

(19)



(11)

EP 3 764 006 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

13.01.2021 Bulletin 2021/02

(51) Int Cl.:

F24F 9/00 (2006.01)**F24F 13/06** (2006.01)**F24F 13/072** (2006.01)**E06B 9/11** (2006.01)**F25D 23/02** (2006.01)**E06B 9/02** (2006.01)(21) Application number: **20000239.2**(22) Date of filing: **03.07.2020**

(84) Designated Contracting States:

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

Designated Extension States:

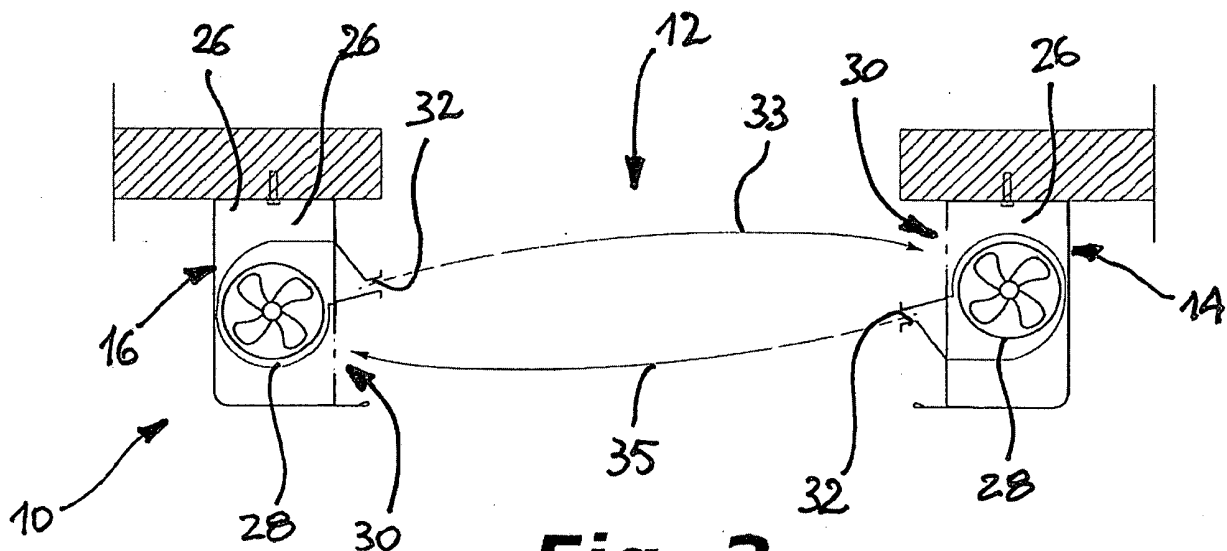
BA ME

Designated Validation States:

KH MA MD TN(71) Applicant: **B.PROJET S.r.l.****12040 Vezza D'Alba (CN) (IT)**(72) Inventor: **Benotto, Danilo****12040 Vezza D'Alba (Cuneo) (IT)**(74) Representative: **Cian, Paolo****Saconney & Cian****Corso Vittorio Emanuele II, 14****10123 Torino (IT)**(30) Priority: **08.07.2019 IT 201900011145**(54) **DEVICE FOR GENERATING AN AIR BLADE BARRIER**

(57) Device for generating an air blade barrier between two environments communicating through a passage (12) of a portal structure (10) which extends between a pair of opposite side uprights (14, 16) and between an upper crosspiece (18) and a base plane (20). The uprights (14, 16) have an inner cavity (26) connected to said passage (12), in which an air flow is admitted as a result of the activation of fan means (28) incorporated

in each upright (14, 16). Both the uprights (14, 16) have an inlet opening (30) to suck in an air flow from the passage (12), and an outlet opening (32) to allow the air flow to exit, with the purpose of continuously generating a double air blade barrier at the passage (12), which consists of a pair of independent air flows at opposite areas of the passage (12).

**Fig. 3****EP 3 764 006 A1**

Description

[0001] The present invention refers in general to portal structures for industrial use, adapted to separate two adjacent environments at different temperatures.

[0002] More particularly, the invention concerns a device for generating an air blade barrier between two environments in communication with each other through a portal structure that defines a passage.

[0003] The reduction or elimination of the heat exchanges between two adjacent environments at different temperatures, for example between a cold room and the outer environment at a higher temperature, or between a hot room and the colder outer environment, can be obtained by using a barrier of the so-called "air blade" type, essentially consisting of a continuous air flow that passes in parallel through the surface of a communication passage defined by a portal structure, between the two environments to be kept separated. The air flow of the barrier, which usually moves along a single direction, allows to prevent the air to pass from one environment to the other, so as to limit the heat exchange between the two environments and to facilitate the thermal insulation thereof.

[0004] More particularly, the invention concerns a device for generating an air blade barrier of the type defined in the preamble of appended claim 1.

[0005] A device for generating an air blade barrier of the type defined above, is disclosed by GB-2397116-A1. This document describes an industrial door having a pair of closure members that can be folded like an accordion in a position adjacent to a respective side upright of the portal structure in the open condition, which are supported in a laterally slidable manner. A fan arranged inside the upper cross member of the portal structure generates an air flow, for example having a horizontal direction, coplanar with a passage defined by the portal structure, which air flow is ejected from air discharge openings formed in a first upright and is sucked through openings formed in the second upright opposite to the first one, so as to generate a continuous circulation of air which pass through the passage to create an air blade barrier.

[0006] However, the device for generating an air blade barrier of this document is not particularly efficient in the operation.

[0007] The main object of the present invention is to propose a device for generating an air blade barrier, having an improved efficacy, the structure of which is simple so as to require rather low production costs and comprising modular elements to allow it to be adapted to different configurations of use.

[0008] This object is achieved thanks to a device for generating an air blade barrier of the type defined in the appended claims.

[0009] In particular, by virtue of the fact that the device comprises fan means incorporated in each of said uprights, that each upright comprises both said air flow inlet opening and said air flow outlet opening, and that the

device allows a pair of independent air flows to be generated at opposite areas of the passage of the portal structure, which create together a double air blade barrier, it is possible to obtain a device for generating an air blade barrier having very high seal characteristics for the heat exchange between the two environments upstream and downstream of the portal structure.

[0010] According to a preferred feature of the invention, a series of fans is mounted in each upright, which series comprises fans arranged at different heights with respect to the portal structure, the fans of each upright being arranged symmetrically with respect to the fans of the other upright. By virtue of this, it is possible to generate air blade barriers having differentiated intensity as a function of the height of the door, by selectively controlling and modulating the speed of rotation of the fans of the pairs of fans arranged at a same height.

[0011] According to another preferred feature, the speed of the air flow delivered by a pair of fans arranged at a same height in the two uprights is selectively controlled so that the respective air blade barrier portions generated by them are adapted to compensate for the heat exchange at that height.

[0012] According to yet another preferred feature of the invention, the device comprises at least one slidable closure member for closing said passage, each upright comprising at least one vertical guide rail for guiding the sliding of a side edge of said at least one closure member, said two air blade barriers generating a pair of air flows having opposite directions, both of which are arranged adjacent to said at least one closure member.

[0013] The association of the device for generating an air blade barrier with a closure member of the portal structure allows the characteristics of seal of heat exchanges between the two adjacent environments to be improved. Moreover, in this case, the speed of rotation of the fans of the pairs of fans arranged at a same height can be adjusted also taking into account the open portion of the passage as a function of the position of the closure member at that moment.

[0014] According to a further preferred feature of the invention, the two air blade barriers are both arranged on a same side of said at least one closure member. This makes it possible to generate a vortical flow by means of the two adjacent air blade barriers, which effectively traps possible foreign matters in the air flow, preventing these possible foreign matters to enter one of the two adjacent environments.

[0015] According to yet a further preferred feature, the double air blade barrier consists of a first air blade barrier arranged on the side of a first side of said closure member, and of a second air blade barrier arranged on the side of a second side of said closure member. Also this type of double air blade barrier, which includes an air blade barrier on each side of the closure member, allows a sort of vortical movement of the air to be generated around the closure member, which allows a very effective seal to be obtained against the heat exchange between

two adjacent environments at different temperatures.

[0016] Further characteristics and advantages of the invention will be more clear from the following detailed description, which has been provided as a non-limitative example and is referred to the attached drawings in which:

Figure 1 is a schematic perspective view of a portal structure provided with a device for generating an air blade barrier;

Figure 2 is a front elevational view of Figure 1, from the side indicated by arrow II of Figure 1;

Figure 3 is a schematic top elevational view sectioned along the line III-III of Figure 2, of a device for generating an air blade barrier according to a first embodiment of the invention;

Figures 4 and 5 are views similar to Figures 1 and 2, respectively, of a device for generating an air blade barrier to which a movable closure member is associated, for example consisting of a flexible and rolling curtain;

Figure 6 is a schematic top elevational view sectioned along the line VI-VI of Figure 5, showing a device for generating an air blade barrier according to another embodiment of the invention;

Figures 7 and 8 are front elevational views of each of the uprights of the door of Figure 6, from the side of arrows VII and VIII, respectively;

Figure 9 is a view similar to Figure 6, of a device according to a third embodiment of the invention;

Figures 10 and 11 are front elevational views of each of the uprights of the door of Figure 9, from the side of arrows X and XI, respectively;

Figure 12 is a view similar to Figure 6, of a device according to a fourth embodiment of the invention; Figures 13 and 14 are front elevational views of each of the uprights of the door of Figure 12, from the side of arrows XIII and XIV, respectively;

Figure 15 is a view similar to Figure 3, of a device according to a fifth embodiment of the invention;

Figures 16 and 17 are front elevational views of the uprights of the door of Figure 15, from the side of arrows XVI and XVII, respectively; and

Figures 18 and 19 are front elevational views of each of the uprights of a device of the invention according to a possible modification.

[0017] With initial reference to Figures 1 to 3 of the drawings, a device for generating an air blade barrier according to a first embodiment of the invention comprises a portal structure indicated 10 as a whole. The structure 10 defines a passage 12 between a pair of opposite vertical uprights 14 and 16, as well as between a horizontal upper cross member 18 which is connected to the upper ends of the uprights 14 and 16, and a base plane 20.

[0018] Each upright 14, 16 has an inner cavity 26 in which a series of respective fans 28 are mounted, which

are placed at different heights, the fans 28 being arranged symmetrically in the two uprights 14, 16.

[0019] The inner cavity 26 of each upright 14, 16 communicates with the passage 12 through an input opening preferably formed by aligned series of holes 30, and an outlet opening in the form of a longitudinal slit 32.

[0020] In particular, each upright 14, 16 comprises a series of openings, or holes, 30 for entry of the air flow, and a respective slit 32 for the exit of the air flow, the series of holes 30 and the slit 32 extending substantially parallel to the corresponding upright 14, 16. In the configuration of use of the portal structure 10, that is with the uprights 14 and 16 arranged opposite to each other, the series of holes 30 and the slit 32 of the upright 14 face directly the slit 32 and the series of holes 30 of the upright 16, respectively.

[0021] Between the series of holes 30 of an upright and the slit 32 of the opposite upright, a continuous air flow is generated which constitutes a corresponding air blade barrier indicated 33 and 35 in Figure 3.

[0022] In the operation, and as a result of the activation of the fans 28, an air flow is sucked into the inner cavity 26 of the uprights 14, 16 from the passage 12 through the respective series of holes 30. The sucked air flow is then ejected by the various fans 28 by means of a common diffuser for each upright 14, 16, which has a longitudinal slit 32 so as to allow a corresponding continuous air blade barrier 33, 35 to be created. The two air blade barriers 33, 35 coming out from the two slits 32 of the uprights 14, 16, respectively, pass through the passage 12 with opposite directions of flow, creating a pair of independent air flows at opposite areas of the passage 12 of the structure 10, which constitute together a double air blade barrier. In this manner, a good seal is achieved towards the heat exchanges between the two adjacent environments to be isolated to each other, that is between the two environments upstream and downstream of the portal structure 10. The two air blade barriers 33 and 35 having opposite directions of flow, then generate a sort of vortex that allows a better seal for the heat exchanges, and which allows to effectively confine possible impurities or foreign agents present in the air flow passing through the passage 12.

[0023] By selectively adjusting the speed of the pairs of fans 28 placed at the same height in the two uprights 14 and 16, it is possible to change the intensity of the air flow as a function of the height with respect to the portal structure 10, in order to obtain a series of desired effects, for example to better compensate the heat exchange between the two environments in areas located at different height of the portal structure, and/or to modify the intensity of the air flow at specific zones of the passage 12, for example at an area close to that of the head of the users in order to improve the comfort of the users passing through the flow passage 12.

[0024] With reference to Figures 4 to 8 of the drawings, another embodiment of the invention comprises the same portal structure 10 already described for the pre-

vious embodiment, to which a movable closure member 22 is associated, for example consisting of at least one flexible and vertically slidable curtain, for closing the passage 12. Typically, the flexible curtain 22 is made by means of a continuous sheet of plastic or plasticized textile material, having a transverse upper edge secured, in a per se known manner, to a rotatable winding shaft (not shown) housed inside the cross member 18. The rotation of the winding shaft about its own axis is controlled by a motorized control unit that can be operated by a user, for example by means of one or more control buttons 23, by means of which the quick rising and descent of the curtain 22 into the passage 12 can be controlled, which forms in this manner a closure of the "quick sliding" type, that is in which opening and closing are performed with a relatively high speed, or by an automatic control including sensors of a known type adapted to detect the passage of a body in the vicinity of the passage 12. Despite this, the movable closure member 22 could be different from the curtain considered above, and be movable with respect to the opening 12 in a not quick manner, according to a conventional operation.

[0025] To allow the movement of the closure member 22, the device comprises a pair of guide rails 24, each of which is rigidly connected to a respective vertical upright 14, 16, in which the opposite side edges of the curtain 22 are slidably engaged.

[0026] In particular, the guide rail 24 of the upright 14 is arranged in a position more adjacent to the upstream environment with respect to the portal structure 10. An elongated slit 32 extending longitudinally along the respective upright in order to allow the air flow to exit, is formed at a position parallel to and spaced from said rail 24, a series of inlet openings, or holes, 30 being interposed between the rail 24 and the slit 32. The opposite upright 16 also includes a guide rail 24 facing the guide rail 24 of the upright 14, which extends longitudinally with respect to the relevant upright and a series of inlet openings, or holes, 30, in a position parallel to and spaced therefrom, a respective elongated slit 32 being interposed between the rail 24 and the series of holes 30.

[0027] In the operation of this embodiment, as a result of the activation of the fans 28, an air flow is sucked into the inner cavity 26 of the uprights 14, 16 from the passage 12 through the relevant series of holes 30. The sucked air flow is then ejected from the various fans 28 into the passage 12 by means of a common diffuser for each upright 14, 16, through a longitudinal slit 32 so as to allow a pair of continuous and independent air blade barriers to be created, indicated by 34 and 36 in Figure 6, at the passage 12. The two air blade barriers 34, 36 coming out from the two slits 32, pass through the passage 12 along opposite directions of flow and at respective positions substantially adjacent to the curtain 22, which allows an optimum seal to be obtained towards the heat exchanges between the upstream and downstream environments of the curtain 22, also when the curtain 22 is raised to allow passing through the passage 12. The two

air blade barriers 34, 36 having opposite air flow directions, generate a vortical circulation with a vertical axis arranged at the center of the passage 12, which enables a better seal of thermal exchanges, and allows also to confine effectively possible impurities or foreign agents present in the air flow.

[0028] By selectively adjusting the speed of the pairs of fans 28 placed at the same height in the two uprights 14 and 16, it is possible to change the intensity of the air flow as a function of the height with respect to the door 10, so as to better oppose the heat exchange between the two environments at areas located at different height of the portal structure, and/or to change the intensity of the flow during raising of the curtain 22 and when it is fully raised, and/or to modify the intensity of the air flow at specific zones of the passage 12, as already described for the previous embodiment.

[0029] In this manner, at least one of the air blade barriers laps at least partially onto the closure member 22, or a zone adjacent to it, thus preventing a direct contact between this closure member and the air of the environment downstream of the portal structure, thus limiting the heat exchange between the two environments even when the closure member moves along the portal structure to allow the passage of persons and/or objects.

[0030] In a third embodiment of the invention shown in Figures 9 to 11, and without prejudice to the general characteristics already described above, each of the uprights 14, 16 comprises a respective guide rail 24 for the sliding engagement of the opposite edges of the curtain 22. Moreover, an inlet opening consisting of the series of holes 30 is formed in each upright 14, 16 on one side of the rail 24, as well as a respective longitudinal slit 32 that constitutes the air flow outlet opening, at the opposite side of the guide rail 24. Since the uprights 14, 16 in the mounted condition have respective rails 24 placed at a central position, and the series of holes 30 and the respective longitudinal slit 32 at respectively opposite positions, the two uprights have a symmetrical shape.

[0031] More particularly, the series of holes 30, or air flow inlet openings, extends in a zone close to the guide rail 24 of each upright 14, 16, at an upstream side with respect to the guide rail 24, while the air flow output slit 32 extends in each upright 14, 16 on the downstream side with respect to the guide rail 24, so that the series of air flow inlet openings 30 and the air flow outlet slit 32 are arranged on each upright at opposite positions with respect to the relative guide rail 24, and facing the series of apertures 30 and the slit 32 of the opposite upright.

[0032] In the operation, as a consequence of the activation of the fans 28 of the uprights 14, 16, an air flow is sucked from the upstream environment and close to the passage 12 through the series of holes 30 of the uprights 14, 16. This air flow provides a pair of substantially diverging half air blade barriers, indicated by 38 in Figure 9, which lap at least partially onto the side of the curtain 22 facing the upstream environment. This air flow reaches the series of fans 28 of the uprights 14, 16 and is then

ejected by a common diffuser for each upright 14, 16 through a respective discharge longitudinal slit 32, thus providing a pair of half air blade barriers 40 downstream of the curtain 22, according to two flows that converge toward a central region of the passage 12, which lap at least partially onto the downstream side of the curtain 22.

[0033] The two air blade barriers thus formed, each consisting of a pair of half-barriers 38 and 40, pass through the passage 12 with generally opposite flow directions with respect to the plane of the passage 12, and at a position substantially adjacent to the opposite sides of the curtain 22, which allows an optimum seal to be obtained towards the heat exchanges between the environments upstream and downstream of the curtain 22, even when the curtain 22 is raised to allow the passage through the passage 12. The air blade barriers each constituted by the two half-barriers 38 and 40 generate a continuous vortical circulation at the central part of the passage 12, which allows to improve the seal against the heat exchanges between the two environments upstream and downstream of the curtain 22, and to confine and/or effectively expel possible impurities or foreign agents present in the air flow.

[0034] In this case also, the speed of the pairs of fans 28 placed at the same height in the two uprights 14 and 16 can be selectively adjusted in order to change the intensity of the air flow at the passage 12 as a function of the height, for the same purposes mentioned above in connection with the previous embodiments.

[0035] Figures 12 to 14 of the drawings show a fourth embodiment of the invention. In this case, and without prejudice to the general characteristics of the device described above, each upright 14, 16 has, at a substantially central position, a respective guide rail 24 for the slidable engagement of a corresponding edge of the curtain 22. Each upright 14, 16 further comprises an inlet opening consisting of the series of holes 30, at one side of the respective rail 24, and a respective longitudinal slit 32 constituting the air flow outlet opening, at the opposite side of the guide rail 24 with respect to the series of holes 30. In particular, the series of holes 30 and the respective longitudinal slit 32 of the upright 14 are arranged at opposite sides with respect to the series of holes 30 and to the respective longitudinal slit 32 of the upright 16. Therefore, as it can be seen from Figures 10 and 11, the uprights 14 and 16, in the mounted condition, have substantially the same shape.

[0036] The series of holes 30, or air flow inlet openings, of each upright 14, 16 extend at a zone close and on the side of the guide rail 24, while the air flow output slit 32 extends in each upright 14, 16 on the side opposite to the series of holes 30 with respect to the guide rail 24, the series of air flow inlet openings 30 and the air flow outlet slit 32 being provided on the relevant upright 14, 16 on opposite sides with respect to the respective guide rail 24.

[0037] In the operation of the device according to this embodiment, the activation of the fans 28 causes the

suction of air flows from the passage 12 to the hollow zone 26 of the uprights 14, 16, through the series of holes 30 of these uprights. These air flows indicated by 42 and 44 in Figure 12, come out from the slits 32 of the two uprights 14 and 16 because of the action of the fans 28, until they reach the series of holes 30 of the opposite upright, after passing through the passage 12, owing to the suction action performed by the fans 28.

[0038] Therefore, the air flow 42 upstream of the curtain 22 generates a first air blade that laps onto the side of the curtain 22 facing the upstream environment, while the air flow 44 downstream of the curtain 22 generates a second air blade that laps onto the side of the curtain 22 facing the downstream environment, the two air blades having air flow directions opposite to one another.

[0039] In the lowered position of the curtain 22, the two air flows 42 and 44 creates two independent air blade barriers, which are separated owing to the presence of the curtain 22.

[0040] The double air flow 42, 44 of this embodiment in practice provides two continuous air blade barriers 42 and 44 adjacent to the inner face and to the outer face of the curtain 22, respectively, which form a continuous circulation of air that surrounds the curtain 22, which makes it possible to keep separated the environments upstream and downstream of the curtain 22 close to the passage 12, and to prevent the access of foreign matters in the respective environments.

[0041] When the curtain 22 is raised to open the passage 12, the two air blade barriers 42 and 44 with opposite flow directions become adjacent to each other and, in a manner similar to that described for the previous embodiments, allow a vortical air flow circulation to be generated, with a vertical axis arranged substantially at the center of the passage 12, which allows the seal to be made highly effective for the heat exchanges between the two environments, as well as to confine and/or expel any impurities or foreign agents present in the air flow.

[0042] In this case also, the speed of the pairs of fans 28 placed at the same height in the two uprights 14 and 16 can be selectively adjusted in order to change the intensity of the air flow in the passage 12 as a function of the height, for the same purposes mentioned above in connection with the previous embodiments.

[0043] Figures 15 to 17 of the drawings show a fifth embodiment of the invention. In this case, and without prejudice to the general characteristics of the device described above, the passage 12 defined by the portal structure 10 can be closed by a pair of parallel flexible curtains 22, 22a, whose sliding movement can be coordinated.

[0044] The side edges of the two curtains 22, 22a slidably engage respective pairs of vertical guide rails 24, two of such guide rails 24 being fixed to each of the uprights 14, 16. Between the two guide rails 24 of each upright 14, 16 there is a series of air flow inlet openings, or holes, 30 and an air flow outlet slit 32.

[0045] More particularly, each upright 14, 16, at its re-

gion interposed between the two guide rails 24 thereof, comprises an inlet opening consisting of the series of holes 30, and a respective longitudinal slit 32 that constitutes the air flow outlet opening. The series of holes 30 and the longitudinal slit 32 of a respective upright 14, 16 are arranged opposite, so that the series of holes 30 and the slit 32 of the upright 14 face directly facing and are opposite to the slit 32 and to the series of holes 30 of the upright 16, respectively. Therefore, as it can be seen in Figures 16 and 17, the uprights 14 and 16 in their mounted condition have substantially the same shape.

[0046] The upright 14, at an area close to one of the guide rails 24 of the first curtain 22, that is of the curtain 22 closest to the upstream environment, comprises the series of air flow inlet holes 30, and then the air flow outlet slit 32, after which the second guide rail 24 of the other curtain 22a, that is of the curtain arranged closest to the downstream environment with respect to the portal structure, extends, the two guide rails 24 being parallel to each other. In a similar manner, the upright 16 comprises the air flow outlet slit 32 at a zone thereof close to one of the guide rails 24 of the first curtain 22, and then the series of air flow inlet holes 30, after which the guide rail 24 of the other curtain 22a is provided, also the two guide rails 24 of the upright 16 being parallel to each other. In particular, the series of air flow suction openings 30 of an upright 14, 16 is positioned opposite to the slit 32 of the air flow of the other upright, and vice-versa.

[0047] In this embodiment, a pair of air blade barriers having opposite direction are generated between the two parallel flexible curtains in their lowered and closed condition, each being adjacent to one of the faces of the two flexible curtains 22, 22a so as to generate a vortical air flow circulation between the two curtains 22 and 22a.

[0048] In particular, a first air flow indicated by 46 in Figure 15, come out from the slit 32 of the upright 16 and, after having passed through the passage 12, it is sucked through the series of holes 30 of the other upright 14. This first air flow laps onto the downstream face of the curtain 22 creating a first air blade barrier close to the curtain 22.

[0049] A second air flow comes out from the slit 32 of the upright 14 and, after having passed through the passage 12, it is sucked by the other upright 16 through the respective series of holes 30. This second air flow, indicated 48 in Figure 15, laps onto the upstream face of the second curtain 22a creating a second air blade barrier in the vicinity of the curtain 22a.

[0050] When the two curtains 22 and 22a are both in their lowered configuration of closure of the passage 12, the two air blade barriers 46 and 48 having opposite direction are adjacent, and their behavior and operation is similar to that described with reference to the second embodiment. The continuous air circulation of the flows 46 and 48 of the two air blade barriers generates a vortical circulation with a vertical axis arranged substantially at the center of the passage 12, which allows the seal towards the heat exchanges between the two environ-

ments to be made highly effective, as well as any impurities or foreign agents present in the air flow to be confined and/or expelled.

[0051] In the raised configuration of only one of the curtains 22 or 22a, the behavior of the two air blade barriers is identical or similar to that one described for the second embodiment of the invention, while in the raised configuration of both the curtains 22, 22a the behavior of the two air blade barriers is identical to that described for the first embodiment of the invention.

[0052] Also in the case of the present embodiment, the speed of the pairs of fans 28 placed at the same height in the two uprights 14 and 16 can be selectively adjusted in order to change the intensity of the air flow in the passage 12 as a function of the height, for the same purposes mentioned above in connection with the previous embodiments.

[0053] With reference to Figures 18 and 19, there is schematically shown a modification of the structure of the side uprights 14, 16 of the portal structure 10, each of which is made by joining a pair of different sections indicated 14a, 14b and 16a, 16b, respectively. In particular, the uprights 14 and 16 of this modification have a symmetrical shape, and their upper longitudinal part, 14a and 16a, respectively, corresponds to the upper longitudinal part of the uprights of the third embodiment described above. In spite of this, their lower longitudinal part 14b and 16b, respectively, has a specular structure with respect to the upper longitudinal part. Each longitudinal upper or lower part of the uprights 14, 16 here shown, is provided with respective series of inlet air flow openings, or holes, 30 as well as with corresponding air flow output slits 32a, 32b, upper and lower, respectively, arranged on opposite sides for each upright 14, 16. Of course, the position of the fans 28 placed at the lower part 14b and 16b of the uprights 14, 16 is reversed with respect to the position of the fans 28 located at the upper part 14a and 16a, taking into account that each fan 28 must have its own discharge conduit directed at the relative slit 32.

[0054] Although in these Figures 18 and 19 the shape of the uprights 14 and 16 comprising guide rails 24 for the vertical sliding of the opposite edges of a curtain 22 has been considered, the configuration of these uprights in the case in which the device for generating an air blade barrier does not comprise a movable closure member, is achieved simply by eliminating the curtain 22 and the respective guide rails 24, so as to be able to adapt it for the use with the device of the first embodiment described above.

[0055] The arrangement of this modification has the purpose of improving locally, in particular at different heights of the portal structure 10, the seal against the positive or negative heat exchange between the two environments upstream and downstream of the portal structure 10, as a function of the height of the uprights 14, 16.

[0056] If, as often happens, the two environments to be isolated upstream and downstream of the door 10 are

at different temperatures, for example if the outer or downstream environment is hot and the inner or upstream environment is cold, in the absence of the curtain 22 or in its raised condition, there will be a higher tendency of penetration into the inner environment of a hot air flow coming from the outer environment through the upper portion of the portal structure, while the cold air flow of the inner environment will tend more to penetrate into the outer environment through the lower portion of the portal structure 10.

[0057] Therefore, when the inner environment with respect to the structure 10 is colder than the outer environment, and according to this modification, the upper part 14a, 16a of each upright 14, 16 sucks air from the colder inner environment and thus causes the formation of a usually colder pair of air barriers having opposite directions. Vice-versa, the lower part 14b, 16b of each upright 14, 16 sucks air from the hotter outer environment and causes the formation of a usually hotter pair of air barriers having opposite directions. In this manner it is possible to compensate at least in part the tendency of colder air of the inner environment to go out from the lower portion of the passage 12, and the tendency of the hotter air of the outer environment to penetrate through the upper portion of the passage 12 when the curtain 22 is missing or is raised.

[0058] Of course, other combinations of parts of the uprights 14, 16 are possible, for example comprising more than 2 parts having different configurations, taking into account also the fact that the inner environment could be hotter than the outer environment.

Claims

1. Device for generating an air blade barrier between two environments communicating with each other through a portal structure (10) that defines a passage (12), such a passage extending horizontally between a pair of opposite side uprights (14, 16) and vertically between an upper crosspiece (18) connected to such uprights (14, 16) at their upper ends, and a base plane (20), which uprights (14, 16) have an inner cavity (26) connected with said passage (12) and in which an air flow is admitted as a result of the operation of fan means (28) associated with the portal structure (10), a first upright (14, 16) having at least one inlet opening (30) to allow an air flow to be sucked from said passage (12), and a second upright (14, 16) having at least one outlet opening (32) to allow said air flow to exit in order to continuously generate said air blade barrier at said passage (12), **characterized in that** said fan means (28) are incorporated in each of said uprights (14, 16), **in that** each upright (14, 16) comprises both said air flow inlet opening (30) and said air flow outlet opening (32), and **in that** the device allows a pair of independent air flows to be generated at said passage

(12), at opposite zones of the passage (12) of the portal structure, which air flows create together a double air blade barrier.

2. Device according to claim 1, **characterized in that** a series of fans (28) is mounted in each upright (14, 16), which series comprises fans (28) arranged at different heights with respect to the portal structure (10), the fans (28) of each upright (14, 16) being arranged symmetrically with respect to the fans (28) of the other upright (14, 16).
3. Device according to claim 2, **characterized in that** the speed of the air flow delivered by a pair of fans (28) arranged at the same height in the two uprights (14, 16), is selectively controlled so that the respective air blade barrier portions generated by them are adapted to compensate for the heat exchange at that height.
4. Device according to any one of Claims 1 to 3, **characterized in that** it comprises at least one slidable closure member (22; 22, 22a) for closing said passage (12), each upright (14, 16) comprising at least one vertical guide rail (24) for guiding the sliding of a side edge of said at least one closure member (22; 22, 22a), and **in that** said two air blade barriers (34, 36; 46, 48) generate a pair of air flows having opposite directions, both of which are arranged adjacent to said at least one closure member (22; 22, 22a).
5. Device according to claim 4, **characterized in that** said at least one closure member consists of a quick sliding flexible curtain (22; 22, 22a), which is adapted to be wound, in the closed condition of the door (10), about a motorized rotary shaft that extends along the upper crosspiece (18) of said structure.
6. Device according to claim 4 or 5, **characterized in that** said two air blade barriers (34, 36; 46, 48) are both arranged on a same side of said at least one closure member (22; 22, 22a).
7. Device according to claim 6, **characterized in that** a first vertical upright (14) comprises a first vertical guide rail (24) for the sliding engagement by a side edge of a respective flexible curtain (22; 22, 22a) and, in a position parallel and spaced apart from said first guide rail (24), said air flow outlet opening, which is made in the form of a first slit (32) parallel to said first guide rail (24), a first series of air flow inlet openings (30) being interposed between said first guide rail (24) and said first slit (32), and **in that** a second vertical upright (16) comprises a second vertical guide rail (24) for guiding a respective side edge of a respective flexible curtain (22; 22, 22a) and, in a position parallel and spaced apart from said second guide rail (24), a second series of air flow inlet open-

ings (30), an air flow outlet opening, which is made in the form of a second slit (32) parallel to said second guide rail (24), being interposed between said second guide rail (24) and said second series of air flow inlet openings (30).

5

8. Device according to claim 4 or 5, **characterized in that** said double air blade barrier consists of a first air blade barrier (38; 42) arranged on the side of a first side of said closure member (22, 22, 22a), and of a second air blade barrier (40; 44) arranged on the side of a second side of said closure member (22; 22, 22a). 10
9. Device according to claim 8, **characterized in that** said series of air flow inlet openings (30) and said air flow outlet slit (32) are arranged in said uprights (14, 16) on opposite sides of the respective guide rail (24). 15
20
10. Device according to claim 8, **characterized in that** said series of air flow inlet openings (30) and said air flow outlet slit (32) are arranged in both the uprights (14, 16) according to a symmetrical configuration, on the same side with respect to the respective guide rail (24). 25
11. Device according to claim 4 or 5, **characterized in that** each upright (14, 16) comprises a pair of vertical guide rails (24) for the slidable engagement of the side edges of a pair of closure members (22, 22a), a series of inlet air flow openings (30) and an air flow outlet slit (32) being provided in each upright (14, 16) between said pair of guide rails (24), which are arranged in such a manner that the series of air flow inlet openings (30) of an upright (14, 16) faces directly the air flow outlet slit (32) of the other upright (14, 16) and vice-versa, so that a pair of air blade barriers having opposite directions are generated between the two parallel flexible curtains (22, 22a) in their closed condition, each air blade barrier being adjacent to one of the mutually facing sides of said two closure members (22, 22a). 30
35
40
12. Quick-sliding door according to any one of claims 1 to 11, **characterized in that** each upright (14, 16) includes at least two longitudinal portions (14a, 14b), each of which has its respective series of air flow inlet openings (30) and the respective air flow outlet slit (32) arranged on mutually opposite sides, with the purpose to compensate locally for a positive or a negative heat exchange depending on its position in height with respect to the respective upright (14, 16). 45
50
55

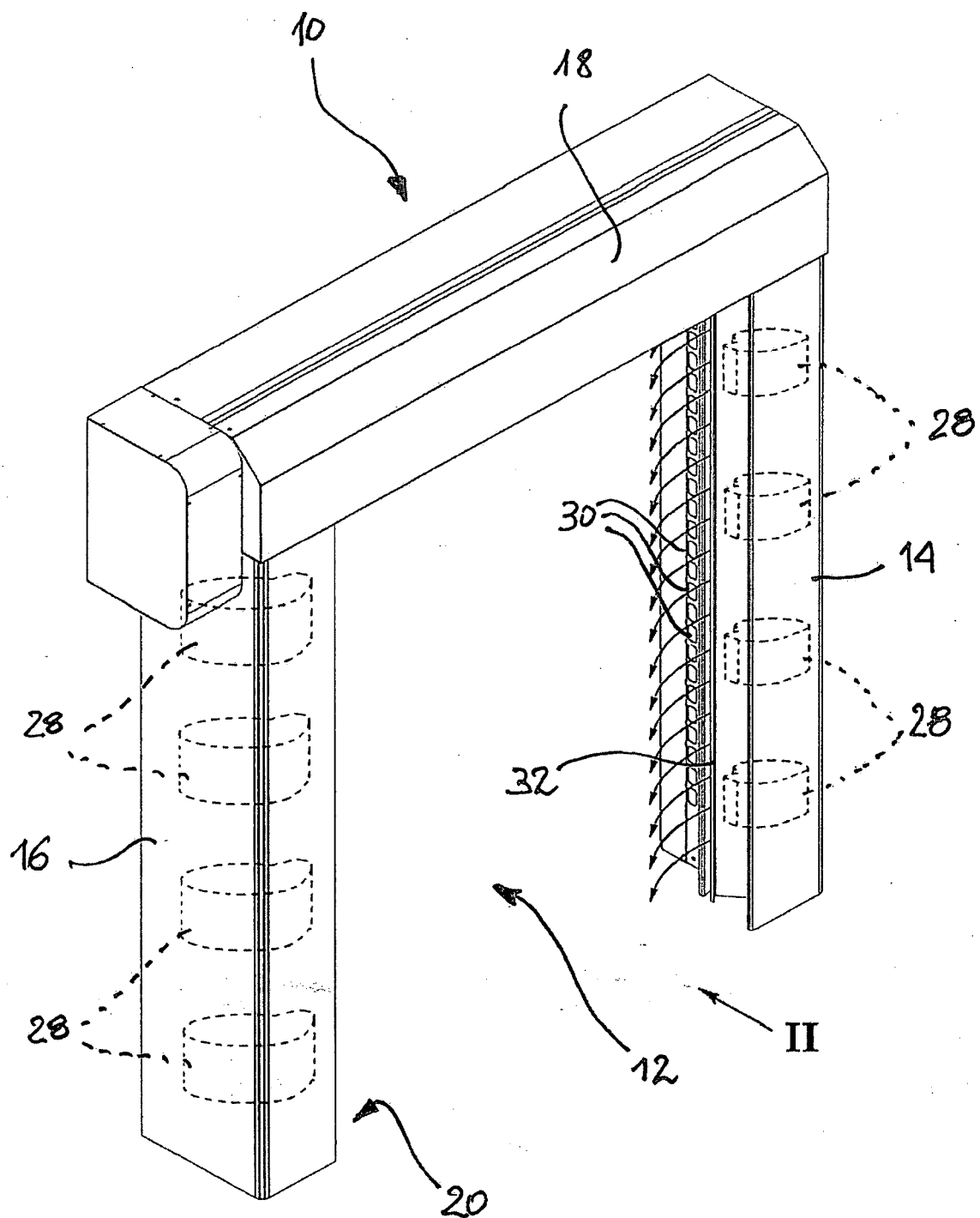
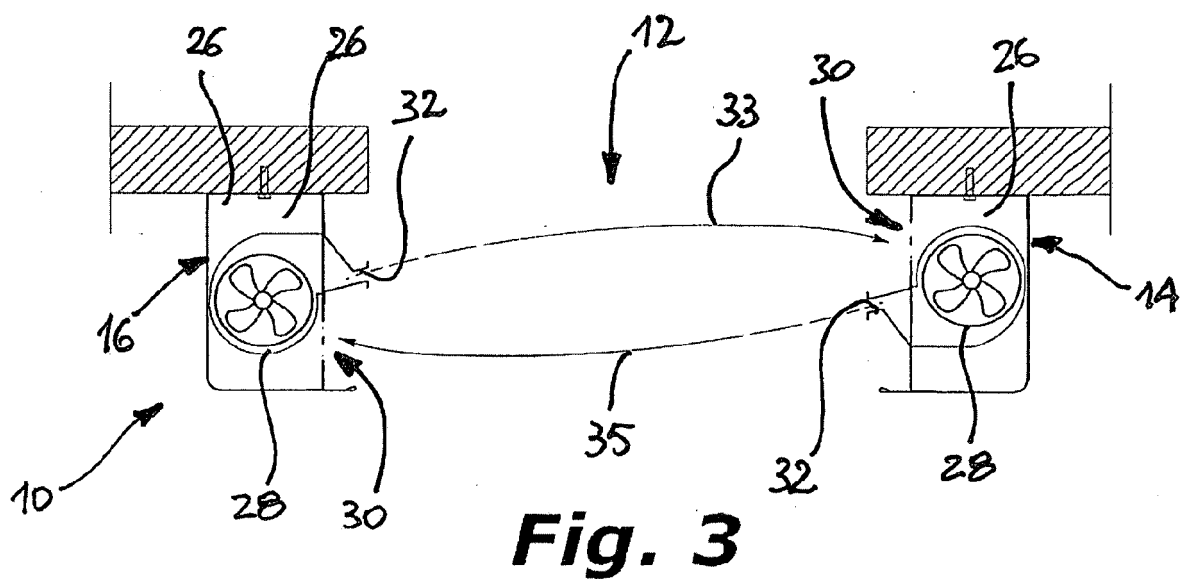
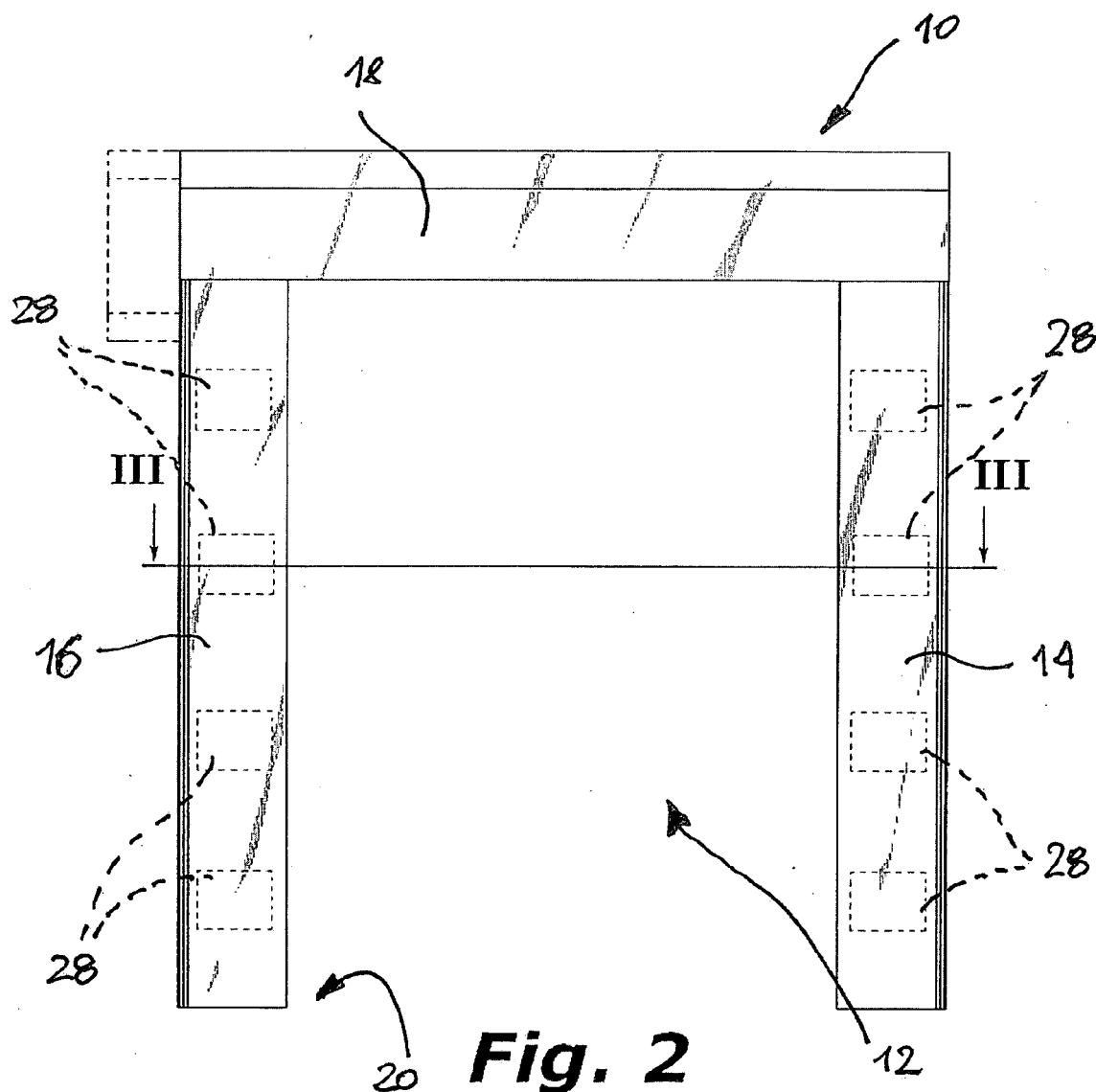


Fig. 1



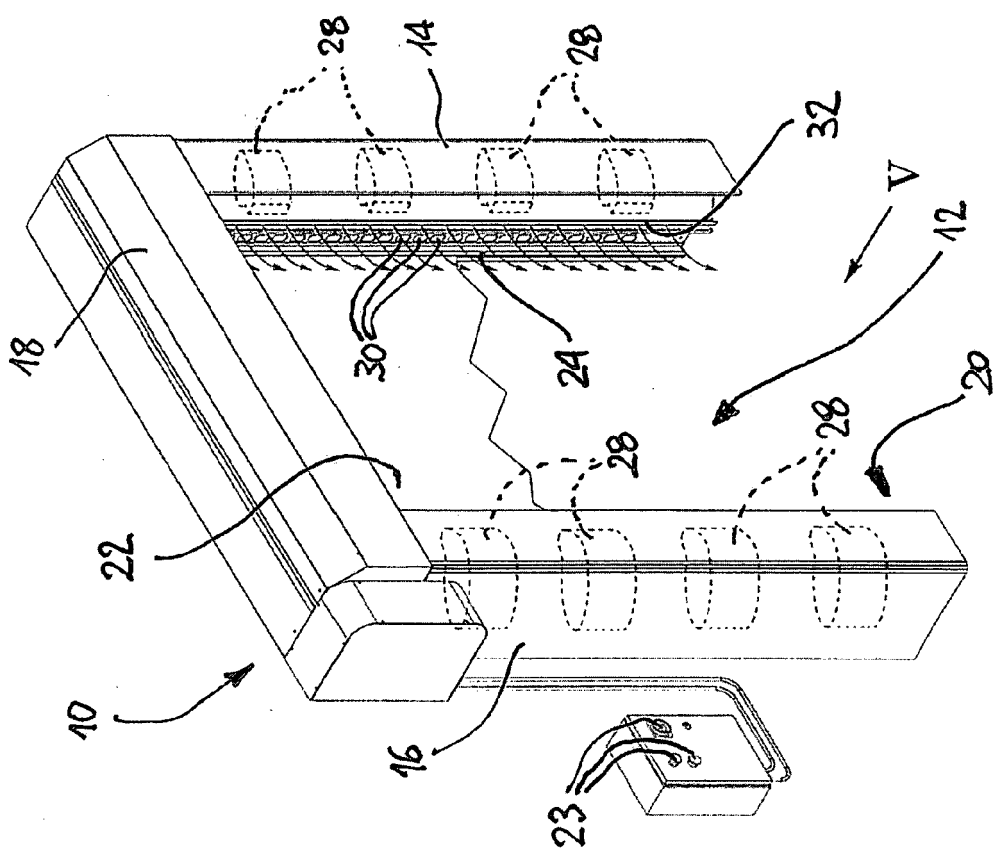


Fig. 4

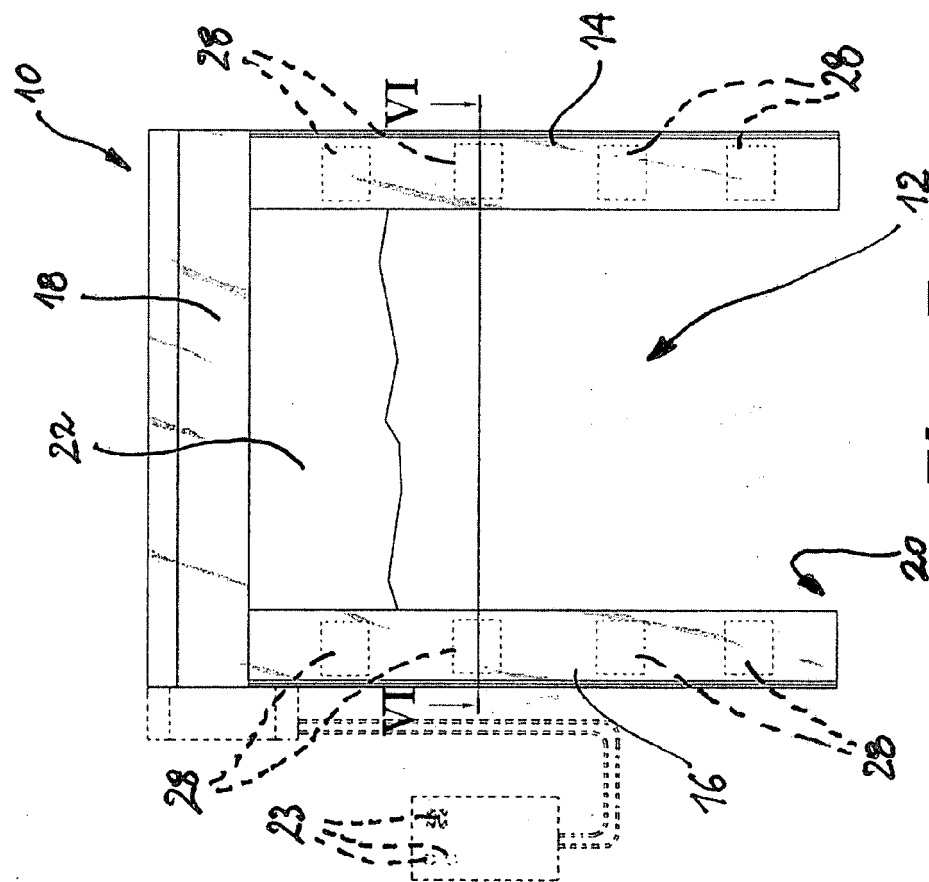


Fig. 5

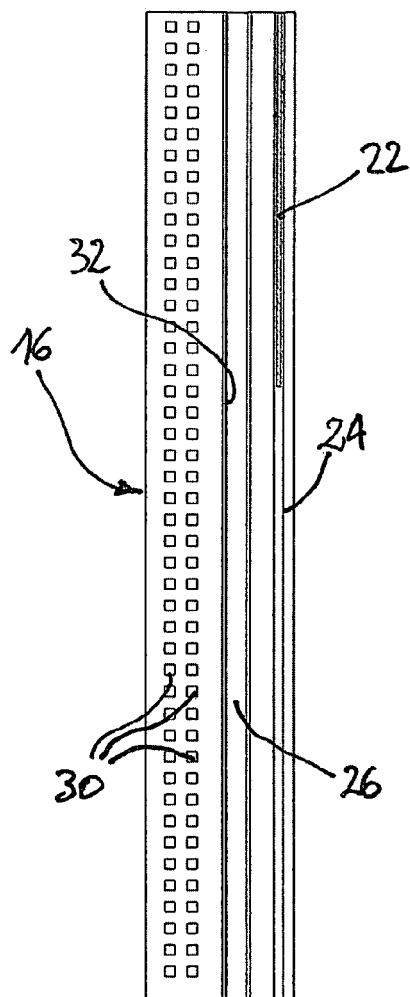
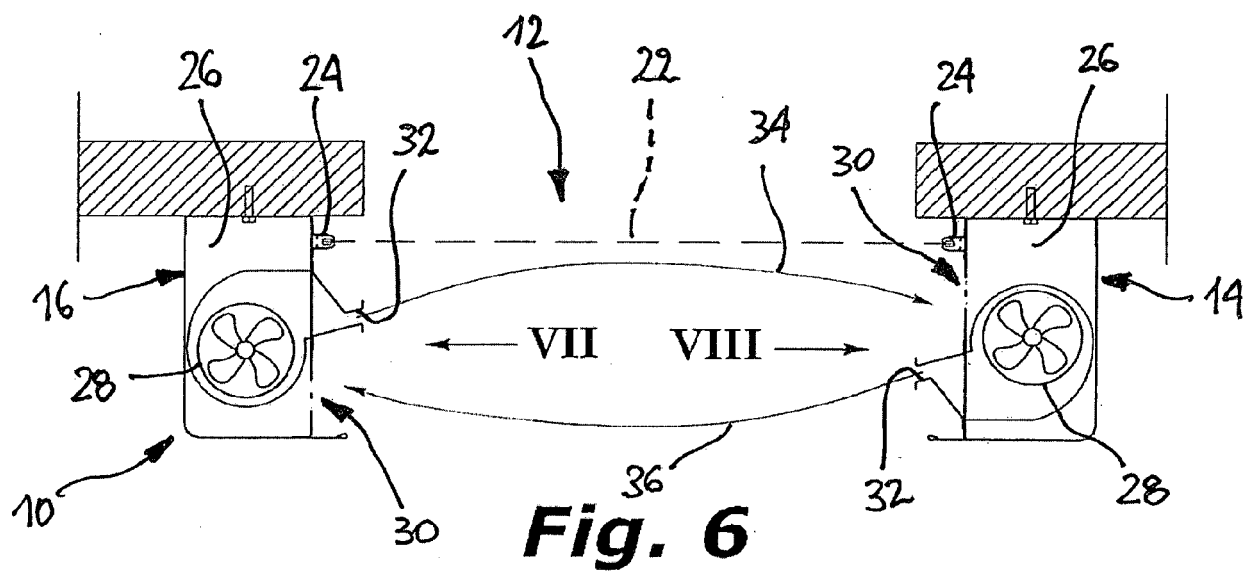


Fig. 7

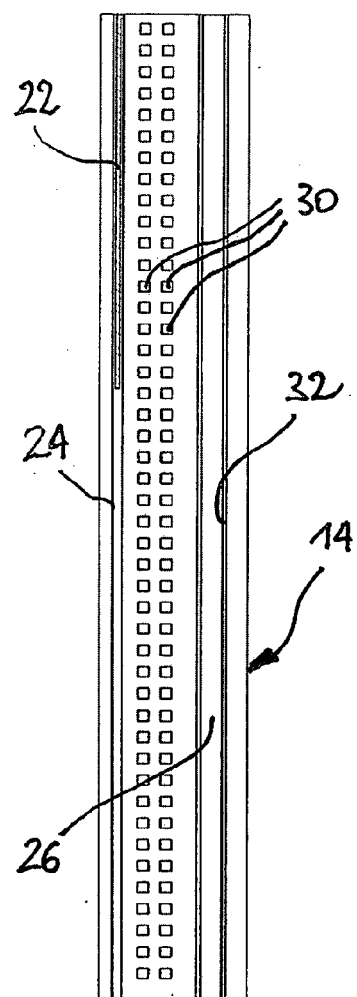
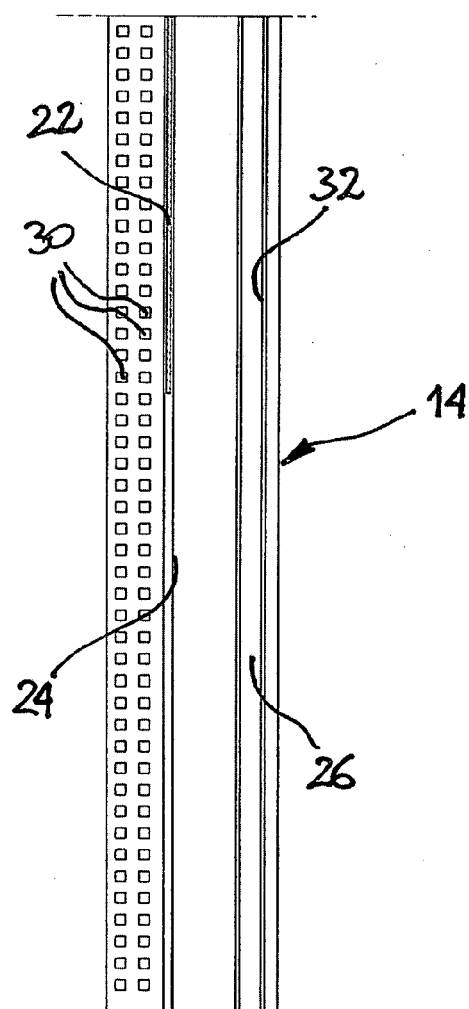
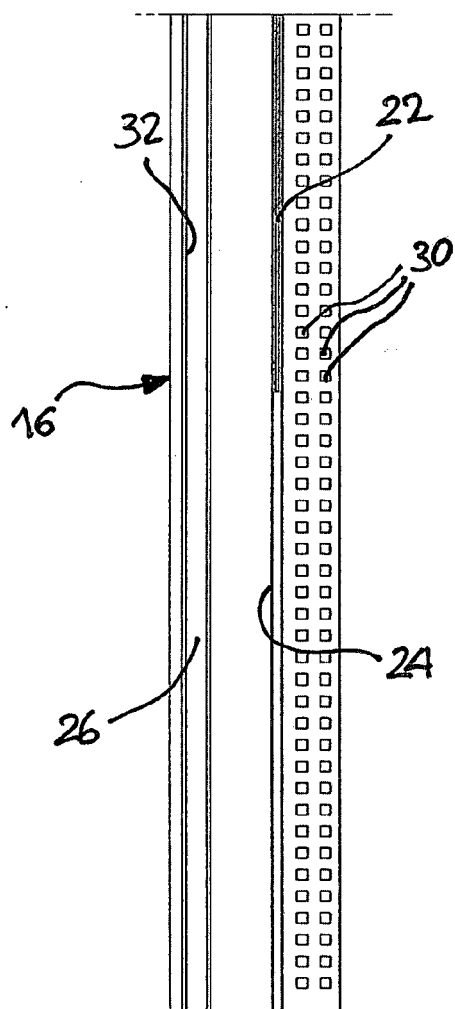
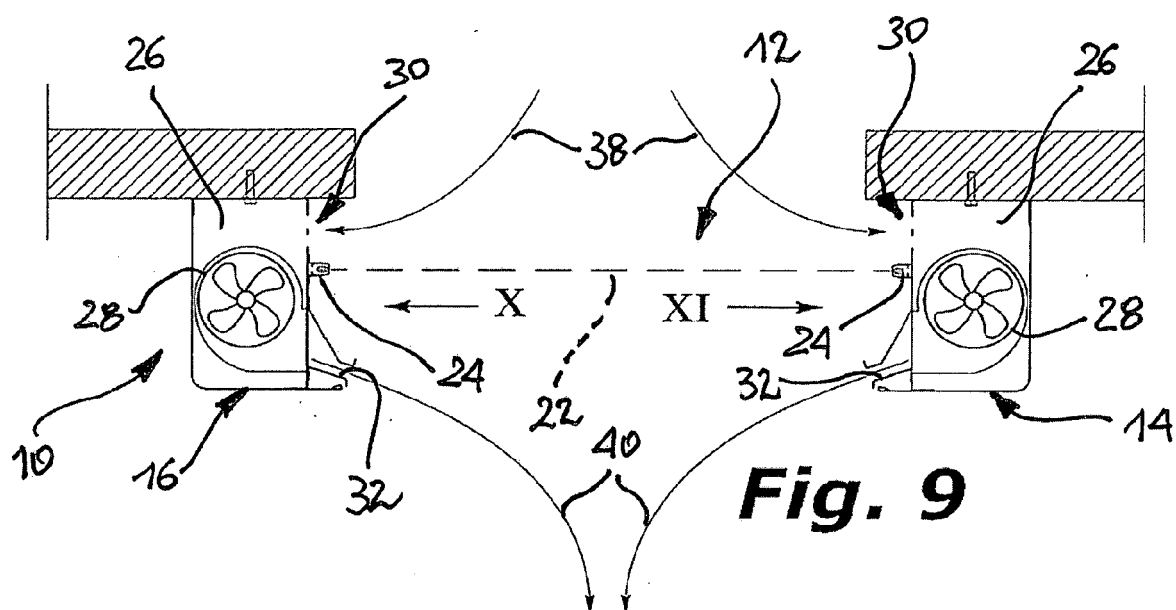
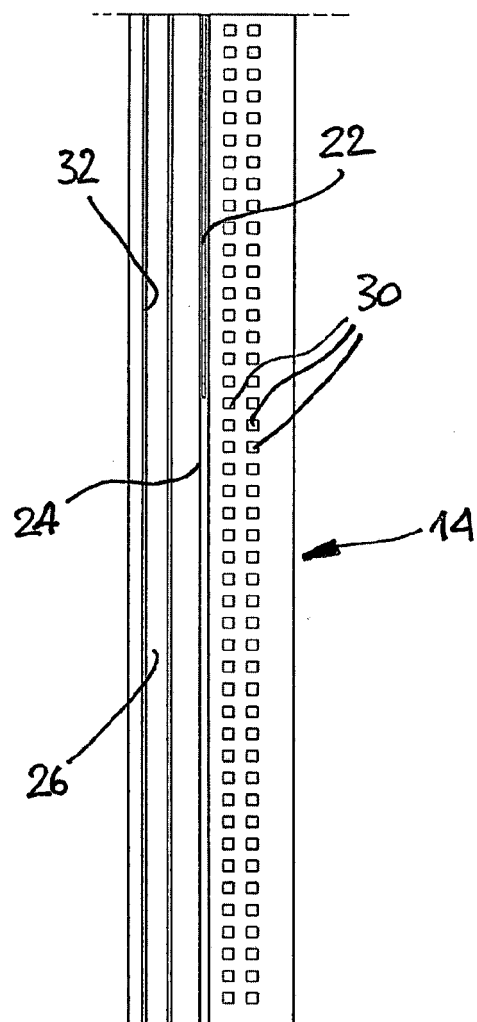
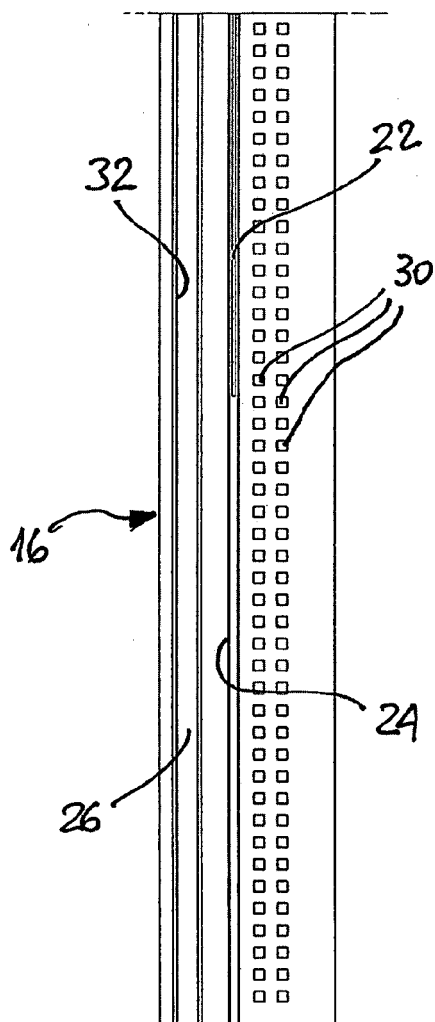
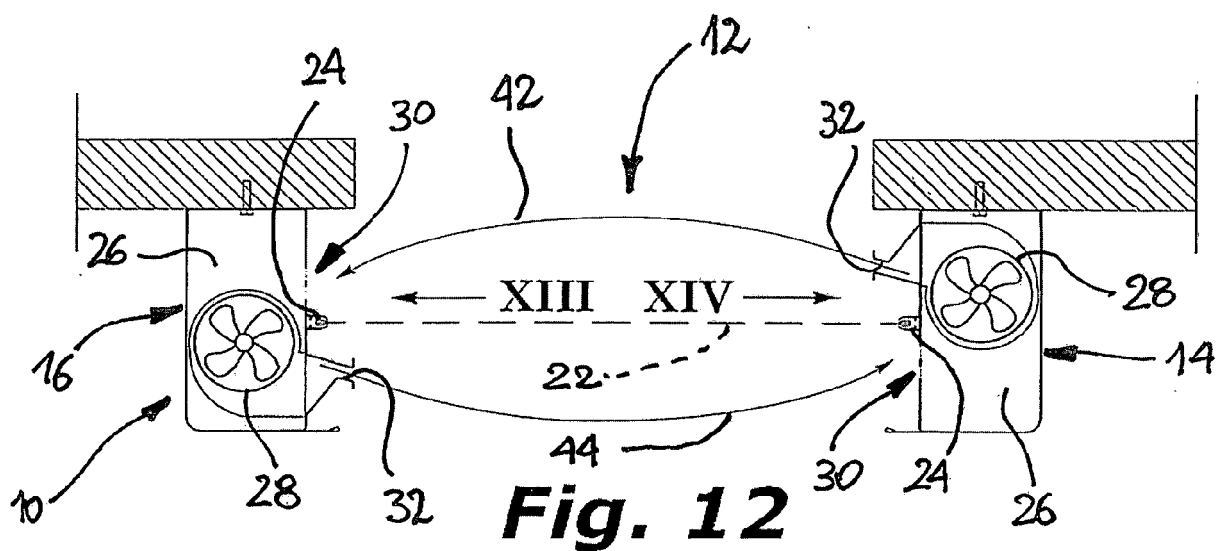
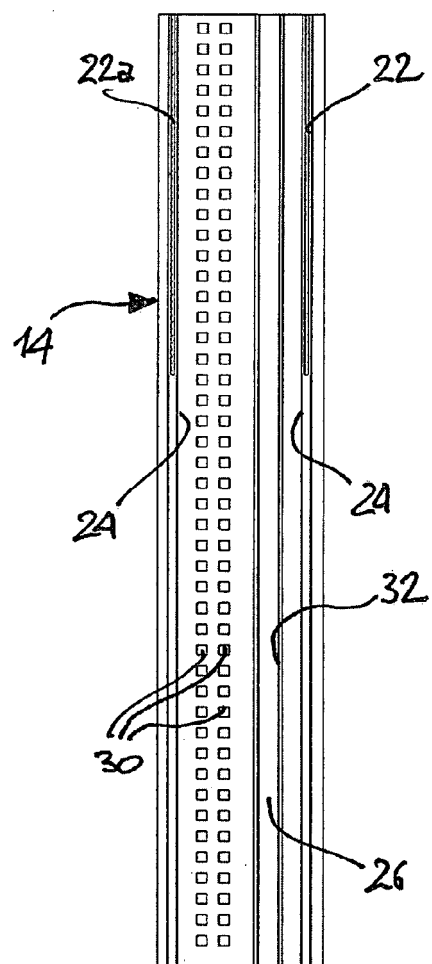
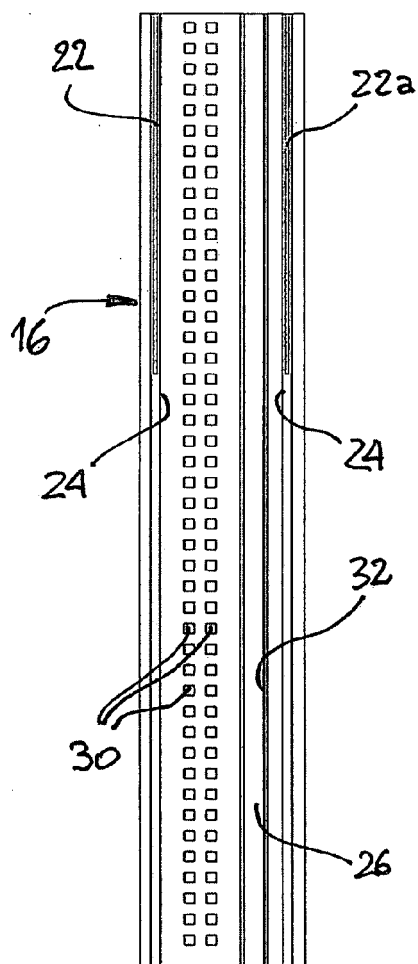
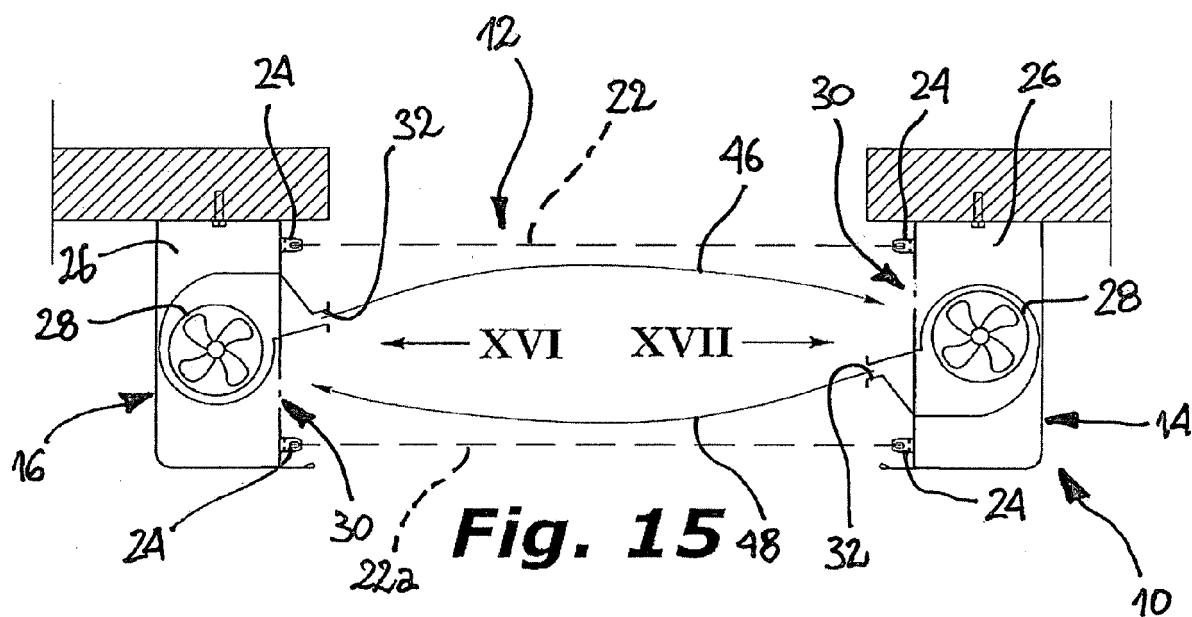


Fig. 8







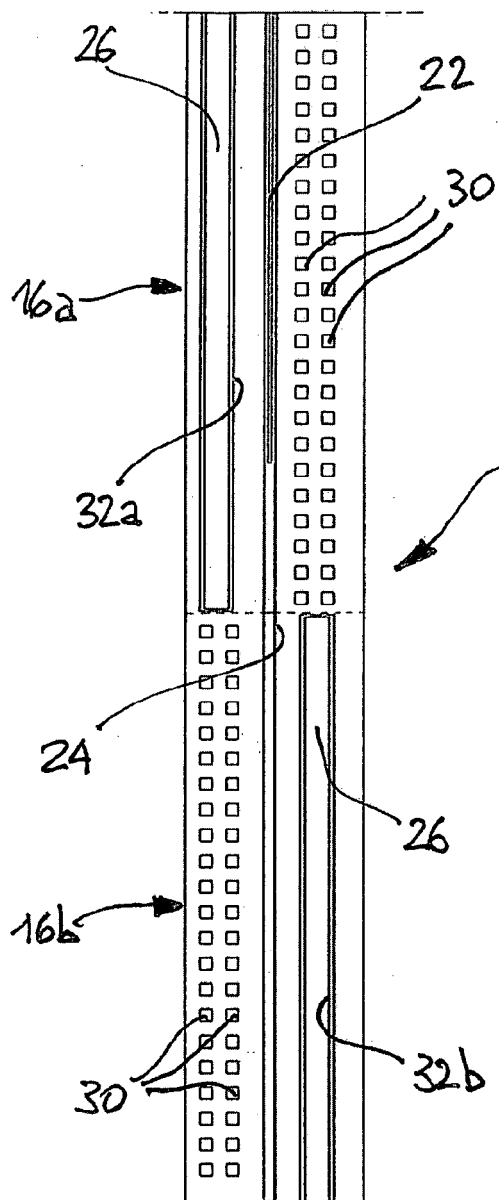


Fig. 18

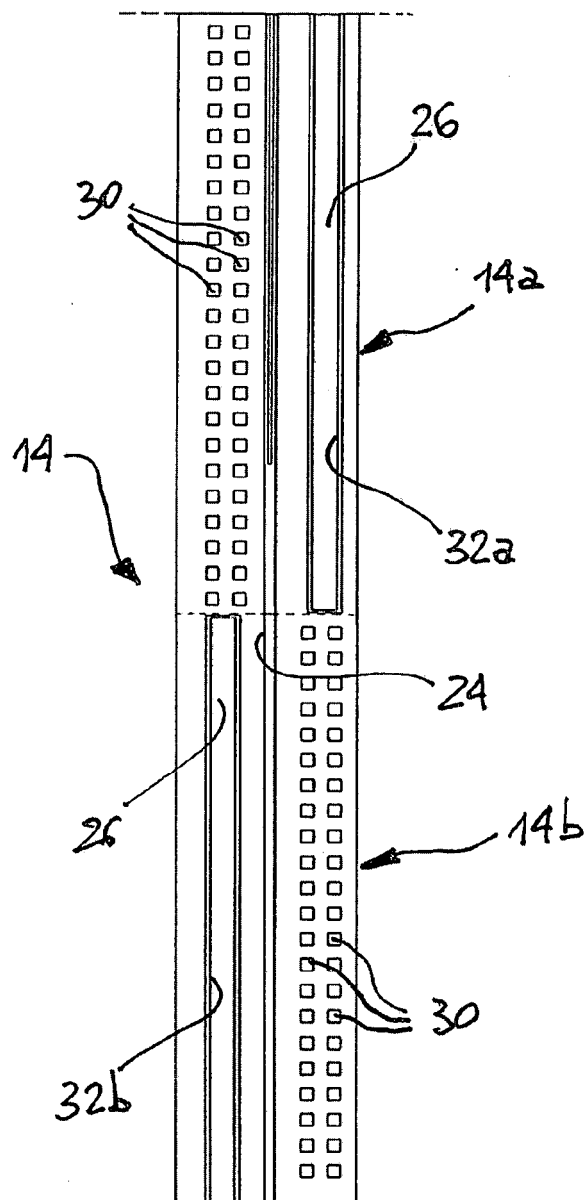


Fig. 19



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 00 0239

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/117017 A1 (MAEKAWA SEISAKUSHO KK [JP]; TSUBATA KOUICHI [JP] ET AL.) 18 October 2007 (2007-10-18)	1,2,4-7, 12	INV. F24F9/00 F24F13/06 F24F13/072 E06B9/11 F25D23/02 E06B9/02
A	* page 11, paragraph 3 - page 12, paragraph 6; figures 1,2a,2b,12,13,14a,14b *	3,8-11	
X	GB 1 155 880 A (FIRTH CLEVELAND LTD [GB]) 25 June 1969 (1969-06-25)	1,2	
A	* page 2, lines 57-74; figures 2,4 *	3-12	
A	US 3 859 900 A (FORDSMAND MARC) 14 January 1975 (1975-01-14) * column 1, line 47 - column 2, line 52; figures 1-4 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) F24F E06B F25D
A	DE 100 05 964 A1 (KESSLER & LUCH GMBH & CO KG [DE]) 23 August 2001 (2001-08-23) * paragraphs [0012], [0013], [0022]; figures 1,3 *	1-12	
A	JP 2006 057928 A (MAEKAWA SEISAKUSHO KK) 2 March 2006 (2006-03-02) * abstract; figure 1 *	1-12	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 November 2020	Examiner Degen, Marcello
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			

 1
 EPO FORM 1503 03.82 (P04C01)

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

EP 20 00 0239

5

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

26-11-2020

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007117017 A1	18-10-2007	BR PI0709765 A2	26-07-2011
		CA 2646569 A1	18-10-2007
		CN 101460784 A	17-06-2009
		EP 2005072 A1	24-12-2008
		JP 2007278577 A	25-10-2007
		TW 200804737 A	16-01-2008
		US 2009137198 A1	28-05-2009
		WO 2007117017 A1	18-10-2007

GB 1155880 A	25-06-1969	NONE	

US 3859900 A	14-01-1975	CH 546930 A	15-03-1974
		DE 2305923 A1	16-08-1973
		FR 2171411 A1	21-09-1973
		US 3859900 A	14-01-1975

DE 10005964 A1	23-08-2001	NONE	

JP 2006057928 A	02-03-2006	JP 4588387 B2	01-12-2010
		JP 2006057928 A	02-03-2006

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2397116 A1 [0005]