(19) DANMARK

Patent- og
Varemærkestyrelsen

(10) **DK/EP 3945761 T3**

(12) Oversættelse af
europæisk patentskrift

(51) Int.Cl.: ***H 05 K 7/20 (2006.01)*** ***H 02 B 1/56 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2024-10-21**

(80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2024-09-11**

(86) Europæisk ansøgning nr.: **20188597.7**

(86) Europæisk indleveringsdag: **2020-07-30**

(87) Den europæiske ansøgnings publiceringsdag: **2022-02-02**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **KABELINSTALLATIONSHUS MED KØLING**

(56) Fremdragne publikationer:
EP-A1- 3 772 876
DE-A1- 102008 022 000
DE-B3- 102008 056 062
DE-U1- 29 823 425

Cable installation housing with cooling

The present invention relates to a cable installation housing for signal cables that can be cooled by a fan.

Cable installation housings are known per se, e.g. as so-called distribution cabinets indoors (inside buildings) and outdoors. These are housings in which lines, in this case signal lines (in particular for telecommunications), enter and/or exit, are coupled with one another, pass through signal amplifiers, are coupled to signal converters (e.g. from electrical to optical signals and vice versa) or similar.

Such housings have the task of protecting their interior against mechanical damage and soiling. In this context, cable installation housings with double housing walls have already been used, in particular with side walls that have an outer wall in addition to an inner wall.

DE102008022000 A1 discloses a cabinet-like housing for receiving heat-generating electrical/electronic components.

The present invention is based on the problem of providing a cable installation housing for signal cables that is improved in terms of its functionality.

For this purpose, the invention is directed to a cable installation housing for signal cables according to claim 1.

The invention is initially based on the consideration that the interior may require cooling, at least in the case of certain installation locations and certain cable installations. This concerns, for example, semiconductor components sensitive to elevated temperatures as part of devices provided in the cable installation housing, e.g. amplifiers, signal processing circuits, electrically operated signal converters (and controlled by electrical signals) for generating optical signals, optoelectronic sensors for receiving optical signals and converting them into electrical signals, etc. Such components can be damaged if, for example, excessive temperatures are generated inside the cable construction housing due to direct sunlight and corresponding heating.

In addition, active components may generate a considerable amount of waste heat, which can lead to problems in addition to solar radiation or high outside temperatures, or even independently of these.

Such problems collide with the fundamental need to protect the interior against soiling (and thus not simply to make it more or less open, especially at the top).

Accordingly, the invention provides a fan for cooling the interior, this fan being connected to a space between the housing walls. This intermediate space corresponds to the intermediate space between the inner and outer walls on at least one double part of the housing walls. By connecting to the fan, such an intermediate space is penetrated by a forced air flow and thus cooled, at least in typical problem situations. Thus, the intermediate space can be cooled by the air flow when the outer wall is exposed to sunlight or when there is a considerable build-up of heat in the interior and the inner wall heats up accordingly. Preferably, the intake or discharge side of the fan is connected exclusively to one or more such intermediate spaces.

In principle, the fan could of course circulate the air in the intermediate space and/or exchange it with air in another region of the line installation housing, such as another intermediate space (e.g. on the side facing away from the sun). However, ventilation takes place against the environment outside the line installation housing. For this purpose, the outer wall can, for example, have ventilation openings through which the intermediate space can exchange air with the environment to a certain extent. The fan can therefore blow ambient air into the intermediate space with its discharge side, where it is partially or completely discharged to the outside through the ventilation openings, or conversely, it can draw air from the intermediate space with its intake side and discharge it into the environment, wherein the intermediate space draws in ambient air through the ventilation openings.

The fan (in the fully installed operating state of the cable installation housing) is preferably arranged above the interior or the intermediate space, i.e. in the upper region of the cable installation housing. In this region, the placement of an additional component is particularly unobtrusive because neither the installation depth nor the width has to be changed. If the fan is connected with its intake side to the intermediate space, it can be supported by a convection flow that may occur in the intermediate space to a certain extent anyway and does not have to work against it. Preferably, the fan is separated from the interior by a wall and preferably arranged in its own housing (possibly with further components, which will be discussed later). Again preferably, the fan is arranged more on the edge of the upper region of the line installation housing and can thus, if it is the edge associated with the intermediate space, be easily connected to the intermediate space. The arrangement at the edge is also advantageous for the combination with a condensation fan, which will be discussed in more detail.

The intermediate space preferably has a vertical format, which is particularly advantageous in combination with the above arrangement of the fan and support by convection and otherwise also fits in well with the typical dimensions of cable installation housings. I. e. it is at least higher than it is wide (from the perspective of looking towards a door of the housing that can be opened) and preferably also higher than it is deep, although this statement does not necessarily apply to all intermediate spaces.

Further, the inner wall can be made of sheet metal and thus, even without ventilation holes and with a structure that is largely sealed to prevent soiling, can still effectively transfer heat from the inside to the outside. Of course, the sheet metal wall can also have additional reinforcing structures made of other materials or metal elements that cannot be described as sheet metal. The housing can also be made of sheet metal. However, plastic housings, e.g. made of polycarbonate, can also be advantageous.

The invention provides for an active cooling unit for cooling the interior of the housing, whereby "active" means the use of a refrigerant circuit with compressor, evaporator and condenser. Such a cooling unit can be used to handle particularly demanding thermal tasks. An evaporator fan is provided for the evaporator and also a condenser fan for the condenser, wherein these fans are each provided to exchange air around the corresponding refrigerant heat exchangers, e. g. to generate an air flow past conduit coils. At least one of these two fans can then be the fan already described for connection to the intermediate space, in particular the condenser fan. For example, the condenser fan can draw in air from the intermediate space and blow it into the condenser in order to dissipate the heat generated there (in particular to the outside environment).

A further fan, in particular another of the two cooling unit fans and in particular the evaporator fan, can be connected to the interior. Preferably, this is done with the intake side and the discharge side of this fan, so that a temperature stratification in the interior is mixed up. This is advantageous insofar as introducing outside air into the interior creates additional risks of soiling, firstly due to the necessary openings themselves and secondly due to the forced air transport through them. Instead, with a recirculated air solution in the interior, this can be largely separated from the outside environment. Nevertheless, stratification can be counteracted and the air flow can also promote heat transfer to the surrounding walls and thus also to the intermediate space (or, where there are no double walls, to the surroundings). If it is the evaporator fan, this can of course transfer the heat generated in the interior to the evaporator and thus support active cooling.

However, even when the compressor is not in operation, the two fans can contribute to cooling the interior, in principle each individually and of course especially both in combination. This applies in particular to situations with a cooling requirement in which operation of the compressor should or can still be avoided. Thus, by operating at least one of the two fans, in particular the fan connected to the intermediate space, a significant thermal improvement can be achieved despite the avoidance of active cooling in the sense of compressor operation due to the described air flows. This means that the temperature switch-on thresholds for the cooling unit can be increased and the noise level and energy consumption can be further reduced.

For example, you can imagine that in the morning only one or both of the fans described are running at first and then, as the sunlight and/or ambient temperature increases, the refrigerant circuit with the compressor is also switched on at some point. Conversely, perhaps in the evening or late afternoon. If there is a higher cooling requirement, pure fan operation at night could be sufficient, for example, and the compressor could only be used during the day or only on warm or sunny days, etc.

A particularly preferred field of application is cable installations with converters for electrical/optical signal conversion, i.e. for transmitting signals between electrical signal lines on the one hand and optical signal lines on the other. These can be, for example, transitions from fiber optic lines to local copper line systems.

Finally, the invention is also directed to the category of use and the foregoing and following description are accordingly also to be understood in relation to this category.

The cooling problem according to the invention also occurs primarily with cable installation housings in outdoor areas, especially in sunlit situations and in the warm season, which is why cable installation housings designed for outdoor use or a corresponding use are preferred.

The invention is explained in more detail below with reference to an example embodiment.

In detail

Figure 1 is a perspective view of a line installation housing according to the invention with the front doors open and with a cooling unit mounted in the upper region;

Figure 2 shows in the lower region a top view of the line installation housing of figure 1, but after removal of the cooling unit and without the internal structure of figure 1, and in the upper region a side view on a reduced scale;

Figure 3 a front view of the cable installation housing of figure 1, again without internal structure;

Figure 4 a perspective view of the cooling unit visible at the top in figure 1 and figure 3, omitting the housing;

Figure 5 a perspective view of a part of the front housing part of figures 1 to 3 with acoustic panels.

Figure 1 shows a cable installation housing for fibre optical cable installations according to the invention. This housing has a lower part 1, a middle part 2 and an upper part 3. The lower part 1 is used to insert fiber optic cable bundles, for example rising from the ground under the cable installation housing, which then, divided into individual strands, pass through basically horizontal intermediate elements between the lower part 1 and the middle part 2 in a known form. A module unit 4 with a number of splice and patch modules stacked on top of each other is shown on the left in the middle section 2. An active electronic module is shown in the right-hand region, and further down an emergency power supply 6, whose battery 7 is shown in the lower part on the right. All these elements are shown as examples and, as far as elements 4 and 5 are concerned, in relatively small numbers. Other elements are used for so-called cable management, i.e. the orderly geometric routing of a large number of fiber optic cables not shown here, and are known per se.

The middle section can be closed at the front by two doors 8 and 9, which are open in the figures. It ends in the upper region in a horizontal partition, to be explained in more detail with reference to Figure 2, above which the upper part 3 with a cooling unit is shown. This cooling unit is accommodated in a housing with sheet metal walls and, as far as the inner technical part is concerned, is shown in more detail in Figure 4. In the square cut-out in Figures 1 and 3, the sheet metal housing has an insert 10, shown on the right in Figure 4, with slit openings separated by slats for the removal of exhaust air or waste heat and small ventilation openings pointing forwards in Figures 1 and 3.

Similar ventilation openings can be found with the reference sign 11 in the right side wall of the middle part 2 in Figure 1 and, on the opposite side, in the side view in Figure 2 above. These serve to ventilate a respective lateral intermediate space, because the two corresponding side walls of the middle part 2 of the cable installation housing are double-walled. This also applies, although it cannot be seen in the drawings, to the rear facing back in Figures 1 and 3. Further ventilation openings 12 can be found in the lower region of the two side walls and the rear wall, see Figure 2 above including the enlarged view at the top left.

In principle, the intermediate spaces could consequently be cooled by a passive convection flow, because the described ventilation openings 11 and 12 are arranged at very different heights. According to the invention, however, a forced flow is also provided through these intermediate spaces, using a condenser fan 13 of the cooling unit shown in more detail in Figure 4.

Figure 4 shows the aforementioned condenser fan 13 of the cooling unit on the right. It is connected via a funnel-shaped air guide housing 14 to the aforementioned insert 10 for discharging the warm exhaust air. To the left of the condenser fan 13, you can see the heat exchanger coils of the refrigerant circuit assigned to it, wherein this unit is labeled 15. The condenser fan 13 draws in air from this unit 15 as an axial fan (and guides it to the outside via the air guide housing 14 and the insert 10), wherein this air is drawn in from the internal volume of the housing of the entire cooling unit. It is fed into this internal volume through slit-like openings 16 attached to the upper sides of the respective intermediate spaces of the side walls and the rear wall, see Figure 2, so that a forced flow is created in the intermediate spaces and outside air is fed in through the previously mentioned ventilation openings 11.

Figures 1 and 3 also show ventilation slots at the front of the cooling unit housing, through which ventilation slots air is also supplied. This does not significantly impair the cooling effect of the forced convection flow already explained. However, the total cross-section of the supply air for the condenser fan 13 is increased by these ventilation slots of the cooling unit housing, which gives benefit when the compressor 16 and the refrigerant circuit are in full operation. In this full operation, ventilation would be somewhat scarce solely via the spaces between the double side walls. Of course, the size and number of openings between these spaces and the refrigeration unit housing could be increased to achieve a similar result.

Although, as Figure 4 indicates, the plate 17 has a trough shape (similar to the base plate of the entire cooling unit) to collect any condensate, it is also a deliberately heavy steel plate weighing approximately 2,000 g. This weight is determined empirically depending on the mass of the compressor and the mechanical properties of the elastomer feet 18 and 14 and plays a role in the suppression of structure-borne noise.

To the left of the condenser block consisting of the elements 13, 14 and 15, a refrigeration compressor 16 is shown, which stands on a separate mounting plate 17 with vibration-absorbing elastomer feet 18. The mounting plate 17 is mounted approximately square with four elastomer feet 18, wherein the compressor 16 itself stands on three further (smaller) vibration-absorbing elastomer feet 24 in this case and is coupled to the mounting plate 17 via these. In another preferred embodiment, this connection can also be designed with four elastomer feet 24, i. e. with a more square rather than triangular geometry.

Further to the left you can see an electronic micro-controller 19 and to the left of it an evaporator block, the left part of which is a radially acting evaporator fan 20. This is connected to the inner volume of the line installation housing at the bottom through an opening (not to the space between the left side wall). To the right of the evaporator fan is an air duct box 21, which is connected to the interior of the line installation housing via another opening at the bottom. In between is a block of heat exchanger coils 22 of the refrigerant circuit. This allows the evaporator fan 20 to draw in interior air (e.g. from below) and return air to the interior (e.g. via the air duct box 21). Even without operation of the refrigerant circuit or the compressor 16, the evaporator fan 20 can thus circulate and mix up the interior air in a manner already described.

Both fans are EC fans with controllable speed. This means that the fans can be operated at different speeds during operation of the refrigerant circuit and also outside of it, and therefore with only the unavoidable noise emission.

The entire technology described (in addition to the vibration-absorbing mounting of the plate 17 and the compressor 16) is mounted on a separate mounting plate 23, which in turn is mounted on the upper side of the middle part 2 of the line installation housing visible in Figure 2 via further vibration-absorbing elastomer feet.

Figure 4 shows various further largely free-running pipe portions of pipelines of the refrigerant circuit in the region of the air duct box 21 and the heat exchanger coil block 22 as well as around the compressor 16 and from there to the heat exchanger coil block 15. These lines are supported in a vibration-absorbing manner with the interposition of elastomer parts at some points, for example in Figure 4 to the left of the plate 17 and also to the right thereof and in the passage through the plate 17. Otherwise, however, they are specifically weighted at certain points, which is not shown in detail in Figure 4. In this way, resonance frequencies can be influenced and, in particular, reduced and the overall vibration behavior of the line system can be improved.

If there is no significant cooling requirement, the individual elements of the cooling unit remain out of operation and the line installation housing, in particular its central part 2, is cooled in a conventional manner by radiation and by passive convection of the air in the intermediate spaces between the double walls. When the cooling requirement increases, the refrigerant circuit, in particular the compressor 16, can initially remain out of operation and thus considerable savings in noise emissions and energy consumption can be achieved by initially using at least one of the two fans 13 and 20 described. The condenser fan 13 leads to an increased forced air flow through the intermediate spaces and the evaporator fan 20 mixes the interior air and thus distributes the waste heat more evenly. This avoids local temperature peaks at critical points, especially in power components. Depending on the individual case, only one of the two fans 13 and 20 can of course be used initially, wherein the speed of the fans 13 and 20 can of course also be adjusted, either additionally or alternatively.

If the cooling requirement continues to increase, the compressor 16 and thus the refrigerant circuit are switched on. The effects described remain, but the air returned to the interior by the evaporator fan is then actively cooled. The refrigerant circuit transports the waste heat to the heat exchanger 15 of the condenser fan, so that the waste heat generated there is then dissipated to the outside via the condenser fan 13, the air guide housing 14 and the insert 10. Both the mixing by the evaporator fan 20 and the suction convection support in the intermediate spaces are particularly effective because both fans with the cooling unit are arranged above the interior to be cooled.

The cooling requirement is typically not caused by fiber optic installations installed in the cable installation housing and associated passive components, but by active optoelectronic components and electronic circuits, such as those present in the assembly 5 shown as an example. The electronic components are typically also the most temperature-sensitive components. In this respect, the arrangement of the components in Figure 4 is not quite optimal in view of the arrangement of assembly 5 in Figure 1 on the right (and to a certain extent belongs to a right/left-swapped example). It makes sense to arrange the temperature-generating and the most temperature-sensitive components and assemblies below the evaporator fan 20, because in the active cooling mode it not only removes hot air and conveys actively cooled cold air downwards, but also counteracts a temperature peak caused by a heat build-up most effectively in the fan-only mode.

In the event of a possible power failure, such line installations, including the optoelectronic and electronic components as in the element 5, should continue to run at least in an emergency mode. Therefore, an emergency power supply 6 with a battery 7 is provided, which according to the invention is designed so that at least one of the two described fans 13, 20 of the cooling unit, preferably both, can continue to be operated. In this way, an improved basic cooling function can be provided for this emergency operation, which should generally be sufficient because emergency operation typically results in a reduced heat build-up.

In addition, the operation of the fans and the entire cooling unit can be temperature-controlled using appropriate temperature sensors at characteristic points or simply (based on empirical findings) be controlled by the time of day. If the line installation housing is typically set up outdoors or in any case exposed to sunlight, the components described can, for example, remain out of operation at night, a pure fan function could initially be started after sunrise in the course of the morning, for example, and active cooling with the refrigerant circuit and compressor 16 could then run around midday and until late afternoon, for example. Then, in the evening, it would be possible to switch back to pure fan operation and to stop this later in the evening.

Figure 5 shows the upper housing part 3 from Figures 1 to 3 by itself and without side parts (front side). For illustration purposes, inner acoustic panel coatings 25 are shown at the left end (which of course are actually only present inside the sheet metal walls). These are actually multi-layer panels 25, which on the one hand are relatively heavy layers on the outside (heavy foil) and on the other hand increasingly lighter layers with an insulating function towards the inside. Such coatings are basically completely provided inside the housing part 3 with the exception of the regions with the ventilation slots (as shown in Figure 5 and also on the right-hand side of Figures 1 to 3), i. e. at the top, rear, front and left. This also effectively reduces noise emissions.

PATENTKRAV

1. Kabelinstallationshus (1, 2, 3) til signalkabler, med husvægge, et indvendigt rum til installation af signalkabler indesluttet af husvæggene, hvor husvæggene har mindst delvis en indvendig væg og en yderligere udvendig væg af kabelinstallationshuset, der mellem sig afgrænser et mellemrum, en ventilator (13) til afkøling af det indvendige rum, hvor ventilatoren (13) er forbundet med mindst ét mellemrum af husvæggene, i drift tvinger en luftstrøm gennem den mellemrummet for afkøling af det indvendige rum, og hvor mellemrummet ventileres mod et miljø uden for kabelinstallationshuset, og kendetegnet ved en køleenhed (13-23) til aktiv køling af det indvendige rum, hvilken køleenhed (13-23) har et kølemiddelkredsløb med en kompressor (16) til kølemidlet, en fordamper (22) og en kondensator (15) og endvidere en fordamperventilator (20) og en kondensatorventilator (13), hvor mindst én fra gruppen af kondensatorventilatoren (13) og fordamperventilatoren (20) er ventilatoren (13) forbundet med mellemrummet.

2. Kabelinstallationshus (1, 2, 3) ifølge krav 1, hvor den mindst ene udvendige væg har ventilationsåbninger (11, 12) til mellemrummet og den mindst ene indvendige væg ikke har.

3. Kabelinstallationshus (1, 2, 3) ifølge krav 1 eller 2, hvor ventilatoren (13) er anbragt over det indvendige rum eller mellemrummet og er forbundet ved sin indsugningsside med det mindst ene mellemrum.

4. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor det mindst ene mellemrum har et vertikalt format.

5. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor den mindst ene indvendige væg består af en metalplade.

6. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor ventilatoren forbundet med mellemrummet er kondensatorventilator (13).

7. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor en yderligere ventilator, navnlig fordamperventilatoren (20), er forbundet med sin indsugningsside og sin udledningsside med det indvendige rum og udformet til at hvirvle en temperaturlagdeling deri.

8. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, udformet således, at køleenhedens (13-23) kondensatorventilator (13) forbindes med mellemrummet og drives i situationer med kølebehov med køleenhedens (13-23) kompressor (16) udkoblet, og således, at køleenheden (13-23), herunder kompressoren (16), drives i situationer med større kølebehov.

9. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav med en nødstrømforsyning (6, 7) til kabelinstallationen, fortrinsvis et batteri (7), udformet således, at i nøddrift og ved kølebehov mindst en del af køleenheden (13-23) drives og forsynes af nødstrømforsyningen (6, 7).

10. Kabelinstallationshus (1, 2, 3) ifølge krav 9, udformet således at i nøddrift og ved kølebehov mindst én fra gruppen af kondensatorventilatoren (13) og fordamperventilatoren (20) drives til køling, men ikke køleenhedens (13-23) kompressor (16).

11. Kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor en kabelinstallation i kabelinstallationshuset har omformere (5) til signaloverførsel mellem elektriske og optiske signalkabler eller omvendt, navnlig til telekommunikationskabler.

12. Anvendelse af et kabelinstallationshus (1, 2, 3) ifølge et af de foregående krav, hvor anvendelse af ventilatoren (13) forbundet med mellemrummet tvinger luftstrømmen gennem mellemrummet for at afkøle det indvendige rum.

13. Anvendelse ifølge krav 11, hvor anvendelse af kabelinstallationshuset (1, 2, 3) sker uden for en bygning i det fri.

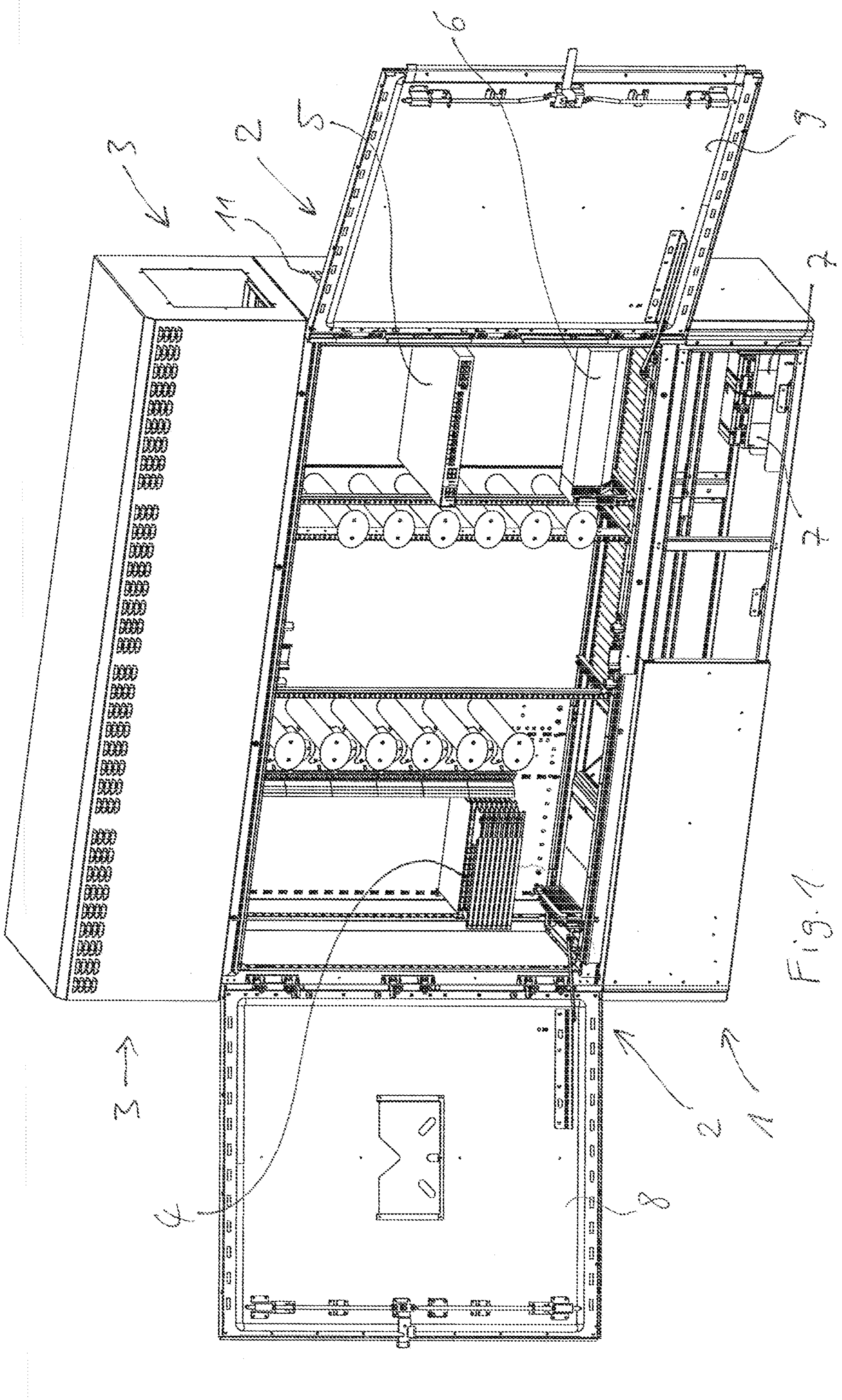

Fig. 1

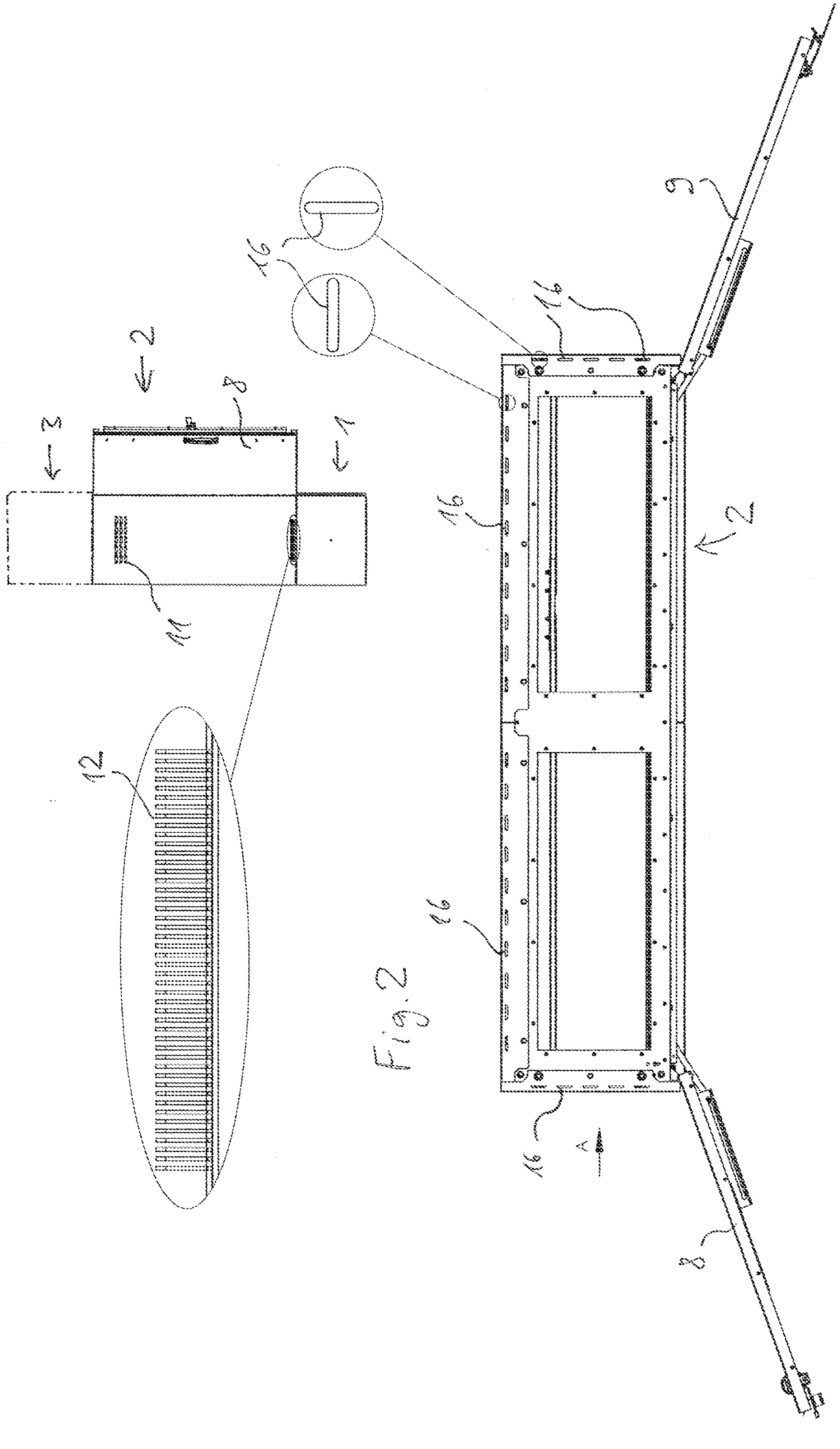

Fig. 2

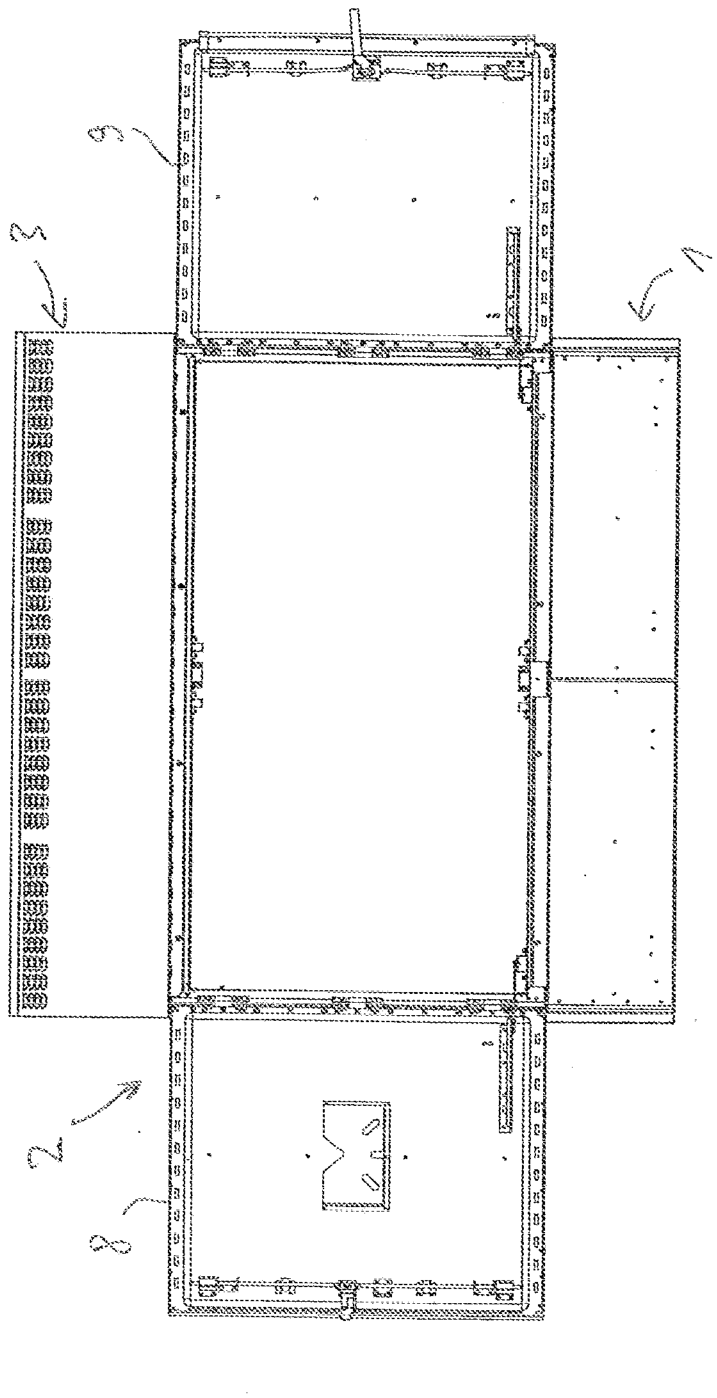

Fig. 3

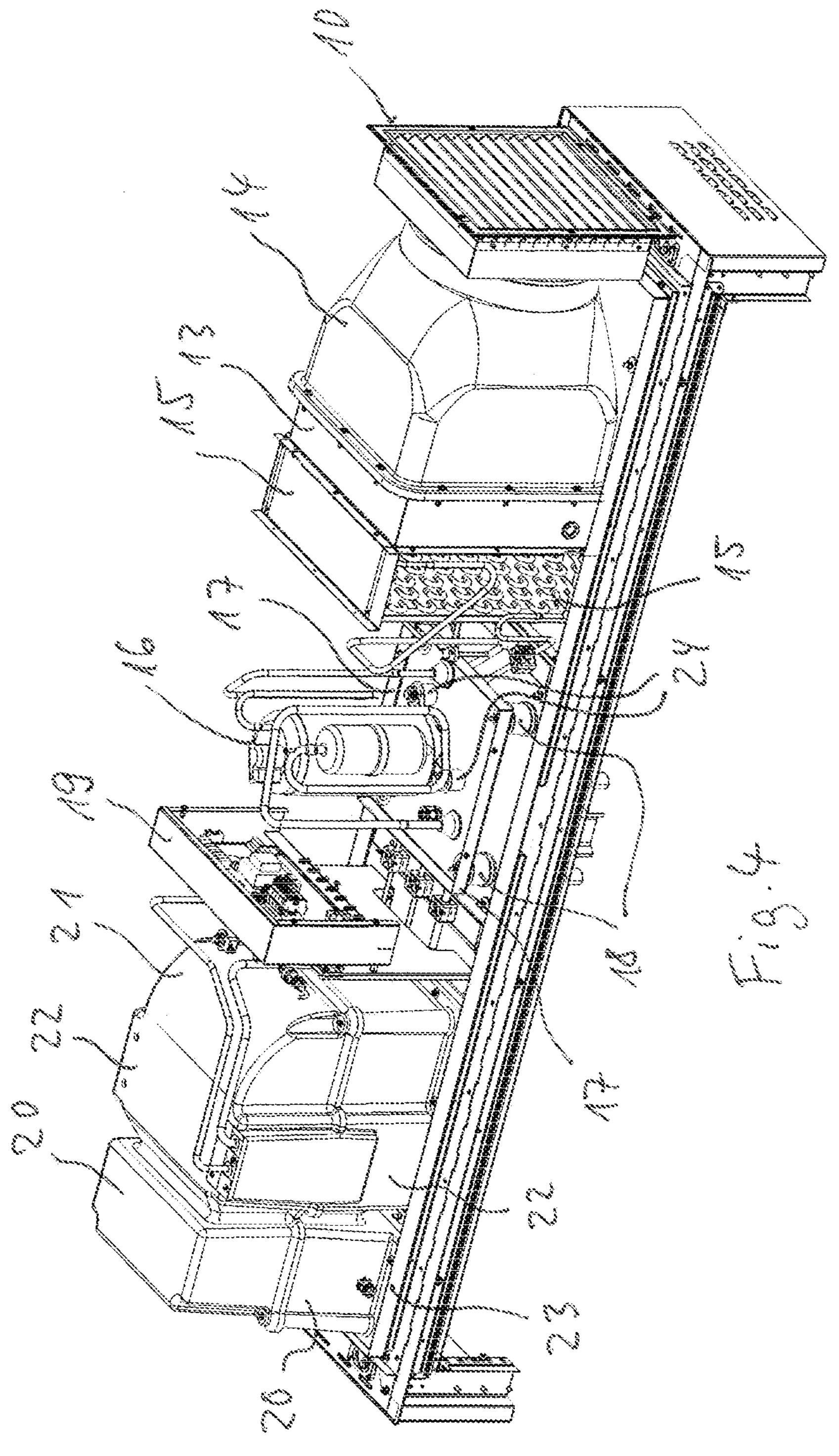

Fig. 4

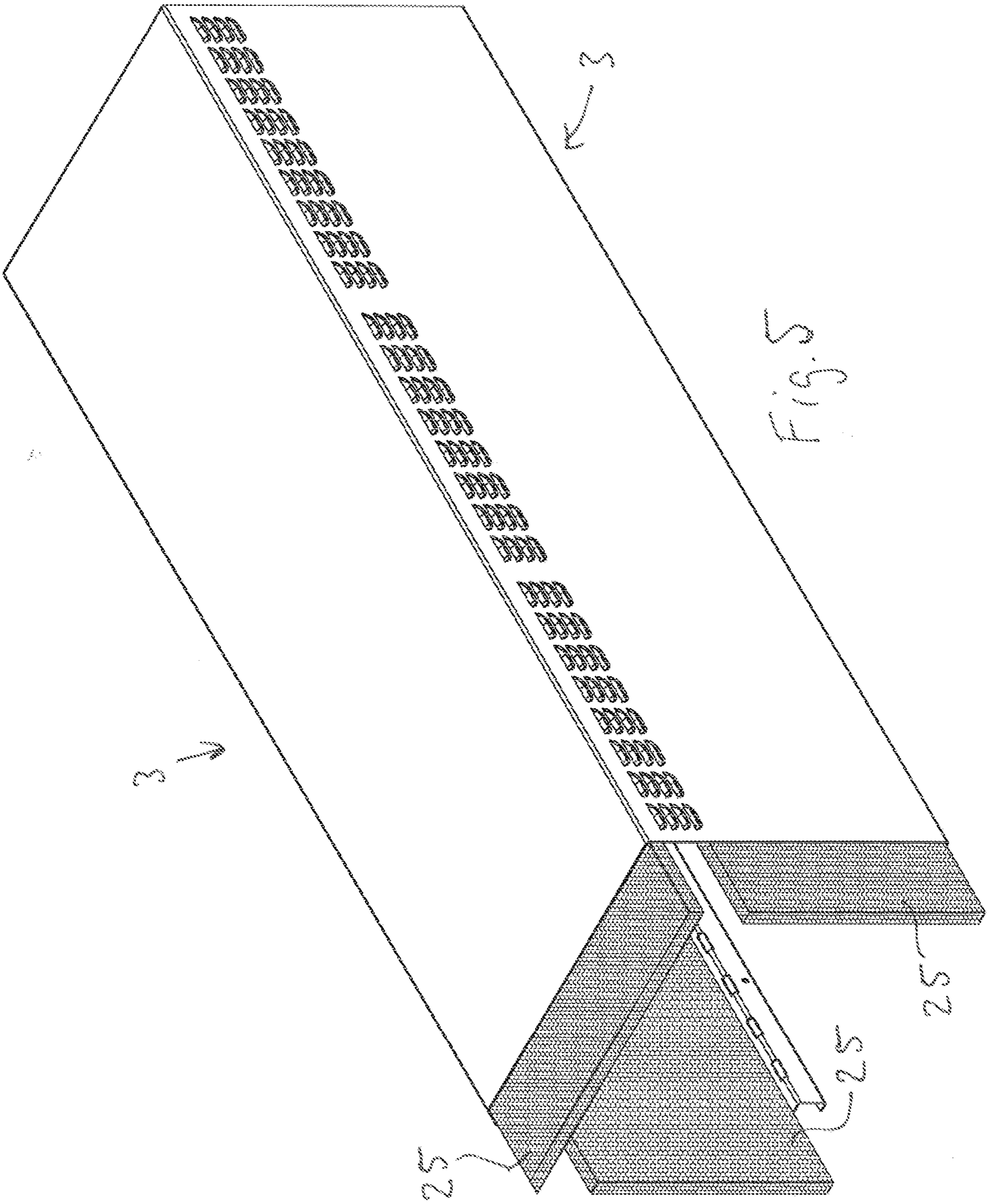

Fig. 5