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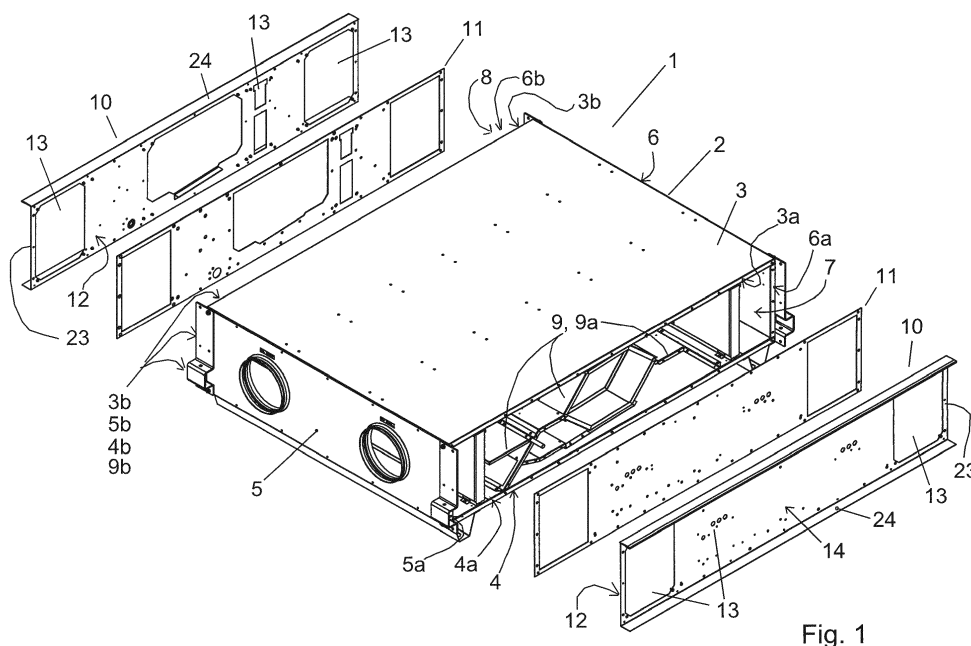
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(54) **Stabilizing and sealing arrangement**

(57) Stabilizing and sealing arrangement for an side-by-side air handling unit (1), with a housing (2), comprising a top-, a bottom, two connection panels (3, 4, 5, 6), and a service side (7) and an installation side (8). The invention is characterized by that a support plate (10) is fixedly arranged to the end sides of the housing (2), at the service side (7) and at the installation side (8) respectively, and the support plate (10) comprising a first seal

(11) arranged between adjacent end sides (3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b; 9a, 9b) and the support plate (10). Any opening (13) in respective support plate (10) is in turn covered by at least one hatch-like panel (15a,...15n), each comprising a second seal (16a,...16n) facing the support plate (10) such as each opening (13) is surrounded by the second seal (16a,...16n).



**Fig. 1**

## Description

### Field of invention

**[0001]** Present invention relates to a stabilizing and sealing arrangement for smaller air handling units with low installation height, so called "side-by-side" air handling units, which differs from "normal" air handling units which in turn can be categorized as "double deckers". The side-by-side air handling unit is often installed in the false ceiling and are normally available up to air flows around 3200 m<sup>3</sup>/s.

### Background of the invention

**[0002]** Since all air handling units (AHU) handles over pressure and under pressure in different sections within the AHU, air leakage is an issue while constructing, installing and operating the AHU. Based on standards within the field, AHU's is categorized in leakage classes L1, L2 and L3, where L1 is the class with highest demands, i.e. with low amount of air leakage. As easily can be understood, a large AHU is easier to design to the higher demands (L2, L1) because it is handling larger amounts of air, but still it has the same number of corners and edges where leakage normally occur, if compared to a small AHU like the side-by-side type. Small AHU's are often built with similar design as large units, and therefore the leakage has a greater impact due to that a small amount of leakage air represents a larger part of the total airflow, since the airflows in these segments are lower. Several manufacturers states that class L2 is fulfilled, but to achieve this class a lot of sealing effort has to be made, often with the use of a great amount of sealing mastic. Benchmarking tests has been performed by the applicant and these shows that several L2-classified AHU's in this segment don't fulfil the stated demands.

**[0003]** Air handling units in this segment can be divided into two types - "framework units" and "housing units". Framework units are designed in a similar way as what is common at larger AHU's, with framework profiles as the stabilizing construction and panels inserted and screwed to the framework, for enclosure, stability and isolation. A typical panel consists of two steel sheet plates with insulation in between. Access to the interior for maintenance and service of filters, heat exchangers, fans, controls etc. is normally solved by openable panels in form of doors with hinges and locks. Panels and doors are sealed with either sealing mastic, seals or sealing strips or a combination of them, depending on function and where in the construction. Typically, sealing mastic is used for permanent sealing and seals/sealing strips are often used at doors. The framework units often have plastic or metal corners to join the framework profiles and a lot of efforts have to be done to solve the sealing issue at the corners, which are a critical spot in the framework construction.

**[0004]** Existing housing units are, roughly speaking,

designed only with enclosing panels, like top panel, bottom panel and connection panels (for connecting ducts), and interior stabilizing walls and/or supports, which all are coupled together to a stable housing with pop-rivets, screws or the like. Because of the stabilizing interior, the enclosing panels on the installation side and the service side, is normally the same as the doors used to access the interior parts for service and inspection. Since the smaller air handling units, like side-by-side units, have small dimensions, it is often cheaper to design them according to the "housing concept", but also the framework design exists. Leakage is a common problem especially at the corners and around the doors.

**[0005]** All air handling units are more or less constantly exposed for movements and vibrations due to running fans, over pressure and under pressure etc. Further, the design must include access of filters, fans, heat exchangers etc., which means that doors or hatches must be included. Because the access openings are to be opened and closed several times per year there are problems to keep over time sustained seal. Existing solutions for the actual segment (airflows up to 3200 m<sup>3</sup>/s) have problems to provide a robust and air tight housing/unit with a competitive cost, without the use of great amounts of sealing mastic, to achieve good air tightness.

### Disclosure of the invention

**[0006]** It is an object of the present invention to provide a stabilizing and sealing arrangement for a side-by-side air handling unit which overcomes the problems stated above. The new design of the AHU comprises a top panel, a bottom panel and two connection panels in a similar way as existing units, but the invention is characterized by an extra support plate which is arranged on each long side of the AHU, i.e. one on the installation side and one on the service side. The support plates are fixedly arranged to the sides of the top-, bottom- and connection panels i.e. the end sides facing the installation side and the service side. By this "extra" support plate, preferably a steel sheet metal plate, the housing is stabilized and the interior structures like filter holders, heat exchanger holders, heater holders, partition walls etc. are also preferably attached to the support plate at their end sides, and thereby gets stable, but it is mainly the support plates that provides the stability of the housing. Existing side-by-side units of housing type has normally interior structures for providing stability together with the top-, bottom- and connection panels and the side panels are normally the same as the doors for access, and thus the doors/side panels are not normally a part of the stabilizing construction in existing housing units. According to the invention, each support plate comprises a first seal on a first side, the side facing the housing, and thereby forming a very air tight seal between the sides of the top-, bottom- and connection panel sides and the support plate, when the support plate is fixedly connected to the end sides. The first seal is arranged in such way that any contact be-

tween adjacent end sides and the support plate has the first seal in between them, also including the contact between end sides of the interior structures, holders etc. and the support plate. By natural, the support plate has openings, both for access of the interior, i.e. for service and maintenance, for installation purposes and also openings for assembly of the support plate and assembly of other parts as interior structures and accessories, like holes for pop-rivets and the like. To manage very high air tightness, the first seal on the first side is complemented by that all openings in the support plate are in turn covered by one or more hatch-like panels, each comprising a second seal facing the support plate. This means that the seal abuts the second side of the support plate - the side facing away from the housing, in such way that the second seal is arranged between every possible contact of the hatch-like panel and the support plate. The hatch-like panels are fitted to the support plate in a removable way for access to the interior and covers one or more underlying openings. Existing solutions do not comprise this complete sealing solution since for example assembly holes for pop-rivets, screws or the like are not covered with sealing in a proper way. According to the invention, firstly the first seal surrounds all openings for assembly of the support plate to the sides of the housing in an overlaying manner so the risk of air leakage to the assembly hole is already here a minimum. Secondly, as stated above, all openings in the support plate are in turn covered in an overlaying manner by the one or more hatch-like panels with the second sealing, meaning that also in this layer, every opening is surrounded by seal and thereby provides a complete tight seal. For example, a hatch for access to filters may also cover underlying pop-rivets and their assembly holes and also other eventual holes. By this complete and careful sealing design the AHU-casing nearly reaches similar air tightness as normal air ducts, at least L2 class and even up to L1, which is far better than existing side-by-side air handling units on the market, and also is a more robust and safe solution than prior art solutions.

**[0007]** According to a preferred embodiment of the invention the first seal covers the complete surface of the first side of the support plate - the side facing the housing and the end sides of the housing panels. Holes provided for service and installation access are though not covered by this first seal. By this sealing arrangement all adjacent housing end sides and interior structures as filter holders, heat exchanger holders, heater holders, partition walls etc. all getting an air tight seal to the support plate, which thereby provides high leakage protection as well as stopping internal leakage between the different air spaces within the AHU. The sealing arrangement in existing housing units often consists of a sealing strip applied at the side panel or door, hopefully in the correct position to seal between sides and adjacent interior structures or sides. The present solution is a more "forgiving" design where the seal is overlapping every part which is to be sealed with respect to the sides, and the seal also covers

any assembly hole in an overlapping manner, why the use of sealing mastic for sealing at the end sides is unnecessary. This gives a short assembly time and an easier assembly as well as a better over time sealing compared to prior art solutions.

**[0008]** According to a further preferred embodiment the second side of the support plate has a substantially smooth surface at least in the area where the second seal abuts. The seal thickness is of course adapted to accommodate any irregularities in the underlying surface, when the hatch-like panel is fitted to the support panel. But to keep the seal thickness as low as possible and the leakage as low as possible it is an object of the invention to keep the surface as smooth as possible for a good seal between the second side of the support plate and the abutting hatch-like panels.

**[0009]** To keep the good sealing arrangement throughout the complete design of the air handling unit also the hatch-like panels are adapted in the same way as the support plate. Some of the hatch-like panels comprises/carries installations as a heater or controls, which in turn needs to be covered since the installation in the hatch-like panel means holes in the panel. Therefore according to a preferred embodiment of the invention, any service opening, like for installations or maintenance, in the hatch-like panels is covered by a lid-like arrangement, each arranged with a third seal, facing the hatch-like panel, so that every contact between the lid-like arrangement and the hatch-like panel has the third seal between them. The object of the invention is maintained with always having a seal surrounding any possible leakage source like openings. The lid is screwed to the hatch-like panel and the seal is achieved when the lid is assembled. If a leakage occurs through openings in the hatch-like panels it is taken care of by the third sealing applied on the lid. According to a preferred embodiment also any assembly hole for pop-rivets or screws in the hatch-like panels is covered by a plug to further stop any possible leakage this way. Even though all assembly holes are surrounded with sealing through the second sealing attached to the hatch-like panel for sealing between the support plate and the panel, there might be a small leakage through the hole itself, if not covered by a lid as presented in the preceding claim description. Therefore an extra sealing is provided through the plug covering the assembly hole in the outer panel material. Throughout the whole construction design the seal arrangement is well thought out to fulfill the high demands regarding leakage. Known side-by-side units don't fulfill the demands and therefore suffers from high leakage values.

**[0010]** In a preferred embodiment of the invention the support plate has a stabilizing C-shape design. The C-shape is formed by folding a steel sheet plate in such a way as the web is forming the connection part with dimensions corresponding to the installation side and the service side of the housing and one flange at each end of the web is formed, i.e. along the top and the bottom of the AHU and protruding away from the housing. All

eventual openings are located in the connection part and it is the connection part that is covered with the first seal on the side facing the housing. The flanges haven't only a stabilizing function, they also embraces the hatch-like panels on the upper and lower side so that, when a hatch is opened it doesn't fall down, but instead rests on the lower flange, which is convenient for the service technician. The upper flange is also used for connecting a roof in a simple manner, if the unit is arranged as an outdoor unit and need weather protection. By the flanges it is possible to attach a roof to the housing without making holes in the housing and thereby so to speak "puncture" the air tight enclosure. Prior art solutions without the support plate have attachments for roof or eyebolts screwed directly into the housing.

**[0011]** By the invention a number of advantages compared to known solutions are obtained:

- A robust and safe construction design which minimizes impact of vibrations and fluctuations in pressure and thereby is less sensitive for air leakage.
- The design also is less sensitive to assembly variations depending on the skill and experience of the assembler, but also tolerances.
- Very air tight housing both with respect to air leakage to the surroundings as well as internal leakage.
- The "layer-by layer" sealing solution always makes sure that any assembly openings or service/installation openings are covered with at least one layer of sealing arrangement, which give a very high level of air tightness.
- The C-shape of the support plate is stabilizing and also provides other advantages as for example the possibility to attach a weather protection roof without affecting the air tightness of the housing.
- A smooth surface in the area where a seal abuts the underlying areas gives a better sealing.

Brief description of the drawings

**[0012]**

Fig. 1 shows a perspective view of a side-by-side air handling unit 1 during assembly of a housing 2, where a support plate 10 with a first seal 11 are about to be assembled to the housing 2.

Fig. 2 shows the side-by-side air handling unit 1 when the support plate 10 is attached to the housing 2 and a number of hatch-like panels 15a...15n, each comprising a second seal 16a...16n, are to be assembled.

**[0013]** The constructive design by the present invention is obvious in the following description in detail of an example of embodiment of the invention related to the accompanying figure showing a preferred, but not limited example of embodiment of the invention. In addition the

invention forwards the prior art in the field in different aspects. This is realized in the present invention by that the device of the below described art principally is constituted in a way that is obvious from the characterised part of claim 1.

**Detailed description of the drawing**

**[0014]** Fig. 1 shows a preferred embodiment of the invention where a side-by-side air handling unit 1, with a housing 2 comprising a top panel 3, a bottom panel 4, and two connection panels 5, 6, for connection of air ducts on respective short end of the housing 2. The long sides of the housing 2 can be described as a service side 7 and an installation side 8, and the housing 2 further comprises a number of interior structures 9, like filter holders, heat exchanger holders, heater holders, partition walls etc. The side-by-side air handling unit 1 of course also includes normal equipment for an AHU, like supply fan, exhaust fan, controls, filters, heat exchangers etc. but these are not shown or described here. The top panel 3, the bottom panel 4, and connection panels 5, 6 have end sides 3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b facing the service side 7 and the installation side 8 respectively, which end sides 3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b have a substantially smooth surface provided for best sealing possibilities. Also at least some of the interior structures 9 have at least one end side 9a, b facing the service side 7 and installation side 8 respectively. To the housing 2, on each long side, i.e. on the service side 7 and on the installation side 8, a respective support plate 10 is fixedly attached to the housing 2, preferably by pop-rivets or screws. The support plate 10 is preferably also fixedly attached to the interior structures 9 to stabilize also these structures which give a robust housing 2 and interior. To gain stability and also provide other positive features, the support plate 10 has a stabilizing C-shape design. The C-shape is formed by folding a steel sheet plate in such a way as a web 23 is formed and utilizing the connection part with dimensions corresponding to the service side 7 and the installation side 8 of the housing 2, and further one flange 24 at each end of the web 23 is formed and protruding away from the housing 2, in direction of a second side 14 of the support plate 10. By the flanges 24 it is possible to attach a weather protection roof (not shown) on top of the housing 2, without "puncture" the air tight housing 2. For sealing purposes the support plate 10 comprises a first seal 11, attached on a first side 12 (connection side) of the support plate 10. The first side 12 is facing the housing 2 and thereby also facing the panel and interior end sides 3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b; 9a, 9b. The first seal 11 covers the whole surface of the first side 12 of the support plate, which means that only openings 13 in the support plate is not covered by the first seal 11. By this arrangement all contact surfaces between the end sides 3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b; 9a, 9b and the support plate 10 comprises a seal which give a good leakage control both for internal leakage between air spaces in-

side the housing 2 as well as the external leakage, which is tested according to the earlier presented standard classes. Since the support plate 10 is a steel sheet metal plate both the first side 12 and the second side 14 have a smooth surface, which is preferred to achieve a good seal.

**[0015]** Fig. 2 shows the side-by-side air handling unit 1 with the support plate 10 fixedly attached to the housing 2. The support plate 10 comprises openings 13 for access to the interior for service and maintenance of fans, heat exchanger, filter exchange, etc. Any opening/hole in the support plate 10 is a possible leakage source and therefore any opening 13, like assembly holes, service openings and openings for installations like heaters etc. is covered in an overlapping manner by a hatch-like panel 15a...15n, each comprising a second seal 16a...16n, facing the second side 14 of the support plate 10, such as each opening 13 is surrounded by the second seal 16a...16n. The second seal 16a...16n preferably covers the whole surface, facing the second side 14 of the support plate 10, of the hatch-like panel 15a...15n. This means that all positions where screws or pop-rivets are used for attaching the support plate 10 to the end sides of the housing 2 are covered as well as the access openings for service and maintenance. Installations like electrical heater (not shown) are assembled direct to the support plate 10 and therefore built up in the same way as the hatch-like panels with a seal between the installation mounting plate and the support plate. The installation plate is then in turn covered with one of the hatch-like panels 15a...15n, and thereby also is sealed in a proper manner according to the scope of the invention. In turn some of the hatch-like panels 15a...15n comprises one or more openings like service openings 17 or installation openings 18. One example is the controls which are attached on an installation plate directly to the support plate 10. The hatch-like panel 15b with the second seal 16b covers the control installation plate in the same way as other hatch-like panels covers underlying openings/installations, but the hatch-like panel 15b in this case also comprises an opening 17, 18 for access the supervision and settings of the control system. This opening 17, 18 is in turn covered by a lid-like arrangement 19, which is arranged with a third seal 20, facing the hatch-like panel 15b in such way that every contact between the lid-like arrangement 19 and the hatch-like panel 15b has the third seal 20 in between, for sealing of the underlying opening/openings. Some of the hatch-like panels 15a...15n, like hatches for maintenance access of filters etc., are arranged to be easily removed and therefore comprises hand operated "finger screws" for unlocking and removing the hatch. Other hatch-like panels 15a...15n are not to be opened frequently, and therefore fixedly assembled with standard screws. These can of course be removed and the hatch removed if necessary, but this by using tools. Assembly holes 21 in the outer skin of the hatch-like panel 15a...15n are in that case covered by a plug 22 inserted in the assembly hole 21,

to stop any possible leakage this way. The plug 22 can be removed if the hatch-like panel shall be removed.

## PARTS LIST

### [0016]

- 1 = side-by-side air handling unit
- 2 = housing
- 3 = top panel
- 4 = bottom panel
- 5 = connection panel
- 6 = connection panel
- 7 = service side
- 8 = installation side
- 9 = interior structures
- 10 = support plate
- 11 = first seal
- 12 = first side (of the support plate)
- 13 = opening
- 14 = second side (of the support plate)
- 15 = hatch-like panel
- 16 = second seal
- 17 = service opening
- 18 = installation opening
- 19 = lid-like arrangement
- 20 = third seal
- 21 = assembly hole
- 22 = plug
- 23 = web
- 24 = flange

## Claims

1. Stabilizing and sealing arrangement for an side-by-side air handling unit (1), which air handling unit (1) comprises a housing (2), with a top panel (3), a bottom panel (4), two connection panels (5, 6) for connection of ducts, and a service side (7) and an installation side (8), and the panels (3, 4, 5, 6) have end sides (3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b) facing the service side (7) and the installation side (8), which end sides (3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b) have substantially smooth surface, and the housing (2) further comprises interior structures (9) like filter holders, heat exchanger holders, heater holders, partition walls etc. where at least some of the interior structures (9) have at least one end side (9a,b) facing the service side (7) and installation side (8) respectively, **characterized by** that a support plate (10) is arranged at the service side (7) and at the installation side (8) respectively, which support plate (10) is respectively fixedly connected to the end sides (3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b) of the top-, bottom- and connection panels (3, 4, 5, 6) in a stabilizing manner, and preferably fixedly connected to at least some of the end sides (9a,b) of interior structures (9), and

which respective support plate (10) comprising a first seal (11) at least on one first side (12) facing the housing (2), and which first seal (11) is arranged in such way that every contact between adjacent end sides (3a, 3b; 4a, 4b; 5a, 5b; 6a, 6b; 9a, 9b) and the support plate (10) has the first seal (11) in between, and further that any opening (13) in respective support plate (10) is covered, at a second side (14) of the support plate (10), opposite the first side (12) and facing away from the housing (2), by at least one hatch-like panel (15a,...15n), each comprising a second seal (16a,...16n) facing the second side (14) of the support plate (10), and which second seal (16a,...16n) is arranged in such way that every contact between the at least one hatch-like panel (15a,...15n) and the second side (14) of the support plate (10) has the second seal (16a,...16n) in between, whereby every opening (13) in the support plate (10) is covered in an overlapping manner, such as each opening (13) is surrounded by the second seal (16a,...16n).

2. Arrangement according to claim 1, **characterized by** that the first seal (11) covers the whole surface of the first side (12) of the support plate (10).
3. Arrangement according to claim 1 or 2, **characterized by** that that the second side (14) of the support plate (10) has a substantially smooth surface, at least in the area where the second seal (16a,...16n) abuts.
4. Arrangement according to any of the preceding claims, **characterized by** that any service opening (17) and installation opening (18) in the at least one hatch-like panel (15a,...15n) is covered by a lid-like arrangement (19), arranged with a third seal (20) facing the at least one hatch-like panel (15a,...15n), and which third seal (20) is arranged in such way that every contact between the lid-like arrangement (19) and the at least one hatch-like panel (15a,...15n) has the third seal (20) in between.
5. Arrangement according to any of the preceding claims, **characterized by** that any assembly hole (21) in the at least one hatch-like panel (15a,...15n) is covered by a plug (22).
6. Arrangement according to any of the preceding claims, **characterized by** that the support plate (10) is C-shaped, with a web (23) which forms the connection part and two flanges (24) perpendicular to the web (23) and protruding away from the housing (2).

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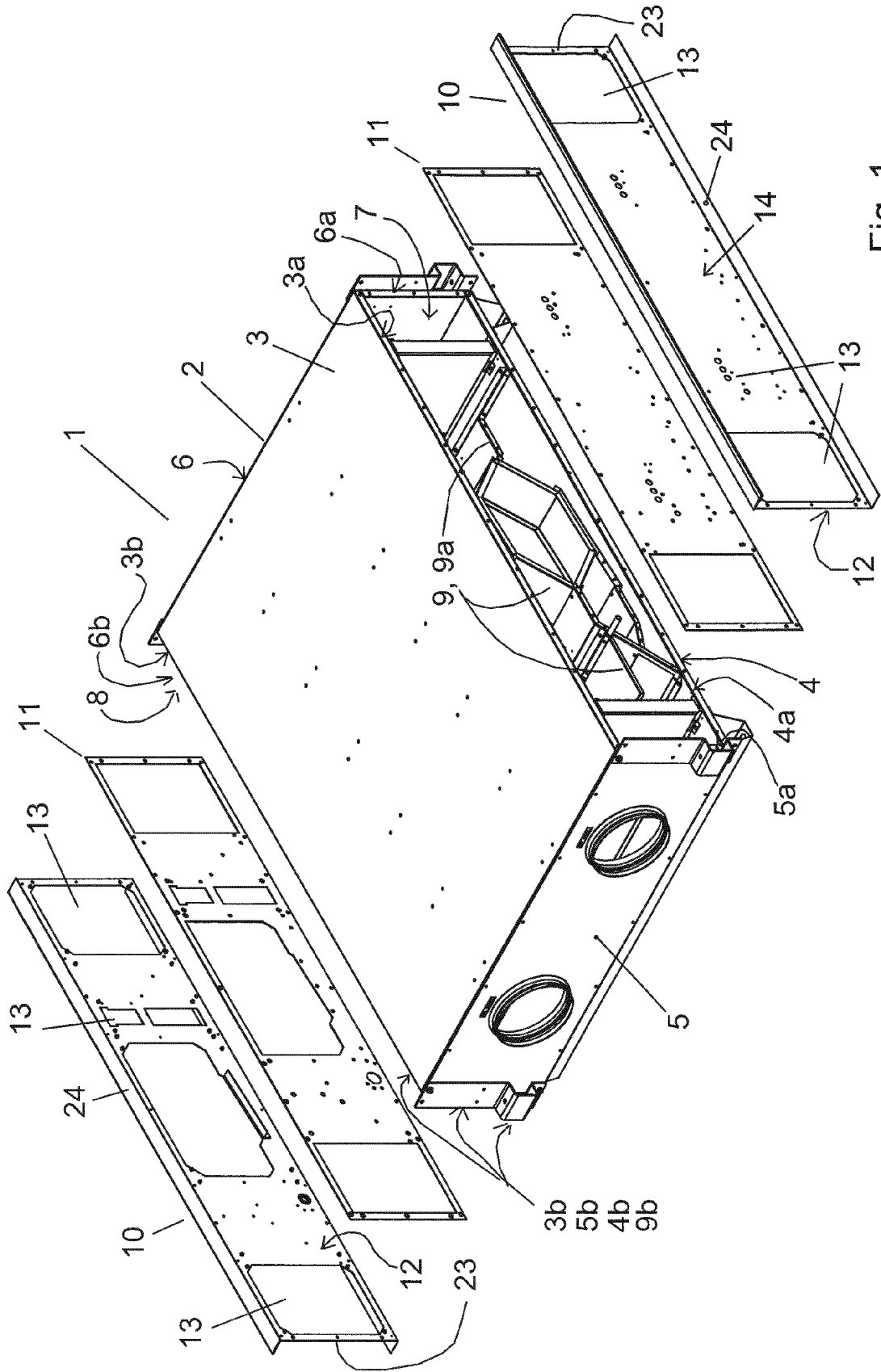


Fig. 1

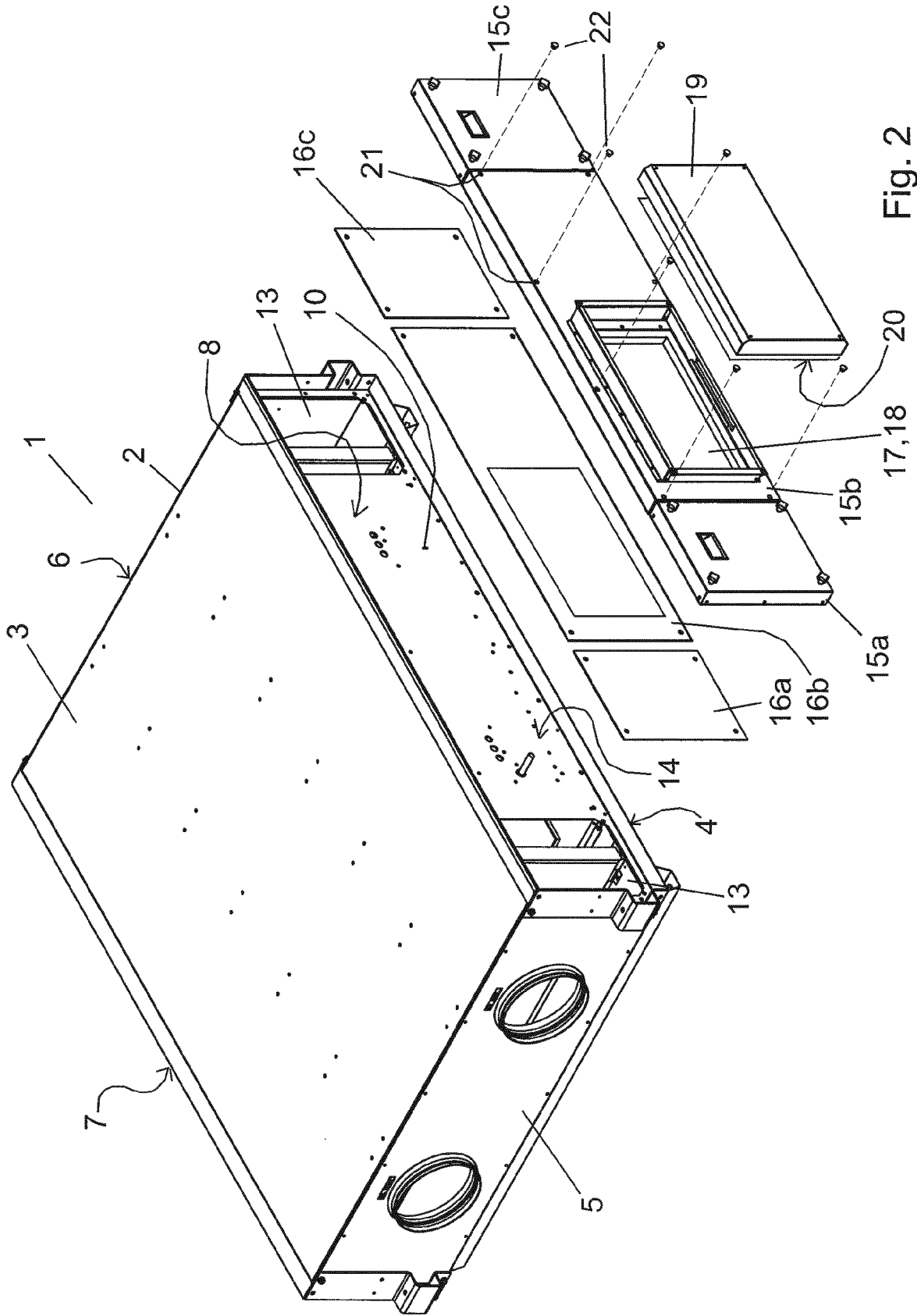


Fig. 2





EUROPEAN SEARCH REPORT

Application Number  
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The present search report has been drawn up for all claims			
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ANNEX TO THE EUROPEAN SEARCH REPORT  
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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