlet, allowing cleaning of all the modules, flowmeters and circuits. This would avoid having to manually disconnect and reconnect the standard and inert cylinders, or apply external cleaning systems, and consequently save time.

[0006] Another problem with the current equipment that should be noted is the little homogeneity of the resulting mixture. In this regard, given that the deposits where the mixture is produced have a small volume, and the flows are normally in the same direction, the mode of operation of these devices cannot obtain sufficient homogeneity for certain mixing processes.

[0007] Lastly, the majority of these devices are not usually compatible to work interchangeably with inert gases and oxidizing gases, as said devices are normally designed to operate exclusively with one or another type of gas, which significantly increases the cost of the product if it is expected to use only one or a few channels with an oxidizing gas inlet.

[0008] The present invention solves the previously mentioned problems by means of a sophisticated gas mixer, optimized and highly manageable and compact that allows working with a greater number of feed gases, performing automatic cleaning of the circuit without disconnecting the cylinders, obtaining more homogenous mixtures and working interchangeably with inert gases and oxidizing gases. Similarly, the mixer of the present invention incorporates a number of operational modules that provide greater precision, versatility, easy use and safety.

Description of the invention

[0009] The gas mixer of the present invention is of the type that comprises one or more feed modules, each one of these connectable to the supply sources of a first and of a second inlet gas, wherein each feed module is designed to supply a feed gas selectable among the first and the second inlet gas towards a flow regulator.

[0010] The gas mixer of the present invention is **characterized in that** the feed module comprises:

- a selecting body that receives the first and the second inlet gas coming from a first and second inlet channel respectively, and that has an internal circuit to carry the selected feed gas towards an outlet channel connectable to the flow regulator;
- a first solenoid valve joined to the selecting body, connected to the internal circuit to open or close the path of the first inlet gas towards the outlet channel, and
- a second solenoid valve joined to the selecting body, connected to the internal circuit to open or close the path of the second inlet gas towards the outlet channel.

[0011] The first and second solenoid valves are, preferably, two-way.

[0012] Preferably, in order to facilitate the input of the first and second inlet gas, the feed module additionally comprises:

- a support body joined to the selecting body, which has a first and second passage that connect to the first and second inlet channel respectively, which in turn connect to the internal circuit of the selecting body, wherein each passage houses in its interior a filter and retention means thereof.

[0013] Preferably, in order to appropriately regulate the pressure of the circuit and control any undesired loss thereof, the feed module (10) additionally comprises:

- a pressure regulator joined to the selecting body and connected to the internal circuit thereof, which is designed to regulate the pressure of the feed gas, and
- a safety pressure switch joined to the selecting body and connected to the internal circuit thereof, which is designed to detect a pressure deficit of the feed gas.

[0014] Preferably, the feed module additionally comprises:

- a third inlet channel of balancing gas connected to the internal circuit of the selecting body, that is designed to balance the feed gas, with the input of a balancing fluid, for example air, dry nitrogen, argon, methane, etc.

[0015] Preferably, the feed module additionally comprises:

- A third solenoid valve joined to the selecting body, connected to the internal circuit to open or close the path of the balancing gas towards the outlet channel.

[0016] The third solenoid valve is, preferably, three-way.

[0017] Preferably, the selecting body has a solid rectangular shape, with a mechanical interior that forms the internal circuit and a plurality of connection holes on its external surface that are connected to said internal circuit. Among the various materials with which the selecting body can be made, there is a great interest in polyetheretherketone (PEEK) for its excellent resistive properties against mechanical and chemical actions.

[0018] Preferably, to obtain more homogeneous mixtures, the gas mixer comprises a homogenizing module that has:

- an inlet block comprising:
 - a mixture cavity with a plurality of inlet holes fac-

ing each other and one outlet hole oriented perpendicular to the inlet holes; and

- a plurality of inlet fittings each one connected to one of the inlet holes, wherein said fittings are designed to receive the feed gas coming from each flow regulator and allow its turbulent mixing inside the cavity;

- a first mixture deposit that connects to the outlet hole and that is designed to contain in its interior the mixture of feed gases coming from the inlet block; and
- an outlet block of the mixture of gases coming from the first deposit (36) that has an outlet fitting.

[0019] Among the various materials with which the mixing cavity can be made, there is a great interest in stainless steel for its excellent resistive properties against mechanical and chemical actions.

[0020] Preferably, the homogenizing module additionally comprises:

- A second mixing deposit that connects to the outlet block and to the outlet fitting by means of a non-return valve.

[0021] The second mixing deposit has one or more auxiliary inlet fittings, especially enabled to receive oxidizing gases and carry them directly towards the outlet fitting. The non-return valve prevents said oxidizing gases from flowing in the opposite direction, which can seriously damage other sensitive components in the mixture, such as the flow regulators with inert gases, or any other type of component that is not compatible with this type of oxidizing or corrosive gas.

[0022] Preferably, in order to provide a direct balancing fluid output from one or more input modules, the mixer of the present invention comprises one balance outlet module that has:

- A balance flow regulator designed to supply a balancing fluid.

[0023] Said balance outlet module sets up a circuit of balancing gas that connects to each feed module through one of the routes of the third solenoid valve.

[0024] Preferably, in order to perform automatic cleaning of the circuit without disconnecting the cylinders, the gas mixer comprises a cleaning module that is designed to operate as a vacuum system or by means of injecting inert gases. Said cleaning module comprises:

- a two-way cleaning solenoid valve designed to close and open the path of the cleaning channel; and
- a flow regulator of the cleaning gas.

[0025] Preferably, in order to guarantee correct operation in the event of possible leaks in the pneumatic circuit, the gas mixer comprises a leak detection module,

which includes:

- a unit of precision measurement connected to the pneumatic circuit of the mixer; and
- a leak control that is programmed to pressurize the pneumatic circuit of the mixer to a reference pressure during a period of time to detect whether said reference pressure decreases.

[0026] The leak control is designed to close and open the path of the cleaning channel acting on the cleaning solenoid valve, and in order to set the reference pressure, acting on the flow regulator of the cleaning gases.

[0027] The versatility of the gas mixer of the present invention allows for two separate pneumatic circuits formed by a circuit of inert gases and by a circuit of oxidizing gases, with the ability to operate interchangeably with inert gases and oxidizing gases. A balancing gas circuit is added to these circuits, which comprises its own feed module, connecting to the rest of the feed modules of inert and/or oxidizing gases, and that has its own direct outlet through the balance outlet module.

Brief description of the drawings

[0028] Following is a brief description of a number of drawings that help to aid a better understanding of the invention and are expressly related to a preferred embodiment of said invention and are presented as a non-limitative example thereof.

Figure 1 shows a perspective view of the mixer with its upper part open, where its interior can be seen.

Figure 2 shows a plant view of the mixer with its upper part open, where its interior can be seen.

Figure 3 shows a first partial exploded perspective of the feed module.

Figure 4 shows a second partial exploded perspective of the feed module.

Figure 5A shows a front view of the feed module.

Figure 5B shows a dorsal view of the feed module.

Figure 5C shows a side view of the feed module.

Figure 5D shows a cross-section according to cut line A-A of Fig.5C.

Figure 6A shows a dorsal view of the selecting body.

Figure 6B shows a front view of the selecting body.

Figure 6C shows a plant view of the selecting body.

Figure 6D shows a cross-section according to cut line B-B of Fig.6A.

Figure 6E shows a cross-section according to cut line C-C of Fig.6B.

Figure 6F shows a cross-section according to cut line D-D of Fig.6C.

Figure 6G shows a cross-section according to cut line E-E of Fig.6C.

Figure 6H shows a cross-section according to cut line F-F of Fig.6C.

Figure 6I shows a cross-section according to cut line

G-G of Fig.6C.

Figure 6J shows a cross-section according to cut line H-H of Fig.6C.

Figure 6K shows a cross-section according to cut line I-I of Fig.6C.

Figure 7A shows a perspective view of the homogenizing module.

Figure 7B shows a front view of the homogenizing module.

Figure 7C shows a longitudinal cross-section of the homogenizing module.

Figure 8 shows the diagram of the operation of the mixer.

15 Preferred embodiment of the invention

[0029] Figures 1 and 2 show a perspective view and a plant view of the gas mixer (1) of the present invention respectively, where its inside can be seen. As shown, the gas mixer (1) is of the type that comprises one or more feed modules (10) each one of them connectable to supply courses, not shown, of a first and of a second inlet gas, wherein each feed module (10) is designed to supply a feed gas selectable among the first and second inlet gas towards a flow regulator (20).

[0030] Figures 3 and 4 show a first and second partial exploded perspective of the feed module (10) respectively. As shown, the feed module (10) comprises:

- a selecting body (11) that receives the first and the second inlet gas from a first (1A) and a second inlet channel (1B) respectively, Figure 1, and which has an internal circuit (100) designed to carry the selected feed gas towards the outlet (2) connectable to the flow regulator (20);
- a first solenoid valve (12A) joined to the selecting body (11), connected to the internal circuit (100) to open and close the path of the first inlet gas towards the outlet channel (2); and
- a second solenoid valve (12B) joined to a selecting body (11), connected to the internal circuit (100) to open and close the path of the second inlet gas towards the outlet channel (2).

[0031] In order to facilitate the input of the first and second inlet gas, the feed module (10) additionally comprises:

- a support body (13) joined to the selecting body (11), that has a first (13A) and a second passage (13B) that respectively connect to the first (1A) and the second inlet channel (1B), and which in turn connect to the internal circuit (100) of the selecting body (11), where each passage (13A, 13B) houses a filter (131) and retention means (132) thereof in its interior, springs according to the present example.

[0032] In order to ensure a correct connection between

the support body (13) and the selecting body (11), screws are used (133) that work together with the threaded connection holes (102), Figure 6A. In order to guarantee air tightness, elastic seals (18) can be used between the interior of the circuit (100) and the passages (13A, 13B).

[0033] In order to appropriately regulate the pressure of the circuit and control any undesirable loss thereof, the feed module (10) additionally comprises:

- a pressure regulator (14) joined to a selecting body (11) and connected to the internal circuit (100) thereof, which is designed to regulate the pressure of the feed gas; and
- a safety pressure switch (15) joined to the selecting body (11) and connected to the internal circuit (100) thereof, which is designed to detect a deficit in the pressure of the feed gas.

[0034] The feed module (10) additionally comprises:

- a third inlet channel (1C) of balancing gas connected to the internal circuit (100) of the selecting body (11), that is designed to balance the feed gas with the input of a balancing fluid, for example air, dry nitrogen, etc.

[0035] As shown in Figure 4, there is the option that the feed module (10) comprises:

- a third solenoid valve (12C) joined to a selecting body (11), connected to the internal circuit (100) to open or close the path of the balancing gas towards the outlet channel (2).

[0036] In the case that the third solenoid valve is not needed (12C), for example where a feed module (10) is connected to a supply source of balancing gas, said solenoid valve (12C) can easily be exchanged for a cap (16), without the need to modify the internal circuit (100) of the selecting body (11). In order to guarantee the air tightness, an elastic seal (18) can be used between the internal circuit (100) and the cap (16).

[0037] Figures 6A - 6K show in great detail, the design of the selecting body (11) and of the mechanical interior that forms the internal circuit (100). As shown, the selecting body (11) has a solid rectangular shape, that has a mechanical interior that forms the internal circuit (100) and a plurality of holes arranged on the external surface thereof giving access to said internal circuit (100).

[0038] Figure 6A shows a first and a second inlet hole (101A, 101B) which receive the first and second inlet gas from the first (1A) and the second inlet channel (1B) respectively. In turn, the threaded connection holes (102) can be observed which work together with the screws (133) allowing for the connection between the support body (13) and the selecting body (11), as well as auxiliary holes (103), which assist with the performance of the machine, and once in operation, they are sealed by pins

(17), Figure 4.

[0039] Figure 6B shows an outlet hole (104) of the selected feed gas, pressure regulation holes (105) that connect to the pressure regulator (14) and a balance inlet hole (106) that connects to the third inlet channel (1C) of the balancing gas.

[0040] Figure 6C shows some first opening and closing holes (107) of the path of the first inlet gas that connect a first two-way solenoid valve (12A), and some second opening and closing holes (108) of the second inlet gas that connect to a second two-way solenoid valve (12B). In turn, some third opening and closing holes (110) can be observed that connect to a third three-way solenoid valve (12C), and allow to commute the flow of the selected feed gas or of the balancing gas towards the outlet channel (2). Positioned around it, are the corresponding retention holes (109) of said solenoid valves (12A, 12B, 12C), or of the cap (16) if it does not have a third solenoid valve (12C). Finally, a safety hole (111) that connects the safety pressure switch (15) can be observed.

[0041] Figures 6D - 6K show the continuity of the front holes in the interior of the selecting body (11), and how they are connected to each other to form the internal circuit (100).

[0042] Figures 7A - 7C show the homogenizing module (30) in great detail. As shown, the homogenizing module (30) comprises:

- an inlet block (31) that has:
 - a mixing cavity (32) with a plurality of inlet holes (33) facing each other, and one outlet hole (34) oriented perpendicular to the inlet holes (33); and
 - a plurality of inlet fittings (35) each one connected to one of the inlet holes (33), wherein said fittings (35) are designed to receive the feed gas coming from each flow regulator (20) and allow its turbulent mixing inside the cavity (32);
- a first mixture deposit (36) that connects to the outlet hole (34) and that is designed to contain in its interior the mixture of feed gases coming from the inlet block (31); and
- an outlet block (37) of the mixture of gases coming from the first deposit (36) that has an outlet fitting (38).

[0043] According to the present example, the homogenizing module (30) additionally comprises:

- A second mixing deposit (39) that connects to the outlet block (37) and to the outlet fitting (38) by means of a non-return valve (301).

[0044] The second mixing deposit (39) has one or more auxiliary inlet fittings (302), especially enabled to receive oxidizing gases and carry them directly towards the outlet

fitting (38).

[0045] Figure 8 shows the diagram of the operation of the mixer (1) of the present invention. According to the present example, the mixer (1) is designed to work uninterruptedly, that is, without the need to manipulate the supply sources, with six different inert gases (three simultaneously), two different balancing gases (one simultaneously) and two different oxidizing gases (one simultaneously). Resulting in a highly versatile mixer (1).

[0046] As shown, there are two separate pneumatic circuits formed by one circuit of inert gases (2), represented by solid lines, and by a circuit of oxidizing gases (3), represented by a dashed dotted line. In this way, the mixer (1) can work with either inert gases or oxidizing gases.

[0047] A balancing gas (4) is added to these circuits, represented by a dashed line without dots, which comprises its own feed module (10), connecting to the rest of the feed modules (10) of inert and/or oxidizing gases. To provide a direct output of balancing fluid, from one or more feed modules, the mixer of the present invention comprises a balance outlet module (40) which includes:

- A balance flow regulator (41) designed to supply a balancing fluid.

[0048] Said balance outlet module (40) sets up a circuit of balancing gas (4) that connects to each feed module (10) through one of the routes of the third solenoid valve (12C), through the third inlet channel (1C).

[0049] In order to perform automatic cleaning of the circuit without disconnecting the cylinders, the gas mixer (1) comprises a cleaning module (50) that is designed to operate as a vacuum system or by means of injecting inert gases. Said cleaning module (50) comprises:

- a two-way cleaning solenoid valve (51) designed to close and open the path of the cleaning channel; and
- a flow regulator of the cleaning gas (52).

[0050] In order to guarantee correct operation in the event of possible leaks in the pneumatic circuit, the gas mixer (1) comprises a leak detection module (60) which includes:

- a unit of precision measurement (61) connected to the pneumatic circuit of the mixer (1); and
- a leak control, not shown, that is programmed to pressurize the pneumatic circuit of the mixer (1) to a reference pressure and monitor the value detected by the precision measurement unit (61) during a period of time to detect whether said reference pressure decreases.

[0051] The leak control is designed to close and open the path of the cleaning channel acting on the cleaning solenoid valve (51), and in order to set the reference pressure, acting on the flow regulator of the cleaning gases

(52).

Claims

1. Gas mixer, that comprises one or more feed modules (10) each one of these connectable to the supply sources of a first and of a second inlet gas, wherein each feed module (10) is designed to supply a feed gas selectable among the first and the second inlet gas towards a flow regulator (20), said mixer (1) **characterized in that** the feed module (10) comprises:

- selecting body (11) that receives the first and the second inlet gas coming from a first (1A) and from a second inlet channel (1B) respectively, and that has an internal circuit (100) designed to carry the selected feed gas towards an outlet channel (2) connectable to the flow regulator (20);
- a first solenoid valve (12A) joined to the selecting body (11), connected to the internal circuit (100) to open or close the path of the first inlet gas towards the outlet channel (2); and
- a second solenoid valve (12B) joined to the selecting body (11), connected to the internal circuit (100) to open or close the path of the second inlet gas towards the outlet channel (2).

2. Gas mixer according to claim 1 **characterized in that** the feed module (10) additionally comprises:

- a support body (13) joined to the selecting body (11), that has a first (13A) and a second passage (13B) that connect to the first (1A) and second inlet channel (1B) respectively, and which in turn connect to the internal circuit (100) of the selecting body (11), wherein each passage (13A, 13B) houses in its interior a filter (131) and retention means (132) thereof.

3. Gas mixer according to any one of the previous claims 1 to 2 **characterized in that** the feed module (10) additionally comprises:

- a pressure regulator (14) joined to a selecting body (11) and connected to the internal circuit (100) thereof, which is designed to regulate the pressure of the feed gas; and
- a safety pressure switch (15) joined to the selecting body (11) and connected to the internal circuit (100) thereof, which is designed to detect a deficit in the pressure of the feed gas.

4. Gas mixer according to any one of the previous claims 1 to 3 **characterized in that** the feed module (10) additionally comprises:

- a third inlet channel (1C) of balancing gas connected to the internal circuit (100) of the selecting body (11), that is designed to balance the feed gas with the input of a balancing fluid.
5. Gas mixer according to claim 4 **characterized in that** the feed module (10) additionally comprises:
- a third solenoid valve (12C) joined to a selecting body (11), connected to the internal circuit (100) to open or close the path of the balancing gas towards the outlet channel (2).
6. Gas mixer according to any of the previous claims 1 to 5 **characterized in that** the selecting body (11) has a solid rectangular shape, that has a mechanical interior forming the internal circuit (100) and a plurality of holes arranged on the external surface thereof connecting to said internal circuit (100).
7. Gas mixer according to any of the previous claims 1 to 6 **characterized in that** it comprises a homogenizing module (30) comprising:
- an inlet block (31) that has:
 - a mixture cavity (32) with a plurality of inlet holes (33) facing each other and one outlet hole (34) oriented perpendicular to the inlet holes (33); and
 - a plurality of inlet fittings (35) each one connected to one of the inlet holes (33), wherein said fittings (35) are designed to receive the feed gas coming from each flow regulator (20) and allow its turbulent mixing inside the cavity (32);
 - a first mixture deposit (36) that connects to the outlet hole (34) and that is designed to contain in its interior the mixture of feed gases coming from the inlet block (31); and
 - an outlet block (37) of the mixture of gases coming from the first deposit (36) that has an outlet fitting (38).
8. Gas mixer according to claim 7 **characterized in that** the homogenizing module (30) additionally comprises:
- a second mixing deposit (39) that connects to the outlet block (37) and to the outlet fitting (38) by means of a non-return valve (301).
9. Gas mixer according to any of the claims 1 to 8 **characterized in that** it comprises a balance outlet module (40) that has:
- a balance flow regulator (41) designed to supply a balancing fluid.
10. Gas mixer according to claims 5 and 9 **characterized in that** the balance outlet module (40) sets up a circuit of balancing gas (4) that connects to each feed module (10) through one of the routes of the third solenoid valve (12C).
11. Gas mixer according to any of the claims 1 to 10 **characterized in that** it comprises a cleaning module (50) that is designed to operate as a vacuum system or by means of injecting inert gases.
12. Gas mixer according to claim 11 **characterized in that** the cleaning module (50) comprises:
- a two-way cleaning solenoid valve (51) designed to close and open the path of the cleaning channel; and
 - a flow regulator of the cleaning gas (52).
13. Gas mixer according to any of claims 1 to 12 **characterized in that** it comprises a leak detection module (60) which includes:
- a unit of precision measurement (61) connected to the pneumatic circuit of the mixer (1); and
 - a leak control (62) that is programmed to pressurize the pneumatic circuit of the mixer (1) to a reference pressure and monitor the values detected by the precision measurement unit (61) during a period of time to detect whether said reference pressure decreases.
14. Gas mixer according to claims 12 and 13 **characterized in that** the leak control (62) is designed to close and open the path of the cleaning channel acting on the cleaning solenoid valve (51), and in order to set the reference pressure, acting on the flow regulator of the cleaning gases (52).
15. Gas mixer according to any of the claims 1 to 14 **characterized in that** it comprises two separate pneumatic circuits formed by a circuit of inert gases (2) and by a circuit of oxidizing gases (3).

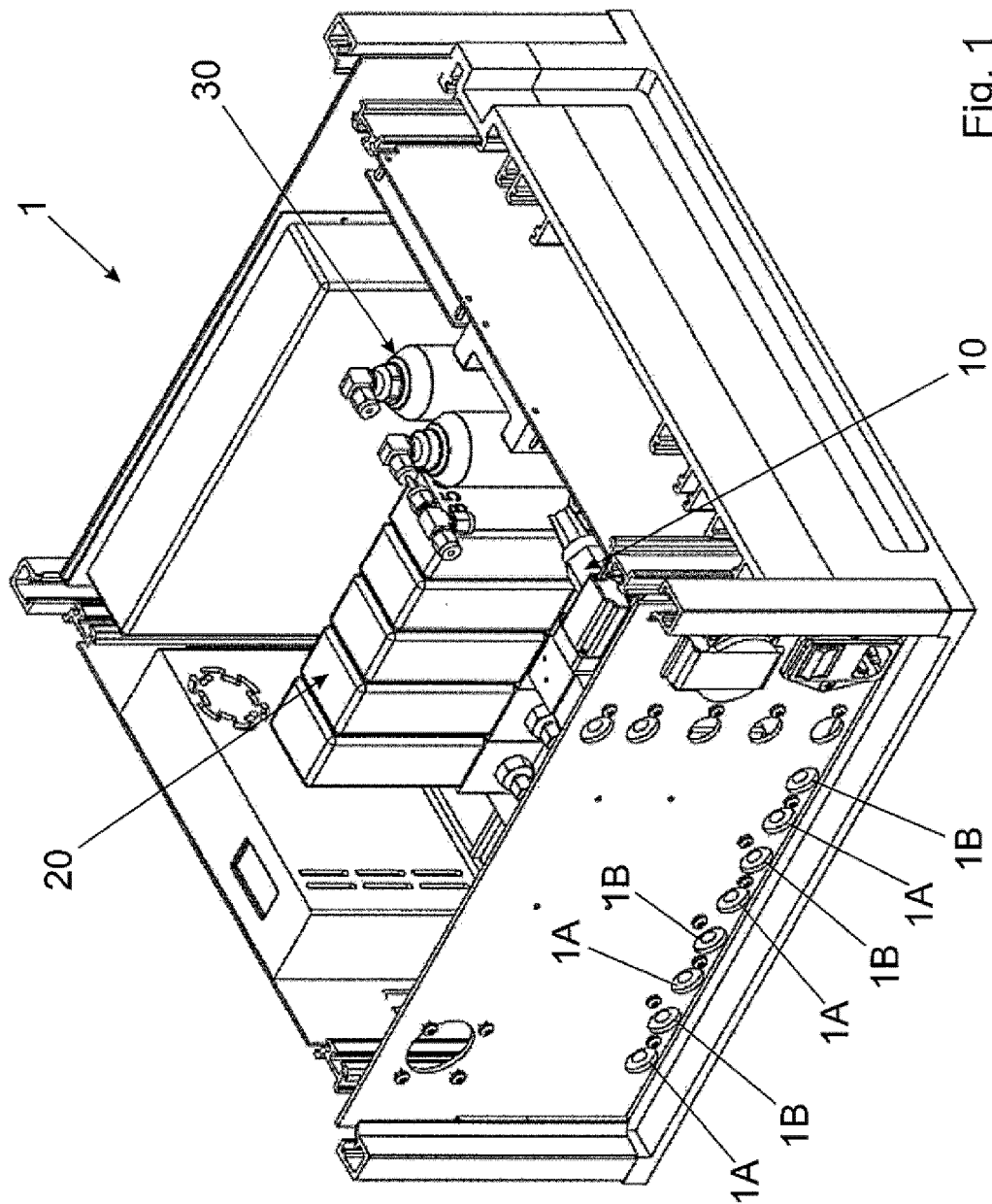


Fig. 1

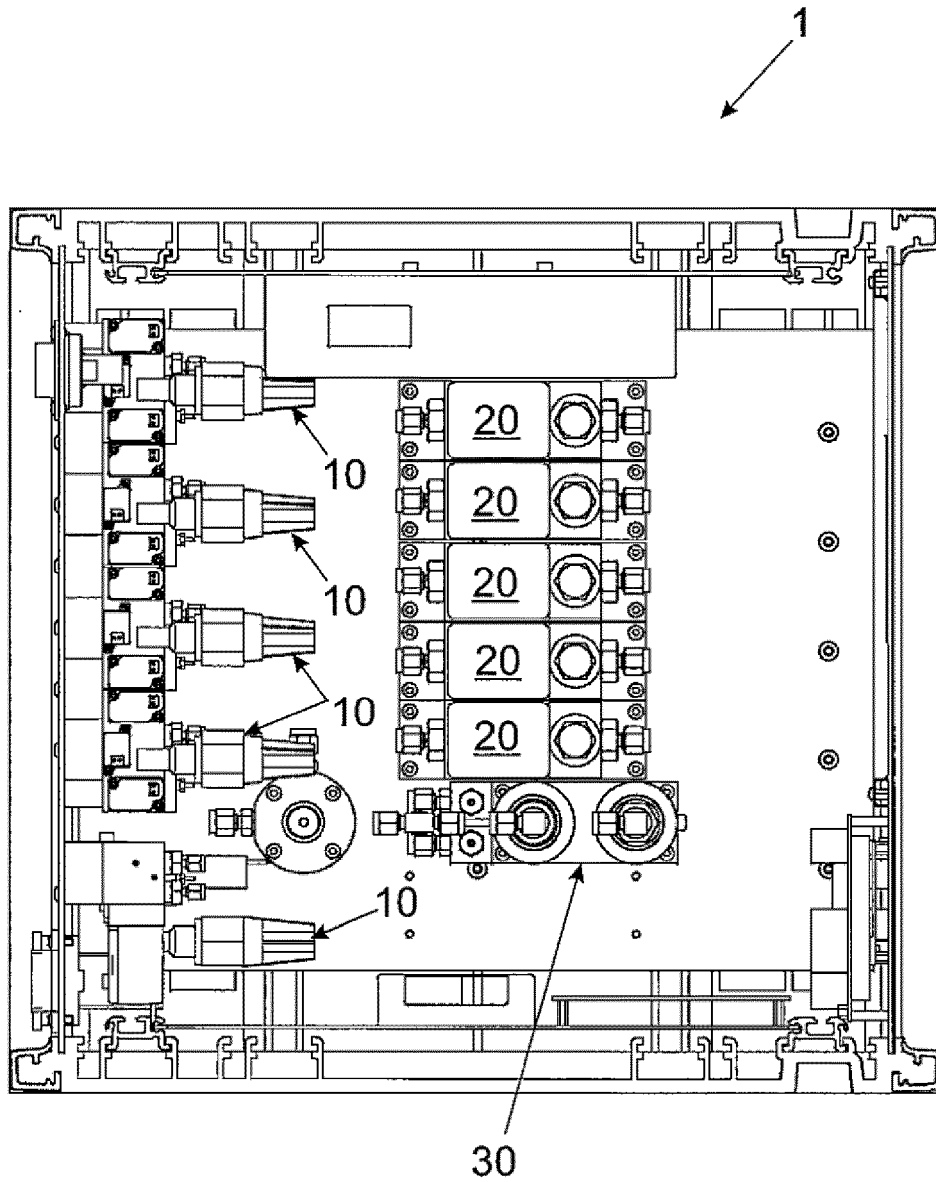


Fig. 2

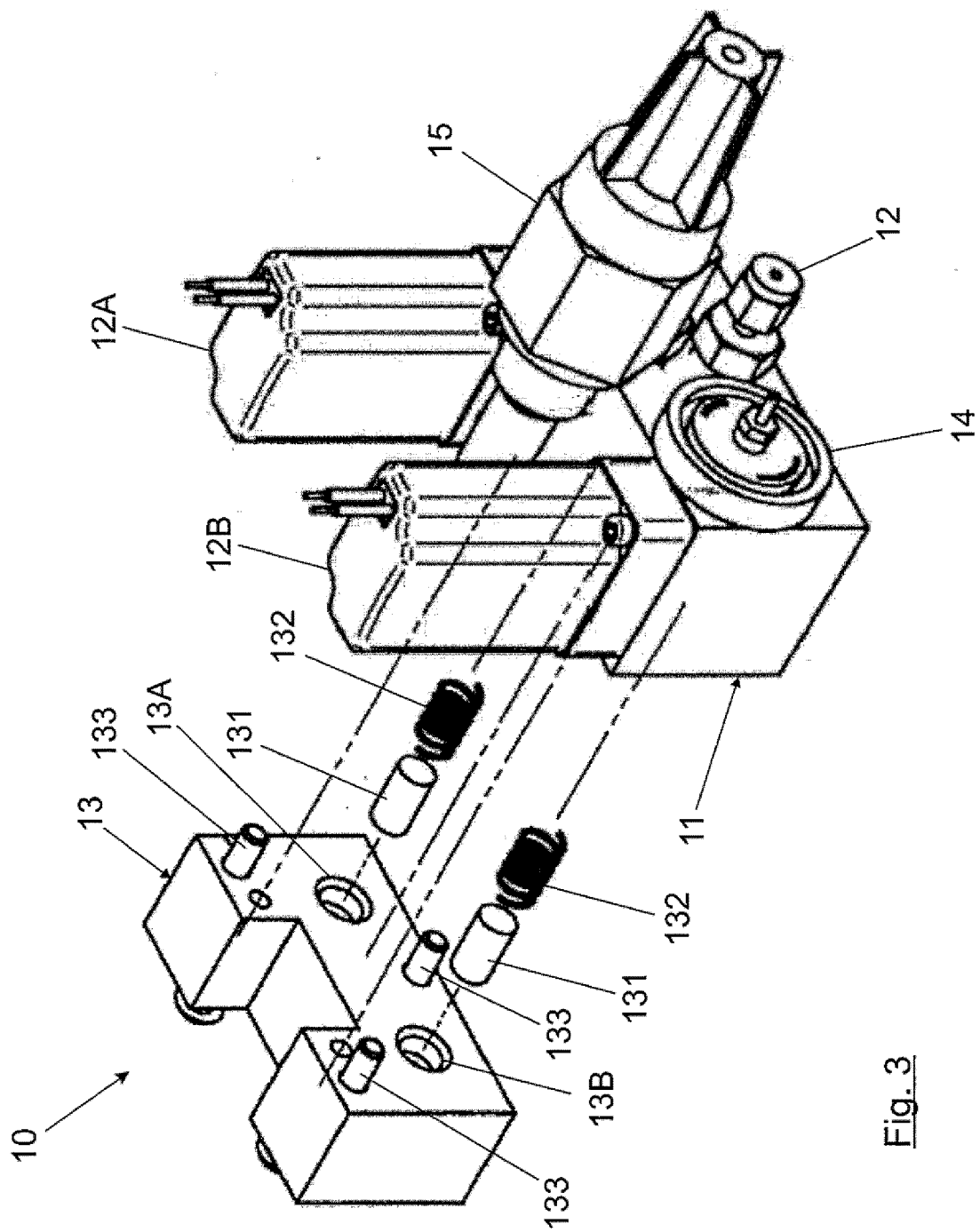


Fig. 3

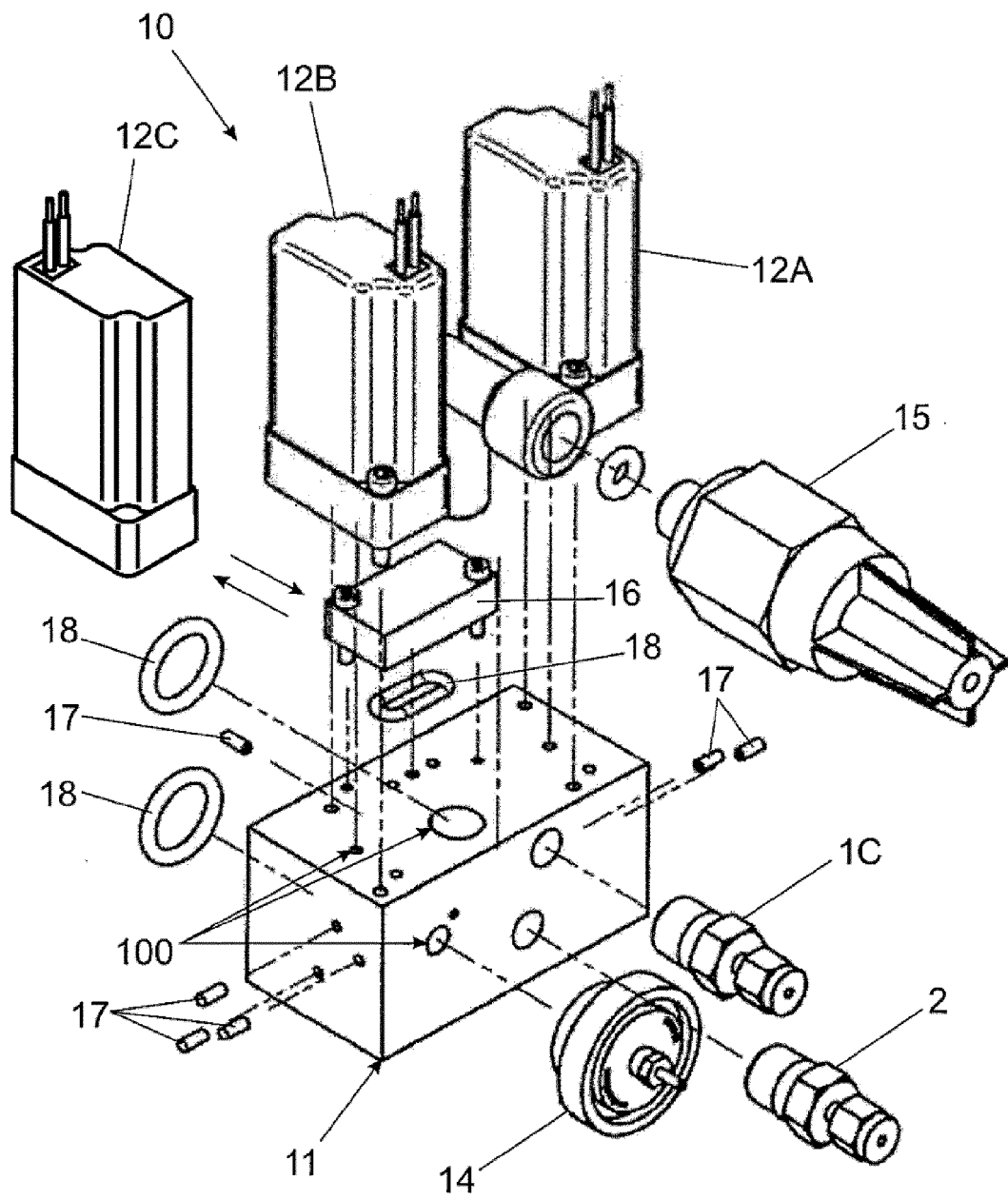


Fig. 4

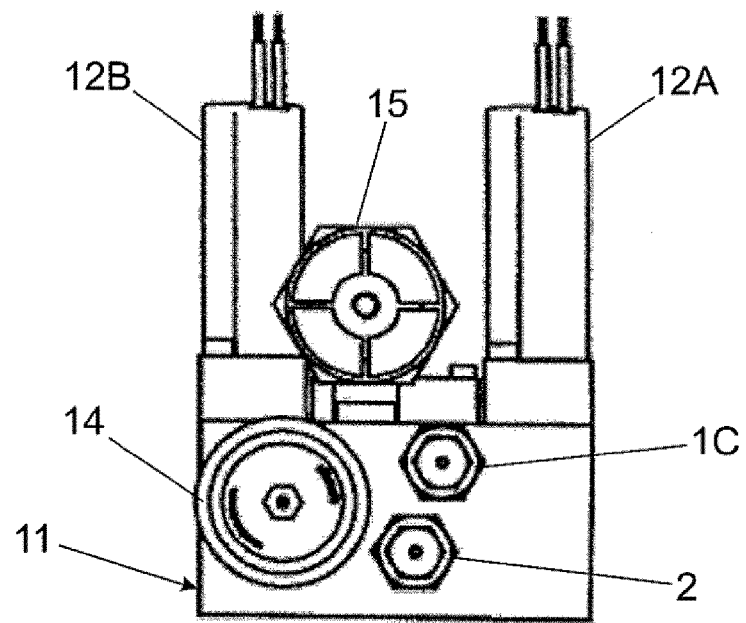


Fig. 5A

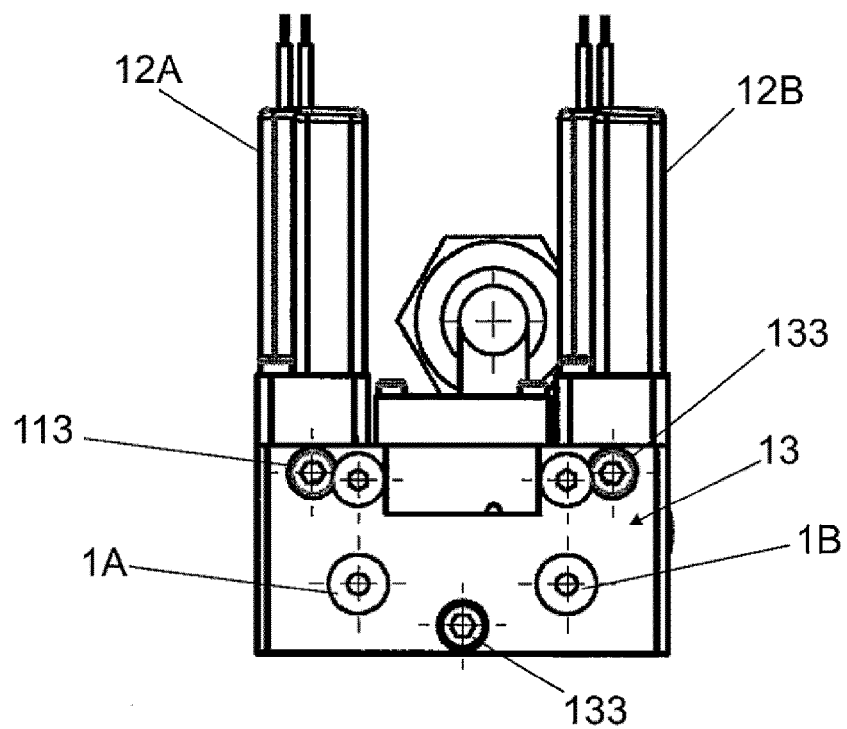


Fig. 5B

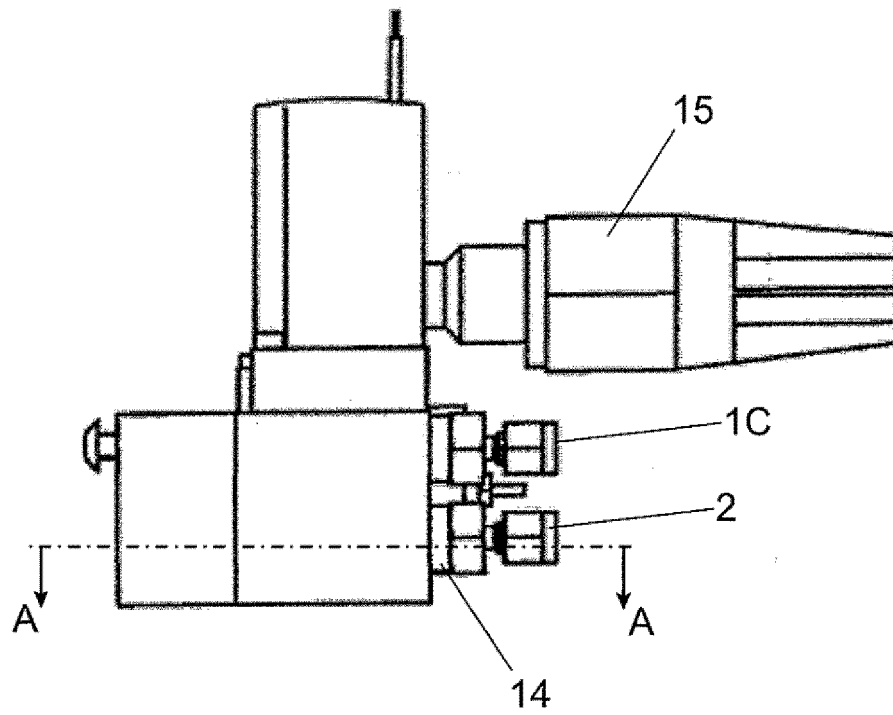


Fig. 5C

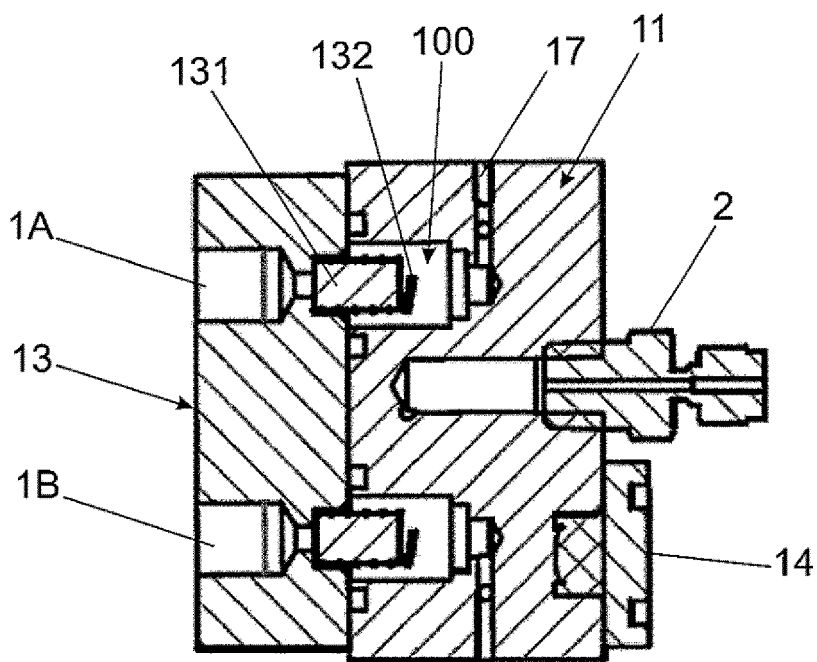


Fig. 5D

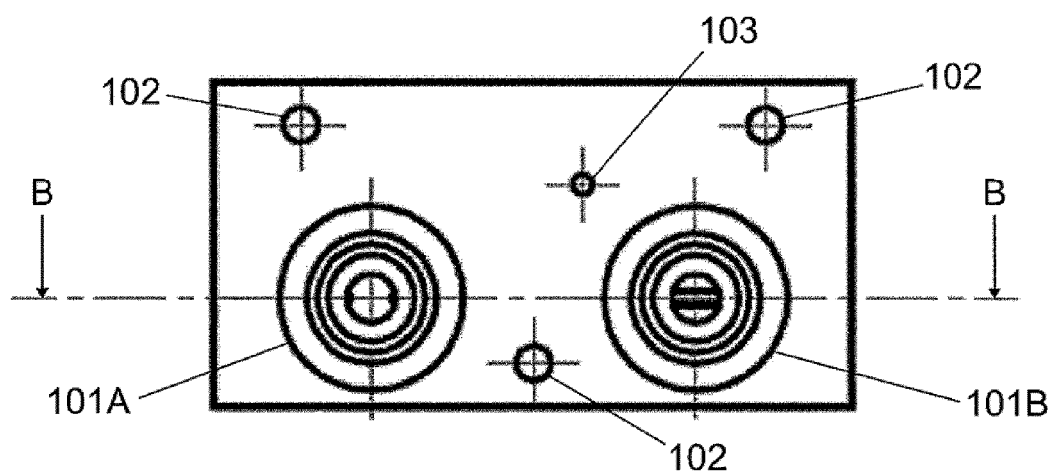


Fig. 6A

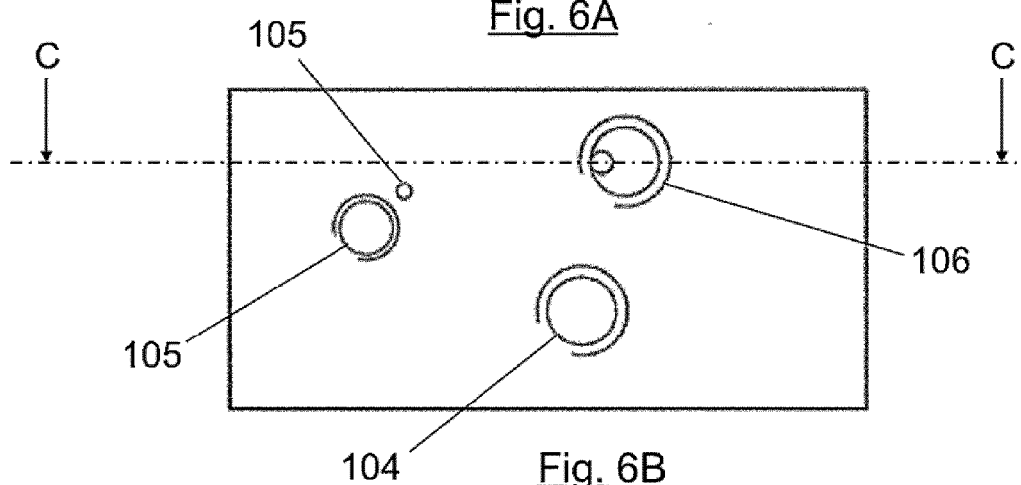


Fig. 6B

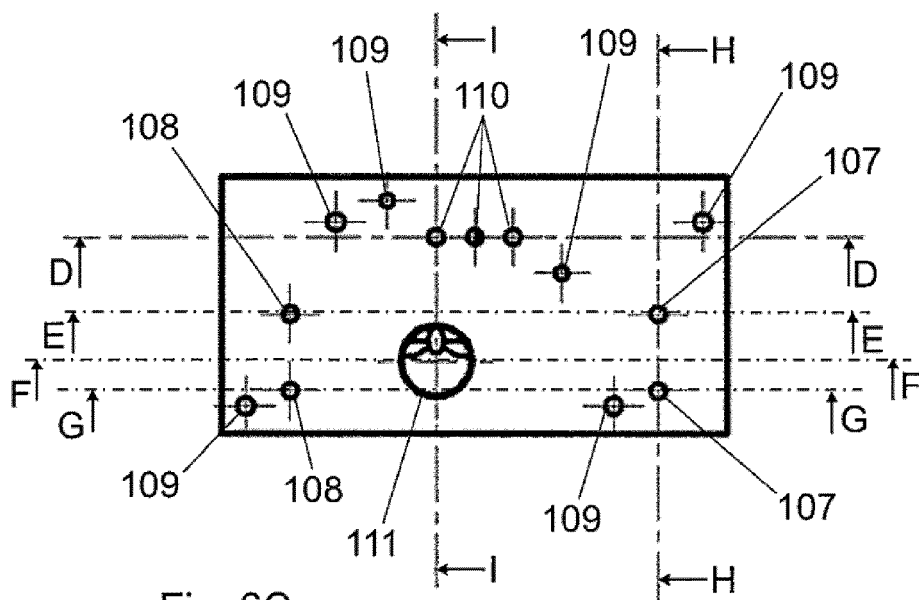


Fig. 6C

Cross - section B-B

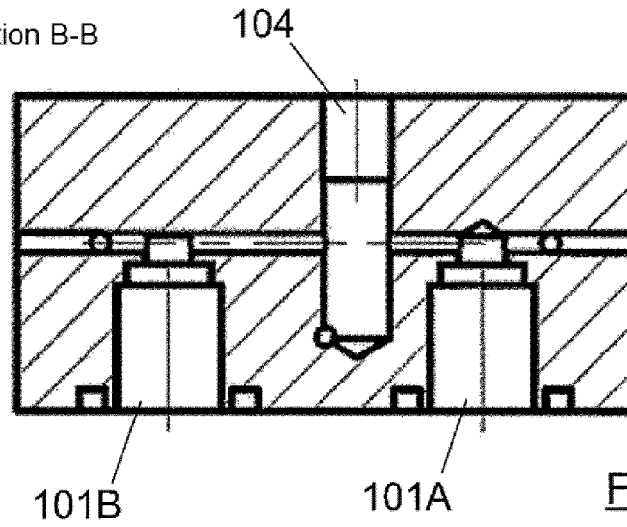


Fig. 6C

Cross - section C-C

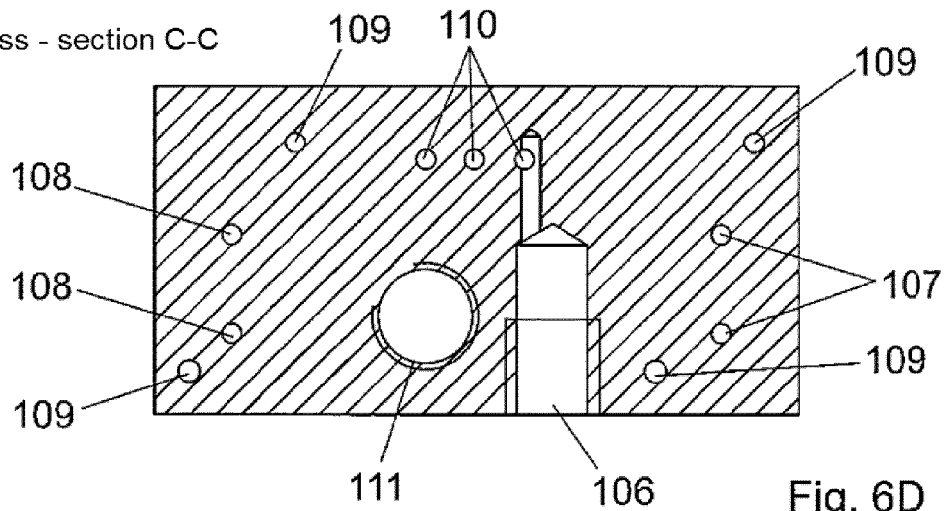


Fig. 6D

Cross - section D-D

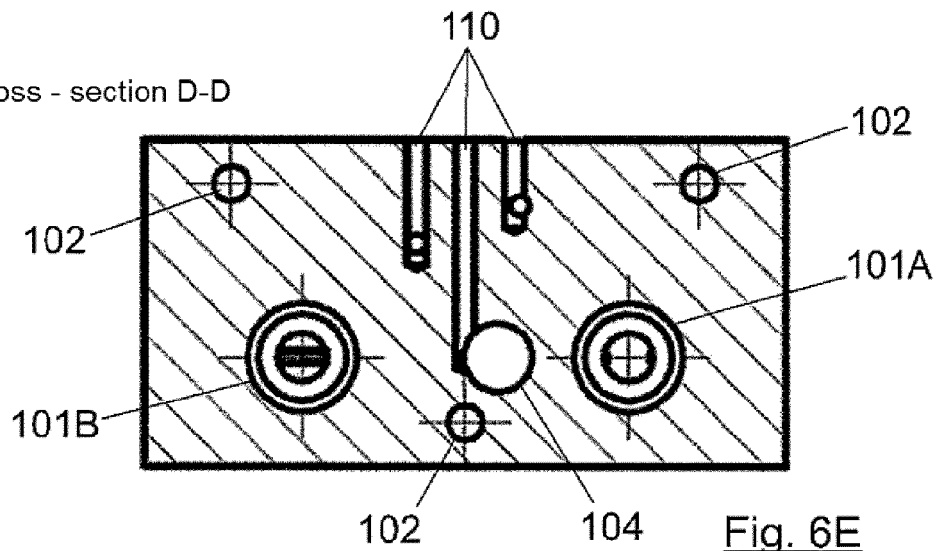


Fig. 6E

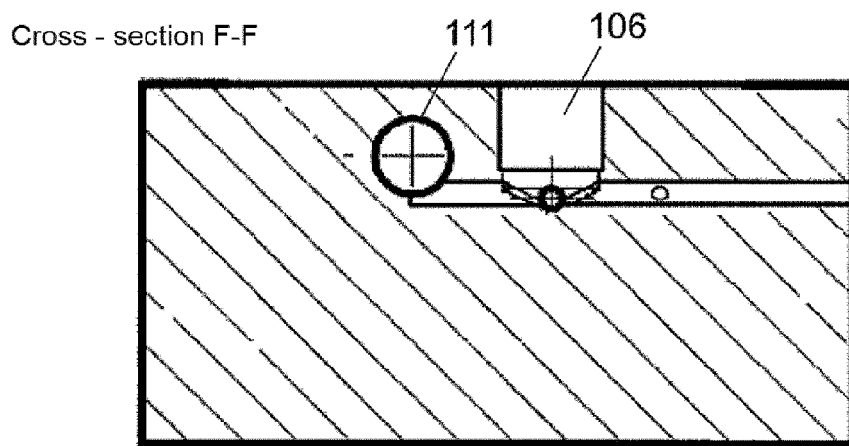
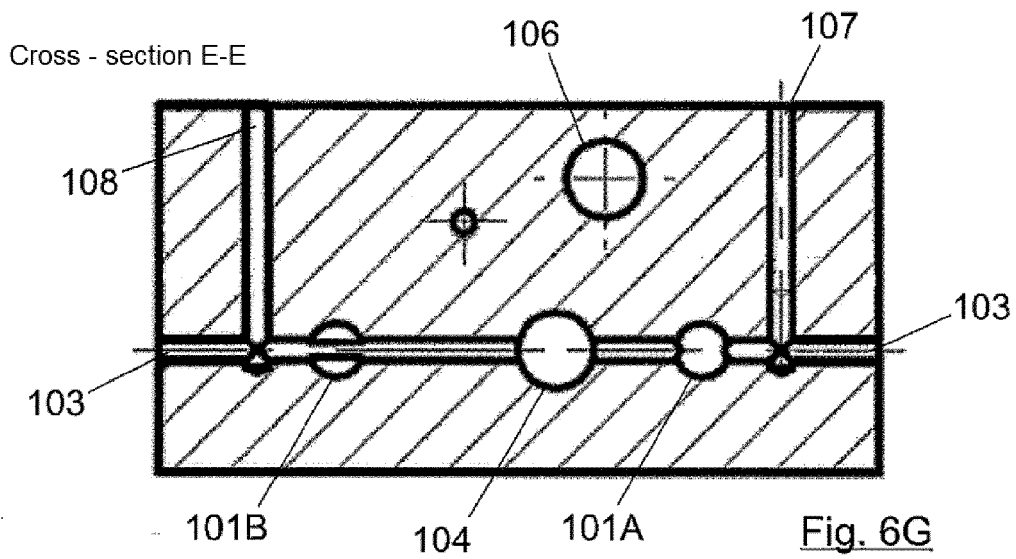


Fig. 6H

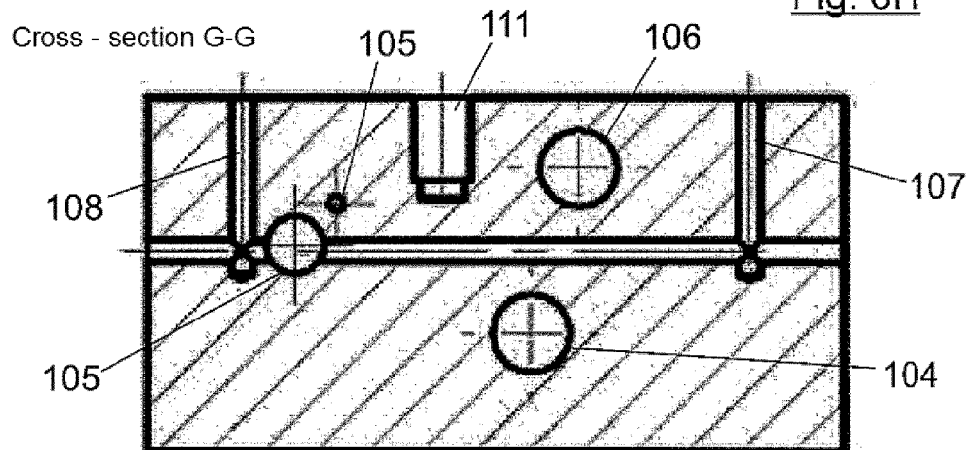


Fig. 6I

Cross - section H-H

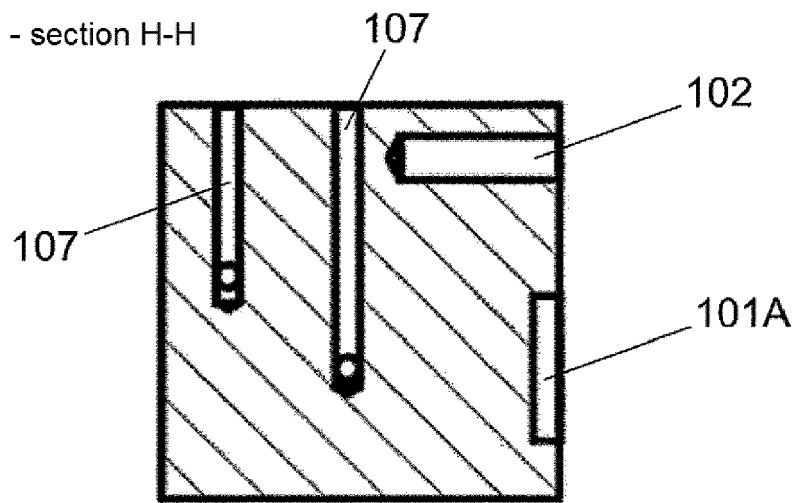


Fig. 6J

Cross - section I-I

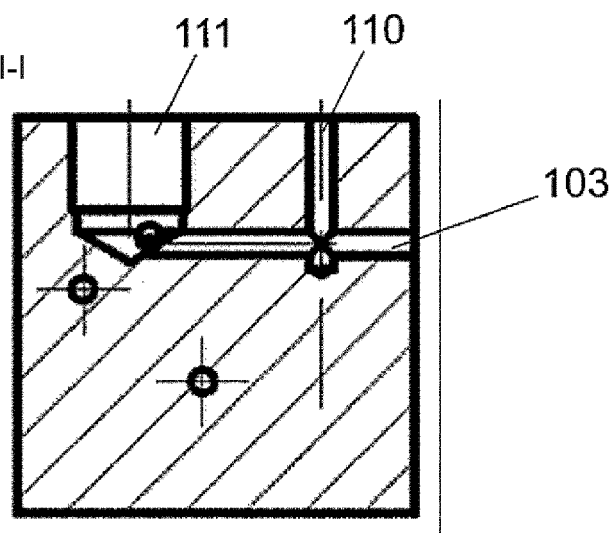
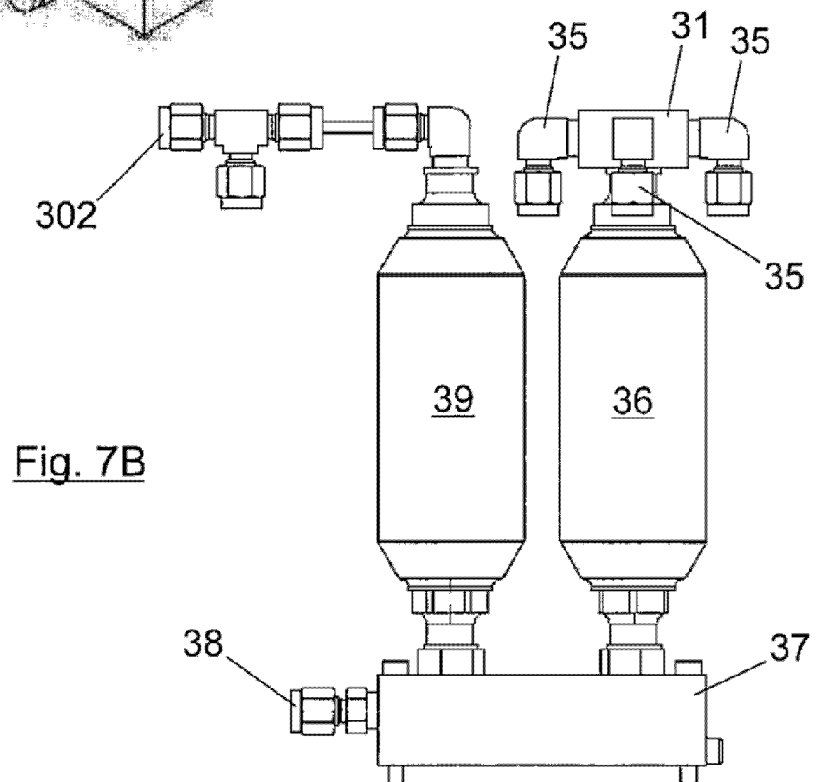
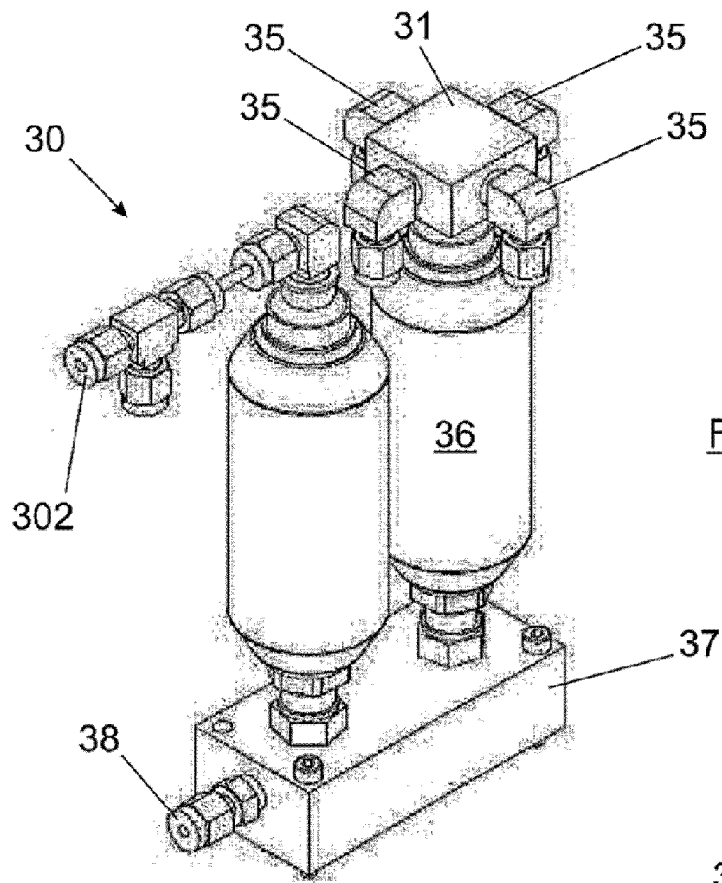


Fig. 6K



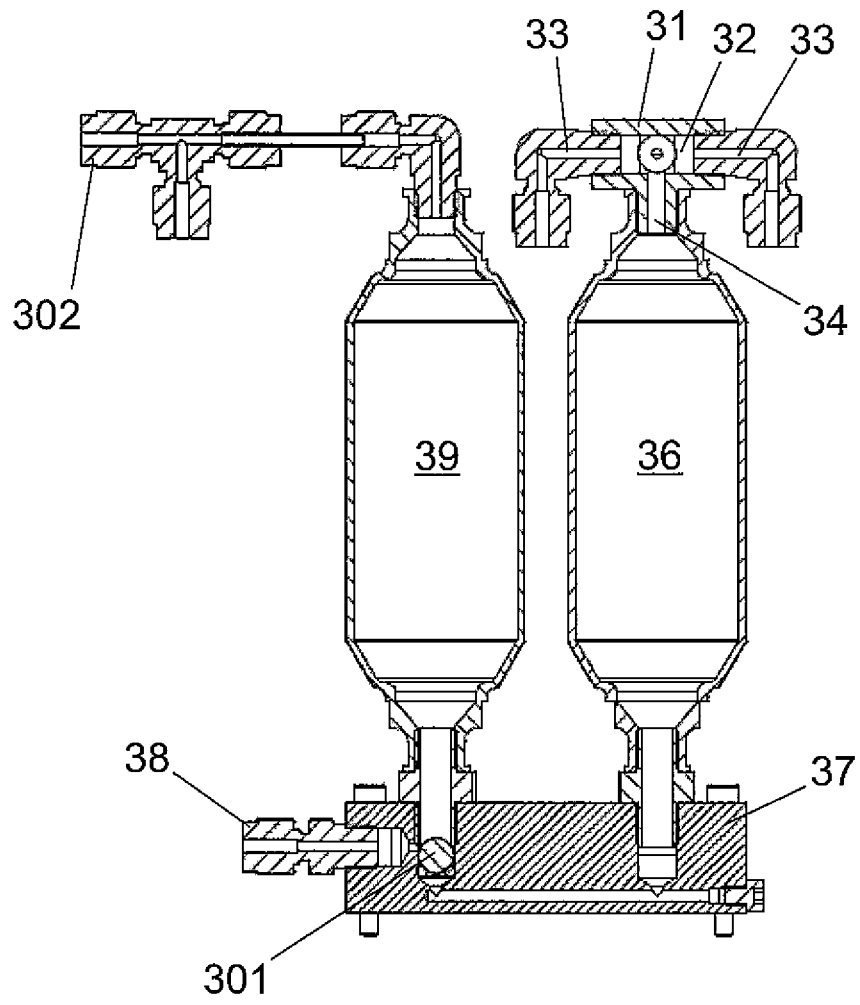


Fig. 7C

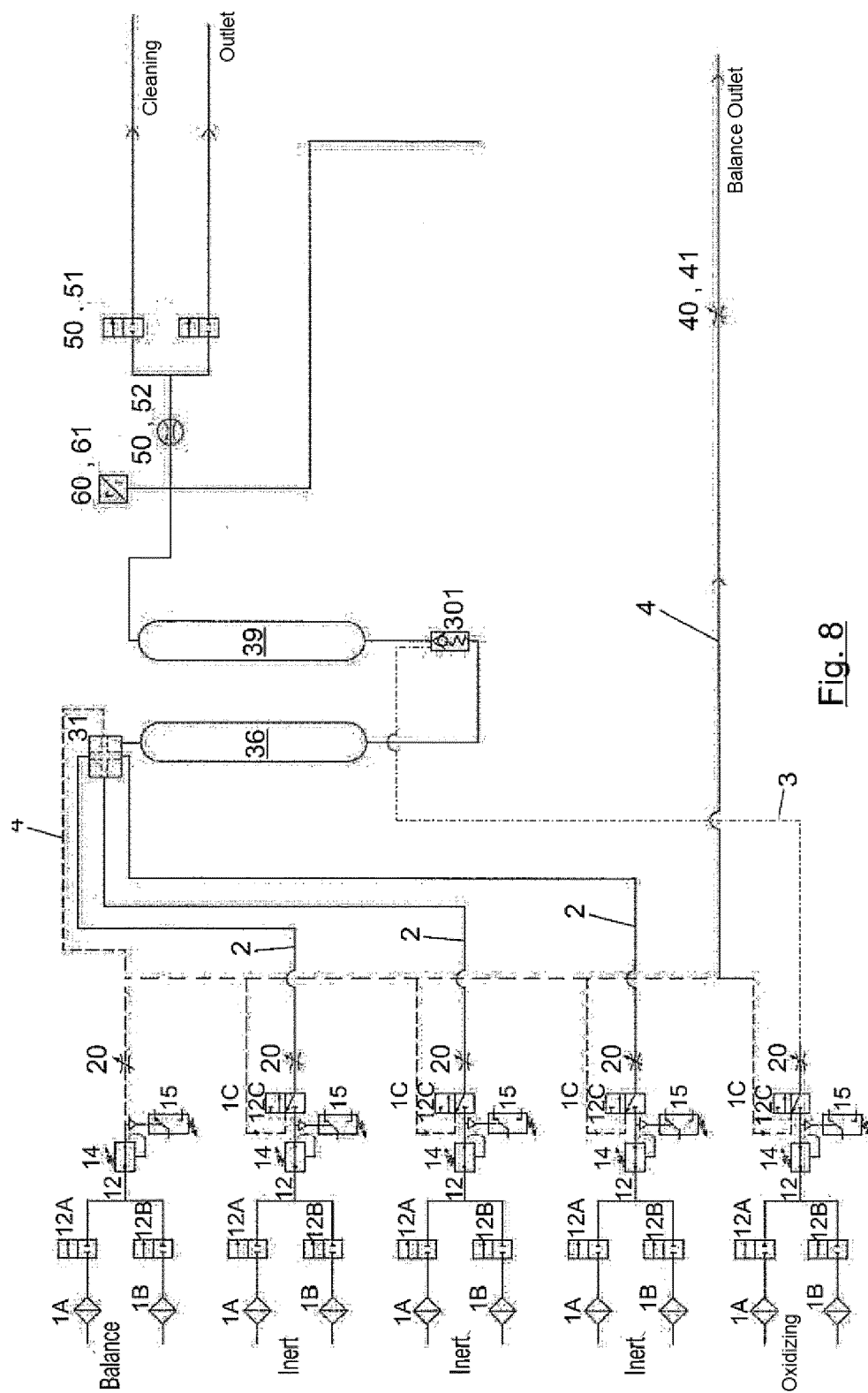


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 12 38 2490

DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
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Y	* page 4, line 45 - page 5, line 123; figures *	2-5,15		
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X	US 2012/000559 A1 (MUSSOT JEAN-LUC [FR]) 5 January 2012 (2012-01-05) * paragraph [0034] - paragraph [0042]; figures *	1,6		
Y	US 2007/186775 A1 (DIPRIZIO ANTHONY [US] ET AL) 16 August 2007 (2007-08-16) * claim 1 *	2		
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A	JP 2010 110663 A (KOIKE SANSEI KOGYO KK) 20 May 2010 (2010-05-20) * abstract; figures *	7		
The present search report has been drawn up for all claims				
Place of search The Hague		Date of completion of the search 22 August 2013	Examiner Zattoni, Federico	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document				

 2
EPO FORM 1503 03.82 (P04C01)



Application Number

EP 12 38 2490

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- 1-10, 15
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 12 38 2490

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 2, 6, 15

Gas mixer with solenoid valves

2. claims: 1, 3

Gas mixer with a safety device

3. claims: 1, 4, 5, 9, 10

Gas mixer with a balancing gas

4. claims: 1, 7, 8

Gas mixer with a homogenizing module

5. claims: 1, 11, 12, 14

Gas mixer with a cleaning module

6. claims: 1, 13, 14

Gas mixer with a leak detection module

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 38 2490

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82