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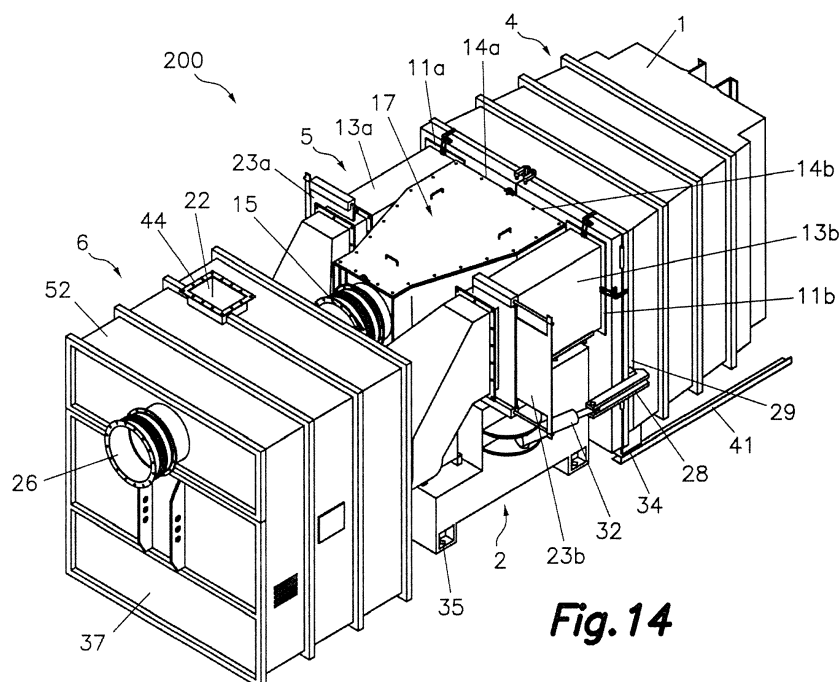
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(54) PNEUMATIC REFUSE COLLECTION APPARATUS

(57) The present invention relates to a pneumatic refuse collection apparatus which comprises a container module (4) having a compartment (7a) with a refuse inlet (8a), an air outlet (9a) and a compacting inlet (10a); a compactor-duct carrier module (5) having a compactor device (2), an air duct (13a) and a refuse duct (16); and a suction module (6) having a suction device (3). The air outlet (9a) and the compacting inlet (10a) of the container

module (4) are aligned and coupled with an air inlet (11a) and a compacting outlet (38a) of the compactor-duct carrier module (5) when both modules are connected to one another in an operative position. The compactor device (2) has a compacting ram (18a) which in an extended position enters the compartment (7a) of the container module (4) through the compacting inlet (10a).

**Fig. 14****EP 3 296 094 A1**

Description

Field of the Art

[0001] The present invention relates generally to a pneumatic refuse collection apparatus, and more particularly to a pneumatic collection apparatus which is capable of selectively collecting two different fractions and is constituted by three easily transportable modules having a compact design.

Background of the Invention

[0002] A large amount of refuse is generated in some places, such as large buildings that are usually related to public access in general, for example hospitals, shopping centers, etc., and it would therefore be suitable to install pneumatic refuse collection apparatus in such places. Nevertheless, a drawback that these places have in general is that they have a small and limited space for installing the pneumatic refuse collection apparatus.

[0003] An objective of the present invention is to provide a pneumatic refuse collection apparatus that can be divided into different compact, modular units which can be easily transported and coupled to one another, does not require a specific infrastructure for installation, and provides easy access to its mechanisms and to the control devices thereof.

[0004] Patent document US 3889830 A discloses a pneumatic refuse collection apparatus comprising a container, a fan-based suction device, and a compacting ram-based compactor device that are installed in a single structure on the chassis of a truck. The container has only one compartment with a refuse inlet and an air outlet, the suction device is arranged such that it draws out air from inside the compartment through the air outlet and thereby generates a negative pressure which suctions the refuse inside the compartment through the refuse inlet, and the compactor device is arranged such that it compacts the refuse inside the compartment.

[0005] Patent document DE 4400007 C1 describes a pneumatic refuse collection apparatus comprising a container and a suction device including a fan installed on the chassis of a truck. The container is provided with three compartments, each of which has a combined refuse and air inlet. The suction device suctions the refuse through an inlet duct and injects the refuse, together with the suction air, selectively into one of the compartments by means of a mobile transfer duct and through the corresponding combined refuse and air inlet. By means of a rotational movement about a vertical section, the outlet of the mobile transfer duct can be arranged to selectively face any one of the three combined refuse and air inlets of the three compartments.

Description of the Invention

[0006] The present invention contributes to achieving

the foregoing and other objectives by providing a pneumatic refuse collection apparatus comprising a container having a refuse inlet and an air outlet, a suction device drawing out air from inside the container through the air outlet, thereby generating a negative pressure which suctions the refuse inside the container through the refuse inlet, and a compactor device compacting the refuse inside the container.

[0007] The container is integrated in a container module comprising a compartment having a refuse inlet, an air outlet and a compacting inlet. The container module has on one of its sides a container coupling face, and at least the air outlet and the compacting inlet are located on a container coupling face.

[0008] The compactor device is integrated in a compactor-duct carrier module comprising an air inlet, an air outlet, an air duct communicating the air inlet with the air outlet, and a compacting ram which is moved by an actuator between a retracted position, in which the compacting ram is inside the compactor-duct carrier module, and an extended position, in which the compacting ram projects outwardly from the compactor-duct carrier module through the compacting outlet. Optionally, the compactor-duct carrier module has installed therein a hydraulic unit, and the actuator moving the compacting ram is likewise a hydraulic cylinder operated by this hydraulic unit.

[0009] The compactor-duct carrier module has on one of its sides a first compactor coupling face and on another preferably opposite side a second compactor coupling face. The air inlet and the compacting outlet are located on the first compactor coupling face and the air outlet is located on the second compactor coupling face.

[0010] The suction device is integrated in a suction module comprising a fan arranged inside an enclosure having an air inlet and an air outlet. The suction module has a suction coupling face in which the air inlet is located. The air inlet of the suction module can be coupled to the air outlet of the compactor-duct carrier module. Optionally, the suction module comprises a cabin having an access door. The cabin houses the suction device and an electrical control panel. The fan is preferably a centrifugal fan having a blade impeller rotating about a horizontal axis, and the air inlet of the enclosure is aligned with the horizontal axis of rotation of the blade impeller, whereas the air outlet is in a position tangent to the blade impeller. An electric motor rotating the blade impeller of the fan is installed in the suction module.

[0011] The container coupling face of the container module and the first compactor coupling face of the compactor-duct carrier module have elements that fit together and anchoring devices which, when activated, attach the container module and the compactor-duct carrier module to one another in an operative position, in which the air outlet and the compacting inlet of the container module are aligned and coupled with the air inlet and the compacting outlet of the compactor-duct carrier module, respectively. The compacting ram is therefore received in

the extended position in the compartment of the container through the compacting outlet of the compactor-duct carrier module and the compacting inlet of the container module.

[0012] The compactor-duct carrier module and the suction module are preferably provided for being supported on the ground and kept in a fixed position by friction. Optionally, the compactor-duct carrier module and/or the suction module comprise legs provided with fixing elements which allow fixing the compactor-duct carrier module and/or the suction module to the ground in the mentioned fixed position.

[0013] The container module is preferably provided with rolling elements for rolling on the ground, and optionally these rolling elements have surfaces that are coupled to alignment rails fixed to the ground in positions adjacent to the compactor-duct carrier module. Therefore, when the container module is moved closer to the compactor-duct carrier module by rolling it on the ground, the alignment rails align the container module with the compactor-duct carrier module and secure the coupling thereof to one another in the operative position.

[0014] The anchoring devices comprise protruding elements fixed in the container module and retractable hooks installed in the compactor-duct carrier module. The retractable hooks hook onto the protruding elements of the container module and are retracted by respective actuators for pressing the container coupling face of the container module against the first compactor coupling face of the compactor-duct carrier module. The actuators retracting the retractable hooks are hydraulic cylinders operated by the hydraulic unit installed in the compactor-duct carrier module, although alternatively they could be actuators based on a manually operated lever.

[0015] In one embodiment, the refuse inlet of the compartment of the container module is located on the container coupling face of the container module and the compactor-duct carrier module further comprises a refuse outlet located on the first compactor coupling face and a refuse inlet. When the container module and the compactor-duct carrier module are attached to one another in the operative position, the refuse inlet of the container module is aligned and coupled with the refuse outlet of the compactor-duct carrier module.

[0016] The container module preferably comprises a door that can be moved between an open position, in which the door provides access to the compartment of the container, and a closed position, in which the door closes the compartment and provides the container coupling face. The refuse inlet, the air outlet and the compacting inlet are formed in the door.

[0017] In another embodiment suitable for the collection of two different refuse fractions, the container module comprises a second compartment having a second refuse inlet, a second air outlet and a second compacting inlet, wherein at least the second air outlet and the second compacting inlet are located on the container coupling face.

[0018] In this embodiment, the compactor-duct carrier module comprises a second air inlet and a second compacting outlet located on the first compactor coupling face, a second air duct communicating the second air inlet with the air outlet by means of a collector to which there is also connected the first air duct, and a second compacting ram which is moved by a second actuator between a retracted position, in which the second compacting ram is inside the compactor-duct carrier module, and an extended position, in which the second compacting ram projects outwardly from the first compactor coupling face through the second compacting outlet. The actuators moving the first and second compacting rams can act simultaneously with or independently of one another, and in a particular embodiment, the actuators are hydraulic cylinders operated by the hydraulic unit installed in the compactor-duct carrier module.

[0019] In this embodiment, when the container module and the compactor-duct carrier module are attached to one another in the operative position, the first and second air outlets and the first and second compacting inlets of the container module are aligned and coupled with the first and second air inlets and the first and second compacting outlets of the compactor-duct carrier module, respectively, and the first and second compacting rams in the extended position are received in the first and second compartments of the container through the first and second compacting outlets of the compactor-duct carrier module and the first and second compacting inlets of the container module.

[0020] Preferably, the first air duct of the compactor-duct carrier module has a first shutter that can be moved between an open position and a closed position, and the second air duct of the compactor-duct carrier module has a second shutter that can be moved between an open position and a closed position. The first and second shutters are moved by respective actuators, such as, for example, hydraulic cylinders operated by the hydraulic unit installed in the compactor-duct carrier module, although alternatively the actuators moving the first and second shutters could be manually operated actuators.

[0021] The first and second refuse inlets of the first and second compartments of the container module are also preferably located on the container coupling face. The compactor-duct carrier module further comprises first and second refuse outlets located on the first compactor coupling face, a refuse inlet, a refuse duct having a first end connected to the refuse inlet, and a distributor device communicating a second end of the refuse duct selectively with either the first or second refuse outlets, so the distributor device allows selecting two different refuse fractions and storing them separately in the two compartments of the container module.

[0022] The first and second refuse inlets of the container module are aligned and coupled with the first and second refuse outlets of the compactor-duct carrier module when the container module and the compactor-duct carrier module are attached to one another in the oper-

ative position.

[0023] In a particular embodiment of the distributor device, the first and second ends of the refuse duct are misaligned with respect to one another, the first end of the refuse duct is connected to the refuse inlet by a rotary joint and the distributor device comprises a rocker arm fixed to the second end of the refuse duct and an actuator causing the rocker arm and the refuse duct to pivot about a shaft between first and second positions, in which the second end of the refuse duct is facing and in communication with the first and second refuse outlets, respectively. The actuator causing the rocker arm to pivot is preferably a hydraulic cylinder operated by the hydraulic unit installed in the compactor-duct carrier module, although alternatively it could be a manually operated actuator.

[0024] Optionally, the container module comprises first and second doors that can be moved between respective open positions, in which the first and second doors provide access to the first and second compartments of the container, respectively, and respective closed positions, in which the first and second doors close the first and second compartments, respectively. The first and second doors together provide the container coupling face when they are in the closed position, and the first and second refuse inlets, the first and second air outlets and the first and second compacting inlets are formed in the first and second doors, respectively.

[0025] In one embodiment, the refuse inlet of the compactor-duct carrier module is located on the second compactor coupling face, and the suction module comprises a refuse duct having a refuse outlet located on the suction coupling face and a refuse inlet. The refuse outlet can be connected to the refuse inlet located on the second compactor coupling face of the compactor-duct carrier module.

[0026] In an alternative embodiment suitable for the collection of only one refuse phase, there is formed in the compactor-duct carrier module a refuse chamber demarcated between the compacting ram, when it is in the retracted position, and the compacting outlet, and the refuse duct opens directly into this refuse chamber instead of being connected to a refuse outlet. The compacting outlet therefore constitutes a refuse and compacting outlet through which the compacting ram transfers the refuse into the compartment of the container module and compacts said refuse in the compartment.

[0027] Accordingly, the refuse inlet and the compacting inlet of the container module are combined constituting a refuse and compacting inlet located on the container coupling face of the container module, such that the refuse and compacting inlet of the container module is aligned and coupled with the refuse and compacting outlet of the compactor-duct carrier module when the container module and the compactor-duct carrier module are attached to one another in the operative position.

[0028] In another alternative embodiment suitable for the collection of two refuse phases, there are formed in

the compactor-duct carrier module first and second refuse chambers demarcated between the first and second compacting rams, when they are in the retracted positions, and the first and second compacting outlets, and the distributor device communicates the refuse duct selectively with either the first or second additional refuse ducts opening directly into the first and second refuse chambers, respectively. The first and second refuse outlets and the first and second compacting outlets are therefore combined forming first and second refuse and compacting outlets.

[0029] Accordingly, the first and second refuse inlets and the first and second compacting inlets of the first and second compartments of the container module are combined constituting respective first and second refuse and compacting inlets located on the container coupling face. These first and second refuse and compacting inlets are aligned and coupled with the first and second refuse and compacting outlets of the compactor-duct carrier module when the container module and the compactor-duct carrier module are attached to one another in the operative position.

[0030] Optionally, in the compactor-duct carrier module, the distributor device can be installed in an inclined position such that the distributed refuse outlets of the device are inclined towards the first compacting coupling face for the purpose of reducing a bend that the first and second additional refuse ducts must have in order to open into refuse inlets located in an upper part of the first and second refuse chambers.

Brief Description of the Drawings

[0031] The foregoing and other features and advantages will be better understood based on the following detailed description of several merely illustrative and non-limiting embodiments in reference to the attached drawings, in which:

Figure 1 is a perspective view of a pneumatic refuse collection apparatus according to a first embodiment of the present invention useful for the collection of only one refuse fraction;

Figure 2 is a perspective view of a container module that is part of the pneumatic collection apparatus of Figure 1, showing a container coupling face thereof; Figure 3 is a front view of the container module of Figure 2 showing a door providing the container coupling face thereof in a closed position;

Figure 4 is a cross-section view taken along plane IV-IV of Figure 3;

Figure 5 is a front view of the container module with the door open;

Figures 6 and 7 are perspective views of a compactor-duct carrier module that is part of the pneumatic collection apparatus of Figure 1, showing opposing second and first compacting coupling faces thereof, respectively;

Figure 8 is a front view of the compactor-duct carrier module of Figures 6 and 7 showing the first compacting coupling face thereof;

Figure 9 is a cross-section view taken along plane IX-IX of Figure 8;

Figure 10 is a perspective view of a suction module that is part of the pneumatic collection apparatus of Figure 1, showing a side thereof with a door open;

Figure 11 is a perspective view of the suction module of Figure 10, showing a suction coupling face opposite the side where the door is located;

Figure 12 is a front view of the suction module with the door open;

Figure 13 is a cross-section view taken along plane XIII-XIII of Figure 12;

Figure 14 is a perspective view of a pneumatic refuse collection apparatus according to a second embodiment of the present invention useful for the collection of two different refuse fractions;

Figure 15 is a perspective view of a container module that is part of the pneumatic collection apparatus of Figure 14, showing a container coupling face thereof;

Figure 16 is a front view of the container module showing doors providing the container coupling face thereof in a closed position;

Figure 17 is a cross-section view taken along plane XVII-XVII of Figure 16;

Figure 18 is a cross-section view taken along plane XVIII-XVIII of Figure 16;

Figure 19 is a front view of the container module with the doors open;

Figures 20 and 21 are perspective views of a compactor-duct carrier module that is part of the pneumatic collection apparatus of Figure 14, showing opposing second and first compacting coupling faces thereof, respectively, and with a distributor device lacking its upper cover;

Figure 22 is a side view of the compactor-duct carrier module of Figures 20 and 21;

Figure 23 is a cross-section view taken along plane XXIII-XXIII of Figure 22;

Figure 24 is a cross-section view taken along plane XXIV-XXIV of Figure 22;

Figures 25 and 26 are top views of the compactor-duct carrier module with the distributor device in two alternative positions, respectively;

Figure 27 is a perspective view of a suction module that is part of the pneumatic collection apparatus of Figure 14, showing a side thereof with a door open;

Figure 28 is a perspective view of the suction module of Figure 27, showing a suction coupling face opposite the side where the door is located;

Figure 29 is a front view of the suction module with the door open;

Figure 30 is a cross-section view taken along plane XXX-XXX of Figure 29;

Figure 31 is a perspective view of a pneumatic refuse collection apparatus according to a third embodi-

ment of the present invention useful for the collection of two different refuse fractions;

Figure 32 is a perspective view of a compactor-duct carrier module that is part of the pneumatic collection apparatus of Figure 31, showing a first compacting coupling face thereof, and with a distributor device lacking its upper cover; and

Figure 33 is a perspective view of a container module that is part of the pneumatic collection apparatus of Figure 31, showing doors providing a container coupling face in a closed position.

Detailed Description of an Embodiment

[0032] First, in reference to Figures 1 to 13, reference number 100 (Figure 1) generally designates a pneumatic refuse collection apparatus according to a first embodiment of the present invention provided for the collection of one refuse fraction, comprising a container module 4, a compactor-duct carrier module 5 and a suction module 6 operatively attached and coupled to one another.

[0033] The container module 4 (best shown in Figures 2 to 5) integrates a container 1 comprising only one compartment 7a with a door 40a articulated with respect to a jamb of the door frame of the container 1 by vertical hinges. The door 40a can be moved between an open position (Figure 5), in which the door 40a provides access to the compartment 7a of the container 1, and a closed position (Figures 2, 3 and 4), in which the door 40a closes the compartment 7a. There are formed in the door 40a a refuse inlet 8a in an upper central position, a pair of air outlets 9a on both sides of the refuse inlet 8a, and a compacting inlet 10a in a lower position.

[0034] The door 40a can be locked in the closed position by means of a lock 43. When it is in the closed position, the door 40a provides a container coupling face 4a on which the refuse inlet 8a, the air outlets 9a and the compacting inlet 10a, which are in communication with the only compartment 7a, are arranged.

[0035] The provision of two air outlets 9a in communication with the only compartment 7a is optional and has the purpose of providing a more uniform airflow in and out of the container 1 and allowing a central position for the refuse inlet 8a. However, in an alternative embodiment (not shown), only one air outlet 9a with equivalent functionality is formed in the door 40a.

[0036] The container module 4 has on its outer surface protruding elements 29 that are formed in the illustrated example by jambs of the door frame, and is provided with rolling elements 34 provided for rolling on the ground. The protruding elements 29 are part of anchoring devices for connecting the container module 4 and the compactor-duct carrier module 5. The container module 4 is configured for being handled and transported by a truck or another vehicle.

[0037] The compactor-duct carrier module 5 (better shown in Figures 6 to 9) has opposing first and second compactor coupling faces 5a, 5b. A pair of air inlets 11a,

a refuse outlet 14a and a compacting outlet 38a are located on the first compactor coupling face 5a. An air outlet 12 is located on the second compactor coupling face 5b. A pair of air ducts 13a communicates the air inlets 11a with the air outlet 12 through a collector 13c. A refuse duct 16 has a first end provided with a refuse inlet 15 provided with connecting elements (not shown) for connection thereof to a refuse delivery duct (not shown) and a second end connected to the refuse outlet 14a.

[0038] In the previously mentioned alternative embodiment (not shown) in which the container module 4 includes only one air outlet 9a, the compactor-duct carrier module 5 has only one air inlet 11a on its first compactor coupling face 5a, and only one air duct 13a communicates the only air inlet 11a with the air outlet 12 located on the second compactor coupling face 5b.

[0039] The compactor-duct carrier module 5 further comprises a compactor device 2 including a compacting ram 18a. An actuator, such as, for example, a hydraulic cylinder 30a operated by a hydraulic unit 32, moves the compacting ram 18a between a retracted position (shown by means of solid lines in Figure 9), in which the compacting ram 18a is inside the compactor-duct carrier module 5 without projecting from the compacting outlet 38a, and an extended position (shown by means of dashed lines in Figure 9), in which the compacting ram 18a projects outwardly from the first compactor coupling face 5a through the compacting outlet 38a.

[0040] Retractable hooks 28 connected to hydraulic cylinders 42 which are operated by the hydraulic unit 32 are installed on both sides of the compactor-duct carrier module 5. Activation of the hydraulic cylinders 42 retracts the retractable hooks 28, which are part of the anchoring devices and which cooperate with the protruding elements 29 of the container module 4.

[0041] In the illustrated example, the hydraulic unit 32 is installed in a structure of the compactor-duct carrier module 5. In an alternative embodiment, the compactor-duct carrier module 5 has a hydraulic connection for being connected to an external hydraulic unit.

[0042] The compactor-duct carrier module 5 comprises legs 35 provided with fixing elements, such as, for example, holes, for fixing the compactor-duct carrier module 5 to the ground by means of screws or bolts.

[0043] The suction module 6 (better shown in Figures 10 to 13) comprises a cabin 52 provided with an access door 37 on one side and a suction coupling face 6a on another opposing side. A suction device 3 and an electrical control panel 36 are housed in the cabin 52. The suction device 3 comprises a fan having a blade impeller 19 arranged inside an enclosure 20 provided with an air inlet 21 located on the suction coupling face 6a and an air outlet 22 located in an upper position. The blade impeller 19 rotates about a horizontal axis being driven by an electric motor 33 installed in the cabin 52, the air inlet 21 of the enclosure 20 is aligned with the horizontal axis of rotation of the blade impeller 19 and the air outlet 22 is located in a position tangent to the blade impeller 19.

[0044] The container module 4, the compactor-duct carrier module 5 and the suction module 6 form compact units sized for being transported individually by normal means of transport and for being operatively installed in relatively small places, such as basements of large buildings, such as, for example, hospitals, shopping centers, etc.

[0045] When the modules are operatively installed (Figure 1), the compactor-duct carrier module 5 is fixed to the ground by means of the fixing elements provided in its legs 35. The suction module 6 is placed on the ground with its suction coupling face 6a facing the second compacting coupling face 5b of the compactor-duct carrier module 5. In this position, the air inlet 21 of the suction module 6 is aligned with the air outlet 12 of the compactor-duct carrier module 5 and coupled to the air outlet 12 by means of a flange 49. The air outlet 22 of the suction module 6 is coupled to an air discharge duct (not shown) by means of a flange 44.

[0046] The container module 4 is moved closer to the compactor-duct carrier module 5 by rolling it on the ground to an operative position, in which the container coupling face 4a of the container module 4 is facing the first compactor coupling face 5a of the compactor-duct carrier module 5. The refuse inlet 8a, the air outlets 9a and the compacting inlet 10a of the container module 4 are positioned such that, in the operative position, they are aligned and coupled with the refuse outlet 14a, the air inlets 11a and the compacting outlet 38a compactor-duct carrier module 5, respectively.

[0047] Alignment rails 41 (Figure 1) are preferably fixed on the ground in positions adjacent to the first compactor coupling face 5a of the compactor-duct carrier module 5. The rolling elements 34 of the container module 4 have surfaces that are coupled to the alignment rails 41 for directing the container module 4 towards the compactor-duct carrier module 5 in the operative position.

[0048] The refuse outlet 14a, the air inlets 11a and the compacting outlet 38a of the compactor-duct carrier module 5 are provided with respective perimetral protrusions that respectively enter the refuse inlet 8a, the air outlets 9a and the compacting inlet 10a of the container module 4 in the operative position, constituting elements that fit together. The air inlets 11a and the refuse outlet 14a of the compactor-duct carrier module 5 have perimetral fins 46, 47 that are supported against the door 40a of the container module 4 compressing respective elastic joints in the operative position. The first compactor coupling face 5a of the compactor-duct carrier module 5 has a support surface 45 which is supported against the door 40a of the container module 4 in the operative position.

[0049] In the operative position, the retractable hooks 28 of the compactor-duct carrier module 5 hook onto the protruding elements 29 of the container module 4 and are retracted by the hydraulic cylinders 42 for pressing the container coupling face 4a of the container module 4 against the first compactor coupling face 5a of the compactor-duct carrier module 5 and for keeping both mod-

ules coupled to one another in the operative position. Additional anchoring elements, such as manually operated levers 53 that can be snapped closed, are arranged for securing the perimetral fins 46 of the air inlets 11a of the compactor-duct carrier module 5 against the door 40a of the container module 4.

[0050] When the container module 4, the compactor-duct carrier module 5 and the suction module 6 are operatively attached and coupled to one another to form the pneumatic refuse collection apparatus 100, the suction device 3 of the suction module 6 draws out air from inside the compartment 7a of the container 1 of the container module 1 through the air outlets 11a, thereby generating a negative pressure which suctions the refuse inside the compartment 7a of the container 1 through the refuse inlet 8a. When moved to the extended position, the compacting ram 18a of the compactor device 2 of the compactor-duct carrier module 5 enters the compartment 7a of the container 1 of the container module 4 through the compacting inlet 10a and compacts the refuse inside the container 1.

[0051] Now in reference to Figures 14 to 30, reference number 200 (Figure 14) generally designates a pneumatic refuse collection apparatus according to a second embodiment of the present invention provided for the collection of two different refuse fractions, comprising a container module 4, a compactor-duct carrier module 5 and a suction module 6 operatively attached and coupled to one another.

[0052] In this second embodiment, the container module 4, the compactor-duct carrier module 5 and the suction module 6 are similar to those described above in relation to the first embodiment except in the following aspects.

[0053] In the pneumatic refuse collection apparatus 200 of this second embodiment, the container module 4 comprises a partition 48 dividing the container 1 into first and second compartments 7a, 7b provided with respective first and second doors 40a, 40b in which respective first and second refuse inlets 8a, 8b, first and second air outlets 9a, 9b and first and second compacting inlets 10a, 10b are formed. The first and second doors 40a, 40b are articulated with respect to opposite jambs of the door frame of the container 1 by vertical hinges and can be moved between open positions (Figure 19) and closed positions (Figures 15, 16 and 18).

[0054] When they are in the closed positions, the first and second doors 40a, 40b together provide a container coupling face 4a, such that the first and second refuse inlets 8a, 8b, the first and second air outlets 9a, 9b and the first and second compacting inlets 10a, 10b are located on the container coupling face 4a.

[0055] Accordingly, the compactor-duct carrier module 5 comprises first and second air inlets 11a, 11b, first and second refuse outlets 14a, 14b, and first and second compacting outlets 38a, 38b located on the first compactor coupling face 5a, in addition to the air outlet 12 located on the second compactor coupling face 5a. First and sec-

ond air ducts 13a, 13b communicate the first and second air inlets 11a, 11b with the air outlet 12 by means of a collector 13c.

[0056] The first air duct 13a of the compactor-duct carrier module 5 has a first shutter 23a that can be moved between an open position and a closed position, and the second air duct 13b of the compactor-duct carrier module 5 has a second shutter 23b that can be moved between an open position and a closed position. The first and second shutters 23a, 23b are moved by respective hydraulic cylinders 29a, 29b, although alternatively they could be manually operated.

[0057] The compactor-duct carrier module 5 further comprises a refuse inlet 15 located on the first compactor coupling face 5a and a refuse duct 16 having a first end connected to the refuse inlet 15 and a second end connected to a distributor device 17 communicating the second end of the refuse duct 16 selectively with either the first or second refuse outlets 14a, 14b. The distributor device 17 acts for selecting two different refuse fractions.

[0058] The first and second ends of the refuse duct 16 are misaligned with respect to one another although they are preferably parallel. The first end of the refuse duct 16 is connected to the refuse inlet 15 by a rotary joint and the distributor device 17 comprises a rocker arm 27 fixed to the second end of the refuse duct 16. An actuator, such as, for example, a hydraulic cylinder 31, causes the rocker arm 27 and the refuse duct 16 to pivot about a shaft 27a between first and second positions, in which the second end of the refuse duct 16 is facing and in communication with the first and second refuse outlets 14a, 14b, respectively (Figures 25 and 26).

[0059] The compactor device 2 comprises first and second compacting rams 18a, 18b which are independently moved by respective first and second hydraulic cylinders 30a, 30b between a retracted position (shown by means of solid lines in Figure 24), in which the first and second compacting rams 18a, 18b are inside the compactor-duct carrier module 5, and an extended position (shown by means of dashed lines in Figure 24), in which the first and second compacting rams 18a, 18b project outwardly from the first compactor coupling face 5a through the corresponding first and second compacting outlets 38a, 38b.

[0060] Therefore, when the container module 4 and the compactor-duct carrier module 5 are attached to one another in the operative position, the first and second refuse inlets 8a, 8b, the first and second air outlets 9a, 9b and the first and second compacting inlets 10a, 10b of the container module 4 are aligned and coupled with the first and second refuse outlets 14a, 14b, the first and second air inlets 11a, 11b and the first and second compacting outlets 38a, 38b of the compactor-duct carrier module 5, respectively, and when they are in the extended position, the first and second compacting rams 18a, 18b are received in the first and second compartments 7a, 7b of the container 1 through the first and second compacting outlets 38b and the first and second com-

pacting inlets 10a, 10b.

[0061] The refuse inlet 15 of the compactor-duct carrier module 5, which is located on the second compactor coupling face 5b,

[0062] The suction module 6 comprises, in addition to the elements already described in relation to the first embodiment, a refuse duct 24 having a refuse outlet 25 located on the suction coupling face 6a and a refuse inlet 26 located above the access door 37. The refuse duct 24 goes through the cabin 52 above the enclosure 20 of the fan.

[0063] When the suction module 6 and the compactor-duct carrier module 5 are attached to one another in the operative position, the refuse outlet 25 of the suction module 6 is connected to the refuse inlet 15 of the compactor-duct carrier module 5 by means of a flange 50. The refuse inlet 26 of the suction module 6 can be connected to a refuse delivery duct (not shown) by means of a flange 51.

[0064] The hydraulic cylinders 30a, 30b which move the first and second compacting rams 18a, 18b, the hydraulic cylinders 29a, 29b which move the first and second shutters 23a, 23b and the hydraulic cylinder 31 which causes the rocker arm 27 to pivot are operated by a hydraulic unit 32 installed in the compactor-duct carrier module 5 or by an external hydraulic unit.

[0065] Now in reference to Figures 31 to 33, reference number 300 (Figure 31) generally designates a pneumatic refuse collection apparatus according to a third embodiment of the present invention provided for the collection of two different refuse fractions, and comprising a container module 4, a compactor-duct carrier module 5 and a suction module 6 operatively attached and coupled to one another.

[0066] In this third embodiment, the suction module 6 is identical to that described above in relation to the second embodiment, whereas the container module 4 and the compactor-duct carrier module 5 only differ from what have been described in relation to the second embodiment as regards the features described below.

[0067] The compactor device 2 of the compactor-duct carrier module 5 comprises first and second refuse chambers 54a, 54b which are comprised between the first and second compacting rams 18a, 18b, when they are in the retracted position, and the first and second compacting outlets 38a, 38b, and first and second additional refuse ducts 55a, 55b communicating outlets of the distributor device 17 with inlets of the first and second refuse chambers 54a, 54b located in an upper part thereof.

[0068] As a result, the distributor device 17 communicates the refuse duct 16 selectively with either the first or second additional refuse ducts 55a, 55b for distributing the refuse to either the first or second refuse chambers 54a, 54b, respectively. In the compactor-duct carrier module 5 of this third embodiment, the first and second refuse outlets 14a, 14b are combined with the first and second compacting outlets 38a, 38b constituting first and second refuse and compacting outlets 14a, 38a; 14b,

28b.

[0069] In the container module 4, the first and second compartments 7a, 7b have the respective first and second refuse inlets 8a, 8b and first and second compacting inlets 10a, 10b combined with one another constituting respective first and second refuse and compacting inlets 8a, 10a; 8b, 10b located on the container coupling face 4a. These first and second refuse and compacting inlets 8a, 10a; 8b, 10b are aligned and coupled with the first and second refuse and compacting outlets 14a, 38a; 14b, 38b of the compactor-duct carrier module 5 when the container module 4 and the compactor-duct carrier module 5 are attached to one another in the operative position.

[0070] Similarly to that described above in relation to the second embodiment, the container module 4 of the third embodiment comprises first and second doors 40a, 40b that can be moved between respective open and closed positions, and these first and second doors 40a, 40b, when they are in the closed positions, together provide the container coupling face 4a. The first and second refuse and compacting inlets 8a, 10a; 8b, 10b and the first and second air outlets 9a, 9b are formed in the first and second doors 40a, 40b, respectively.

[0071] In an alternative embodiment (not shown) useful for the collection of only one refuse fraction, the compactor device has a refuse chamber and the refuse duct introduces the refuse directly in the refuse chamber, such that the refuse outlet and the compacting outlet of the compactor-duct carrier module are combined into a single refuse and compacting outlet, and the refuse inlet and the compacting inlet of the container module are combined into a single refuse and compacting inlet which is aligned and coupled with the refuse and compacting outlet of the compactor-duct carrier module when both modules are coupled in the operative position.

Claims

1. A pneumatic refuse collection apparatus comprising a container (1) having a refuse inlet and an air outlet, a suction device (3) drawing out air from inside the container (1) through said air outlet thereby generating a negative pressure which suctions the refuse inside the container (1) through said refuse inlet, and a compactor device (2) compacting the refuse inside the container (1), **characterized in that:**

the container (1) is integrated in a container module (4) comprising a compartment (7a) having a refuse inlet (8a), an air outlet (9a) and a compacting inlet (10a), wherein at least said air outlet (9a) and said compacting inlet (10a) are located on a container coupling face (4a); the compactor device (2) is integrated in a compactor-duct carrier module (5) comprising an air inlet (11a) and a compacting outlet (38a) located

- on a first compactor coupling face (5a), an air outlet (12) located on a second compactor coupling face (5b), an air duct (13a) communicating said air inlet (11a) with said air outlet (12), and a compacting ram (18a) which is moved by an actuator between a retracted position, in which the compacting ram (18a) is inside the compactor-duct carrier module (5), and an extended position, in which the compacting ram (18a) projects outwardly from said first compactor coupling face (5a) through said compacting outlet (38a);
- the suction device (3) is integrated in a suction module (6) comprising a fan arranged inside an enclosure (20) having an air inlet (21) and an air outlet (22), wherein said air inlet (21) is located on a suction coupling face (6a) and can be coupled to the air outlet (12) of the compactor-duct carrier module (5); and
- said container coupling face (4a) of the container module (4) and said first compactor coupling face (5a) of the compactor-duct carrier module (5) have elements that fit together and anchoring devices which, when activated, attach the container module (4) and the compactor-duct carrier module (5) to one another in an operative position, in which the air outlet (9a) and the compacting inlet (10a) of the container module (4) are aligned and coupled with the air inlet (11a) and the compacting outlet (38a) of the compactor-duct carrier module (5), respectively, and the compacting ram (18a) is received in the extended position in the compartment (7a) of the container (1) through the compacting outlet (38a) and the compacting inlet (10a).
2. The pneumatic refuse collection apparatus according to claim 1, wherein said refuse inlet (8a) of the container module (4) is located on the container coupling face (4a) of the container module (4), the compactor-duct carrier module (5) further comprises a refuse outlet (14a) located on the first compactor coupling face (5a), a refuse inlet (15), and a refuse duct (16) having a first end connected to said refuse inlet (15) and another end connected to said refuse outlet (14a), and the refuse inlet (8a) of the container module (4) is aligned and coupled with said refuse outlet (14a) of the compactor-duct carrier module (5) when the container module (4) and the compactor-duct carrier module (5) are attached to one another in the operative position.
 3. The pneumatic refuse collection apparatus according to claim 2, wherein the container module (4) comprises a door (40a) that can be moved between an open position, in which said door (40a) provides access to the compartment (7a) of the container (1), and a closed position, in which the door (40a) closes

the compartment (7a) and provides the container coupling face (4a), and wherein the refuse inlet (8a), the air outlet (9a) and the compacting inlet (10a) are formed in said door (40a).

4. The pneumatic refuse collection apparatus according to claim 1, wherein the compactor-duct carrier module (5) further comprises a refuse chamber (54a) comprised between the compacting ram (18a) in the retracted position and the compacting outlet (38a), and a refuse duct (16) having a first end connected to a refuse inlet (15) and another end connected to said refuse chamber (54a), the compacting outlet (38a) constituting a refuse and compacting outlet (14a, 38a), and said refuse inlet (8a) of the container module (4) is combined with the compacting inlet (10a) constituting the refuse and compacting inlet (8a, 10a) located on the container coupling face (4a) of the container module (4), wherein said refuse and compacting inlet (8a, 10a) is aligned and coupled with the refuse and compacting outlet (14a, 38a) of the compactor-duct carrier module (5) when the container module (4) and the compactor-duct carrier module (5) are attached to one another in the operative position.
5. The pneumatic refuse collection apparatus according to claim 4, wherein the container module (4) comprises a door (40a) that can be moved between an open position, in which said door (40a) provides access to the compartment (7a) of the container (1), and a closed position, in which the door (40a) closes the compartment (7a) and provides the container coupling face (4a), and wherein the refuse and compacting inlet (8a, 10a) and the air outlet (9a) are formed in said door (40a).
6. The pneumatic refuse collection apparatus according to claim 1, wherein:

the container module (4) comprises a second compartment (7b) having a second refuse inlet (8b), a second air outlet (9b) and a second compacting inlet (10b), wherein at least said second air outlet (9b) and said second compacting inlet (10b) are located on the container coupling face (4a);

the compactor-duct carrier module (5) comprises a second air inlet (11b) and a second compacting outlet (38b) located on the first compactor coupling face (5a), a second air duct (13b) communicating said second air inlet (11b) with said air outlet (12) by means of a collector (13c), and a second compacting ram (18b) which is moved by a second actuator between a retracted position, in which the second compacting ram (18b) is inside the compactor-duct carrier module (5), and an extended position, in

- which the second compacting ram (18b) projects outwardly from said first compactor coupling face (5a) through said second compacting outlet (38b); and
 when the container module (4) and the compactor-duct carrier module (5) are attached to one another in said operative position, the second air outlet (9b) and the second compacting inlet (10b) of the container module (4) are aligned and coupled with the second air inlet (11b) and the second compacting outlet (38b) of the compactor-duct carrier module (5), respectively, and the second compacting ram (18b) is received in the extended position in the second compartment (7b) of the container (1) through the second compacting outlet (38b) and the second compacting inlet (10b).
7. The pneumatic refuse collection apparatus according to claim 6, wherein the first air duct (13a) of the compactor-duct carrier module (5) has a first shutter (23a) that can be moved between an open position and a closed position, and the second air duct (13b) of the compactor-duct carrier module (5) has a second shutter (23b) that can be moved between an open position and a closed position, and wherein said first and second shutters (23a, 23b) are moved by respective actuators.
 8. The pneumatic refuse collection apparatus according to claim 6 or 7, wherein the compactor-duct carrier module (5) further comprises first and second refuse outlets (14a, 14b) located on the first compactor coupling face (5a), a refuse inlet (15), a refuse duct (16) having a first end connected to said refuse inlet (15), and a distributor device (17) communicating a second end of said refuse duct (16) selectively with either the first or second refuse outlets (14a, 14b), where said first and second refuse inlets (8a, 8b) of the first and second compartments (7a, 7b) of the container module (4) are located on the container coupling face (4a) and are aligned and coupled with said first and second refuse outlets (14a, 14b) of the compactor-duct carrier module (5) when the container module (4) and the compactor-duct carrier module (5) are attached to one another in the operative position.
 9. The pneumatic refuse collection apparatus according to claim 8, wherein the container module (4) comprises first and second doors (40a, 40b) that can be moved between respective open positions, in which said first and second doors (40a, 40b) provide access to the first and second compartments (7a, 7b) of the container (1), respectively, and respective closed positions, in which the first and second doors (40a, 40b) close the first and second compartments (7a, 7b), respectively, and together provide the container coupling face (4a), and wherein the first and second refuse inlets (8a, 8b), the first and second air outlets (9a, 9b) and the first and second compacting inlets (10a, 10b) are formed in said first and second doors (40a, 40b).
 10. The pneumatic refuse collection apparatus according to claim 4 or 5, wherein the compactor-duct carrier module (5) further comprises first and second refuse chambers (54a, 54b) comprised between the first and second compacting rams (18a, 18b) in the retracted position and the first and second compacting outlets (38a, 38b), a refuse inlet (15), a refuse duct (16) having a first end connected to said refuse inlet (15), and a distributor device (17) communicating a second end of said refuse duct (16) selectively with either the first or second additional refuse ducts (55a, 55b) communicated with said first and second refuse chambers (54a, 54b), respectively, where the first and second compacting outlets (38a, 38b) constitute first and second refuse and compacting outlets (14a, 38a; 14b, 28b), and where said first and second refuse inlets (8a, 8b) and said first and second compacting inlets (10a, 10b) of the first and second compartments (7a, 7b) of the container module (4) are combined constituting respective first and second refuse and compacting inlets (8a, 10a; 8b, 10b) located on the container coupling face (4a), where said first and second refuse and compacting inlets (8a, 10a; 8b, 10b) are aligned and coupled with said first and second refuse and compacting outlets (14a, 38a; 14b, 38b) of the compactor-duct carrier module (5) when the container module (4) and the compactor-duct carrier module (5) are attached to one another in the operative position.
 11. The pneumatic refuse collection apparatus according to claim 10, wherein the container module (4) comprises first and second doors (40a, 40b) that can be moved between respective open positions, in which said first and second doors (40a, 40b) provide access to the first and second compartments (7a, 7b) of the container (1), respectively, and respective closed positions, in which the first and second doors (40a, 40b) close the first and second compartments (7a, 7b), respectively, and together provide the container coupling face (4a), and wherein the first and second refuse and compacting inlets (8a, 10a; 8b, 10b) and the first and second air outlets (9a, 9b) are formed in said first and second doors (40a, 40b).
 12. The pneumatic refuse collection apparatus according to claim 8 or 10, wherein the refuse inlet (15) of the compactor-duct carrier module (5) is located on the second compactor coupling face (5b) and the suction module (6) comprises a refuse duct (24) having a refuse outlet (25) located on said suction coupling face (6a) and a refuse inlet (26), and said refuse

outlet (25) being able to be connected to the refuse inlet (15) of the compactor-duct carrier module (5).

13. The pneumatic refuse collection apparatus according to claim 8, wherein said first and second ends of the refuse duct (16) are misaligned with respect to one another, the first end of the refuse duct (16) is connected to the refuse inlet (15) by a rotary joint and said distributor device (17) comprises a rocker arm (27) fixed to the second end of the refuse duct (16) and an actuator causing said rocker arm (27) and the refuse duct (16) to pivot about a shaft (27a) between first and second positions, in which the second end of the refuse duct (16) is facing and in communication with the first and second refuse outlets (14a, 14b), respectively, and wherein said actuator causing the rocker arm (27) to pivot is a hydraulic cylinder (31) operated by a hydraulic unit (32) installed in the compactor-duct carrier module (5).
14. The pneumatic refuse collection apparatus according to any one of claims 1, 4, 6 and 10, wherein said anchoring devices comprise protruding elements (29) fixed in the container module (4) and retractable hooks (28) installed in the compactor-duct carrier module (5), wherein said retractable hooks (28) hook onto said protruding elements (29) of the container module (4) and are retracted by respective actuators for pressing the container coupling face (4a) of the container module (4) against the first compactor coupling face (5a) of the compactor-duct carrier module (5) and wherein said actuators retracting the retractable hooks (28) are hydraulic cylinders (42) operated by a hydraulic unit (32) installed in the compactor-duct carrier module (5).
15. The pneumatic refuse collection apparatus according to claim 1 or 6 wherein said actuator moving the compacting ram (18a, 18b) is a hydraulic cylinder (30a, 30b) operated by a hydraulic unit (32) installed in the compactor-duct carrier module (5).

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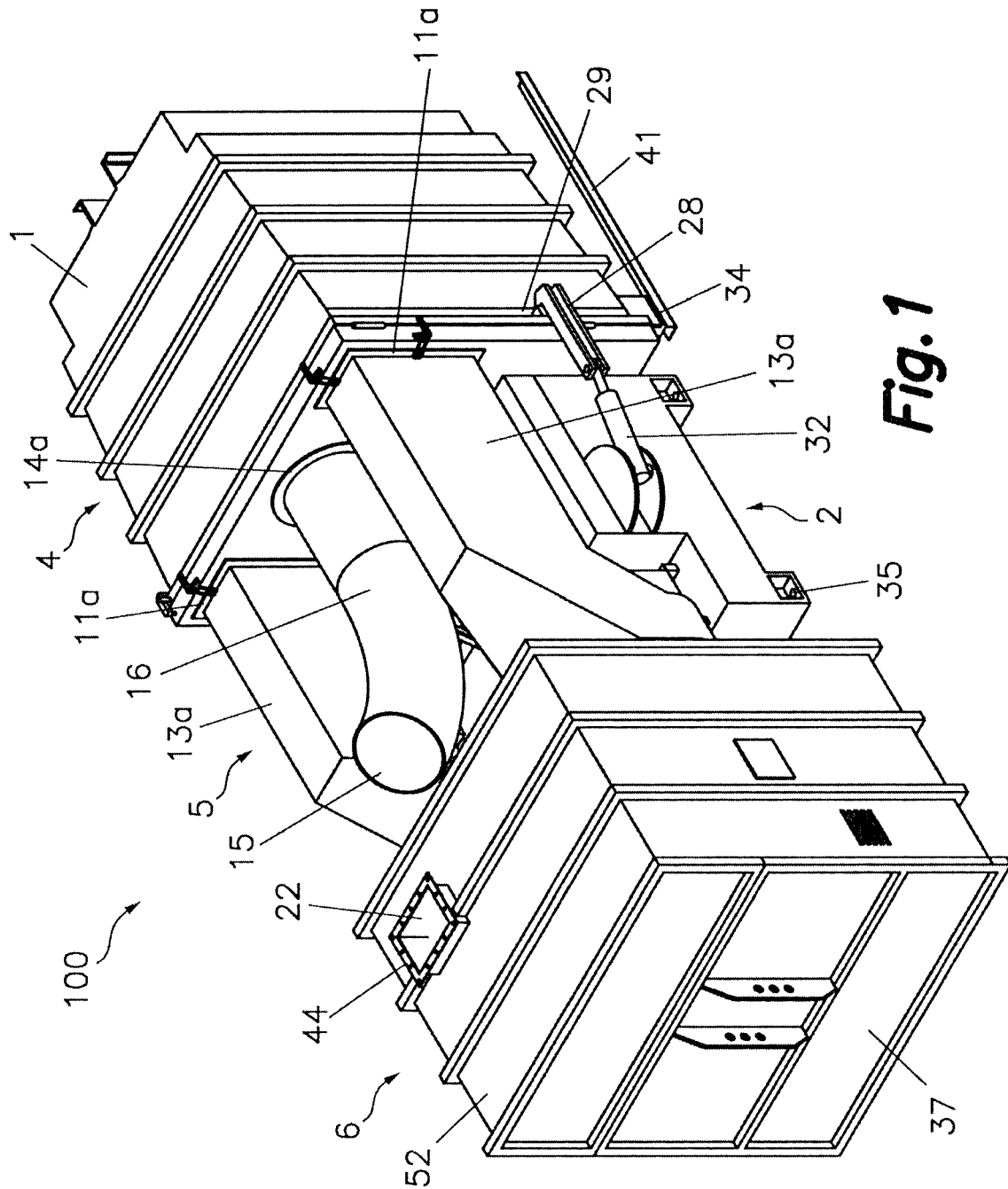


Fig. 1

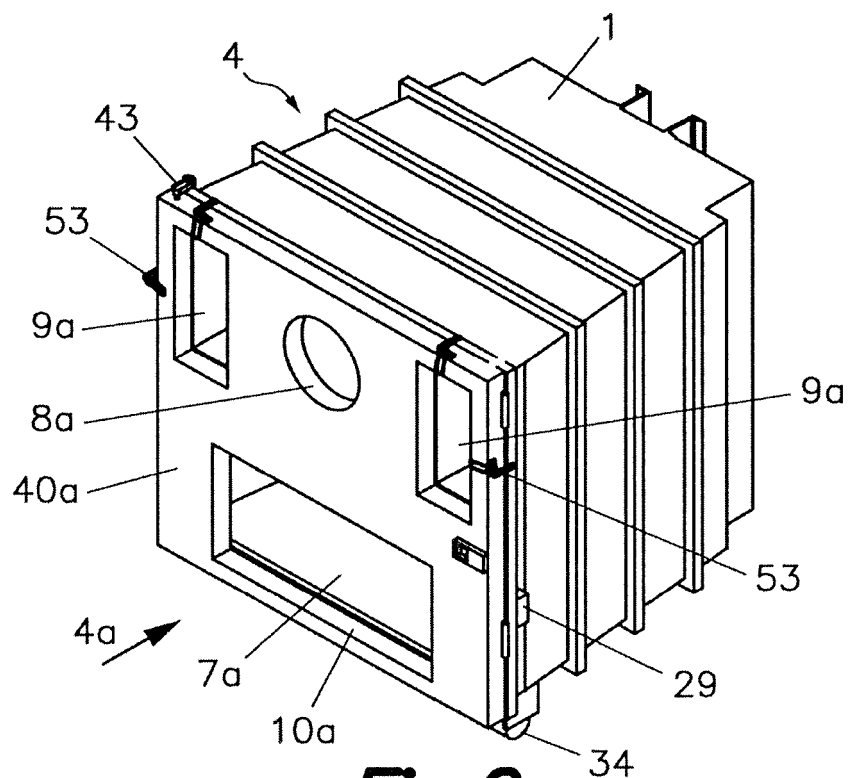


Fig.2

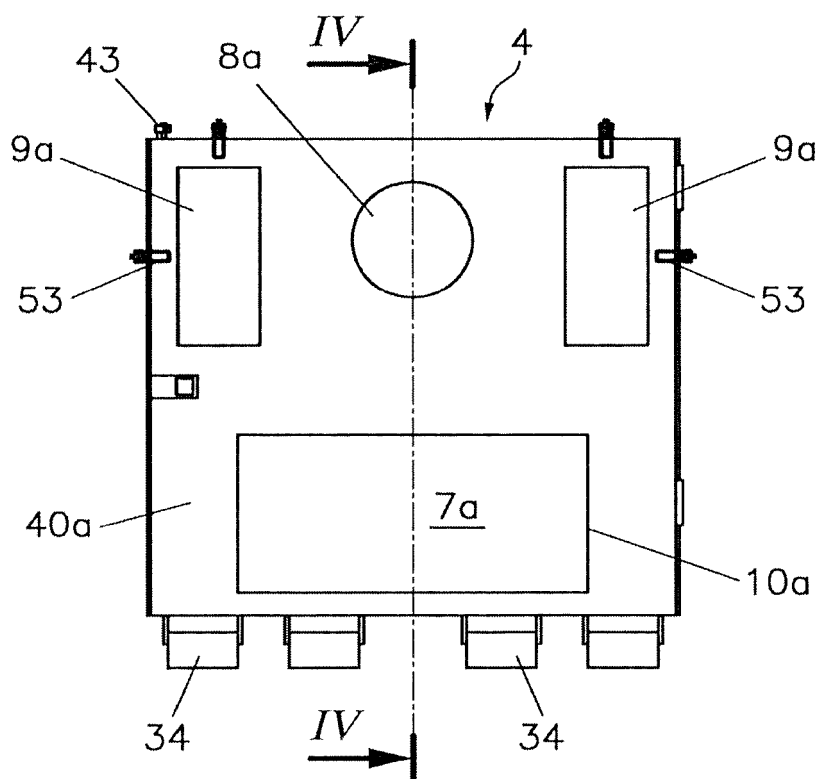


Fig.3

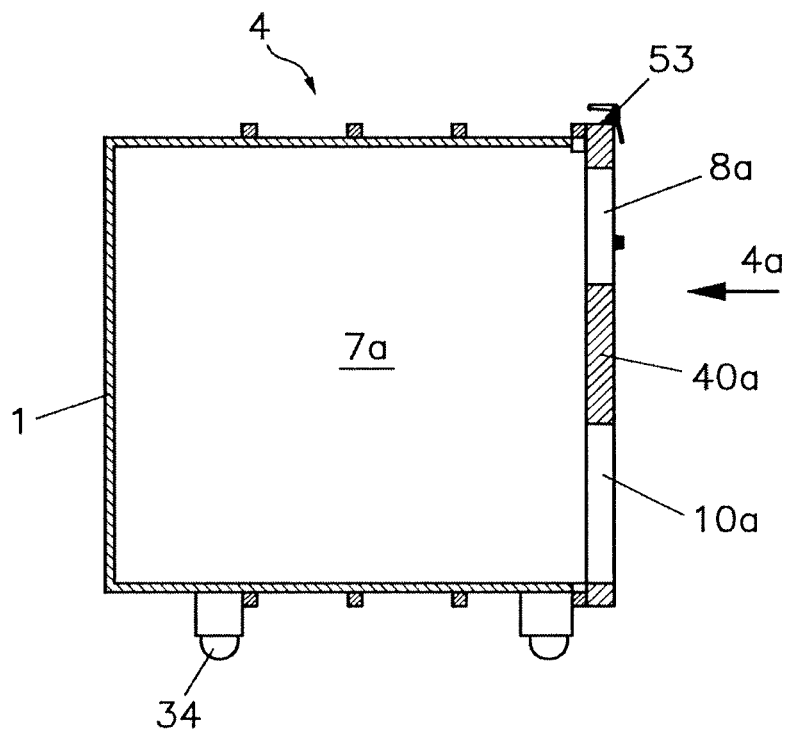


Fig.4

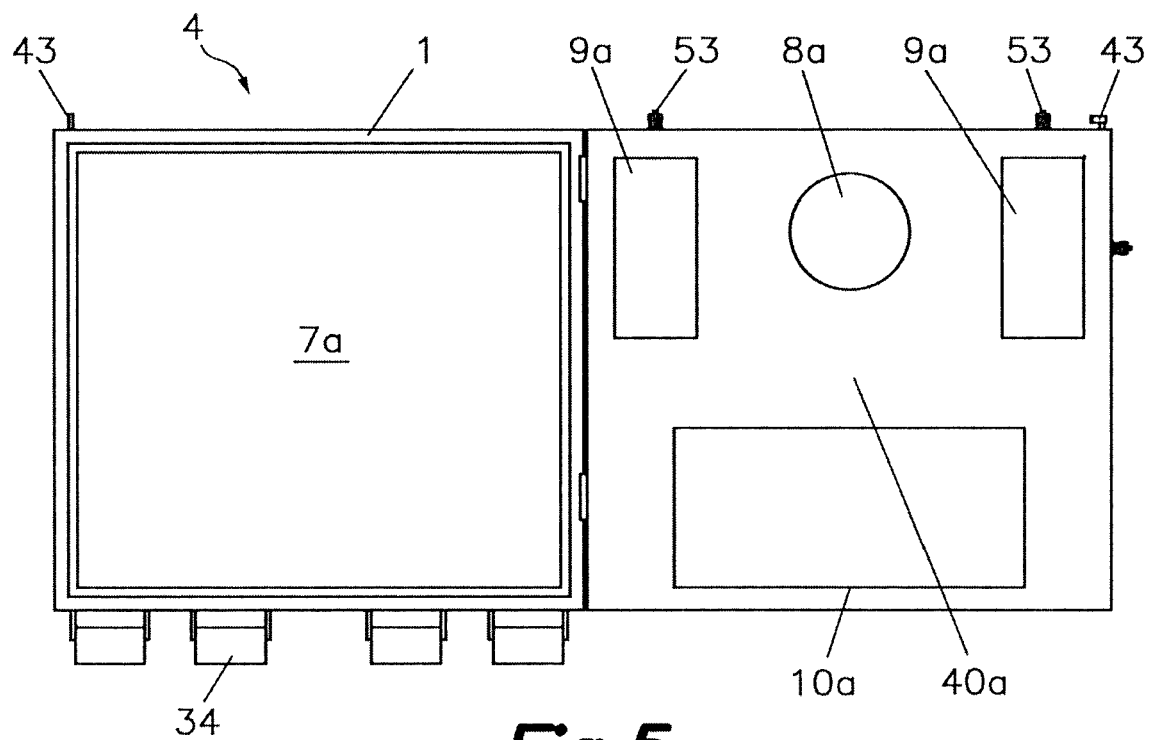
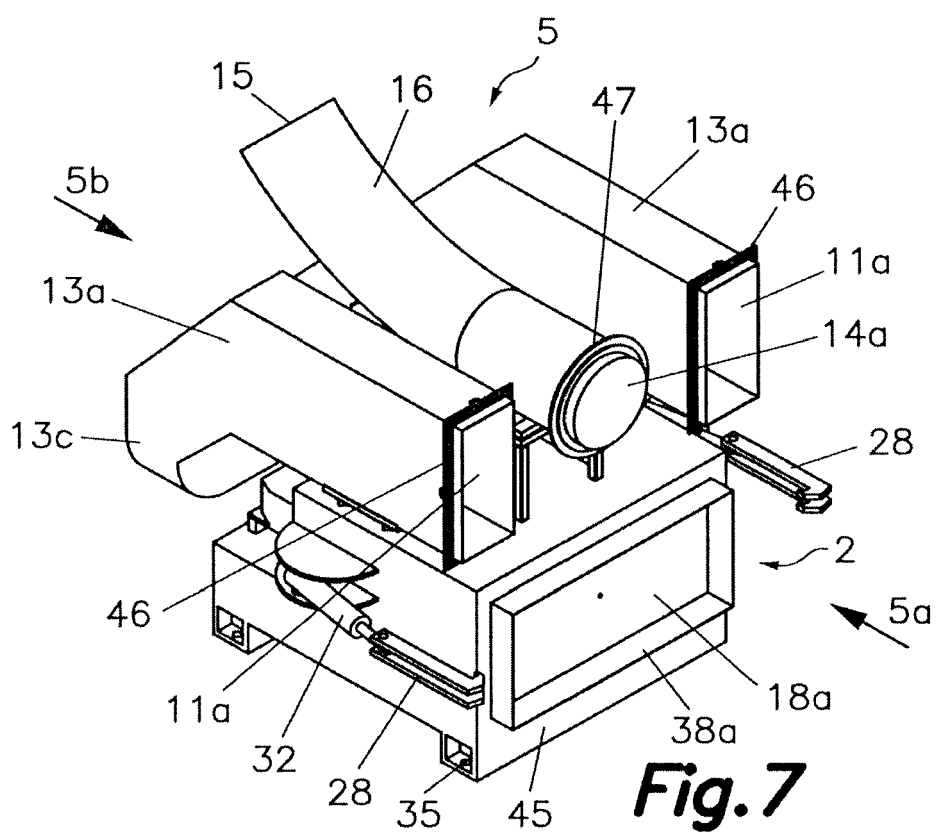
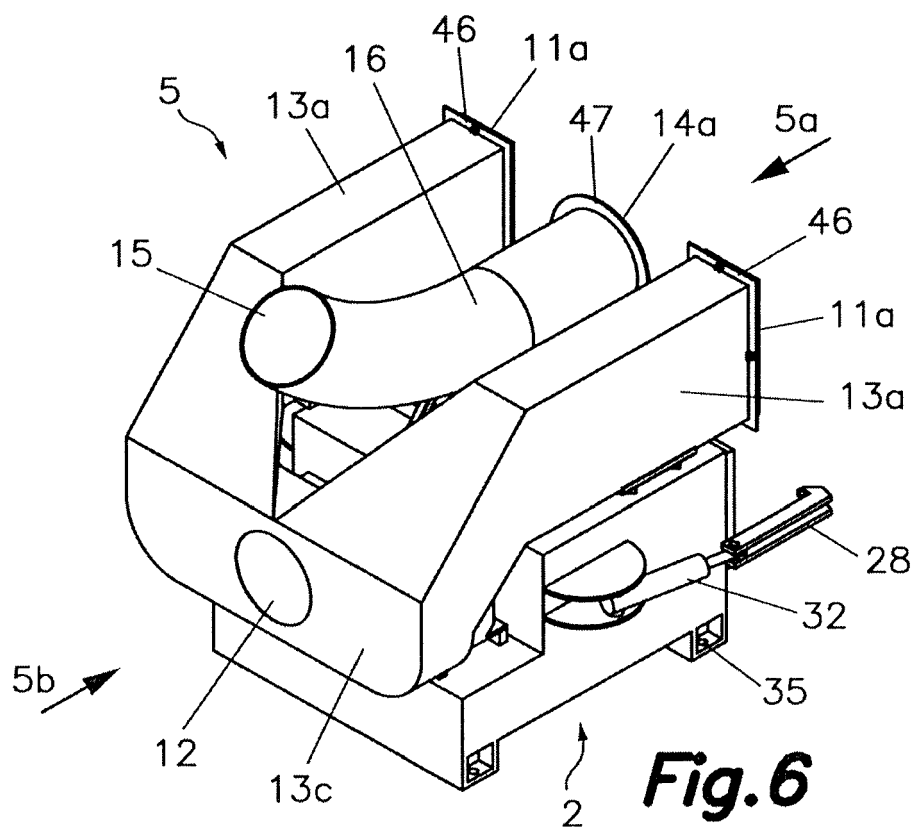


Fig.5



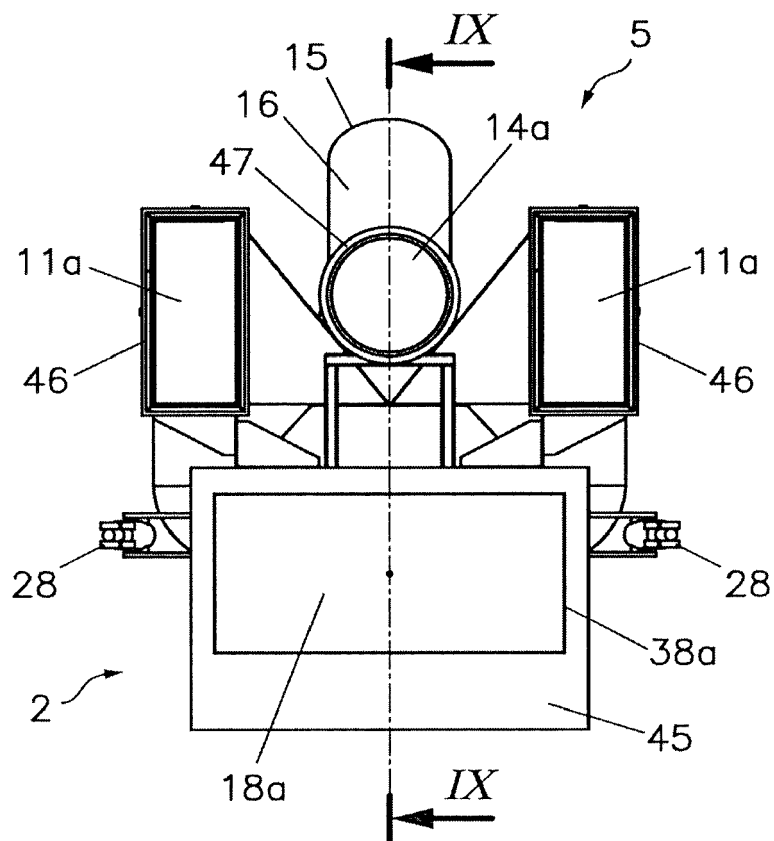


Fig. 8

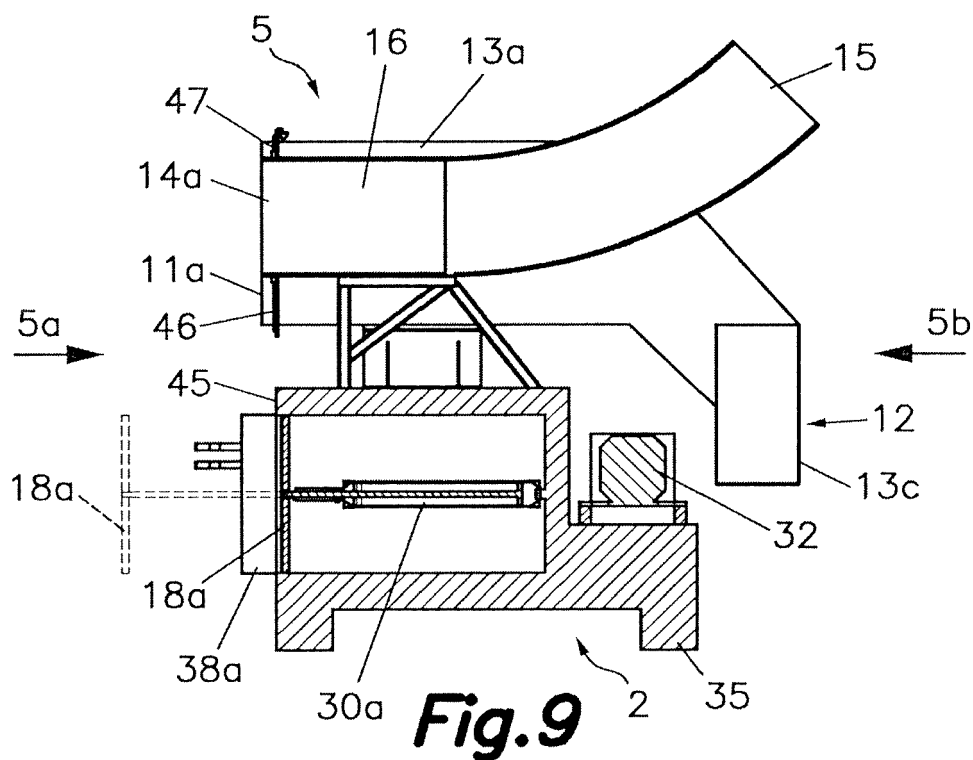


Fig. 9

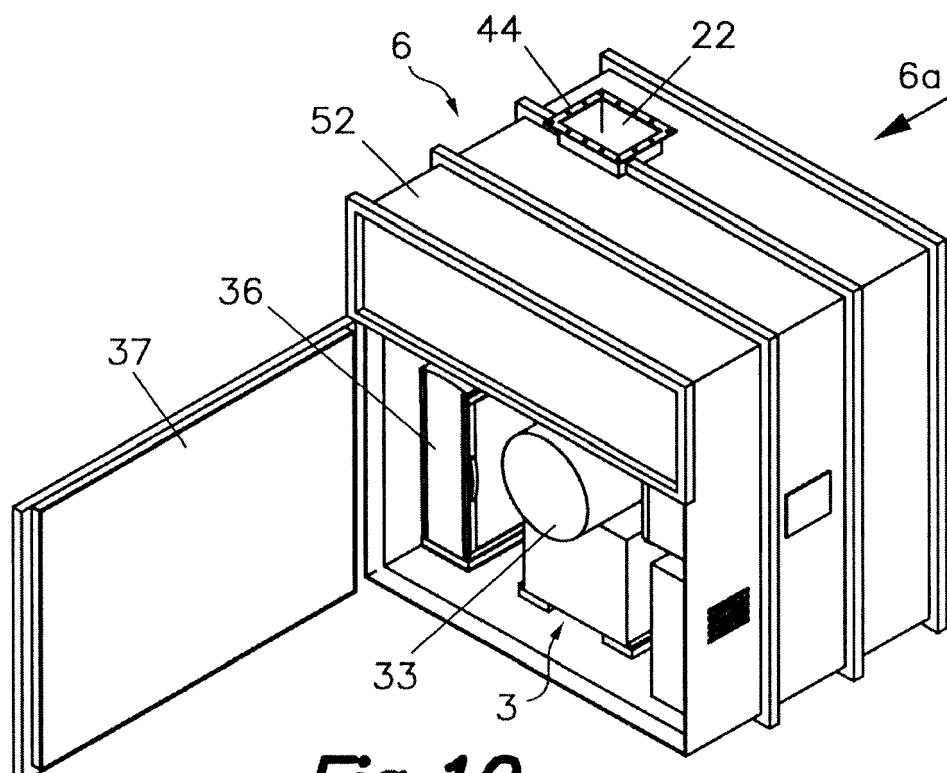


Fig. 10

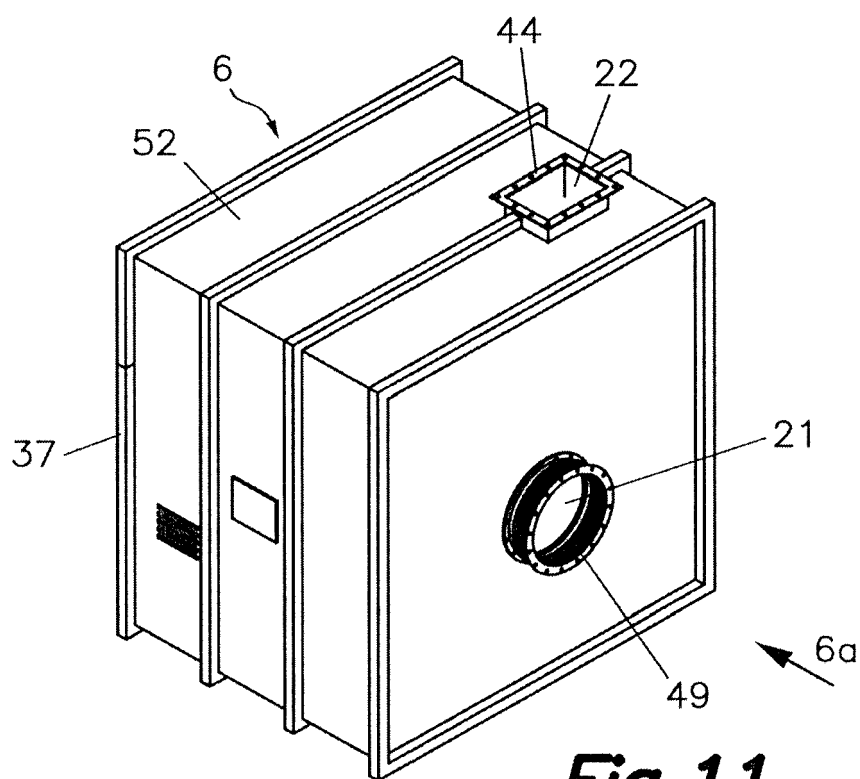


Fig. 11

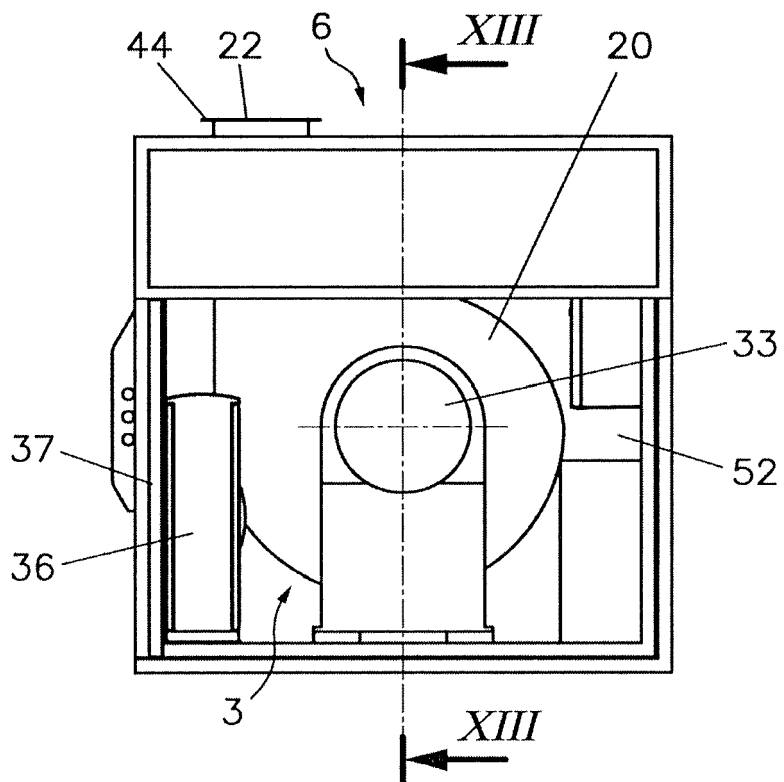


Fig. 12

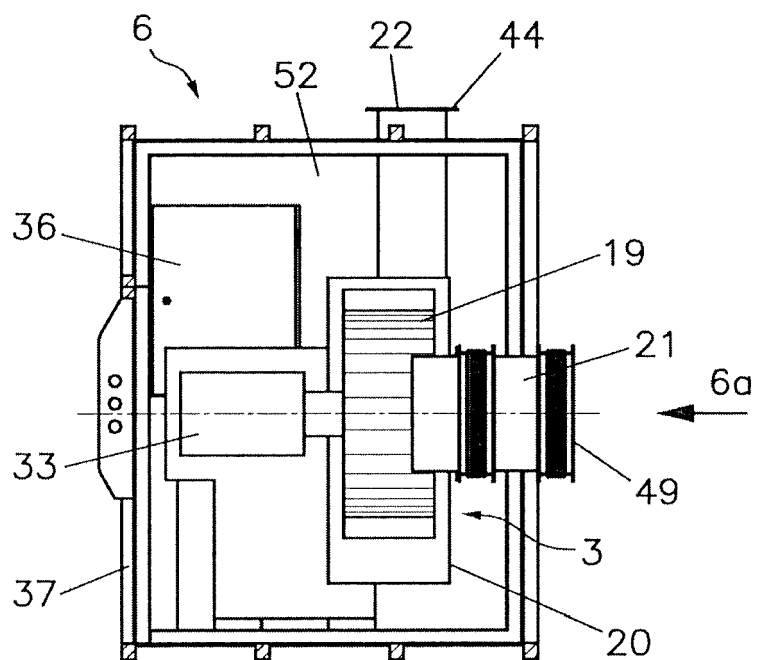


Fig. 13

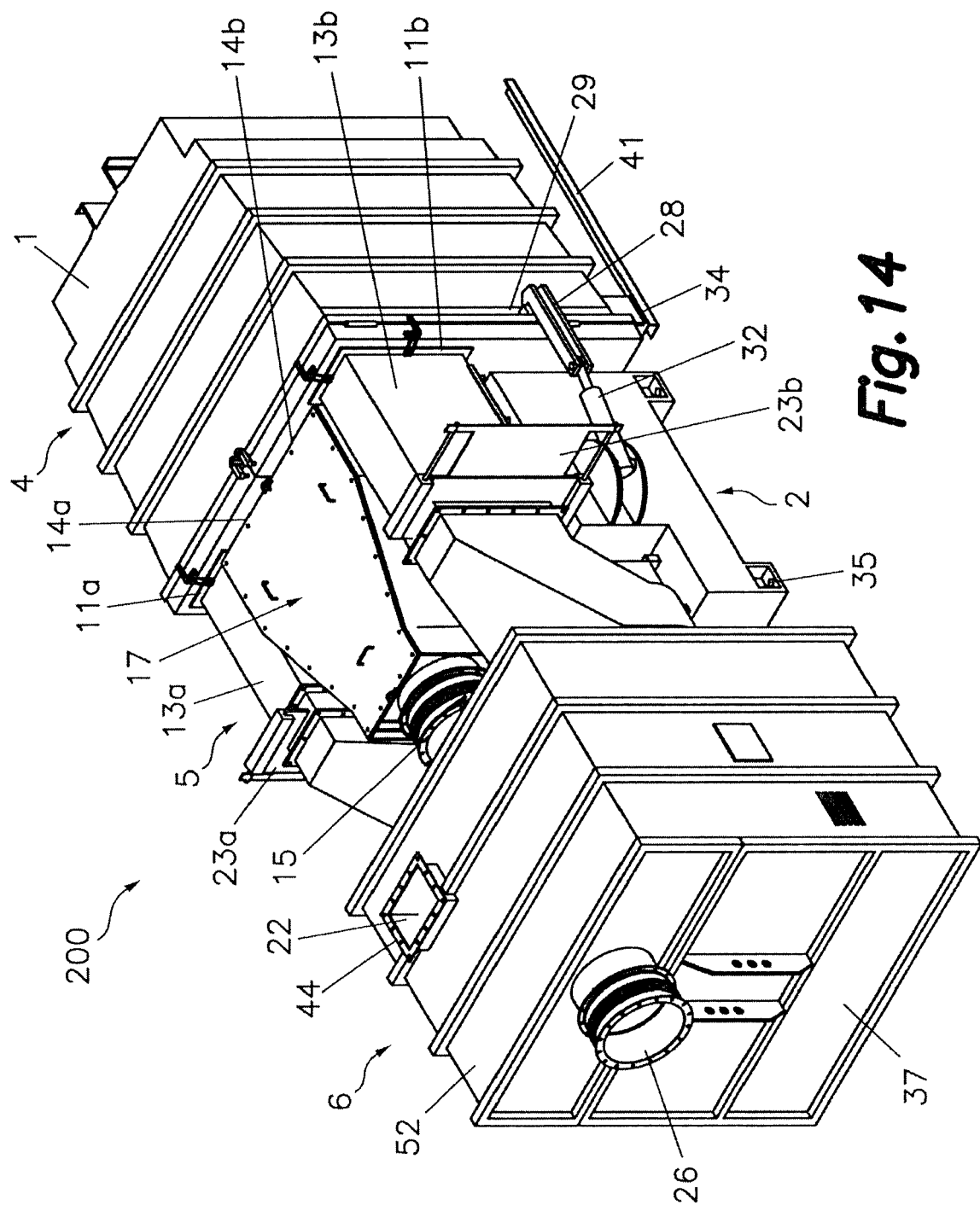


Fig. 14

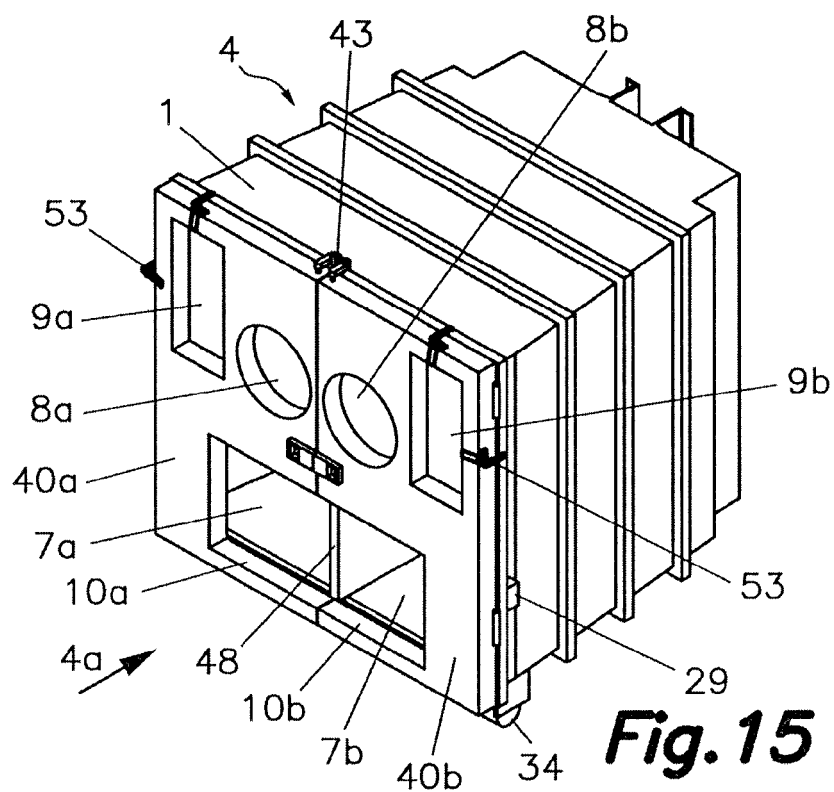


Fig. 15

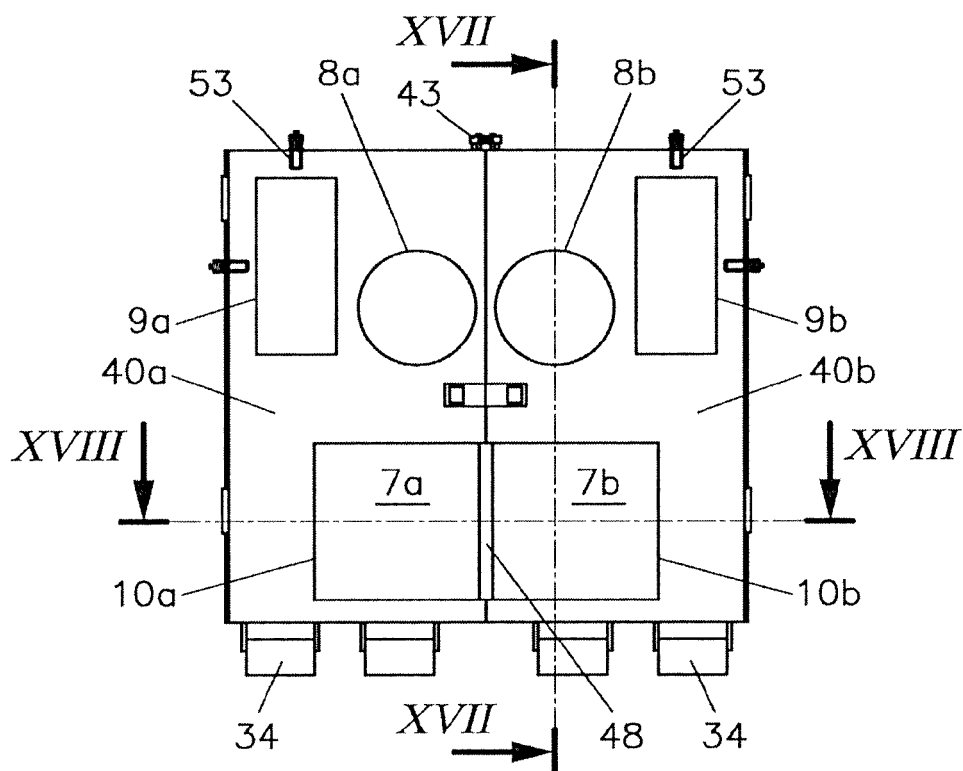
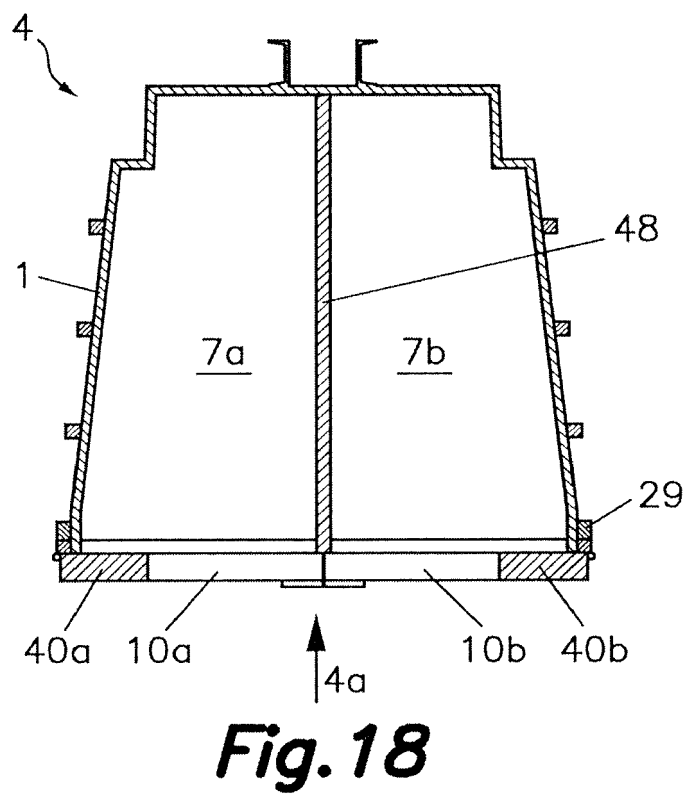
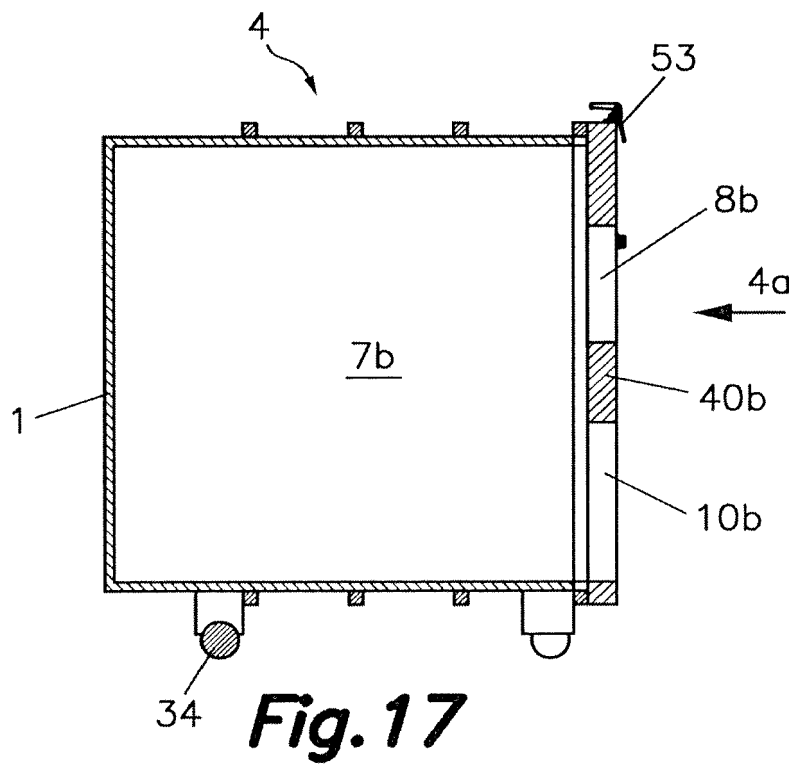
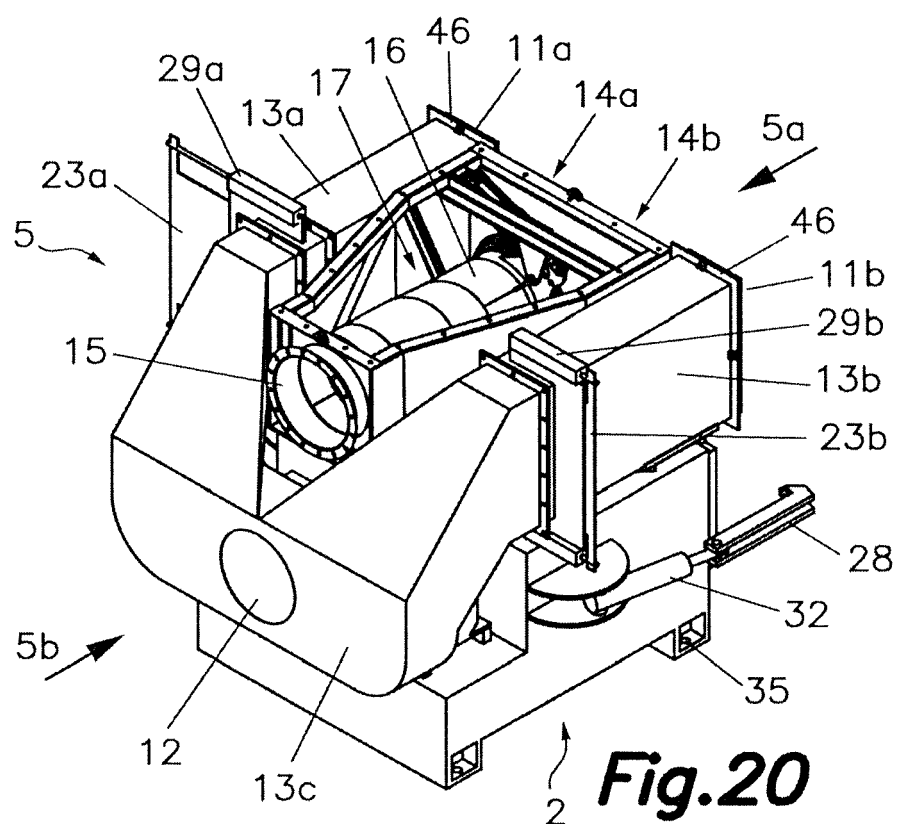
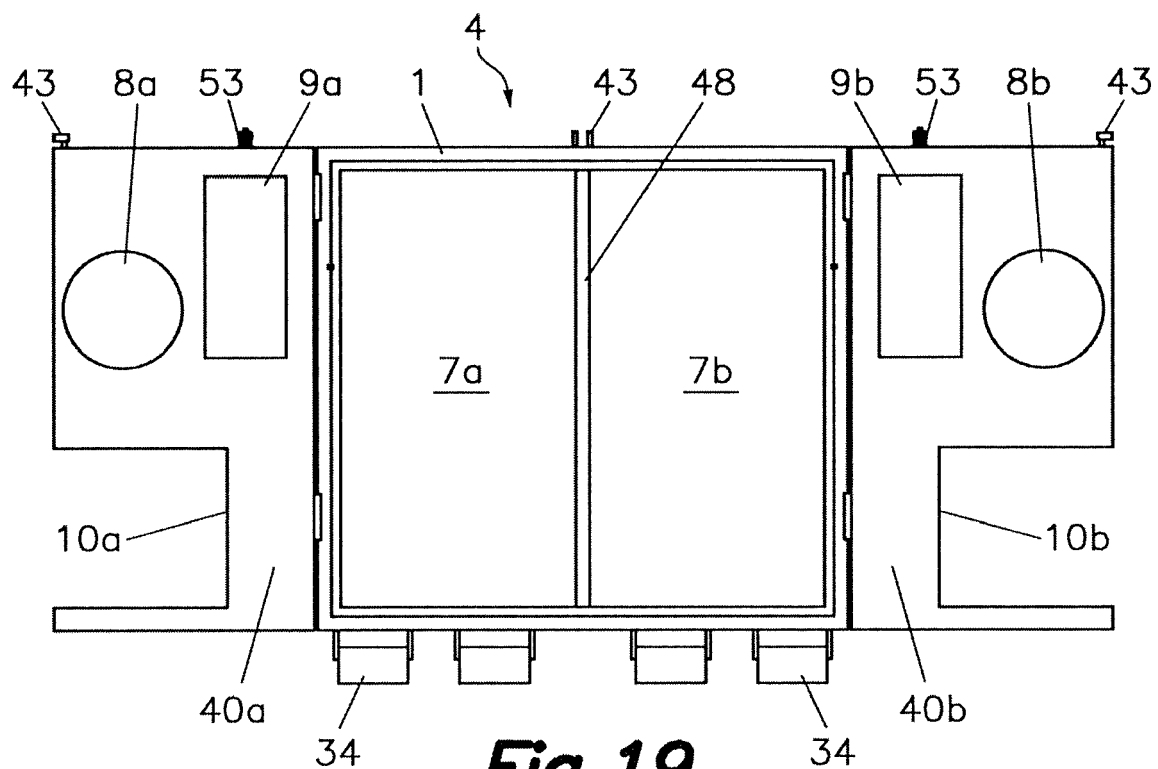
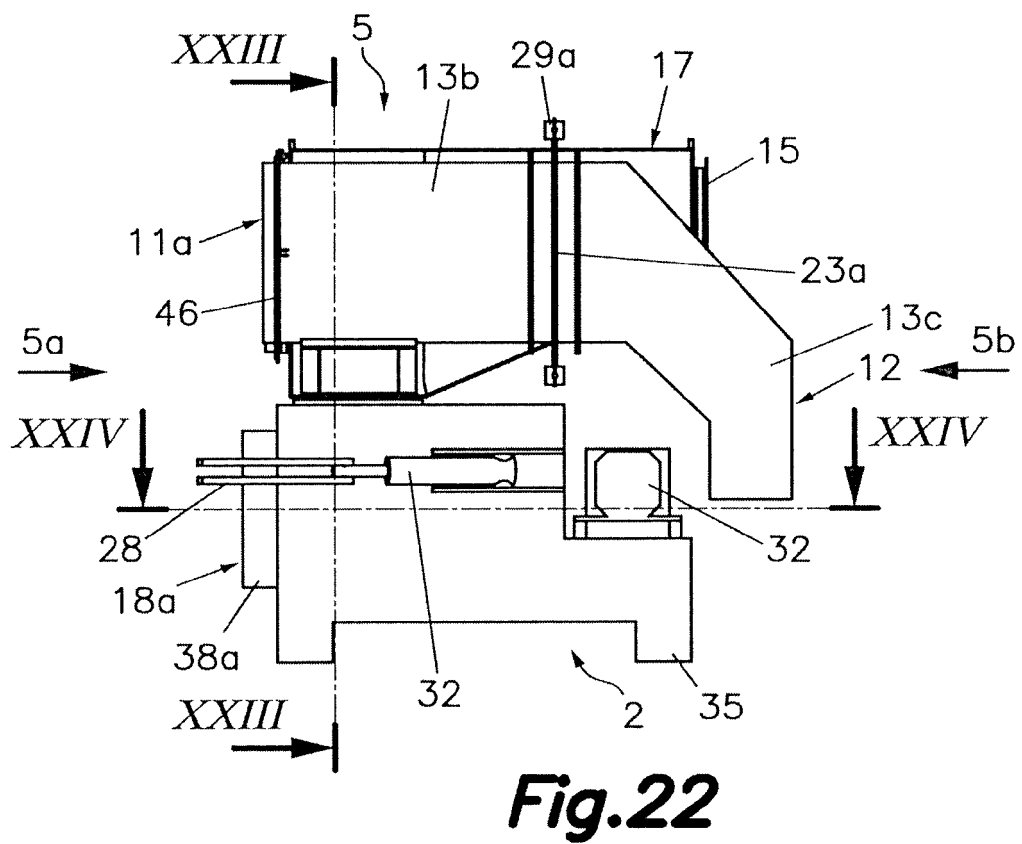
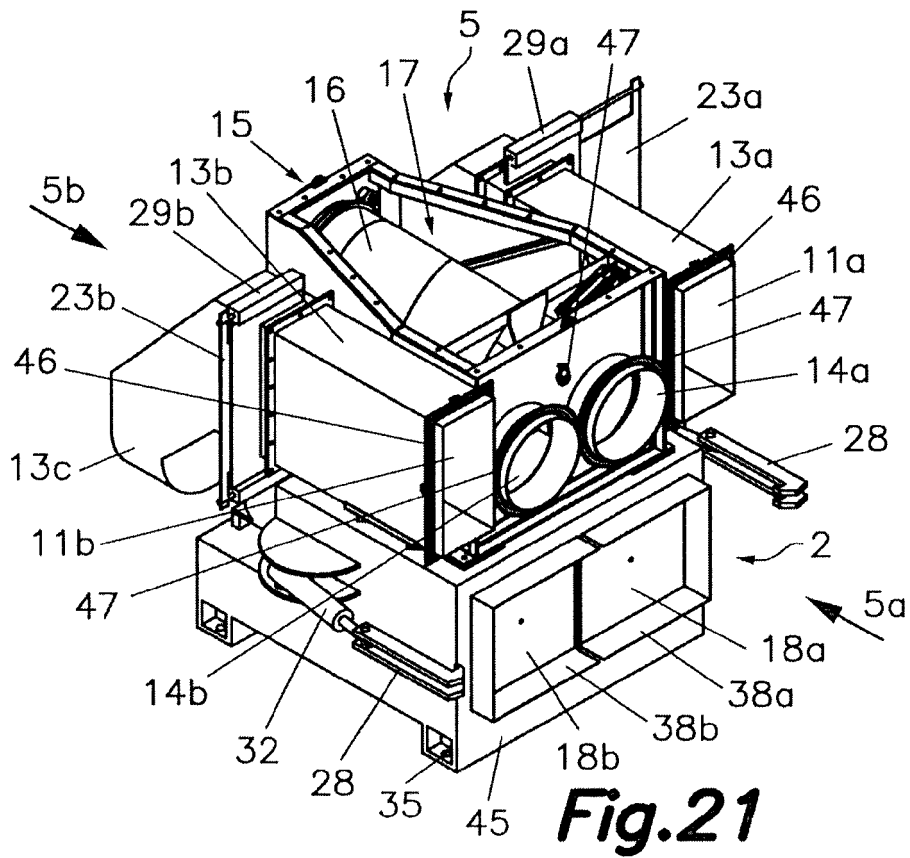


Fig. 16







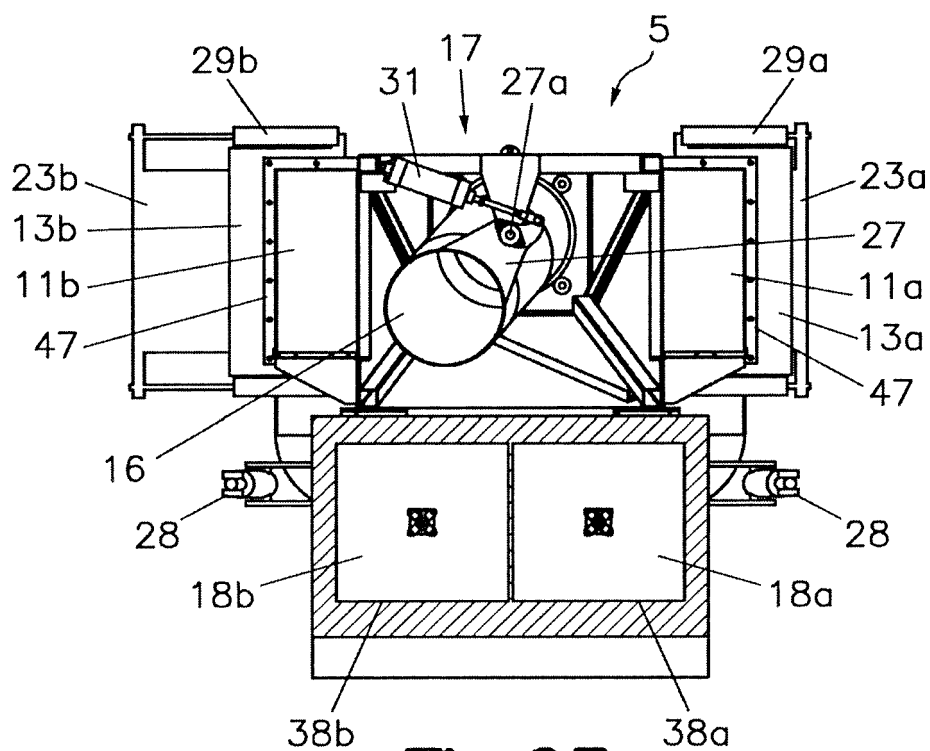


Fig.23

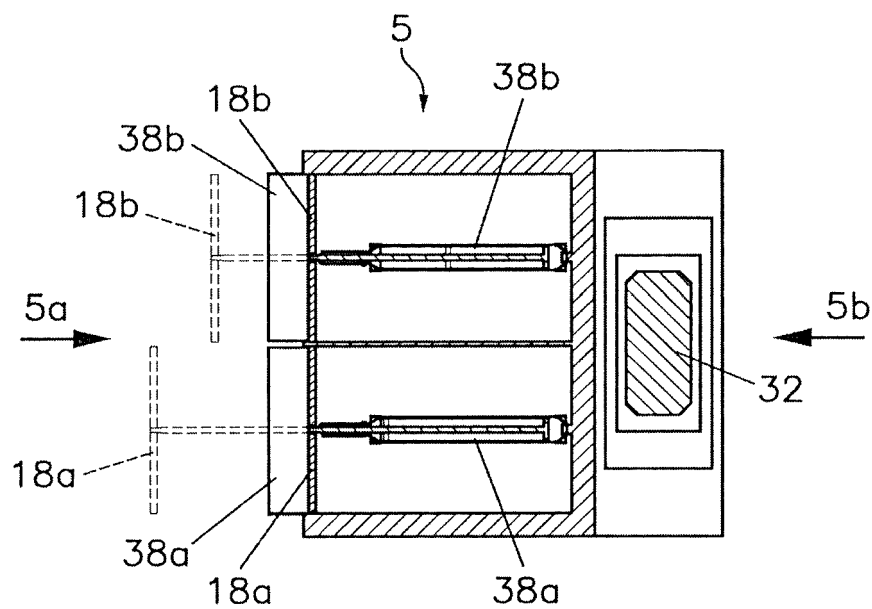


Fig.24

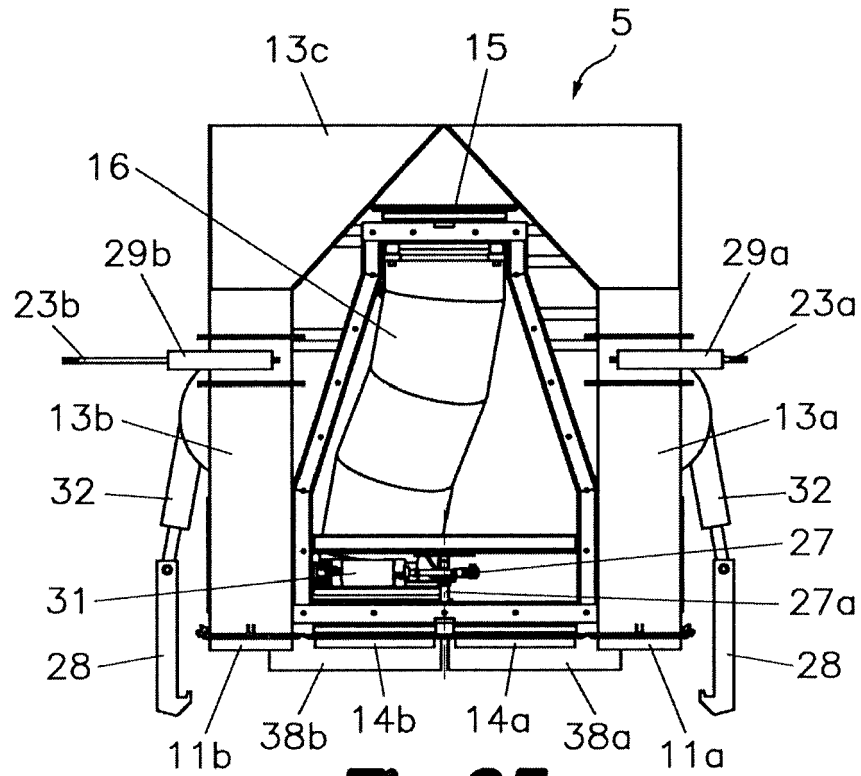


Fig. 25

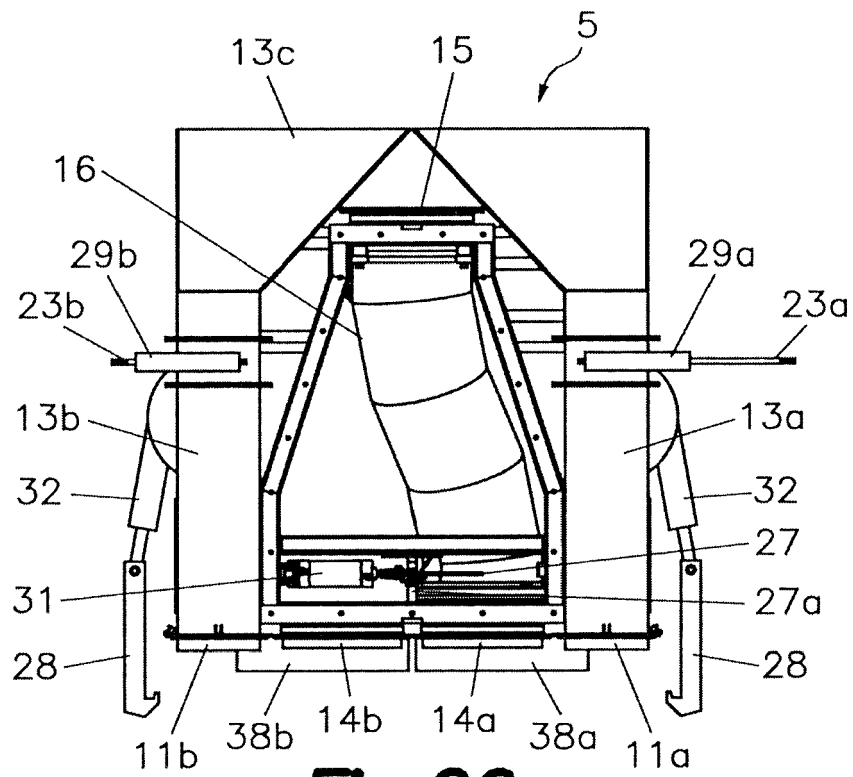


Fig. 26

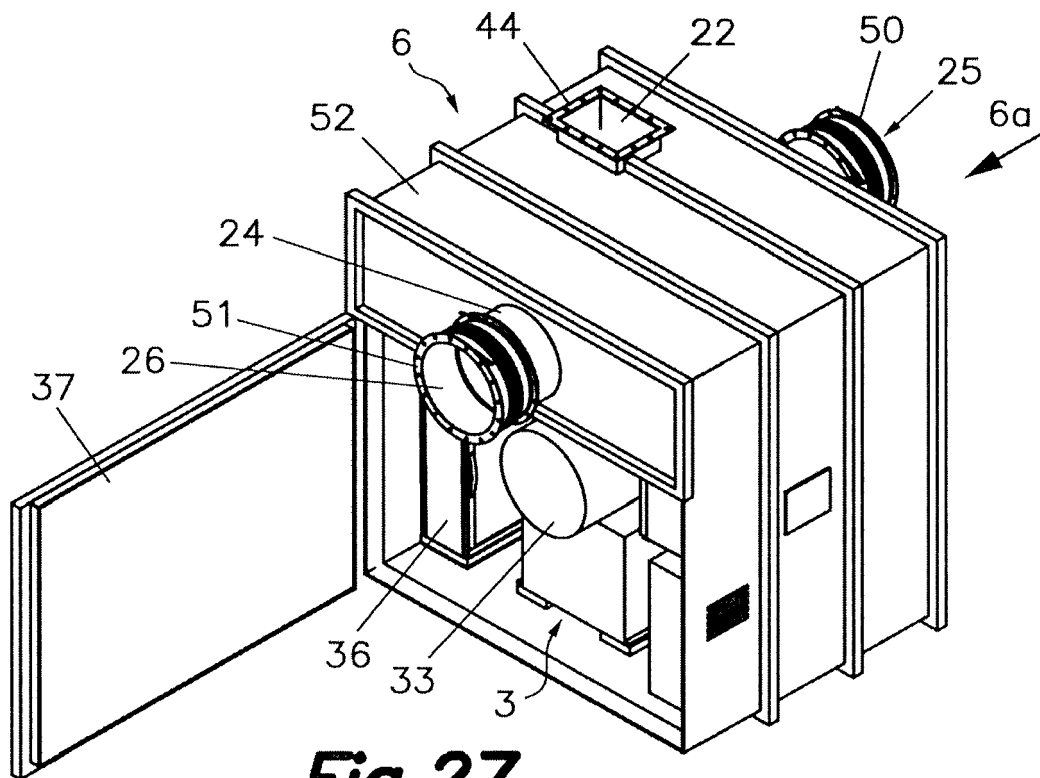


Fig. 27

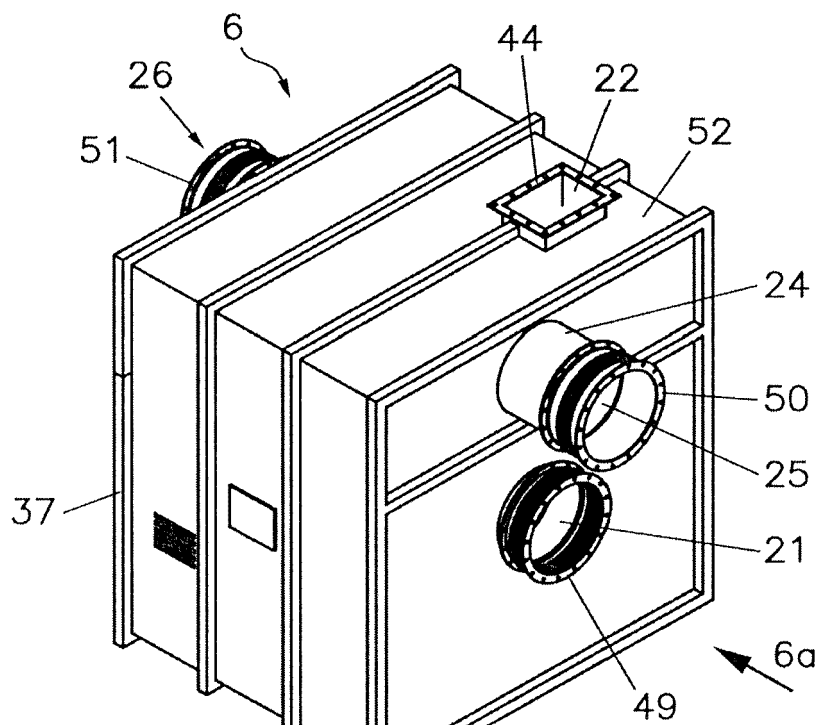


Fig. 28

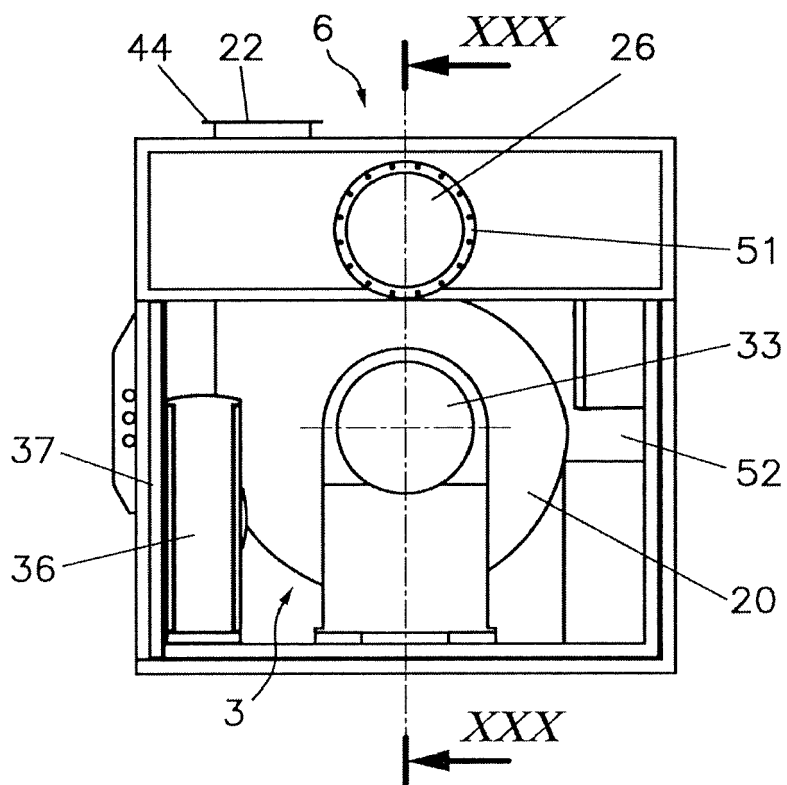


Fig. 29

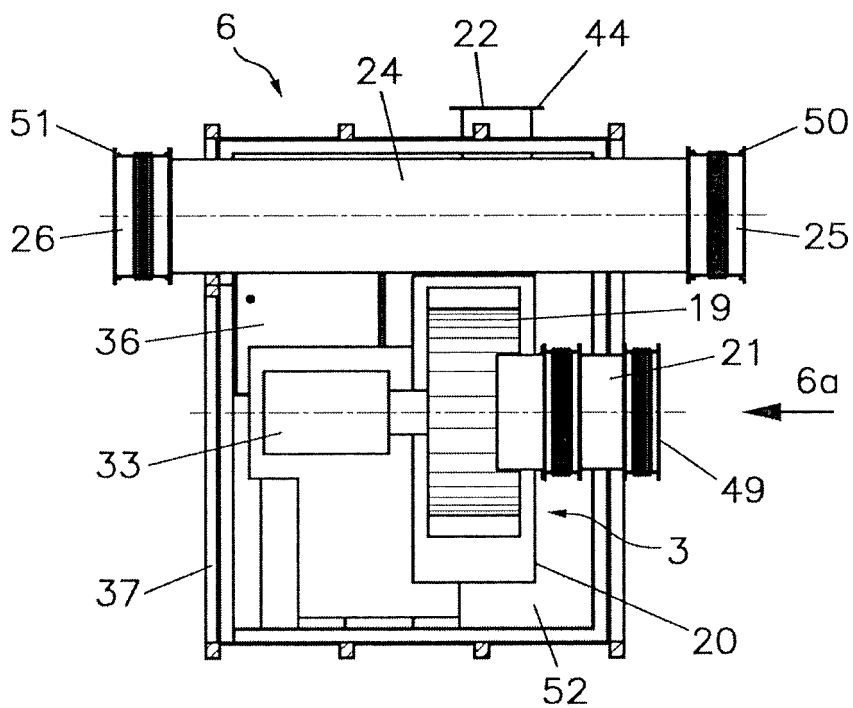


Fig. 30

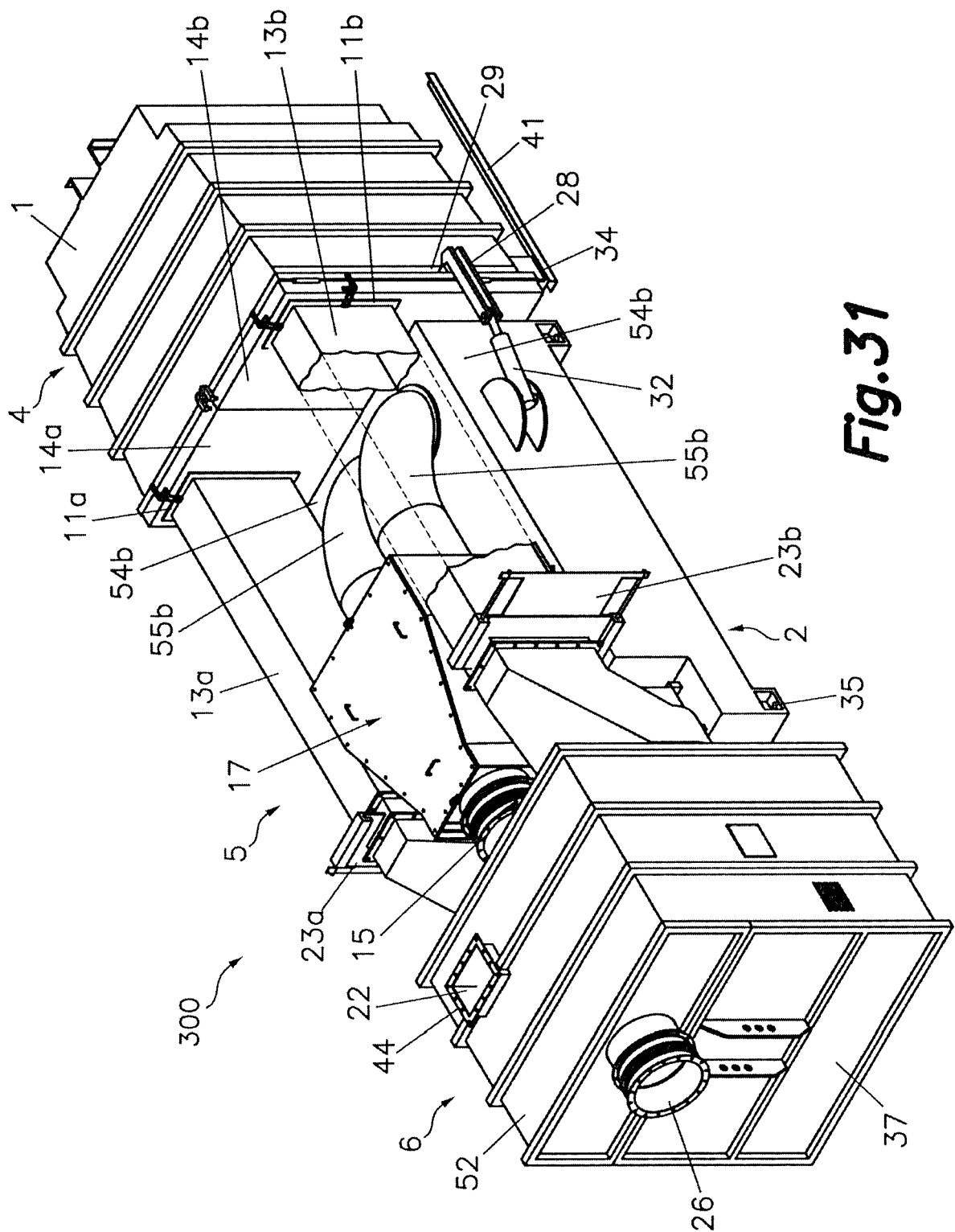
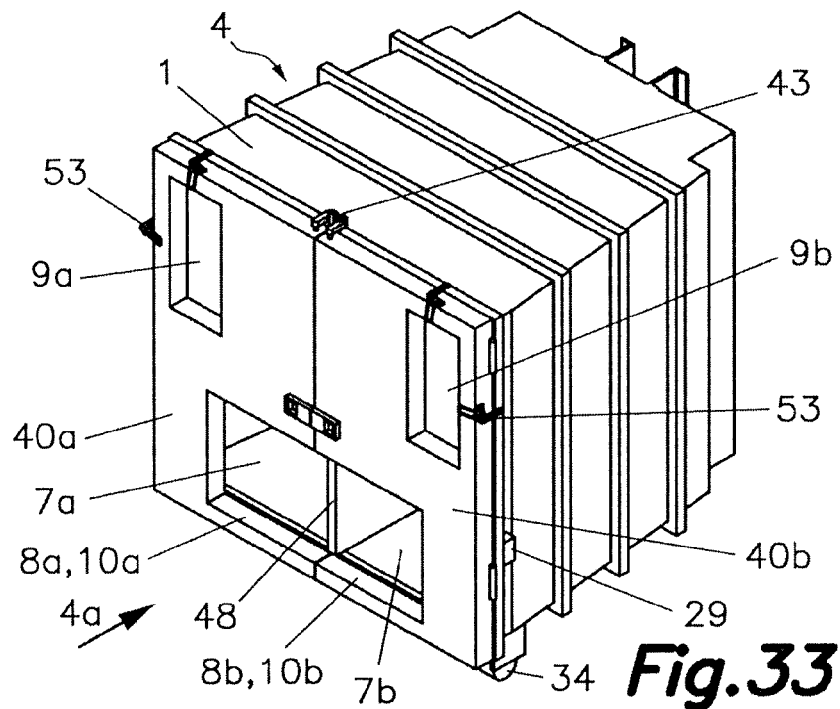
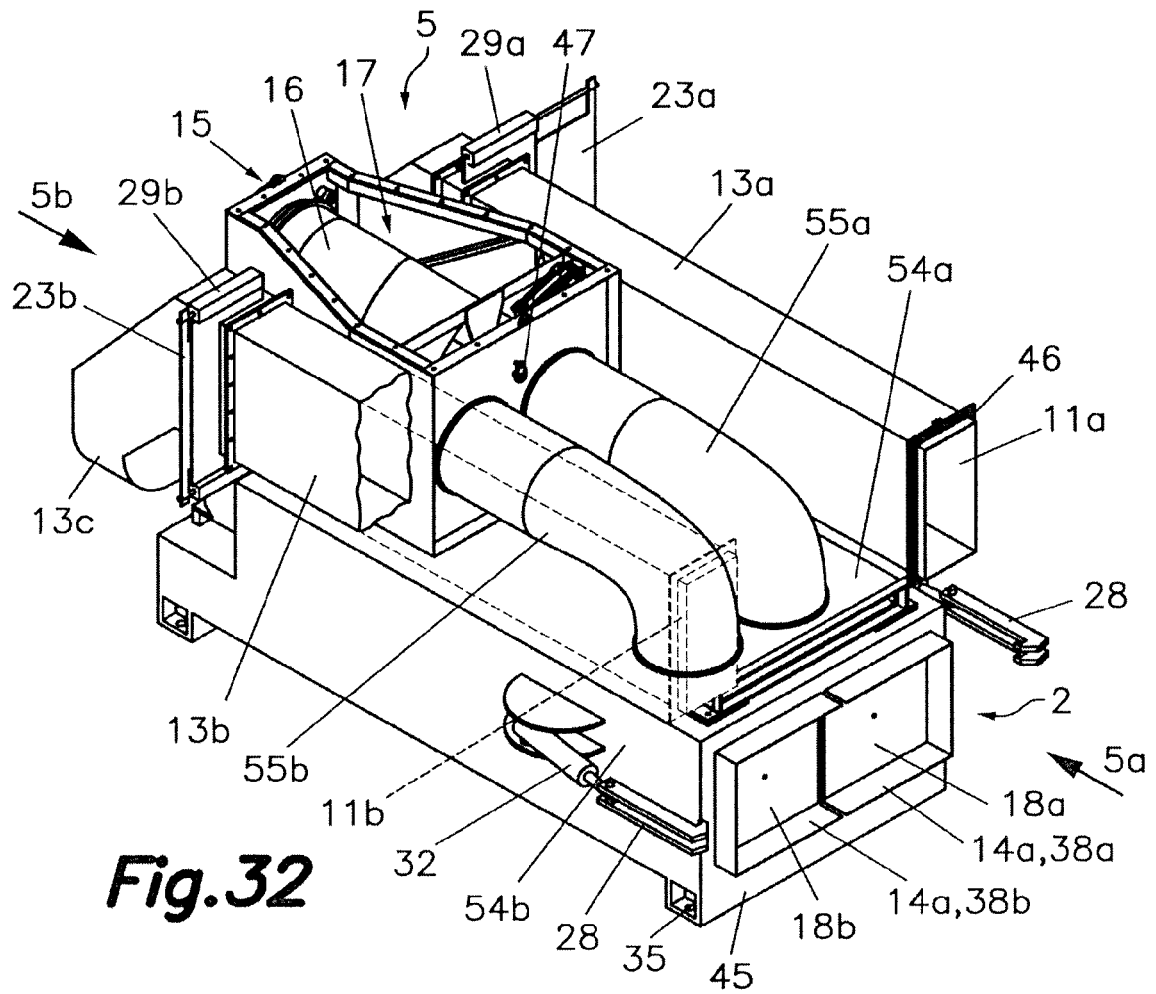


Fig. 31





EUROPEAN SEARCH REPORT

 Application Number
 EP 16 38 0034

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 July 2017	Examiner Baradat, Jean-Luc
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	

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

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