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(54) **MODULAR ELEMENT FOR AIR CURTAINS AND MANUFACTURING METHOD THEREOF**

(57) A modular element (1) for dynamic air curtain barriers (2), said modular element (1) comprising: a supporting frame (3) having a lateral wall (4) internally defining a housing compartment (5) and comprising a lateral through opening (8) substantially extending along a prevalent direction (D) of extension of the frame itself, a channel (9) engaged with the supporting frame (3) and configured to receive an air flow from the ventilating device (12) and channel it along a direction (S) of ejection out of said housing compartment (5) through the lateral opening (8). The channel (9) having a first and a second longitudinal channelling wall (10, 11) extending prevalently inside the housing compartment (5) along the prevalent direction (D) of extension of the frame (3); each channelling wall (10, 11) has an inlet portion (10a, 11a) located inside the housing compartment (5) and an outlet portion (10b, 11b) located outside the housing compartment (5). The inlet portions (10a, 11a) of the channelling walls (10, 11) define a lateral inlet opening (15), whilst the respective outlet portions (10b, 11b) of the channelling walls (10, 11) define an outlet opening (25) configured to direct the air flow along an ejection direction (S); the channelling walls (10, 11) define, in cooperation with each other, a duct (22) for the air flow extending between the inlet opening (15) and the outlet opening (25).

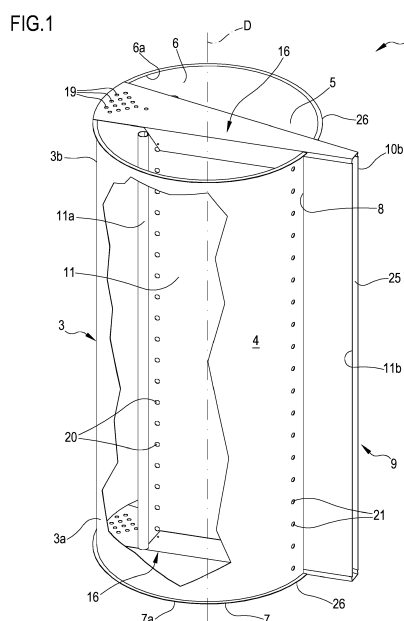


FIG.2

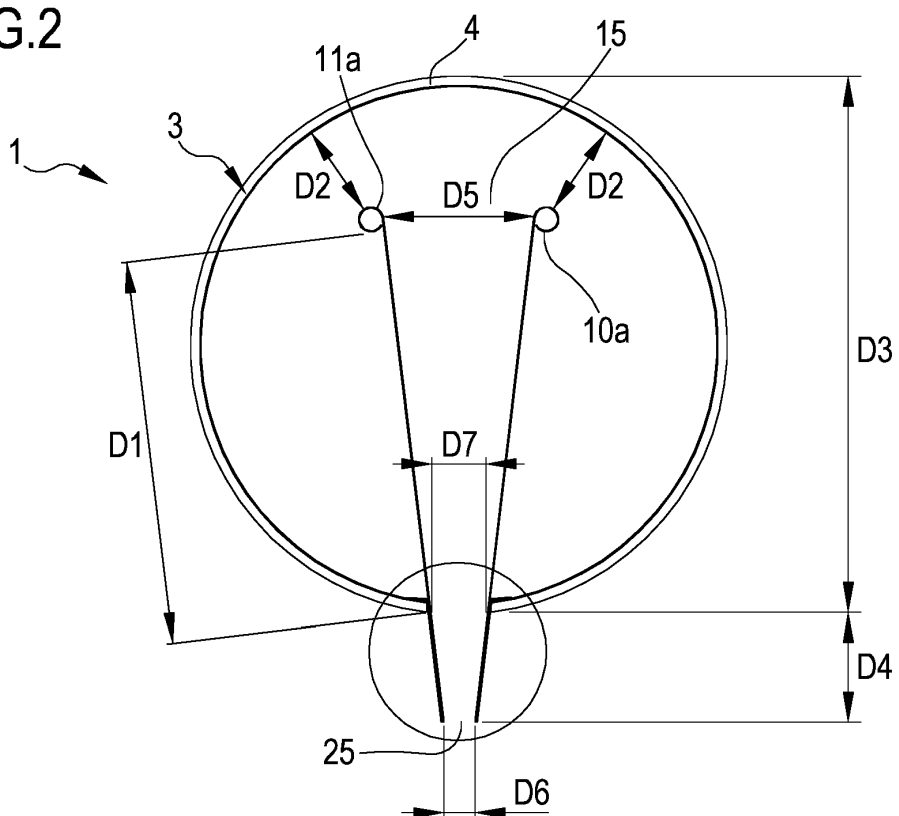
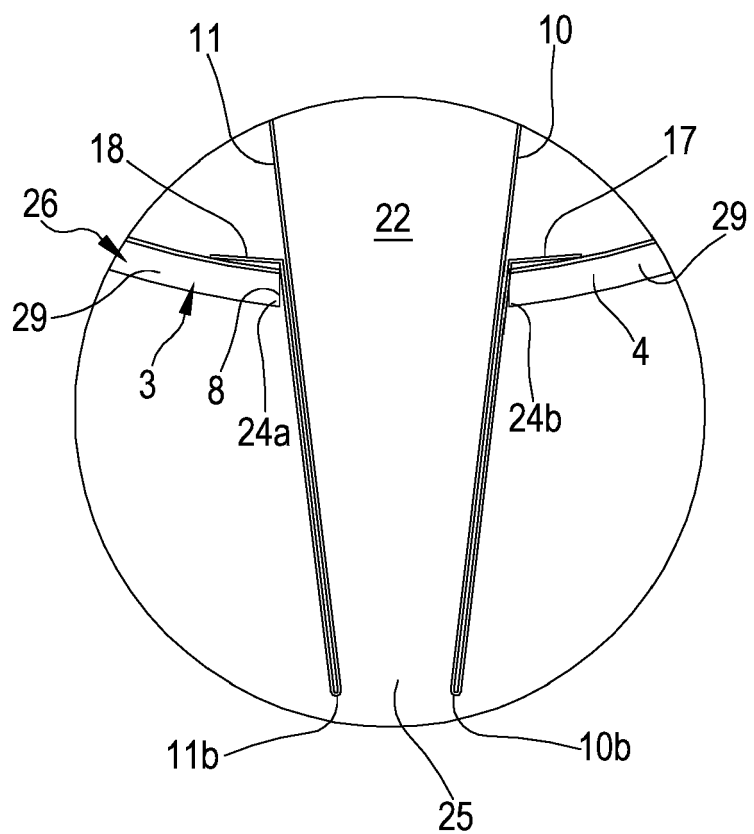


FIG.3



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a modular element for dynamic air curtain barriers, a dynamic air curtain barrier and a process for making the same modular element and the same barrier. Air curtain barriers are in general systems that produce one or more jets of air (hot or cold) along industrial doors in factories, warehouses, hangars or garages, or at the entrance of commercial buildings such as supermarkets, shops, bars, hotels or in general establishments having an indoor temperature that is different from the outdoor one.

BACKGROUND ART

[0002] These barriers create a veritable "air barrier" designed to limit heat exchanges in order to protect the indoor thermal conditions, i.e. to maintain the desired temperature and avoid thermal losses. In reality, air curtain barriers do not treat the air but are an aid to the air conditioning system: they thermally insulate one environment from another, without necessarily having to close the doors, by creating a dynamic air barrier. They produce a continuous jet of air (at least under conditions where the door is open) which is often intense in proximity to the entrance of the interior to be thermally insulated; the barrier produced does not permit the treated air to mix rapidly with that of another environment, e.g. with outdoor air.

[0003] The currently available systems are generally installed above the entrance, with the air jet directed downwards. Alternative solutions, though less widespread, provide for the system to be installed at the sides of entrance doorways or even embedded in the floor. These systems draw air, for example, from inside the air-conditioned interior and direct it along a vertical plane, in such a way as to create a sort of air "barrier" at the entrance. When the entrance to the air-conditioned interior is opened, the pressure equilibrium profile changes and currents of air are generated in proximity to the entrance; obviously, the flows will be such as to tend toward equalizing the temperature of the two communicating environments and therefore in some areas of the entrance currents of air toward the outside environment will be created, whereas in others there will be currents in the opposite direction. Complex patterns of currents will thus be originated and they can also have a non-uniform distribution in terms of speed. Therefore, it is desirable to create an air curtain barrier capable of suitably opposing the currents that are created after the entrance is opened. In the prior art, it is thus necessary to adjust and set the system, seeking to optimize the speeds and the direction (and possibly the temperature) of the air flow so as to isolate the interior as much as possible, while at the same time seeking to provoke as little discomfort as possible to anyone crossing the air barrier, such as may be

caused, for example, by high speed flows. When designing an air barrier, one must consider the interaction between the air flow coming from the outside through the doorway and the air flow created by the barrier itself.

5 Once the system has been set and adjusted, and the conditions representing the best compromise between thermal insulation and comfort, i.e. between air speeds and direction, have been found, in general the set parameters are no longer modifiable or are so to a limited degree. The currently available systems are therefore
10 scarcely flexible, scarcely adjustable in their design conditions and sometimes structurally complicated to install. Furthermore, the maintenance costs are not low, since in the event of malfunctioning the entire system must be
15 shut down and overhauled.

[0004] A further known solution developed by the Applicant envisages an air curtain barrier consisting of a plurality of modular elements, each of which contains within it a device for generating an air flow and is configured to channel this flow through an outlet opening of the element itself. The modular elements are coupled to each other in such a way as to enable them to be set in a plurality of operative positions: the outlet opening of one modular element can be set in an operative position that is different from an operative position of an outlet opening of another modular element. The Applicant's solution is an improvement over the previously developed air curtain barriers, as the possibility of directing the air flows of each individual module improves and increases the adjustability of the entire system, which is thus flexible in use, i.e. adaptable to different operating conditions. Although the above-mentioned barrier enables at least part of the drawbacks of prior inventions to be overcome, the Applicant has found that this barrier as well is improvable in several respects. A first drawback to be found in the prior barrier developed by the Applicant regards the complexity of each individual modular element, which negatively impacts the operations of installing and servicing the same: installation and maintenance require particular care on the part of personnel, who must take account of the presence of devices for generating a flow inside each modular element. It should be noted that replacing or performing the necessary maintenance on even only one flow generating device of a modular element requires disassembling the entire barrier. A further drawback linked to the structure of the previous barrier regards the high cost of each modular element and the high labour costs tied to complexity of installing, maintaining and replacing the components of the barrier.

50

OBJECT OF THE INVENTION

[0005] The object of the present invention is thus to substantially overcome at least one of the drawbacks and/or limitations of the prior solutions.

[0006] It is an object of the present invention to provide a modular element for air curtain barriers capable of permitting a better and greater adjustability of the conditions

of use, without creating situations of discomfort for those whose pass through the entrance, and which has a simplified structure at the same time; in particular, it is a further object of the present invention to propose a modular element for flexible air curtain barriers which is simple to install, easy to customize and adaptable to every structural context. Finally, one object of the present invention is to produce a modular element for air curtain barriers that is capable of adapting any climate difference between indoors and outdoors.

[0007] One or more of the above-described objects, which will become more apparent in the course of the description that follows, are substantially achieved by a modular element, an air curtain barrier and the respective production processes in accordance with one or more of the accompanying claims.

SUMMARY

[0008] Aspects of the invention are described here below.

In a 1st aspect, there is provided a modular element (1) for dynamic air curtain barriers (2), said modular element (1) comprising:

- at least one supporting tubular frame (3) extending along a prevalent direction (D) of extension between a first and a second longitudinal end (3a, 3b), said supporting frame (3) having a lateral wall (4) internally defining a housing compartment (5) and which defines, at the first and second ends (3a, 3b) of the frame, a respective first and second longitudinal openings (6, 7), the first and second longitudinal openings (6, 7) being delimited by respective free edges (6a, 7a), the supporting frame (3) further comprising at least one lateral through opening (8) substantially extending along the prevalent direction (D) of extension of the frame itself, the supporting frame (3) being associable with at least one ventilating device (12) configured to generate an air flow destined for the housing compartment (5) of the frame itself and passing through at least one of said first and second longitudinal openings (6, 7),
- at least one channel (9) engaged with the supporting frame (3) and configured to receive the air flow from the ventilating device (12) and channel it along a direction (S) of ejection out of said housing compartment (5) through the lateral opening (8), the channel (9) having at least a first and a second longitudinal channelling wall (10, 11) extending prevalently, or completely, inside the housing compartment (5) along the prevalent direction (D) of extension of the frame (3), each channelling wall (10, 11) having at least one inlet portion (10a, 11 a) located inside the

housing compartment (5) and one outlet portion (10b, 11 b) preferably, but not necessarily, located outside the housing compartment (5), the respective inlet portions (10a, 11 a) of the channelling walls (10, 11) defining a lateral inlet opening (15), the respective outlet portions (10b, 11 b) of the channelling walls (10, 11) defining an outlet opening (25) configured to direct the air flow along an ejection direction (S), the channelling walls (10, 11) defining, in cooperation with each other, a duct (22) for the air flow extending between the inlet opening (15) and the outlet opening (25), and wherein the inlet portions (10a, 11 a) of the channelling walls (10) have a minimum distance (D1) from the lateral opening (8) that is greater than the minimum distance (D2) present between the same inlet portions (10a, 11 a) and a portion of the lateral wall (4) of the frame (3) opposite the lateral opening.

In a 2nd aspect in accordance with the 1st aspect, the lateral opening (8) of the supporting frame (3) extends over the entire lateral wall (4) along the prevalent direction (D) of extension of the frame; in particular the lateral opening (8) extends from the first longitudinal end (3a) to the second longitudinal end (3b) so as to define a through opening.

In a 3rd aspect in accordance with either of the preceding aspects, the channelling walls (10, 11) are engaged at the lateral opening (8) and extend over the entire lateral wall (4) along the prevalent direction (D) of extension.

In a 4th aspect in accordance with any one of the preceding aspects, the channelling walls (10, 11) of the channel (9) extend over the entire lateral wall (4) along the prevalent direction (D) of extension between the first and second ends (3a, 3b) of the supporting frame (3).

In a 5th aspect in accordance with any one of the preceding aspects, the ratio of a minimum distance (D1) present between the inlet portions (10a, 11 a) and the lateral opening (8) to a minimum distance (D2) present between the same inlet portions (10a, 11 a) and a portion of the lateral wall (4) is greater than 2, in particular, it is comprised between 3 and 10.

In a 6th aspect in accordance with any one of the preceding aspects, the inlet portions (10a, 11 a) of the channelling walls (10) have a minimum distance (D1) from the lateral opening (8) that is greater than 100 mm, in particular greater than 200 mm; in particular it is comprised between 250 and 400 mm.

In a 7th aspect in accordance with any one of the preceding aspects, the inlet portions (10a, 11 a) of the channelling walls (10) have a minimum distance (D2) from a portion of the lateral wall (4) opposite the lateral opening comprised between 20 and 150

mm, in particular between 30 and 100 mm, even more in particular between 40 and 80 mm.

In an 8th aspect in accordance with any one of the preceding aspects, the inlet portions (10a, 11 a) of the channelling walls (10, 11) have a minimum distance (D1) from a portion of the lateral wall (4) opposite the lateral opening (8), the supporting frame (3) having a maximum transversal inner dimension (D3), measured from the lateral wall (8) to a portion of the lateral wall (4) of the frame (3) opposite said lateral wall (8), the ratio of the maximum transversal inner dimension (D3) to the minimum distance (D1) being comprised between 0.5 and 0.95, in particular between 0.7 and 0.9.

In a 9th aspect in accordance with any one of the preceding aspects, the channel (9), in a cross section thereof, has a shape comprising two segments that are inclined relative to each other and define a taper decreasing in an outward direction from the housing compartment (5).

In a 10th aspect in accordance with the preceding aspect, the taper of the two segments of the channel (9) is comprised between 5° and 40°, and even more in particular between 10° and 30°.

In an 11th aspect in accordance with any one of the preceding aspects, the channelling walls (10, 11) are spaced from each other, the channel (9) comprises at least one separating element (16) associated with said channelling walls (10, 11) at longitudinal ends thereof, which is configured to close off said walls at said longitudinal ends to enable the passage of the air flow only through said lateral inlet opening (15).

In a 12th aspect in accordance with any one of the preceding aspects, the first channelling wall (10) extends between a first and a second free longitudinal edge, the second channelling wall (11) extends respectively between a first and a second free longitudinal edge, and the channelling walls (10, 11) are spaced from each other so that the first free longitudinal edge and the second longitudinal edge respectively define a first and a second longitudinal inlet opening (13, 14).

In a 13th aspect in accordance with the preceding aspect, the modular element (1) comprises at least one separating element (16) engaged with the channel (9) and/or with the supporting frame (7), and configured to close off the first and second longitudinal inlet openings (13, 14) so as to enable the air flow entering the housing compartment (5) to reach the outlet opening (25) only through the lateral inlet opening (15).

In a 14th aspect in accordance with the 12th or 13th aspect, the separating element (16) comprises a first and a second plug (16a, 16b) respectively configured to close off the first and second longitudinal inlet openings (13, 14).

In a 15th aspect in accordance with any one of the aspects from the 11th to the 14th, the separating

element (16) is of a shape at least partially mating that of the cross section of the channel (9).

In a 16th aspect in accordance with any one of the aspects from the 11th to the 15th, the separating element (16) substantially extends along a prevalent plane, said separating element (16), according to a view normal to the prevalent plane of extension thereof, having a substantially trapezoidal shape.

In a 17th aspect in accordance with any one of the aspects from the 11th to the 16th, the separating element (16) extends beyond the first inlet portions (10a, 11 a) of the channelling walls (10, 11) to the lateral wall (4) opposite the lateral opening (8).

In an 18th aspect in accordance with any one of the aspects from the 11th to the 17th, the separating element (16) extends over the entire transversal dimension of the supporting frame (3) considered substantially along the extent of the channelling walls.

In a 19th aspect in accordance with any one of the aspects from the 11th to the 18th, the separating element (16) comprises at least one plate having, in a cross section thereof, a substantially "C" shape, whose concavity is facing towards the channel (9) and which consists of two terminal strips and a connecting portion, the terminal strips of the "C" shape extending parallel to the respective channelling walls, while the connecting portion abuts the longitudinal ends of the channelling walls (10, 11) and closes off the respective longitudinal inlet openings.

In a 20th aspect in accordance with the preceding aspect, the separating element (16), at least in the connecting portion, has a plurality of holes (19) passing through the plate of the element itself, said holes (19), in particular, being located in the inlet portions (10a, 11 a) of said channelling walls (10, 11).

In a 21st aspect in accordance with any one of the aspects from the 11th to the 20th, the separating element (16) has a closure portion extending away from the first inlet portions (10a, 11 a) of said channelling walls (10, 11) to a portion of the lateral wall (4) opposite the lateral opening (8).

In a 22nd aspect in accordance with the preceding aspect, the separating element (16) has a plurality of through holes (19) located in the closure portion of the separating element (16) itself.

In a 23rd aspect in accordance with any one of the preceding aspects, the outlet portions (10b, 11 b) of the channelling walls (10, 11) have a minimum distance (D4) from the lateral opening (8) that is greater than 10 mm; in particular, it is greater than 20 mm, in particular comprised between 30 and 100 mm.

In a 24th aspect in accordance with the preceding aspect, the ratio of the minimum distance (D1), measured between the first inlet portions (10a, 11 a) of the channelling walls (10, 11) and the lateral opening (8), to the minimum distance (D4), measured between the outlet portions (10b, 11 b) of the channelling walls (10b, 11 b) and the lateral opening (8), is

greater than 2, in particular comprised between 3 and 7.

In a 25th aspect in accordance with any one of the preceding aspects, the inlet portions (10a, 11 a) of the channelling walls (10, 11) have a minimum distance (D5) from each other that is greater than a minimum distance (D6) measured between the outlet portions (10b, 11 b) of the channelling walls (10, 11).

In a 26th aspect in accordance with the preceding aspect, the ratio of the minimum distance (D5), measured between the inlet portions (10a, 11 a) of the channelling walls (10, 11), to the minimum distance (D6), measured between the outlet portions (10b, 11 b) of the channelling walls (10, 11), is greater than 1.5, in particular, it is comprised between 2 and 7.

In a 27th aspect in accordance with any one of the preceding aspects, each of said channelling walls (10, 11) comprises at least a metal sheet, in particular made of steel, obtained by bending.

In a 28th aspect in accordance with any one of the preceding aspects, each of said channelling walls (10, 11) comprises at least one engagement portion (17, 18) interposed between the respective inlet portion (10a, 11 a) and the respective outlet portion (10b, 11 b), the engagement portion (17, 18) being stably engaged with the supporting frame (3) at the lateral opening (8) so as to constrain the channelling wall (10, 11) inside the latter opening (8).

In a 29th aspect in accordance with the preceding aspect, the engagement portion (17, 18) of each of said channelling walls (10, 11) is engaged with the supporting frame (3) inside the housing compartment (5).

In a 30th aspect in accordance with any one of the preceding aspects, the lateral inlet opening (15) defines an opening having a substantially rectangular shape.

In a 31st aspect in accordance with any one of the preceding aspects, the lateral outlet opening (25) defines an opening having a substantially rectangular shape.

In a 32nd aspect in accordance with any one of the preceding aspects, the lateral inlet opening (15) defines a passage opening having a predetermined area, the lateral outlet opening (25) defines a passage opening having a predetermined area and the ratio of the passage area of the lateral inlet opening (15) to the passage area of the lateral outlet opening (25) is greater than 2, in particular comprised between 3 and 10.

In a 33rd aspect in accordance with any one of the preceding aspects, the lateral opening (8) has, according to a front view perpendicular to the prevalent direction (D) of extension of the supporting frame (3), a substantially rectangular, square or trapezoidal shape.

In a 34th aspect in accordance with any one of the preceding aspects, the channelling walls (10, 11) extend parallel to each other.

In a 35th aspect in accordance with any one of the preceding aspects, the channelling walls (10, 11) extend parallel to the prevalent direction of extension of the supporting frame (3).

In a 36th aspect in accordance with any one of the preceding aspects, the channel (9) has a cross section that is constant along the entire longitudinal extent thereof. In a 37th aspect there is provided an element according to any one of the aspects from the 1st to the 35th, wherein the channel (9) has a cross section that increases along the longitudinal extent thereof.

In a 38th aspect in accordance with the preceding aspect, the channelling walls (10, 11) extend away from each other along the longitudinal extent.

In a 39th aspect in accordance with any one of the preceding aspects, the lateral opening (8) has a predetermined passage section having a predetermined area that is smaller than the passage area of the lateral inlet opening (15) and larger than passage area of the lateral outlet opening (25).

In a 40th aspect in accordance with any one of the preceding aspects, the supporting frame (3) comprises at least one coupling portion (26) configured to reciprocally engage, directly or indirectly, with a respective coupling portion (26) of a further modular element (1) and allow the latter to be placed in a plurality of different operative positions defining different working conditions of the lateral outlet openings (25), the coupling portion (26) being further configured to place the lateral outlet opening (25) of at least one modular element (1) in an operative position that is different from an operative position of a lateral outlet opening (25) of another modular element (1).

In a 41st aspect in accordance with the preceding aspect, the coupling portion (26) is configured to place the lateral outlet opening (25) of at least one modular element (1) in an operative position in which said opening directs the air flow along an ejection direction (S) that is different from the ejection direction (S) of a lateral outlet opening (25) of at least one other modular element (1).

In a 42nd aspect in accordance with the 40th or 41st aspect, at least one coupling portion (26) of a modular element (1) comprises a predetermined number of engagement portions configured to cooperate with relative engagement portions of an adjacent modular element (1) so as to define a predetermined number of operative positions that are distinct and offset from one another, in particular angularly offset from one another.

In a 43rd aspect in accordance with the preceding aspect, the engagement portions of a coupling portion (26) comprise a predetermined number of ele-

ments protruding at least axially, configured to cooperate with a respective predetermined number of axial recesses of a coupling portion (26) of an adjacent modular element (1).

In a 44th aspect in accordance with the preceding aspect, the engagement portions of each modular element (1) are evenly spaced from each other; in particular they are angularly offset in a uniform manner.

In a 45th aspect in accordance with any one of the aspects from the 40th to the 44th, a coupling portion (26) of a modular element (1) comprises an engagement portion (29) configured to cooperate with a respective engagement portion (29) of a coupling portion (26) of an adjacent modular element (1) so as to define, between the lateral outlet openings (25) of respective modular elements (1), a plurality of contiguous operative positions offset from one another. In a 46th aspect in accordance with the preceding aspect, the engagement portion (29) of at least one coupling portion (26) of a modular element (1) comprises a guide configured to cooperate with at least a respective guide of an engagement portion (29) of an adjacent modular element (1), said guides being constrained by sliding relative to each other so as to define said plurality of contiguous operative positions of the modular elements (1).

In a 47th aspect in accordance with any one of the preceding aspects, the ejection direction (S) of the air flow is transversal, in particular perpendicular, to the prevalent direction (D) of extension of the supporting frame (3).

In a 48th aspect in accordance with any one of the preceding aspects, the supporting frame (3) has a substantially tubular shape.

In a 49th aspect in accordance with any one of the preceding aspects, the supporting frame (3) has a substantially cylindrical shape extending between the first and second ends (3a, 3b).

In a 50th aspect in accordance with any one of the aspects from the 40th to the 49th, the coupling portions (26) are located at said first and/or second ends (3a, 3b) of the frame.

In a 51st aspect in accordance with any one of the preceding aspects, the supporting frame (3) comprises a plurality of through holes (21) located at the lateral opening (8) of the same frame (3).

In a 52nd aspect in accordance with the preceding aspect, the plurality of holes (21) of the supporting frame (3) consists of a number of holes comprised between 10 and 100, in particular between 30 and 60.

In a 53rd aspect in accordance with the 51st or 52nd aspect, the plurality of holes (21) comprises at least a first series of holes that are aligned along the prevalent direction (D) of extension of the supporting frame (3) and flank the lateral outlet opening (25).

In a 54th aspect in accordance with the preceding

aspect, the plurality of holes (21) comprises at least a second series of holes that are aligned along the prevalent direction (D) of extension of the supporting frame (3) and flank the lateral outlet opening (25) on the opposite side from the first series of holes relative to the outlet opening itself.

In a 55th aspect in accordance with the 53rd or 54th aspect, the first series of holes consists of a number of holes comprised between 5 and 50, in particular between 10 and 30.

In a 56th aspect in accordance with the 54th or 55th aspect, the second series of holes consists of a number of holes comprised between 5 and 50, in particular between 10 and 30.

In a 57th aspect in accordance with any one of the aspects from the 51st to the 56th, each hole (21) of said plurality of holes has a diameter that is smaller than a minimum air passage size defined by the outlet opening (25).

In a 58th aspect in accordance with any one of the aspects from the 51st to the 57th, the ratio of the minimum air passage size defined by the lateral outlet opening (25) to the diameter of a hole (21) is greater than 2, in particular, it is comprised between 3 and 5.

In a 59th aspect in accordance with any one of the preceding aspects, the element (1) does not comprise ventilating devices (12) directly engaged with the modular element (1) itself.

In a 60th aspect in accordance with any one of the preceding aspects, the element (1) not having ventilating elements located inside the housing compartment (5).

In a 61st aspect in accordance with any one of the preceding aspects, the element (1) does not have, on the lateral wall (4) of the supporting frame (3), intake openings for generating the air flow.

In a 62nd aspect, there is provided a dynamic air curtain barrier (2) comprising at least one modular element (1) in accordance with any one of the preceding aspects.

In a 63rd aspect, there is provided an air curtain barrier (2) comprising:

- at least one modular element (1) in accordance with any one of the preceding aspects,
- at least one ventilating device (12) associated with said modular element (1) and configured to generate and deliver an air flow to the latter,

the modular element (1) being configured to receive the air flow from the ventilating device (12) and channel it outside the lateral outlet opening (25) along the ejection direction (S).

In a 64th aspect in accordance with the 62nd or 63rd aspect, the barrier (2) comprises at least a first plurality of modular elements (1) reciprocally engaged with each other and consecutively located along a

prevalent axis of extension (1 a) parallel to the prevalent direction (D) of extension of each modular element (1), the operative position of a lateral outlet opening (25) of at least one modular element (1) being angularly offsettable about the axis of extension (1a) relative to an operative position of at least one other lateral outlet opening (25) of a different modular element (1).

In a 65th aspect in accordance with any one of the aspects from the 62nd to the 64th, the operative position of a lateral outlet opening (25) of at least one modular element (1) is angularly offsettable relative to an operative position of at least one other lateral outlet opening (25) by a angle greater than 20°, in particular greater than 40°, even more in particular greater than 60°.

In a 66th aspect in accordance with any one of the aspects from the 62nd to the 65th, the ventilating device (12) comprises at least one fan, in particular a centrifugal, radial or axial fan.

In a 67th aspect in accordance with any one of the aspects from the 62nd to the 66th, the barrier (2) comprises at least one spacer (30) interposable between two modular elements (1) successively located along the axis (1 a).

In a 68th aspect in accordance with the preceding aspect, the spacer (30) not generating any air flow.

In a 69th aspect in accordance with the 67th or 68th aspect, the spacer (30) extends along a prevalent direction of extension parallel to the prevalent direction of extension of said modular elements (1) between a first and a second end (30a, 30b), said spacer (30) comprising, at said first and second ends (30a, 30b), a coupling portion configured to be connected with the respective coupling portions (26) of the modular elements (1) between which the spacer (30) is interposed.

In a 70th aspect in accordance with the preceding aspect, the coupling portion of the spacer (30) is configured to reciprocally connect the modular elements (1) between which said spacer (30) is interposed and allow the latter to be placed in a plurality of operative positions defining working conditions of the relative lateral outlet openings (25), the coupling portion of the spacer (30) being further configured to place the lateral outlet opening (25) of at least one modular element (1) in an operative position that is different from an operative position of a lateral outlet opening (25) of another modular element (1) of said air curtain barrier (2).

In a 71st aspect in accordance with the 69th or 70th aspect, the coupling portions (26) of the spacer (30) are configured to place the lateral outlet opening (25) of at least one modular element (1) to which said spacer (30) is connected in an operative position in which said lateral outlet opening (25) directs the air flow along an ejection direction (S) that is different from the ejection direction (S) of a lateral outlet open-

ing (25) of another modular element (1) of the air curtain barrier (2) connected with said spacer (30). In a 72nd aspect in accordance with any one of the aspects from the 69th to the 71st, at least the coupling portions of the spacer (30) comprise an engagement portion configured to cooperate with the respective engagement portions of the modular elements (1) between which the spacer (30) is interposed so as to define, between the respective lateral outlet openings (25) of said modular elements (1), a plurality of contiguous operative positions offset from one another.

In a 73rd aspect in accordance with the preceding aspect, the engagement portion of the coupling portions of the spacer (30) comprises at least one guide designed to cooperate with the guide of the modular elements (1) between which said spacer (30) is interposed, the guide of the engagement portion of the spacer (30) being constrained by sliding relative to the guides of the adjacent modular elements (1) between which said spacer (30) is interposed so as to define said plurality of contiguous operative positions of the modular elements (1).

In a 74th aspect in accordance with any one of the aspects from the 69th to the 73rd, at least the coupling portions of the spacer (30) comprise a plurality of engagement portions configured to cooperate with the respective engagement portions of the adjacent modular elements (1) between which said spacer is interposed so as to define, between the respective lateral outlet openings (25) of said modular elements (1), a predetermined number of operative positions that are distinct from one another, in particular angularly offset from one another.

In a 75th aspect in accordance with any one of the aspects from the 69th to the 74th, the coupling portions of the spacer (30) are substantially identical to the coupling portions (26) of the modular elements (1) between which said spacer (30) is interposed.

In a 76th aspect in accordance with any one of the aspects from the 62nd to the 75th, the modular elements (1) are directly or indirectly connected to each other.

In a 77th aspect in accordance with the preceding aspect, at least two of said modular elements (1) are indirectly connected to each other by means of at least one spacer (30).

In a 78th aspect in accordance with any one of the aspects from the 62nd to the 77th, each modular element (1) extends along a prevalent direction (D) of extension parallel to the axis (1 a) of the barrier. In a 79th aspect in accordance with any one of the aspects from the 62nd to the 78th, the ejection direction (S) of the air flow of each modular element (1) is transversal, in particular perpendicular, to the axis (1 a) of the barrier.

In an 80th aspect there is provided an infrastructure, comprising:

- at least one structure (102) delimiting an interior volume comprising at least one entrance (100) designed to enable passage into and/or out of said structure along a passage direction (101),
- at least one air curtain barrier (2), in accordance with any one of the aspects from the 62nd to the 79th, located at said entrance (100) and configured to generate at least one air flow transversal to the passage direction (101) of said entrance (100).

In an 81st aspect in accordance with the preceding aspect, the air curtain barrier (2) is located along a vertical extent of said entrance (100).

In a 82nd aspect in accordance with the 80th or the 81st aspect the infrastructure comprises at least two air curtain barriers (2) opposite each other relative to the entrance (100).

In an 83rd aspect in accordance with any one of the aspects from the 80th to the 82nd, the air curtain barrier (2) is located inside said interior volume.

In an 84th aspect in accordance with any one of the aspects from the 80th to the 83rd, at least one the modular elements (1) set in the lower part of the air curtain barrier (2) is facing towards the outside environment, and wherein at least one of the modular elements (1) set in the upper part of the air curtain barrier (2) is facing towards the interior volume.

In an 85th aspect, there is provided a process for producing a modular element (1) in accordance with any one of the aspects from the 1st to the 61st, said process comprising at least the following steps:

- preparing the supporting frame (3),
- forming the channel (9) by bending at least one flat metal sheet, in particular made of steel,
- after the steps of preparing the frame (3) and forming the channel (10, 11), engaging the first and the second channelling walls (10, 11) at the opening (8) of the frame (3) in such a way that each of said walls has respective inlet portions (10a, 11 a) located inside the housing compartment (5) and respective outlet portions (10b, 11 b) located outside the housing compartment (5).

In an 86th aspect in accordance with the preceding aspect, the formation of the channel (9) can comprise blanking or piercing of the metal sheet to define the plurality of holes (20) of said first and second channelling wall (10, 11).

In an 87th aspect in accordance with the 85th or the 86th aspect, the bending step comprises folding over at least a portion of the sheet metal so as to define, at least at the lateral outlet opening (25), two segments of overlapping sheet metal, the bending step further comprising an additional folding over of the sheet metal so as to define the respective engagement portions (17, 18) of the walls.

In an 88th aspect in accordance with any one of the aspects from the 85th to the 87th, the step of engaging the channelling walls (10, 11) with the frame (3) comprises at least a step of riveting the sheet metal of said walls to the supporting frame (3) so as to the fix the latter.

In an 89th aspect in accordance with any one of the aspects from the 85th to the 88th, the step of engaging the channelling walls (10, 11) with the frame (3) comprises a step of inserting the latter in the lateral opening (8) and subsequently fixing the engagement portions (17, 18) of the walls (10, 11) to the frame (3).

In a 90th aspect in accordance with any one of the aspects from the 85th to the 89th, the formation of the channel (9) comprises preparing a first and a second metal sheet that are distinct and separate from each other, the first channelling wall (10) being obtained by bending the first metal sheet and the second channelling wall (11) being obtained by bending the second metal sheet.

In a 91st aspect in accordance with any one of the aspects from the 85th to the 90th, the formation of the channel (9) comprises preparing a further metal sheet, which is distinct and separate from the first and second metal sheets, and subsequently bending the same to form the separating element (16); in particular, the formation of the channel (9) comprises preparing two further metal sheets, which are distinct and separate from each other and from the first and second metal sheets, and subsequently bending the same further sheets to form the plugs (16a, 16b).

In a 92nd aspect in accordance with any one of the aspects from the 85th to the 91st, the preparation of the separating element (16) can comprise blanking or piercing the further metal sheet to define the plurality of holes (19) of said separating element.

In a 93rd aspect in accordance with any one of the aspects from the 85th to the 92nd, the preparation of the supporting frame (3) comprises at least the following steps:

- preparing a flat metal sheet having a rectangular or square shape;
- bending said sheet so as to define said lateral wall; in particular, the bending comprises a step of calendering the sheet so as to define a circular tubular frame.

In a 94th aspect in accordance with the preceding aspect, the step of preparing the flat sheet further comprises blanking or piercing the same to form the plurality of holes (21).

In a 95th aspect in accordance with any one of the aspects from the 85th to the 94th, following the formation and engagement of the channelling walls (10, 11) with the frame (3) and following the formation of the separating element (16), the process comprises engaging the latter at free longitudinal edges of the

channelling walls to close off the longitudinal inlet openings (13, 14) of the modular element, and engaging the separating element (16) with the channelling walls (10, 11), maintaining the latter in a pre-determined operative position defining the duct (22). In a 96th aspect, there is provided a modular element according to any one of the aspects from the 1st to the 61st, wherein the tubular supporting frame (3) is substantially cylindrical and wherein the first and second channelling walls (10, 11) of the channel extend on the side opposite the lateral opening (8) beyond the central axis of extension of the supporting frame; in particular, the first and second channelling walls (10, 11) of the channel extend on the side opposite the lateral opening (8) for about 75% of the diameter of the cross section of the supporting frame.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Some embodiments and some aspects of the invention will be described below with reference to the appended drawings, provided solely by way of illustration and hence not by way of limitation, in which:

- > Figure 1 is a perspective view of a modular element in accordance with the present invention;
- > Figure 2 is a view from above of a modular element in accordance with the present invention;
- > Figure 3 is a detailed view of the modular element of figure 2;
- > Figures 4-4B are views from above of respective modular elements in accordance with the present invention;
- > Figure 5 is a side view of a modular element in accordance with the present invention;
- > Figure 6 is a front view of a modular element in accordance with the present invention;
- > Figures 7 and 8 are detailed perspective views partially from above of a modular element in accordance with the present invention;
- > Figure 9 is a further detailed perspective view of a modular element in accordance with the present invention;
- > Figure 10 is a perspective view of a variant embodiment of a modular element in accordance with the present invention;
- > Figure 11 is a perspective view of two air curtain barriers in accordance with the present invention and located, by way of non-limiting example, at an entrance;
- > Figure 12 is a partially cut-away detail of an air curtain barrier in accordance with the present invention;
- > Figure 13 is a view from above of an air curtain barrier in accordance with the present invention;
- > Figures 14 and 15 are schematic illustrations of respective air curtain barriers in accordance with the present invention;

- > Figure 16 is a perspective view of an air curtain barrier in accordance with the present invention;
- > Figures 17 and 18 are respective detailed views of the air curtain barrier of figure 16;
- > Figure 19 is a schematic illustration of an air curtain barrier in accordance with the present invention;
- > Figures 20 and 21 are respective perspective views of an air curtain barrier in accordance with the present invention;
- > Figure 22 is a further schematic illustration of an air curtain barrier in accordance with the present invention.

DETAILED DESCRIPTION

Modular element

[0010] With reference to the appended figures, 1 denotes in its entirety a modular element for a dynamic air curtain barrier 2. In order to better understand the structure of the modular element 1, it is useful to clarify that an air curtain barrier 2 is a system positionable at an entrance 100 to an air-conditioned interior which produces a veritable air "barrier" that serves to thermally insulate the interior from the conditions of the outside environment. In particular, the air curtain barrier 2 is configured to produce an air flow transversal to a passage direction 101 of the entrance 100. The air curtain barrier 2, as will be better described below, comprises a plurality of modular elements 1 connected to each other and aligned along an axis of extension 1a. The appended figures illustrate, in a non-limiting manner, an air curtain barrier 2 comprising three modular elements 1 aligned along the axis of extension 1a: thus arranged, the modular elements 1 substantially form a column 23 suitable for being positioned along the longitudinal and/or transversal extent of the entrance (see figures 11, 14 and 15). Based on requirements, it is possible to install one or more air curtain barriers 2. In fact, figure 11 illustrates, in a non-limiting manner, a condition in which there are two air curtain barriers 2 positioned at the entrance 100 opposite each other relative to the latter. Each modular element 1 extends along a prevalent direction of extension D (figure 1) parallel to the axis of extension 1a of the air curtain barrier 2; in particular the prevalent directions of extension of each modular element 1 coincide with the axis of extension 1a.

[0011] Each modular element 1 comprises a supporting frame 3 having, by way of non-limiting example, an elongated shape: the supporting frame 3 extends along a prevalent direction of extension D (direction of extension of the modular element 1) between a first and a second longitudinal end 3a, 3b. The supporting frame 3 has a lateral wall 4 internally defining a housing compartment 5 and which defines, at the first and second ends 3a, 3b, a respective first and second longitudinal openings 6, 7. In detail, the frame 3 has a tubular shape open at longitudinal ends, in which the first and second longi-

tudinal openings 6, 7 are delimited by respective free ends 6a, 7a (figure 1) and the housing compartment 5 extends for the entire extent of the modular element 1 (the supporting frame 3 defines a tubular structure open at the ends).

[0012] The appended figures illustrate a preferred, but non-limiting embodiment of the invention wherein the supporting frame 3 has a substantially cylindrical shape and the axis of the cylinder substantially coincides with the prevalent direction of extension D of the frame itself, in particular with the axis of extension 1 a of the air curtain barrier 2, and the bases of the cylinder are set at the first and second ends 3a, 3b. Alternatively, in further unillustrated embodiments, the supporting frame 3 can have a box-like shape.

[0013] From a dimensional viewpoint, it is possible to identify a predetermined length of the frame 3 defined by the maximum distance between the first and second ends 3a, 3b. Furthermore, the frame 3 has, in a cross section perpendicular to the prevalent direction of extension D, a predetermined transversal dimension D3. As described above the frame preferably has an elongated shape; the length is thus greater than the transversal dimension; in particular, the ratio of length of the frame to the transversal dimension D3 is comprised between 1.2 and 5, even more in particular between 1.5 and 3.

[0014] As can be seen for example from figures 1 and 3, the supporting frame 3 further comprises at least one lateral through opening 8 substantially extending along the prevalent direction of extension D of the frame itself; in fact, the opening 8 defines a passage in the lateral wall 4 of the frame 3.

[0015] In a preferred, but non-limiting embodiment of the invention, the lateral opening 8 extends over the entire lateral wall 4 along the prevalent direction of extension D of the frame; in particular, the lateral opening 8 extends from the first longitudinal end 3a to the second longitudinal end 3b so as to define a through opening. In other words, by virtue of the opening 8, the frame 3 defines an open profile in a cross section transversal to the prevalent direction of extension D. The lateral opening 8 can further define a passage whose cross section remains substantially constant along the entire extent of the frame 3 (configuration illustrated for example in figure 1); for example, the opening 8 can define a passage having a substantially rectangular shape (configuration illustrated in figure 1) or square shape. Alternatively, the opening 8 can define a passage whose cross section varies along the extent of the frame 3; in particular, the lateral opening 8 can define a passage whose size increases or decreases from the first end 3a to the second end 3b. Figure 10 illustrates, solely by way of example, a lateral opening 8 whose passage decreases linearly from the first end 3a to the second end 3b. In the latter condition, the lateral opening 8 essentially defines a passage having a substantially trapezoidal shape. The shape of the lateral opening 8 can be defined by observing the opening 8 itself from the front according to a di-

rection normal to the prevalent direction of extension D of the supporting frame 3.

[0016] As regards the dimensional aspect of the opening 8, the latter has a passage section having a predetermined area, for example comprised between 200 and 700 cm², in particular comprised between 300 and 500 cm². It is further possible to identify a minimum transversal passage D7 of the opening 8 defined by the minimum distance between a first and a second free longitudinal edge 24a, 24b (figure 3): the minimum passage D7 is greater than 15 mm, in particular comprised between 20 and 100 mm.

[0017] The modular element 1 can further comprise at least one coupling portion 26 configured to reciprocally engage modular elements 1 and allow the latter to be placed in a plurality of operative positions defining operative positions of respective lateral air outlet openings of the same modular elements 1. The lateral outlet opening 25 will be better described below.

[0018] The coupling portion 26 is further configured to place the outlet opening 25 of at least one modular element 1 in an operative position that is different from an operative position of an outlet opening 25 of another modular element 1. In greater detail, the coupling portion 26 is configured to place the outlet opening 25 of at least one modular element 1 in an operative position in which the outlet opening 25 directs the air flow along an ejection direction S transversal, in particular perpendicular, to the prevalent direction of extension D of the supporting frame, and different from the ejection direction S of a outlet opening 25 of at least one other modular element 1 (see, for example, figure 13). Figure 11 shows, by way of non-limiting example, a condition in which all of the ejection directions S of the modular elements 1 differ from one another. The coupling portion 26 is located at the first and/or second ends 3a, 3b of the supporting frame 3; in particular it is located on both of the longitudinal ends of the supporting frame 3. In a first embodiment, illustrated for example in figure 1, the coupling portion 26 of one modular element 1 comprises an engagement portion 29 configured to cooperate with a respective engagement portion 29 of a coupling portion 26 of an adjacent modular element 1 so as to define, between the respective outlet openings 25 of the modular elements 1, an indeterminate number of contiguous operative positions offset from one another. Figure 12 illustrates a configuration in which the engagement portion 29 comprises a flange emerging transversally, in particular perpendicularly, relative to the prevalent direction of extension of the respective modular element 1. During the connection of two modular elements 1, the flange of a first modular element 1 comes to abut against the flange of a second adjacent modular element 1 successively disposed along the axis of extension 1a. In this case the axial constraint is substantially assured by the abutment of the modular elements 1. In order to better secure the modular elements 1 to one another it is possible to use, for example, a locking element 27 designed to ensure the radial con-

straint of the modular elements 1 and better secure the latter along the axial direction. In the illustrated embodiment, the locking element 27 comprises a metal clamp having a substantially "C-shaped" profile and extending along the entire perimeter edge of the flange. The "C" shape serves to provide a grip on the two flanges and thus constrain two modular elements 1 axially whilst the perimetrical extent along said flange prevents the modular elements from moving radially relative to one another. Alternatively, the flange of the modular elements 1 can comprise through seats suitable for receiving respective threaded screws (configuration not illustrated in the appended figures) passing through them. The coupling portion 26 is configured to allow in any case relative movement between coupled modular elements 1. The modular elements 1, being able to slide, and in particular to rotate, relative to one another and describe an indeterminate number of operative positions which are offset, in particular angularly offset, between the outlet opening 25 of a modular element 1 relative to the operative position of an outlet opening of another modular element 1. Again considering this first embodiment of the coupling portion 26, the engagement portion 29 of a first coupling portion 26 can alternatively comprise a guide, having at least one axial protrusion, designed to cooperate with at least a respective guide of an engagement portion 29 of an adjacent modular element 1, having an axial recess. The guides being constrained by sliding relative to one another so as to define the indeterminate number of operative positions of the modular elements 1. In the latter case described, the cooperation between the axial protrusion and the axial recess make it possible to radially constrain the modular elements 1 while allowing the free axial sliding thereof.

[0019] In a second embodiment, at least one coupling portion 26 of a modular element 1 comprises a predetermined number of distinct engagement portions designed to cooperate with corresponding distinct engagement portions of an adjacent modular element 1 so as to define a predetermined number of operative positions offset from one another. In greater detail, based on the structure of the supporting frame 3, the cooperation of the coupling portions 1, in the last embodiment described, enables the modular elements 1 to be placed in a predetermined number of operative positions angularly offset from one another about the axis of extension 1a. The engagement portions of a coupling portion 26 comprise a predetermined number of elements protruding at least axially and cooperating with a respective predetermined number of axial recesses of a coupling portion 26 of an adjacent modular element 1. The engagement portions of each modular element 1 can be evenly spaced from each other so that the modular elements 1 can be moved according to a uniform angular pitch or have a non-uniform offset. Making reference again to the last embodiment described, the engagement portions constrain the modular elements 1 only in direction. The axial constraint is ensured only by the abutment of the modular elements 1.

Alternatively, it is possible to use a locking element 27 capable of more securely ensuring the axial constraint of the modular elements 1.

[0020] Both embodiments of the coupling portion 26 enable each modular element 1 to be independently directable relative to another modular element 1. As previously mentioned, the shape of the supporting frame 3 and respectively of the coupling portion 26 enables a relative rotation of the modular elements about the axis of extension 1a. Through this rotation it is possible to orient the air flow of each modular element 1 out of the outlet opening 25 in the desired direction to create different flow profiles suitable for counteracting the particular flow profile of the incoming air. The outdoor air which passes through the inlet section to the air-conditioned interior does not, in fact, advance with a uniform and compact front, but rather has an ideally oblique profile, with a greater distribution of cold air at the bottom and warm air at the top. Therefore, the possibility of adjusting the orientation of each modular element 1 independently, and thus of varying the direction of the air flow exiting each modular element 1 on the horizontal plane, enables each portion of the current profile to be counteracted in the best manner at the entrance, at various heights from the ground. In other words, a rotation about the axis 1a of the modular element 1 enables the flow generated in the module to be directed parallel to the direction of extension of the entrance, towards the outside or toward the inside of the structure. By way of non-limiting example, figure 11 shows a configuration of the air curtain barrier 2 wherein the bottom modular element directs the flow towards the inside and the top modular element directs the air flow toward the outside of the entrance 100, whereas the middle element directs the air flow perpendicularly to the passage direction 101 of the entrance 100.

[0021] Quantitatively, the coupling portions 26 are configured to allow the operative position of an outlet opening 25 of one modular element 1 to be angularly offset relative to an operative position of at least one other outlet opening 5b by an angle greater than 30°, in particular greater than 60°, even more in particular greater than 90°. It is worth noting that in the case in which there is a spacer 30 between two adjacent modular elements 1, to enable the connection between modular elements 1 the spacer 30 can have a coupling portion 26 designed to abut against the coupling portions 26 of the modular element 1. In particular, the spacer 30 extends between a first and a second end 30a, 30b at which it has a coupling portion 26 having the same technical and functional characteristics as the coupling portion 26 of the supporting frame 3 described above.

[0022] The supporting frame 3 can further comprise a plurality of holes 21 (figure 1) passing through the frame and configured to allow fluid communication between the housing compartment 5 and the outside environment. The holes 21 are substantially located at the lateral opening 8 and are configured to emit air at high speeds into the outside environment and through the lateral opening

of the supporting frame 3. In greater detail, the plurality of holes 21 comprises at least a first series of holes that are aligned along the prevalent direction of extension D of the supporting frame 3 and flank the lateral opening 8 of the frame (flank the lateral outlet opening 25); the plurality of holes 21 further comprises at least a second series of holes that are aligned along the prevalent direction of extension D of the supporting frame 3 and flank the lateral opening 8 of the frame (flank the lateral outlet opening 25) on the opposite side from the first series of holes relative to the outlet opening itself. Advantageously, the first and the second series of holes consist of the same number of holes 21 and are distributed evenly along the lateral opening 8. From a quantitative standpoint, the first series can have a number of holes comprised between 5 and 50, in particular between 10 and 30; likewise, the second series can have a number of holes comprised between 5 and 50, in particular between 10 and 30. By analyzing the plurality of holes from a dimensional standpoint, it is possible to specify that each hole 21 has a diameter that is smaller than a minimum transversal passage size of the lateral opening 8, in particular the ratio of the minimum passage size of the lateral opening 8 to the diameter of a hole 21 is greater than 2, in particular, it is comprised between 3 and 5. The reduced size of the holes 21 enables the emission of air at high speeds around the passage opening 8, which has a high inductive capacity able to draw and then move a large mass of air.

[0023] As can be seen from the appended figures, the modular element 1 comprises at least one channel 9 engaged with the supporting frame 3 and configured to receive the air flow from the at least one ventilating device 12 (the device will be described in detail below) and channel it along a direction S of ejection out of the said housing compartment 5 through the lateral opening 8. The ejection direction S is transversal, in particular perpendicular, to the prevalent direction of extension of the frame 3.

[0024] The channel 9 has at least a first and a second longitudinal channelling wall 10, 11 prevalently extending into the housing compartment 5 along the prevalent direction of extension D of the frame 3. Each channelling wall 10, 11 comprises at least an inlet portion 10a, 11a located inside the housing compartment 5 and an outlet portion 10b, 11b located outside the housing compartment 5; the respective inlet portions 10a, 11a of the channelling walls 10, 11 define a lateral inlet opening 15, whilst the respective outlet portions 10b, 11b of the channelling walls 10, 11 define an outlet opening 25 configured to direct the air flow along an ejection direction S: the channelling walls 10, 11 define, in cooperation each other, a duct 22 for the air flow extending between the inlet opening 15 and the outlet opening 25 (see, for example figures 2 and 3).

[0025] As can be seen, the channelling walls 10, 11 are engaged at the lateral opening 8 and extend over the entire lateral wall 4 along the prevalent direction of extension D, in particular parallel to the direction D (see,

for example the figure 1). In a variant embodiment illustrated in figure 1, the channelling walls 10, 11 extend parallel to each other, in particular parallel to the prevalent direction of extension D of the supporting frame 3. In this condition, the channel 9 has a cross section that is constant along the entire longitudinal extent thereof. In an alternative configuration of the channel 9, the latter has a cross section that varies (increases or decreases) along the longitudinal extent thereof: the channelling walls 10, 11 away (or toward) each other along the longitudinal extent. Figure 10 illustrates a variant embodiment of a modular element 1, wherein the channel has a cross section that increases from second end 3b of the frame 3 in the direction of the first end 3a. As described above, the channel 9 is engaged with the supporting frame 3 at the lateral opening 8, in particular, the channel 9 is internally engaged with the lateral opening 8: the channel 9 is of a shape mating that of the lateral opening 8 so as to allow an air flow entering the housing compartment 5 to pass out of the frame 3 only through the duct 22 and thus through the channel 9. In greater detail, each of said channelling walls 10, 11 comprises at least one engagement portion 17, 18 interposed between the respective inlet portion 10a, 11a and the respective outlet portion 10b, 11b; the engagement portion 17, 18 is stably engaged with the supporting frame 3 at the lateral opening 8 so as to constrain the channelling wall 10, 11 internally to the latter opening 8. The engagement portion 17, 18 of each of said channelling walls 10, 11 is, by way of non-limiting example, engaged with the supporting frame 3 inside the housing compartment 5 (figure 3).

[0026] Even more in detail, each engagement portion 17, 18 comprises a portion of sheet metal emerging substantially perpendicularly from the walls defining the duct 22; each engagement portion 17, 18 is stably fixed to the lateral wall 4 of the frame by means of fastening elements, for example by means of rivets (fastening elements not illustrated in the appended figures).

[0027] In a preferred but non-limiting configuration of the invention, the channelling walls 10, 11 are identical to each other and extend for the length of the lateral opening 8, that is, for the entire length of the supporting frame 3. In other words, the channelling walls 10, 11 of the channel 9 extend over the entire lateral wall 4 along the prevalent direction of extension D between the first and second ends 3a, 3b of the supporting frame 3. In a preferred but non-limiting embodiment of the invention, each of said channelling walls 10, 11 comprises at least one metal sheet, in particular made of steel and obtained by bending; the walls are spaced apart and distinct from each other and disposed in such a way as to define the duct for channelling the air flow: the walls 10, 11 consist of two distinct parts. In fact, the first channelling wall 10 extends between a first and a second free longitudinal edge, whereas the second channelling wall 11 extends respectively between a first and a second free longitudinal edge: the channelling walls 10, 11 are spaced from each other so that the first free longitudinal edges and

second longitudinal edges define, respectively, a first and a second longitudinal inlet opening 13, 14: the lateral inlet opening 15 is interposed between said longitudinal inlet openings.

[0028] In fact, in a cross section of the walls 10, 11 of the channel 9, the latter define two segments inclined relative to each other and define a taper decreasing in an outward direction from the housing compartment 5. Quantitatively, the taper of the two segments of the channel (9) is comprised between 5° and 40°, in particular between 10° and 30°.

[0029] In other words, the inlet portions 10a, 11 a of the channelling walls 10, 11 have a minimum distance D5 from each other that is greater than a minimum distance D6 measured between the outlet portions 10b, 11 b of the channelling walls 10, 11. In particular, the ratio of the minimum distance D5, measured between the inlet portions 10a, 11 a of the channelling walls 10, 11, to the minimum distance D6, measured between the outlet portions 10b, 11b of the channelling walls 10, 11, is greater than 1.5; in particular, it is comprised between 2 and 7.

[0030] The dimension of the minimum distance D7 defined by the lateral opening 8 is in contrast comprised between the distance D5 and the distance D6; the minimum distance D5 between the inlet portions 10a, 11 a is greater than the distance D7, whilst the latter is greater than the minimum distance D6 between the outlet portions 10b, 11 b of the walls 10 and 11.

[0031] Furthermore, it is worth observing that the inlet portions 10a, 11 a of the channelling walls 10 have a minimum distance D1 from the lateral opening 8 that is greater than the minimum distance D2 present between the same inlet portions 10a, 11 a and a portion of the lateral wall 4 of the frame 3 opposite the lateral opening; in particular, the ratio of the minimum distance D1 present between the inlet portions 10a, 11a and the lateral opening 8 to the minimum distance D2 present between the same inlet portions 10a, 11 a and a portion of the lateral wall 4 is greater than 2, in particular, it is comprised between 3 and 10. In fact, the channelling walls 10, 11 are located at a distance closer to a portion of the lateral wall 4 opposite the lateral opening 8. Furthermore, the inlet portions 10a, 11 a of the channelling walls 10 have a minimum distance D1 from the lateral opening 8 that is greater than the minimum distance D4 present between the outlet portions 10b, 11 b and the same lateral opening 8. In particular, the ratio of the minimum distance D1 present between the inlet portions 10a, 11 a and the lateral opening 8 to the minimum distance D4 present between the outlet portions 10b, 11 b and the same lateral opening 8 is greater than 2, in particular, it is comprised between 3 and 10. In fact, as can be seen from the appended figures, the channelling walls 10, 11 extend to a greater extent inside the compartment 5 than outside the compartment itself. It is further possible to establish a ratio between the dimension D1 and the transversal dimension D3 of the supporting frame 3; this ratio is comprised between 0.5 and 0.95, in particular between 0.7

and 0.9. In the configuration illustrated in the appended figures, the transversal dimension D3 is represented by the diameter of the frame. The ratio of D1 to D3 is thus defined between the minimum distance D1 (inlet portions and lateral opening 8) and the diameter of the frame. The ratio identifies that the inlet portions 10a, 11 a extend beyond the centre of the frame in a direction away from the lateral opening 8. Quantitatively, the inlet portions 10a, 11 a of the channelling walls 10 have a minimum distance D1 from the lateral opening 8 that is greater than 100 mm, in particular greater than 200 mm; in particular, it is comprised between 250 and 400 mm. In contrast, the inlet portions 10a, 11a of the channelling walls 10 have a minimum distance D2 from a portion of the lateral wall 4 opposite the lateral opening that is comprised between 20 and 150 mm, in particular between 30 and 100 mm, even more in particular between 40 and 80 mm. The outlet portions 10b, 11 b of the channelling walls 10, 11 instead have a minimum distance D4 from the lateral opening 8 that is greater than 10 mm, in particular greater than 20 mm; in particular, it is comprised between 30 and 100 mm.

[0032] As described above, the channelling walls 10, 11 are spaced from each other and define at longitudinal terminal edges the first and second openings 13, 14. As can be seen from figure 1, 4, 4A, 4B, the channel 9 comprises at least one separating element 16 associated with said channelling walls 10, 11 at longitudinal ends and which is configured to close off said walls at said longitudinal ends to enable the passage of the air flow only through the lateral inlet opening 15.

[0033] In fact, the separating element 16 is engaged with the channel 9 and/or with the supporting frame 7 and is configured to close off the first and second longitudinal inlet openings 13, 14 to allow the air flow entering the housing compartment 5 to reach the outlet opening 25 only through the lateral inlet opening 15. The passage of air entering the duct 22 and directed toward the lateral outlet opening 25 is thus allowed only by means of the lateral inlet opening 15. In a preferred but non-limiting embodiment of the invention, the separating element 16 comprises a first and a second plug 16a, 16b respectively configured to close off the first and second longitudinal inlet openings 13, 14 (figure 5 and 6) and allow the air flow to pass only through the lateral inlet opening 15.

[0034] Advantageously, the separating element 16 is of a shape at least partially mating that of the cross section of the channel 9: the element abutting the extreme longitudinal edges of the channelling walls 10, 11 closes off the openings 13 and 14. In fact, the separating element 16 substantially extends along a prevalent plane and has, according to a view normal to the prevalent plane of extension of the same, a substantially trapezoidal shape. In detail, the separating element 16 comprises a metal sheet, in particular made of steel, which extends beyond the first inlet portions 10a, 11 a of the channelling walls 10, 11 to the lateral wall 4 in a position opposite the lateral opening 8. The separating element 16 extends

over the entire transversal dimension of the supporting frame 3 considered substantially along the extent of the channelling walls. Furthermore, the separating element 16 is bent so as to define, in a cross section thereof, a substantially "C" shape, whose concavity is facing towards the channel 9. The concavity is defined by means of two terminal strips and a connecting portion. The terminal strips of the "C" shape extend parallel to the respective channelling walls 10, 11, while the connecting portion abuts the longitudinal ends of the channelling walls 10, 11 and closes off the respective longitudinal inlet opening 13, 14. The separating element 16, besides defining the closure element for the openings 13 and 14, is configured to define the degree of inclination of the channelling walls 10, 11 by means of the terminal strips: these portions act so as to flatten out the channelling walls and maintain them in a predetermined operative position. Based, therefore, on the shape of the separating element 16, it is possible to define the inclination of the walls and hence the various distances D1, D2, D4, D5 and D6 specified above. Figures 4 to 4B illustrate various configurations of the separating element which thus determines different operative conditions (inclinations) of the channelling walls 10, 11.

[0035] Again observing the appended figures, it is possible to note that the separating element 16 can comprise, at least in the connecting portion, a plurality of holes 19 passing through the plate of the element itself; in particular, the holes 19 are located in the inlet portions 10a, 11a of said channelling walls 10, 11. As described above, the separating element 16 has a closure portion extending away from first inlet portions 10a, 11a to a portion of the lateral wall 4 opposite the lateral opening 8; the separating element 16 has a plurality of through holes 19 located in the closure portion of the separating element 16 itself.

[0036] The channelling walls 10, 11, together with the separating element 16, are such as to define a lateral inlet opening 15 having a substantially rectangular shape. Analogously, the lateral outlet opening 25 defines an opening having a substantially rectangular shape. The lateral inlet opening 15 defines a passage opening having a predetermined area; analogously, the lateral outlet opening 25 defines a passage opening having a predetermined area that is smaller than the passage area of the inlet opening 15. In particular, the ratio of the passage area of the lateral inlet opening 15 to the passage area of the lateral outlet opening 25 is greater than 2, in particular comprised between 3 and 10. The lateral opening 8 also has a predetermined passage section having a predetermined area which is smaller than the passage area of the lateral inlet opening 15 and larger than the passage area of the lateral outlet opening 25.

[0037] The channel can further have a plurality of through holes 20 located in the walls 10 and 11 (figure 1); the holes 20 are evenly distributed along the inlet portions 10a, 11a of the respective walls for the entire longitudinal extent of the same. A preferred configuration,

which does not limit the scope of the invention, envisages a first and a second series of holes 21 located in the respective inlet portions 10a, 11a and aligned along the prevalent direction of extension D of the frame 3. The holes 20, as in the case of the holes 21, have a predetermined size configured to generate, inside the compartment 5, air flows at high speeds capable of moving large air masses.

[0038] Each channelling wall 10, 11 can further comprise inlet portions 10a, 11a formed so as to define a sort of curl. The rounded shape is configured to prevent the formation of turbulent currents which inside the housing compartment 5 could compromise the correct circulation of the air flow entering the lateral inlet opening 15.

Air curtain barrier

[0039] The present invention further relates to at least one air curtain barrier 2 comprising at least one modular element 1. Advantageously, the air curtain barrier 2 comprises a plurality of modular elements 1 connected to one another and aligned along an axis of extension 1a. Figure 11 illustrates, by way of non-limiting example, an air curtain barrier 2 comprising three modular elements 1 aligned along the axis of extension 1a: thus arranged the modular elements 1 substantially form a column 23 suitable for being positioned along the longitudinal extent of the entrance 100 (as can be seen in figure 11, the columns are positioned vertically alongside the entrance 100). Alternatively, the air curtain barriers 2 can be positioned along the transversal extent of the entrance 100, in particular positioned horizontally above and/or below the entrance 100 as illustrated in the schematic illustrations of figures 14 and 15. Based on the requirements, it is possible to install one or more air curtain barriers 2. In fact, figure 11 illustrates, by way of non-limiting example, a condition in which there are two air curtain barriers 2 positioned opposite each other in relation to the entrance 100. Each modular element 1 extends along a prevalent direction of extension D (figure 1) parallel to the axis of extension 1a of the air curtain barrier 2, in particular the prevalent directions of extension of each modular element 1 coincide with the axis of extension 1a. As described above, each modular element 1 can comprise at least one coupling portion 26 configured to reciprocally engage modular elements 1 and allow the latter to be placed in a plurality of operative positions defining operative positions of respective lateral air outlet openings 25 of the same modular elements 1. The coupling portion 26 is further configured to place the outlet opening 25 of at least one modular element 1 in an operative position that is different from an operative position of an outlet opening 25 of another modular element 1 of the air curtain barrier. More in detail, the coupling portion 26 is configured to place the outlet opening 25 of at least one modular element 1 in an operative position in which the outlet opening 25 directs the air flow along an ejection direction S that is different from the ejection direction S

of an outlet opening 25 of at least one other modular element 1 of the air curtain barrier. For example, the operative position of a lateral outlet opening 25 of at least one modular element 1 is angularly offsettable relative to an operative position of at least one other lateral outlet opening 25 by an angle greater than 20°, in particular greater than 40°, even more in particular greater than 60° (see, for example figure 13).

[0040] Figure 11 shows, by way of non-limiting example, a condition in which all the ejection directions S of the modular elements 1 differ from one another. As described above, the coupling portion 26 is located at the first and/or second end 3a, 3b of the supporting frame 3, in particular located at both longitudinal ends of the supporting frame 3. In a first embodiment, illustrated for example in figure 1, the coupling portion 26 of a modular element 1 comprises an engagement portion 29 configured to cooperate with a respective engagement portion 29 of a coupling portion 26 of an adjacent modular element 1 so as to define, between the respective outlet openings 25 of the modular elements 1 of the air curtain barrier 2, an indeterminate number of contiguous operative positions offset from one another.

[0041] The coupling portion 26 is configured to allow in any case relative movements between coupled modular elements 1. The modular elements 1, being able to slide, in particular to rotate, relative to each other and describe an indeterminate number of offset, in particular angularly offset, operative positions of the outlet opening 25 of one modular element 1 relative to the operative position of an outlet opening of another modular element 1 of the air curtain barrier 2.

[0042] In other words, the coupling portion 26 enables the modular element 1 to be independently directed relative to another modular element 1 of the air curtain barrier 2. As previously mentioned, the shape of the supporting frame 3 and respectively of the coupling portion 26 enables the relative rotation of the modular elements about the axis of extension 1a. Through this rotation it is possible to orient the air flow of every modular element 1 exiting the outlet opening 25 in the desired direction so as to create different flow profiles capable of counteracting the particular flow profile produced by the incoming air. The outdoor air that passes through the inlet section into the air-conditioned interior does not, in fact, advance with a uniform and compact front, but rather has an ideally oblique profile, with a greater distribution of cold air at the bottom and warm air at the top. Therefore, the possibility of adjusting the orientation of each modular element 1 independently, and thus of varying the direction of the air flow exiting each modular element 1 on the horizontal plane, enables each portion of the current profile to be counteracted in the best manner at the entrance, at various heights from the ground. In other words, a rotation about the axis 1a of the modular element 1 enables the flow generated in the module to be directed parallel to the direction of extension of the entrance, towards the outside or toward the inside of the structure.

[0043] By way of non-limiting example, figure 11 shows a configuration of the air curtain barrier 2 wherein the bottom modular element directs the flow towards the inside and the top modular element directs the air flow toward the outside of the entrance 100, whereas the middle element directs the air flow perpendicularly to the passage direction 101 of the entrance 100.

[0044] The air curtain barrier 2 can further comprise at least one spacer 30 interposable between two modular elements 1 successively located along the axis of extension 1a (condition can be seen in figure 11) which enables said space to be generated within the air flow. The spacer 30 is substantially a spacer which does not generate any air flow. The appended figures illustrate, by way of non-limiting example, a spacer 30 having a cylindrical tubular shape extending along the axis of extension 1a of the air curtain barrier 2.

[0045] The barrier 2 can further comprise at least one ventilating device 12 associable with the frame 3 outside the housing compartment 5; the device 12 is configured to generate an air flow and direct it to the various modular elements 1: the flow is introduced into the module through the openings 6 and 7, passes only through the lateral inlet opening 15 and is emitted through the outlet opening 25 along the ejection direction. The device 12 can comprise one or more configured fans, for example of the centrifugal, radial or axial type. Figure 14 illustrates a first configuration of an air curtain barrier 2 having two fans designed to serve three different air curtain barriers 2. Alternatively, it is possible to envisage only one fan capable of serving one or more air curtain barriers 2 (figure 15). The structure of the modular elements 1 makes it possible for the air curtain barrier to comprise even only one fan for defining the air flow; the passage of air only through the inlet openings 15 enables the modular elements to render the flow exiting the barriers uniform without the first modular element 1, according to a forward direction of flow, having a greater air flow (larger flow at high speeds) than a modular element situated downstream.

Infrastructure

[0046] The present invention further relates to an infrastructure comprising a structure 102 delimiting an interior volume comprising at least one entrance 100 designed to enable passage into and/or out of said structure along a passage direction 101. The infrastructure further has at least one air curtain barrier 2 positioned at said entrance 100 and configured to generate at least one air flow transversal to the passage direction 101 of said entrance 100. In detail, the air curtain barrier 2 is positioned along a vertical and/or horizontal extent of the entrance 100. Two or more air curtain barriers 2 set opposite each other relative to the entrance 100 can in fact be used to generate air flows that are incident to each other. Figure 11 illustrates, by way of example, an infrastructure having only two air curtain barriers extending substantially ver-

tically and positioned at the entrance 100, whereas figures 14 and 15 illustrate alternative embodiments wherein there are two vertically extending barriers 2 on opposite sides of the entrance and a larger horizontally extending barrier 2. Advantageously, the air curtain barrier 2 is disposed inside the interior volume so as to form an obstacle to the air flow arriving from the outside environment. Furthermore, preferably, the modular elements 1 set in the lower part of the air curtain barrier 2 are turned towards the outside environment, whilst at least one of the modular elements 1 set in the upper part of the air curtain barrier 2 is turned towards the interior volume.

Process for producing a modular element

[0047] The present invention further relates to a process for producing a modular element 1 which comprises preparing the frame 3, for example by bending a steel sheet so as to define a tubular element having at least one lateral opening. The preparation step can comprise steps of blanking, cutting or perforating the sheet metal so as to define the holes 21.

[0048] The process further comprises forming said walls 10 and 11 by preparing two metal sheets, in particular made of steel, and subsequently bending the same so as to define at least a flap consisting of two segments of overlapping sheet metal which will then define the outlet opening 25 of the element 1. The sheet metal is further folded over so as to define the respective engagement portions 17, 18 of the walls. The step of forming the walls can comprise steps of blanking, cutting or perforating the sheet metal so as to define the holes 20.

[0049] The process then comprises a step of engaging the walls 10 and 11 in the opening 8, which entails inserting the walls themselves in said opening 8, and subsequently a fixing step, which may comprise riveting or welding the engagement portions 17 and 18 to the lateral wall 4 of the frame 3.

[0050] The process further comprises forming the separating element 16 by preparing a metal sheet, in particular made of steel, and subsequently bending the same so as to define at least the connecting portion and the terminal strips of the element 16. The step of forming the element 16 can comprise steps of blanking, cutting or perforating the sheet metal so as to define the holes 19.

[0051] Subsequently, the separating element 16 is stably engaged with the walls 10 and 11 so as to close off the longitudinal openings 13 and 14 and further define the degrees of inclination between the walls themselves.

Claims

1. A modular element (1) for dynamic air curtain barriers (2), said modular element (1) comprising:
 - at least one supporting tubular frame (3) extending along a prevalent direction (D) of extension

sion between a first and a second longitudinal end (3a, 3b), said supporting frame (3) having a lateral wall (4) internally defining a housing compartment (5) and which defines, at the first and second ends (3a, 3b) of the frame, a respective first and second longitudinal openings (6, 7), the first and second longitudinal openings (6, 7) being delimited by respective free edges (6a, 7a), the supporting frame (3) further comprising at least one lateral through opening (8) substantially extending along the prevalent direction (D) of extension of the frame itself, the supporting frame (3) being associable with at least one ventilating device (12) configured to generate an air flow destined for the housing compartment (5) of the frame itself and passing through at least one of said first and second longitudinal openings (6, 7),

- at least one channel (9) engaged with the supporting frame (3) and configured to receive the air flow from the ventilating device (12) and channel it along a direction (S) of ejection out of said housing compartment (5) through the lateral opening (8), the channel (9) having at least a first and a second longitudinal channelling wall (10, 11) extending prevalently, or completely, inside the housing compartment (5) along the prevalent direction (D) of extension of the frame (3), each channelling wall (10, 11) having at least one inlet portion (10a, 11 a) located inside the housing compartment (5) and an outlet portion (10b, 11 b) preferably, but not necessarily, located outside the housing compartment (5), the respective inlet portions (10a, 11 a) of the channelling walls (10, 11) defining a lateral inlet opening (15), the respective outlet portions (10b, 11 b) of the channelling walls (10, 11) defining an outlet opening (25) configured to direct the air flow along the ejection direction (S), the channelling walls (10, 11) defining, in cooperation with each other, a duct (22) for the air flow extending between the inlet opening (15) and the outlet opening (25), and wherein the inlet portions (10a, 11 a) of the channelling walls (10) have a minimum distance (D1) from the lateral opening (8) that is greater than a minimum distance (D2) present between the same inlet portions (10a, 11 a) and a portion of the lateral wall (4) of the frame (3) opposite the lateral opening.

2. The element according to the preceding claim, wherein the lateral opening (8) of the supporting frame (3) extends over the entire lateral wall (4) along the prevalent direction (D) of extension of the frame, in particular the lateral opening (8) extends from the first longitudinal end (3a) to the second longitudinal end (3b) so as to define a through opening, and wherein the channelling walls (10, 11) are en-

- gaged at said lateral opening (8) and extend over the entire lateral wall (4) along the prevalent direction (D) of extension, in particular the channelling walls (10, 11) of the channel (9) extend over the entire lateral wall (4) along the prevalent direction (D) of extension between the first and second ends (3a, 3b) of the supporting frame (3).
3. The element according to claim 1 or 2, wherein the ratio of the minimum distance (D1) present between the inlet portions (10a, 11 a) and the lateral wall (8) to the minimum distance (D2) present between the same inlet portions (10a, 11 a) and a portion of the lateral wall (4) is greater than 2, in particular it is comprised between 3 and 10.
 4. The element according to any one of the preceding claims, wherein the supporting frame (3) has a maximum transversal inner dimension (D3), measured from the lateral wall (8) to a portion of the lateral wall (4) of the frame (3) opposite said lateral wall (8), the ratio of the maximum transversal inner dimension (D3) to the minimum distance (D1) being comprised between 0.5 and 0.95, in particular between 0.7 and 0.9.
 5. The element according to any one of the preceding claims, wherein the channel (9), in a cross section thereof, has a shape comprising two segments that are inclined relative to each other and define a taper decreasing in an outward direction from the housing compartment (5), in particular wherein the taper of the two segments of the channel (9) is comprised between 5° and 40°, and even more in particular between 10° and 30°.
 6. The element according to any one of the preceding claims, wherein the first channelling wall (10) extends between a first and a second free longitudinal edge, the second channelling wall (11) extends respectively between a first and a second free longitudinal edge, the channelling walls (10, 11) are spaced from each other so that the first free longitudinal edge and the second longitudinal edge respectively define a first and a second longitudinal inlet opening (13, 14), the modular element (1) comprising at least one separating element (16) engaged with the channel (9) and/or with the supporting frame (7), and configured to close off the first and second longitudinal inlet openings (13, 14) so as to enable the air flow entering the housing compartment (5) to reach the outlet opening (25) only through the lateral inlet opening (15), in particular the separating element (16) comprises a first and a second plug (16a, 16b) respectively configured to close off the first and second longitudinal inlet openings (13, 14).
 7. The element according to claim 6, wherein the separating element (16) is of a shape at least partially mating that of the cross section of the channel (9) and substantially extends along a prevalent plane, said separating element (16), according to a view normal to the prevalent plane of extension thereof, having a substantially trapezoidal shape.
 8. The element according to any one of claims 6 to 7, wherein the separating element (16) extends beyond the first inlet portions (10a, 11 a) of the channelling walls (10, 11) to the lateral wall (4) opposite the lateral opening (8) over the entire transversal dimension of the supporting frame (3) considered substantially along the extent of the channelling walls, in particular the separating element (16) comprises at least one plate having, in a cross section thereof, a substantially "C" shape, whose concavity is facing towards the channel (9) and which consists of two terminal strips and a connecting portion, the terminal strips of the "C" shape extending parallel to the respective channelling walls, while the connecting portion abuts the longitudinal ends of the channelling walls (10, 11) and closes off the respective longitudinal inlet openings (13, 14).
 9. The element according to the preceding claim, wherein the separating element (16), at least in the connecting portion, has a plurality of holes (19) passing through the plate of the element itself, in particular said holes (19) being located at the inlet portions (10a, 11 a) of said channelling walls (10, 11), and wherein the separating element (16) has a closure portion extending away from the first inlet portions (10a, 11 a) of said channelling walls (10, 11) to a portion of the lateral wall (4) opposite the lateral opening (8), the separating element (16) having a plurality of through holes (19) located in the closure portion of the separating element (16) itself.
 10. The element according to the preceding claim, wherein the ratio of the minimum distance (D1), measured between the first inlet portions (10a, 11 a) of the channelling walls (10, 11) and the lateral wall (8), to the minimum distance (D4), measured between the outlet portions (10b, 11 b) of the channelling walls (10b, 11 b) and the lateral opening (8), is greater than 2, in particular comprised between 3 and 7, and wherein the inlet portions (10a, 11 a) of the channelling walls (10, 11) have a minimum distance (D5) from each other that is greater than a minimum distance (D6) measured between the outlet portions (10b, 11 b) of the channelling walls (10, 11), in particular the ratio of the minimum distance (D5) measured between the inlet portions (10a, 11 a) of the channelling walls (10, 11), to the minimum distance (D6), measured between the outlet portions (10b, 11 b) of the channelling walls (10, 11), is greater than 1.5, in particular it is comprised between 2 and

- 7.
11. The element according to any one of the preceding claims, wherein each of said channelling walls (10, 11) comprises at least one engagement portion (17, 18) interposed between the respective inlet portion (10a, 11 a) and the respective outlet portion (10b, 11 b), the engagement portion (17, 18) being stably engaged with the supporting frame (3) at the lateral opening (8) so as to constrain the channelling wall (10, 11) inside the latter opening (8).
12. The element according to any one of the preceding claims, wherein the lateral inlet opening (15) defines a passage opening having a predetermined area, the lateral outlet opening (25) defines a passage opening having a predetermined area, the ratio of the passage area of the lateral inlet opening (15) to the passage area of the lateral outlet opening (25) is greater than 2, in particular comprised between 3 and 10, and wherein the lateral opening (8) has, according to a front view normal to the prevalent direction (D) of extension of the supporting frame (3), a substantially rectangular, square or trapezoidal shape.
13. The element according to any one of the preceding claims, wherein the supporting frame (3) comprises at least one coupling portion (26) configured to reciprocally engage, directly or indirectly, with a respective coupling portion (26) of a further modular element (1) and to enable the positioning of the latter in a plurality of different operative positions defining different working conditions of the lateral outlet openings (25), the coupling portion (26) being further configured to place the lateral outlet opening (25) of at least one modular element (1) in an operative position different from an operative position of a lateral outlet opening (25) of a further modular element (1), and wherein at least one coupling portion (26) of a modular element (1) comprises a predetermined number of engagement portions configured to cooperate with respective engagement portions of an adjacent modular element (1) so as to define a predetermined number of operative positions distinct and offset from one another, in particular angularly offset from one another, the engagement portions of one coupling portion (26) comprising a predetermined number of elements protruding at least axially configured to cooperate with a respective predetermined number of axial recesses of a coupling portion (26) of an adjacent modular element (1).
14. The element according to any one of the preceding claims, wherein the supporting frame (3) has a substantially cylindrical shape extending between the first and second ends (3a, 3b), the coupling portions (26) being located at said first and/or second ends (3a, 3b) of the frame, the supporting frame (3) further comprising a plurality of through holes (21) located at the lateral opening (8) of the same frame (3), wherein the plurality of holes (21) comprises at least a first series of holes that are aligned along the prevalent direction (D) of extension of the supporting frame (3) and flank the lateral outlet opening (25), the plurality of holes (21) further comprising at least a second series of holes that are aligned along the prevalent direction (D) of extension of the supporting frame (3) and flank the lateral outlet opening (25) on the opposite side from the first series of holes relative to the outlet opening itself.
15. The element according to any one of the preceding claims not comprising alternatively or in combination:
- ventilating devices (12) directly engaged with the modular element (1) itself, in particular not having ventilating elements located inside the housing compartment (5);
 - intake openings for generating the air flow on the lateral wall (4) of the supporting frame (3).
16. An air curtain barrier (2) comprising:
- at least a first plurality of modular elements (1) according to any one of the preceding claims, the first plurality of modular elements (1) being reciprocally engaged with each other and consecutively located along a prevalent axis of extension (1a) parallel to the prevalent direction (D) of extension of each modular element (1), the operative position of a lateral outlet opening (25) of at least one modular element (1) being angularly offsettable about the development axis (1a) with respect to an operative position of at least one other lateral outlet opening (25) of a different modular element (1),
 - at least one ventilating device (12) associated to said modular elements (1) and configured for generating and sending an air flow to the latter,
- each modular element (1) is configured for receiving the air flow from the ventilating device (12) and channelling it outside the lateral outlet opening (25) along the ejection direction (S).

FIG.1

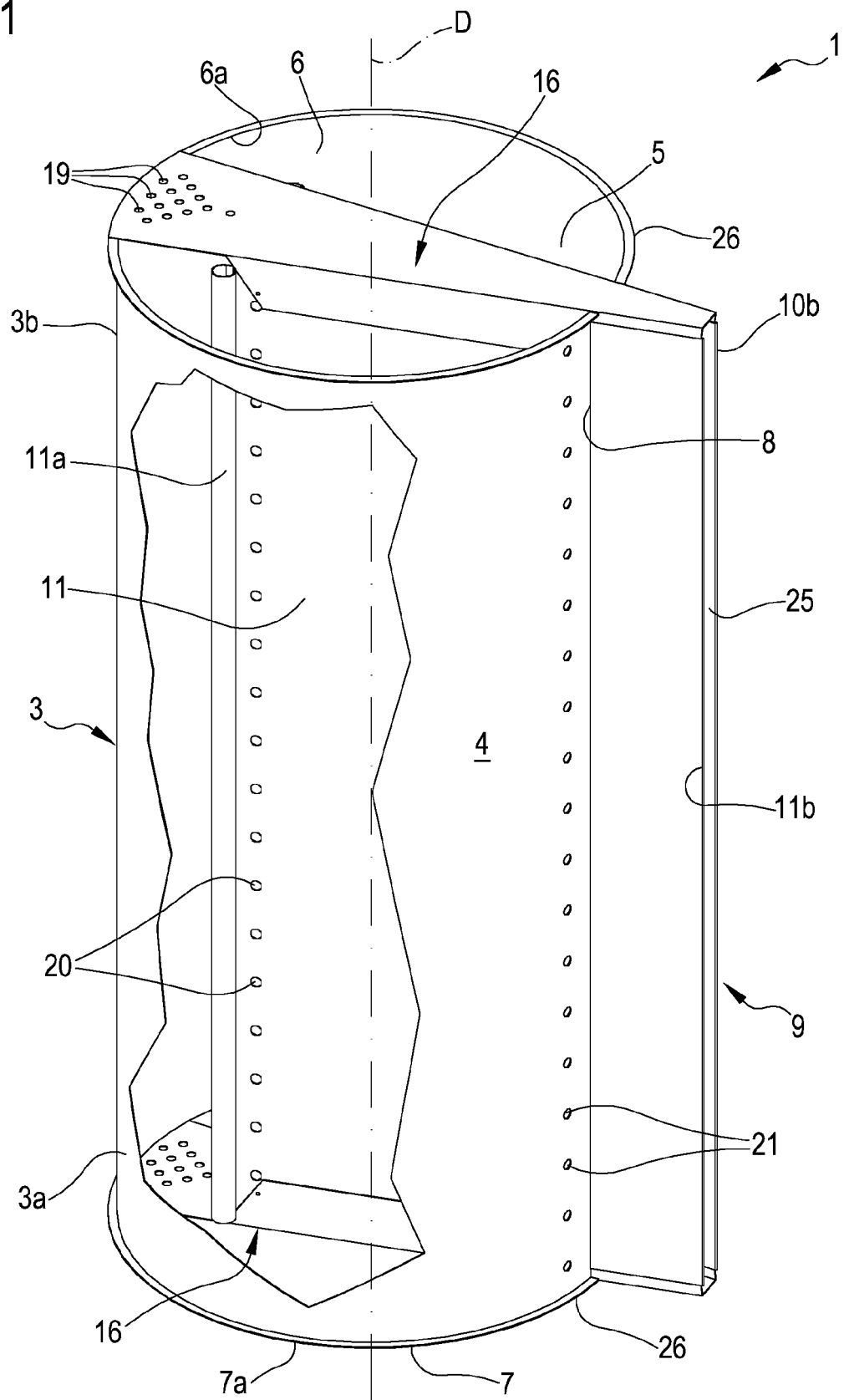


FIG.2

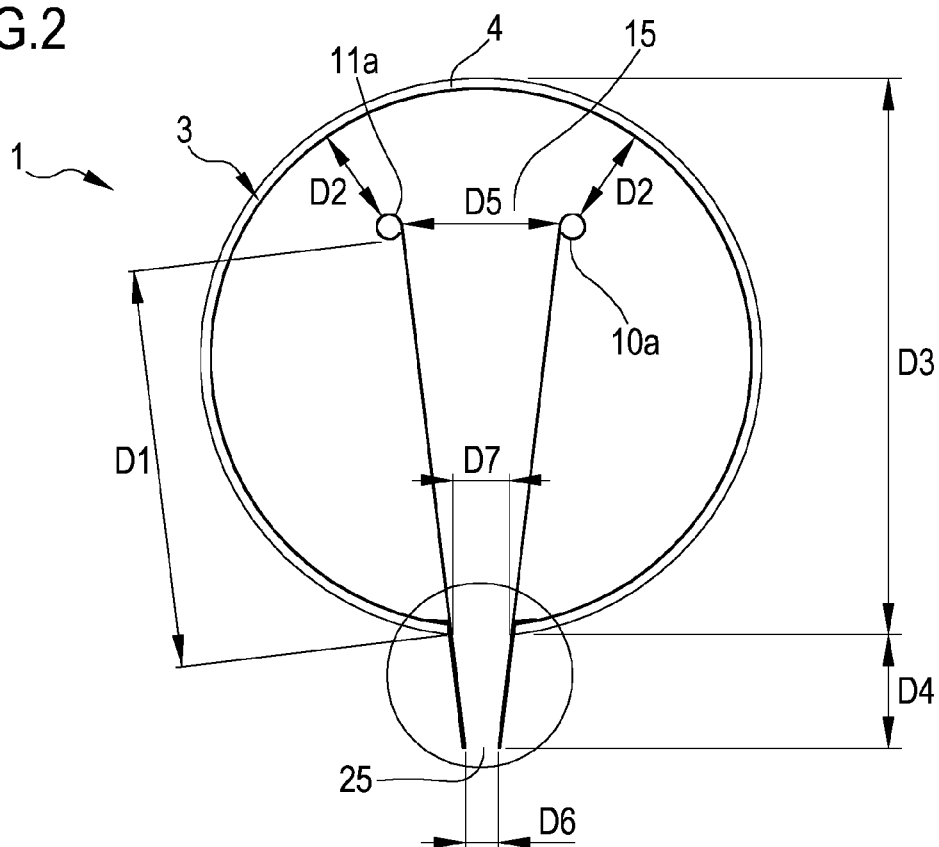


FIG.3

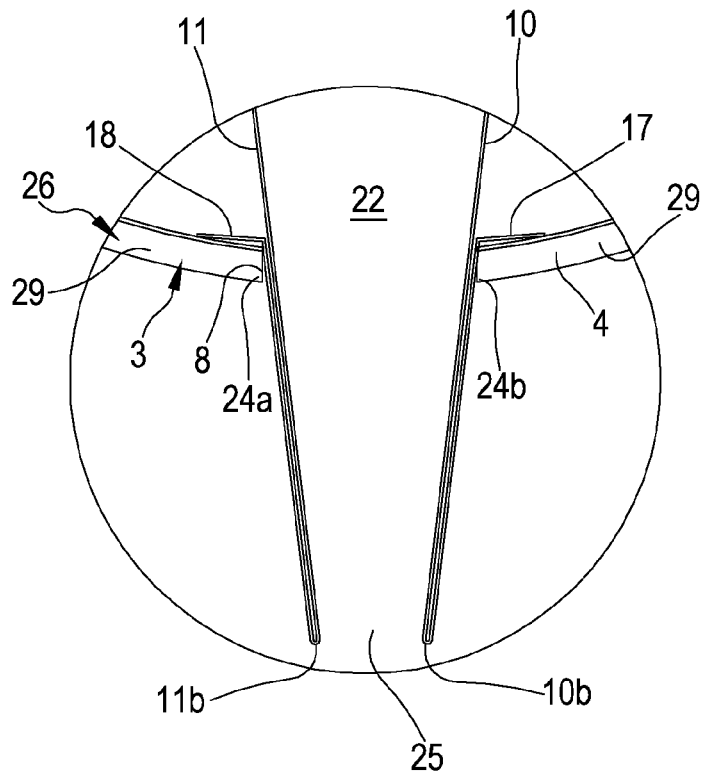


FIG.4

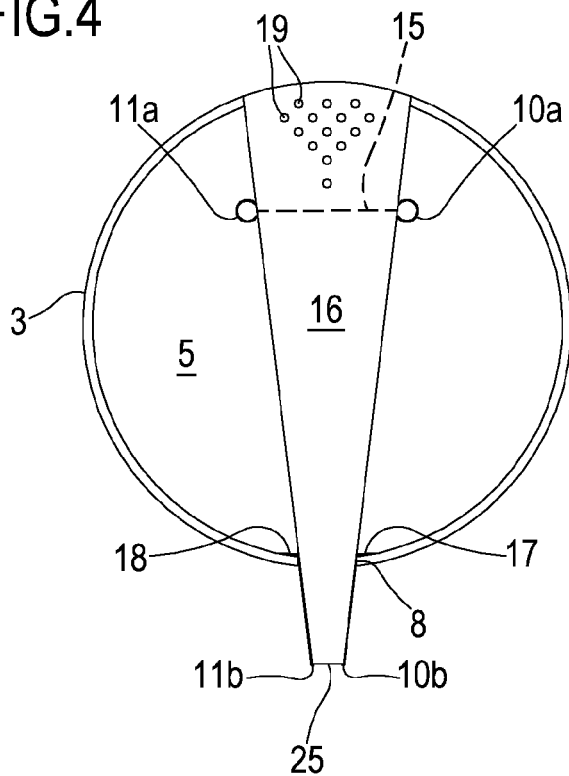


FIG.4a

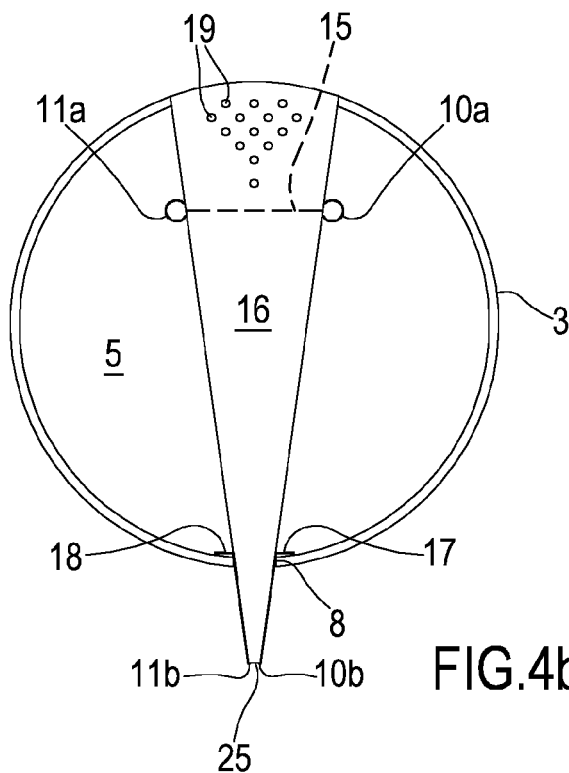
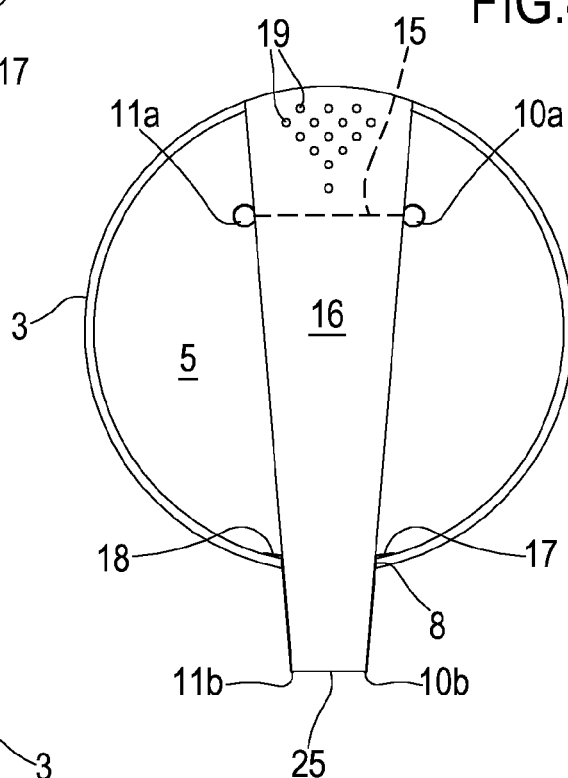


FIG.4b

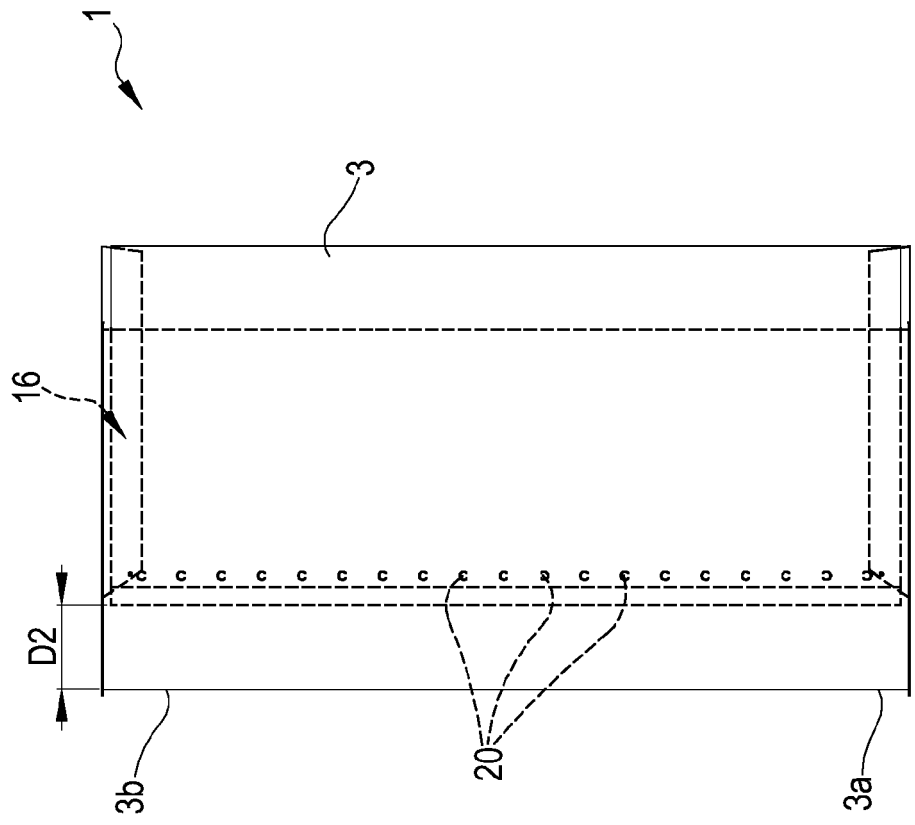


FIG.5

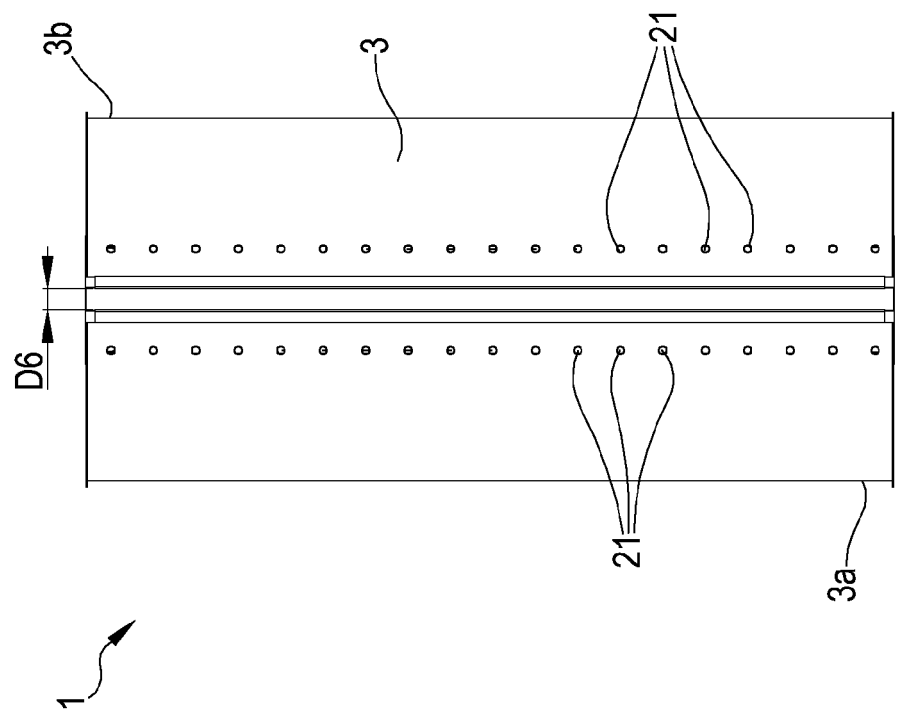
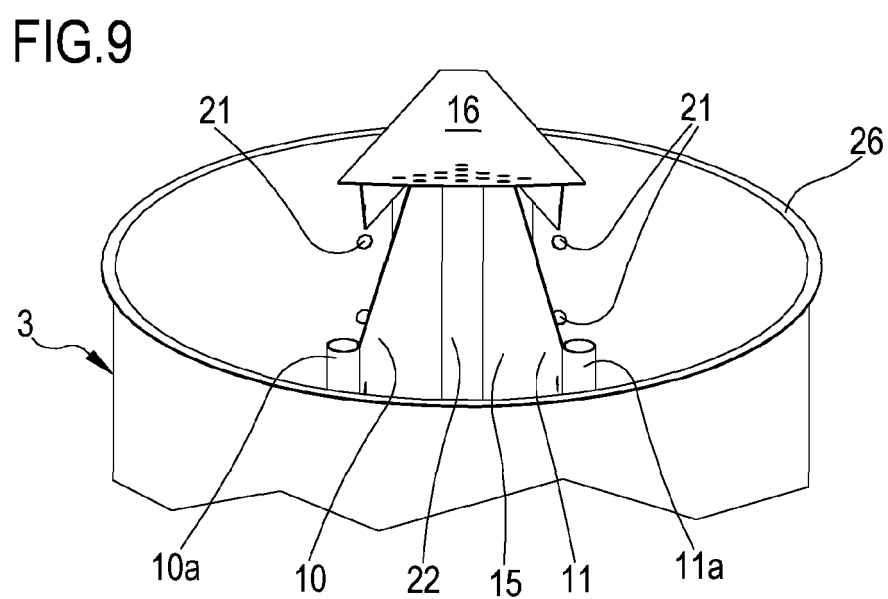
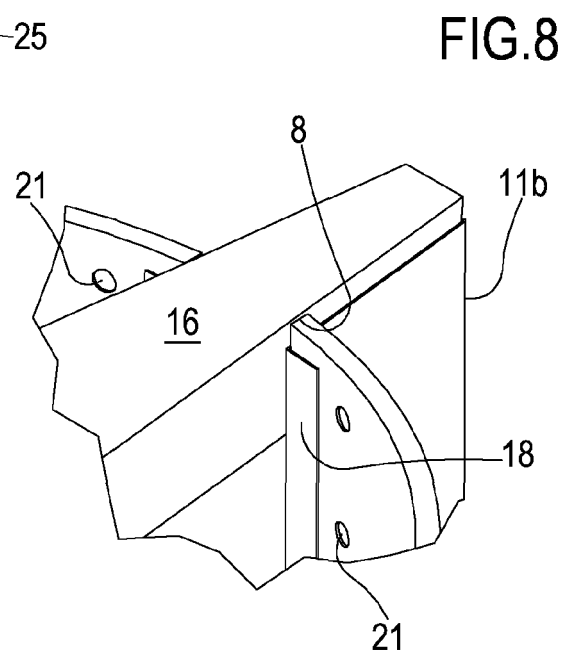
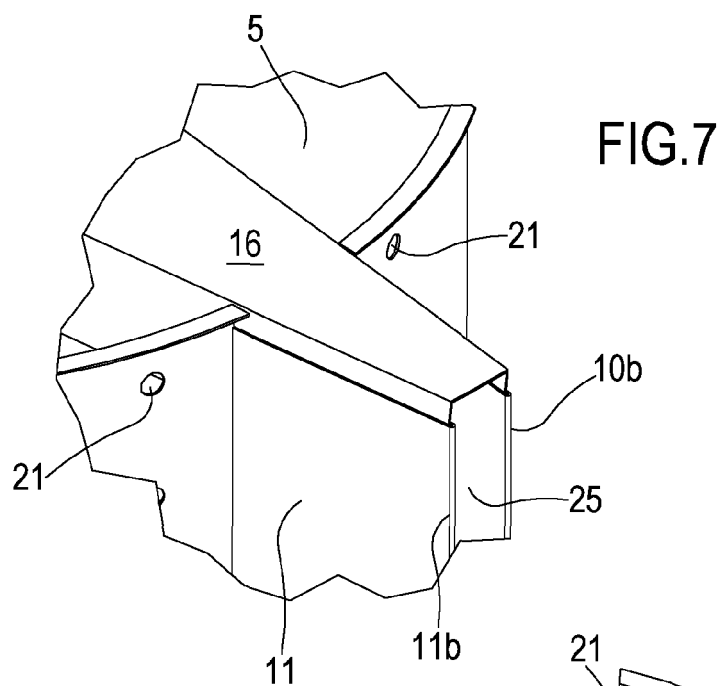


FIG.6



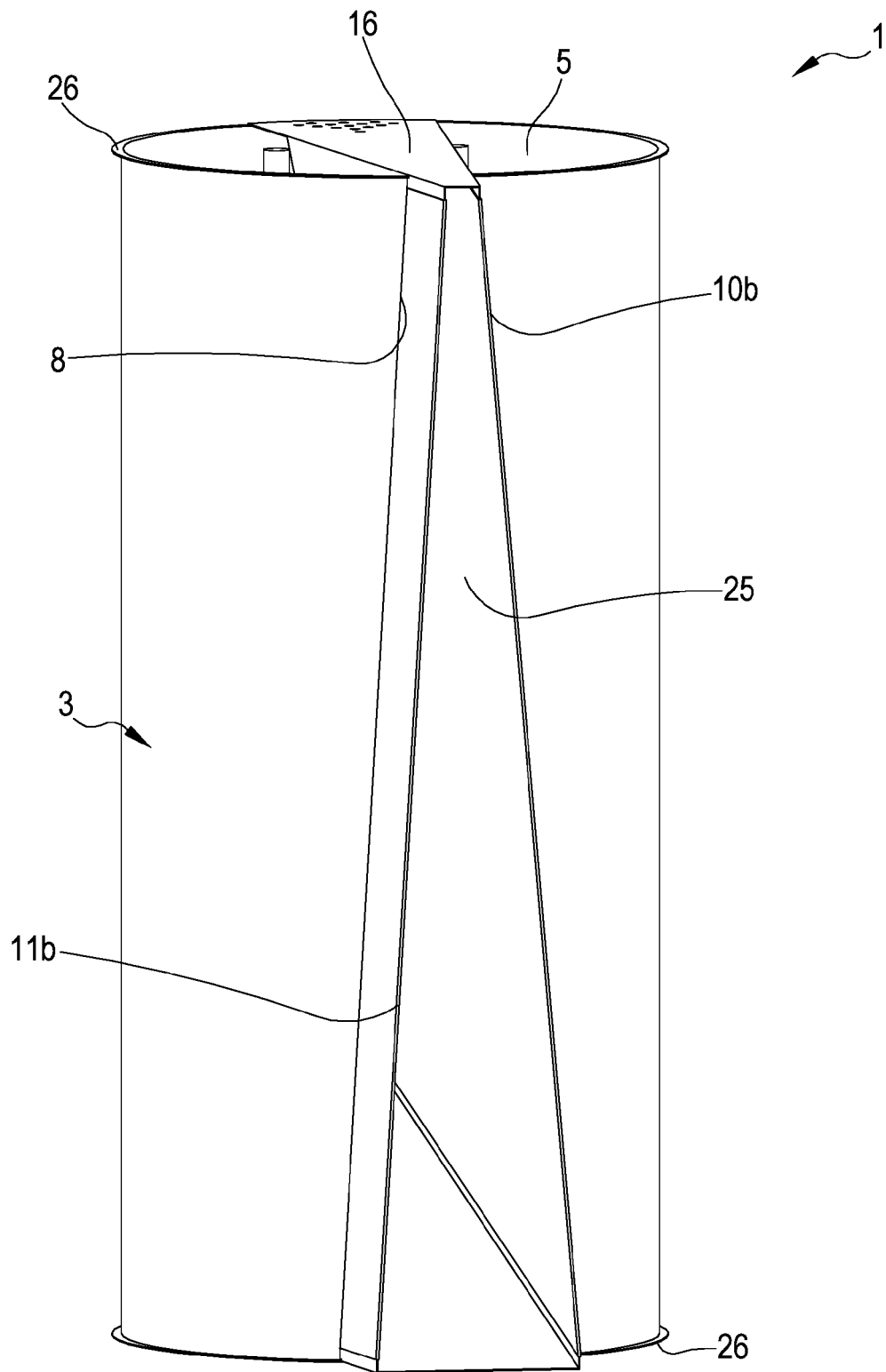


FIG.10

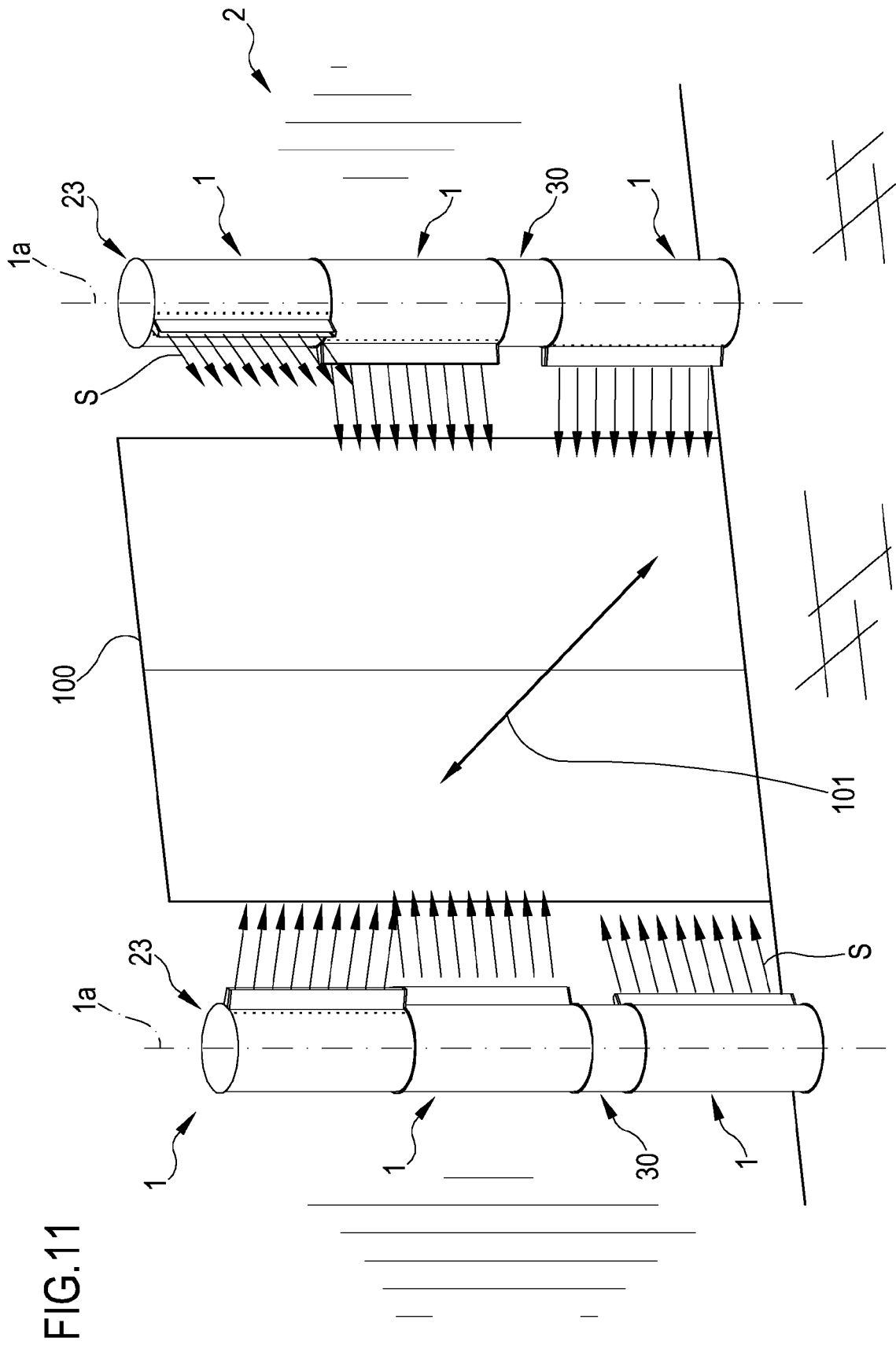


FIG.12

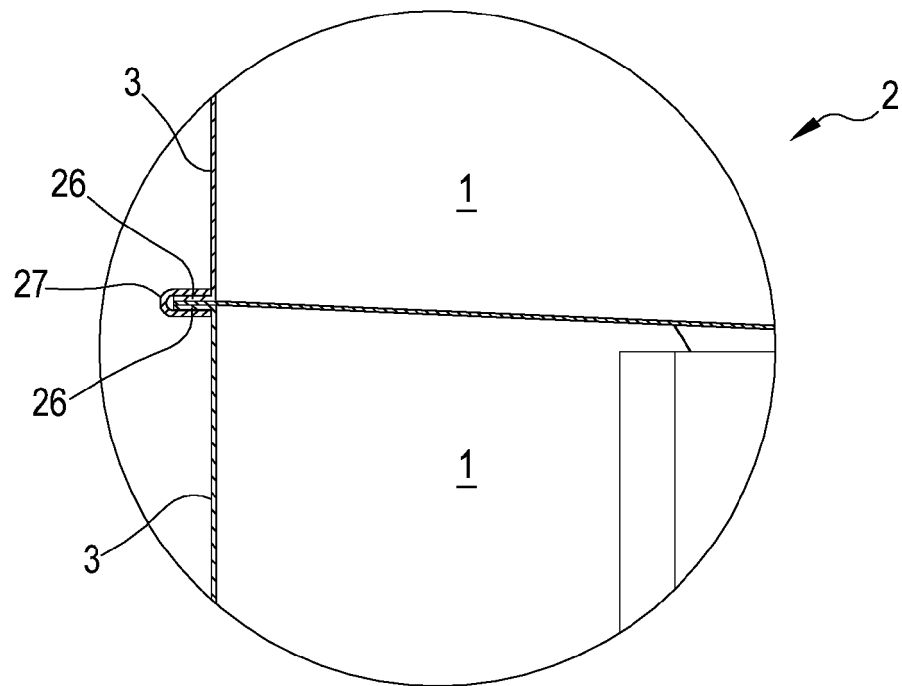
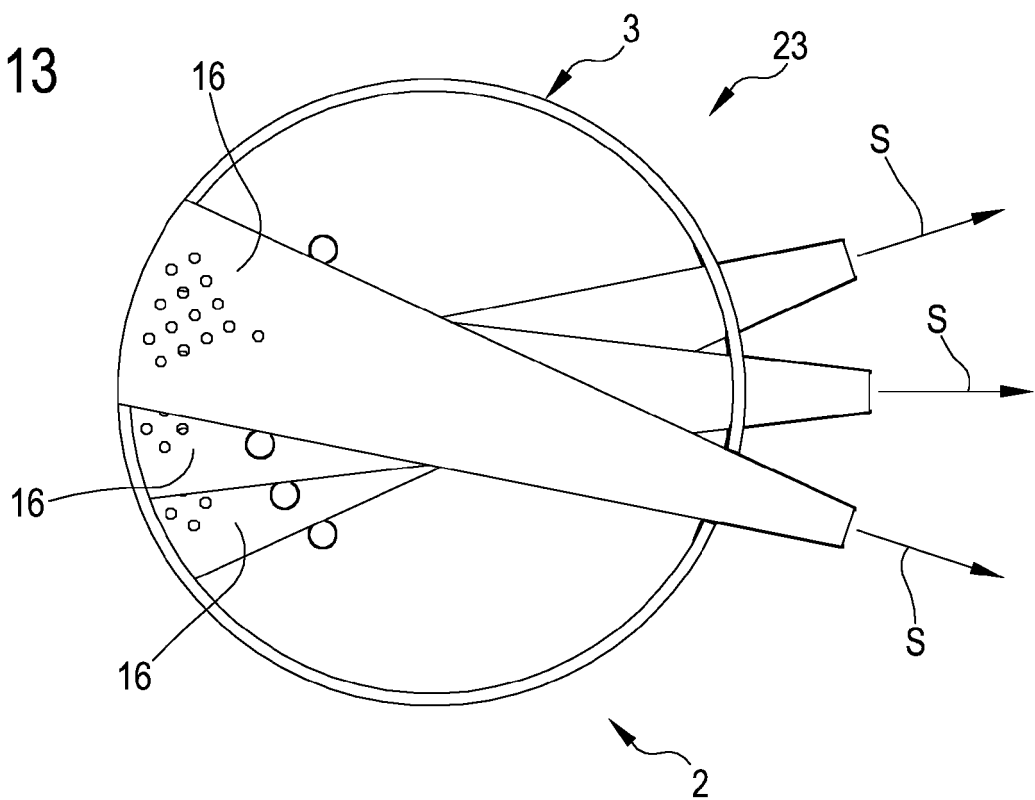


FIG.13



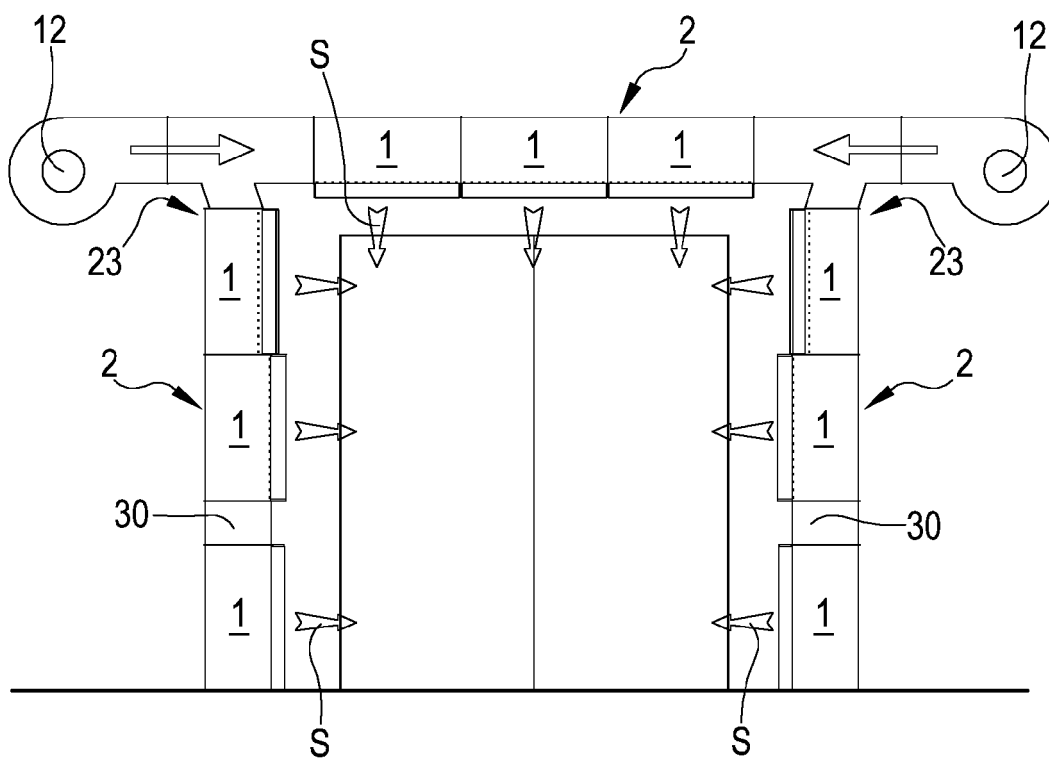


FIG.14

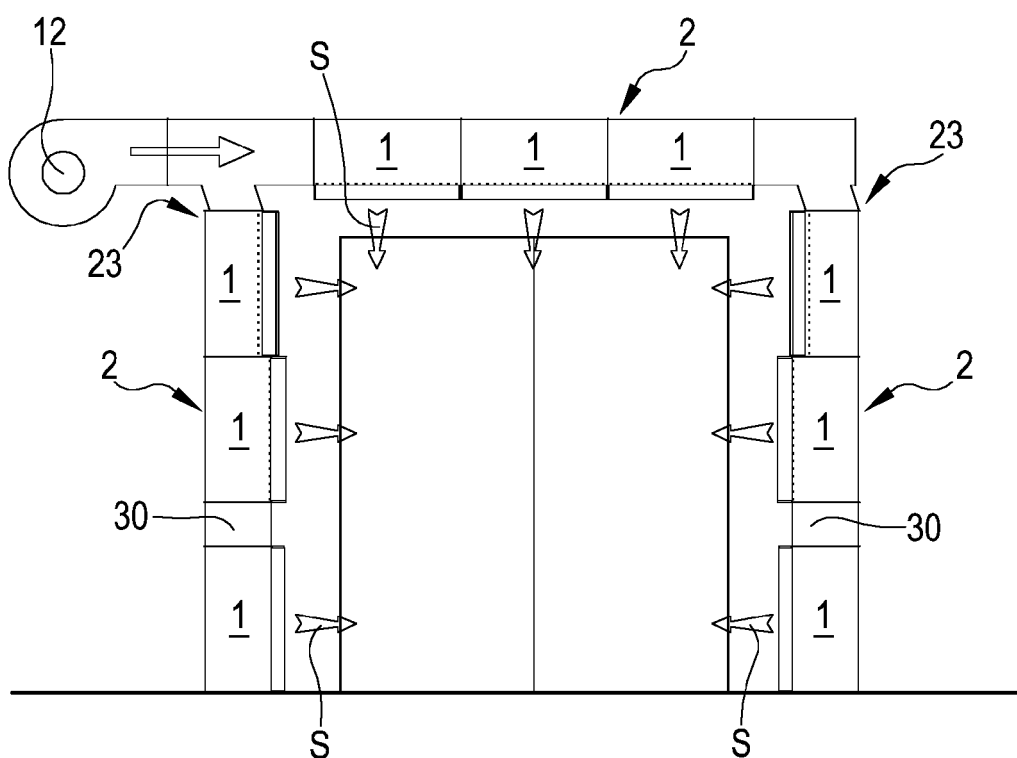


FIG.15

FIG.16

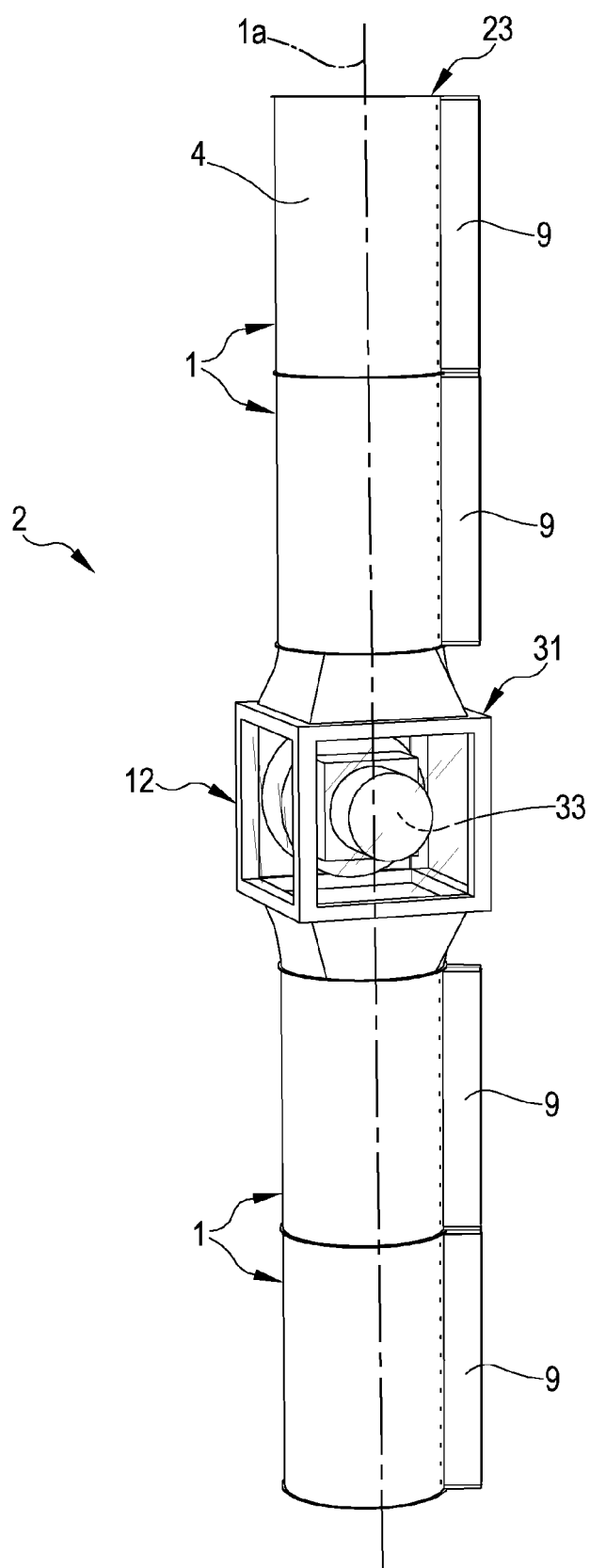


FIG.17

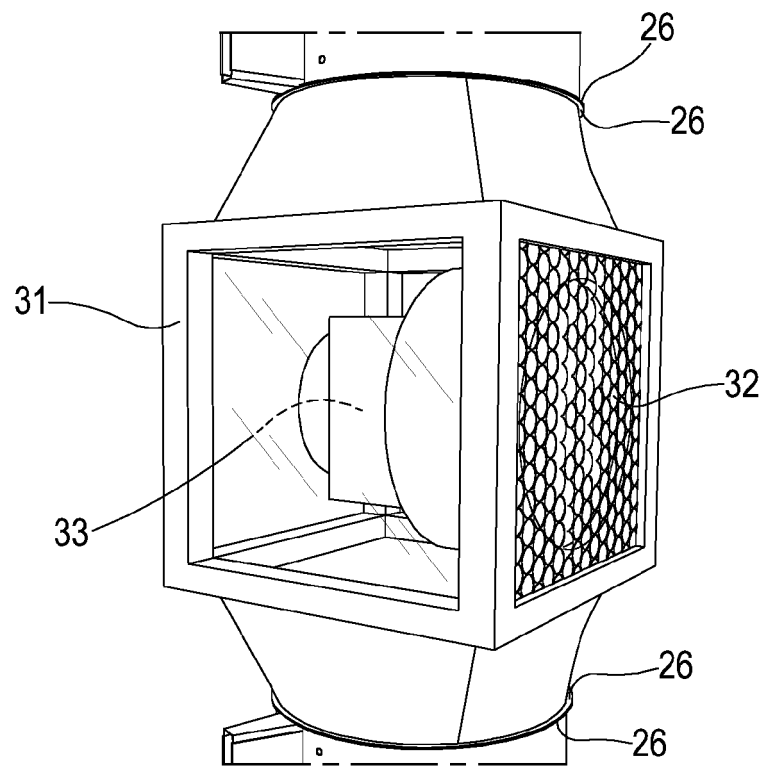


FIG.18

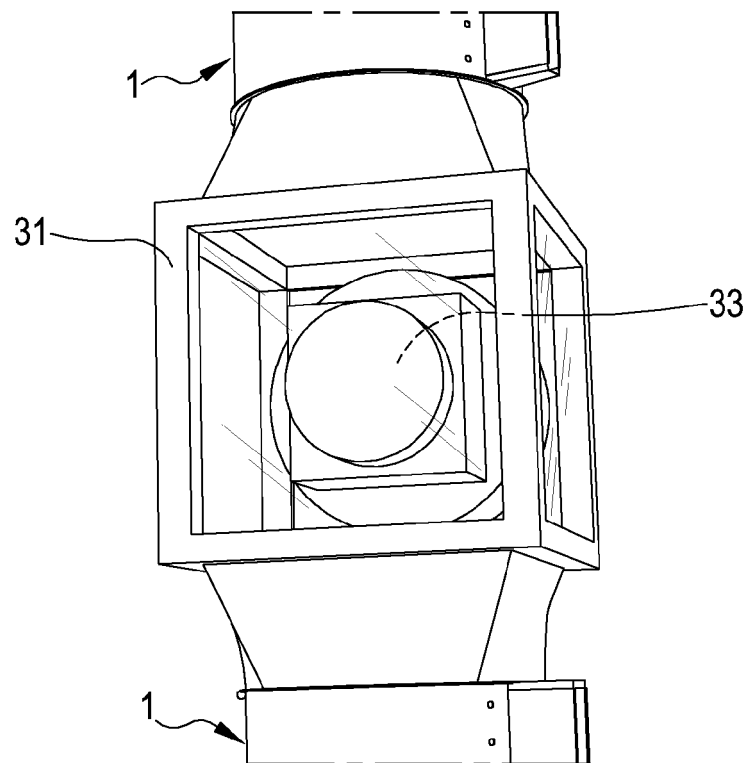


FIG.19

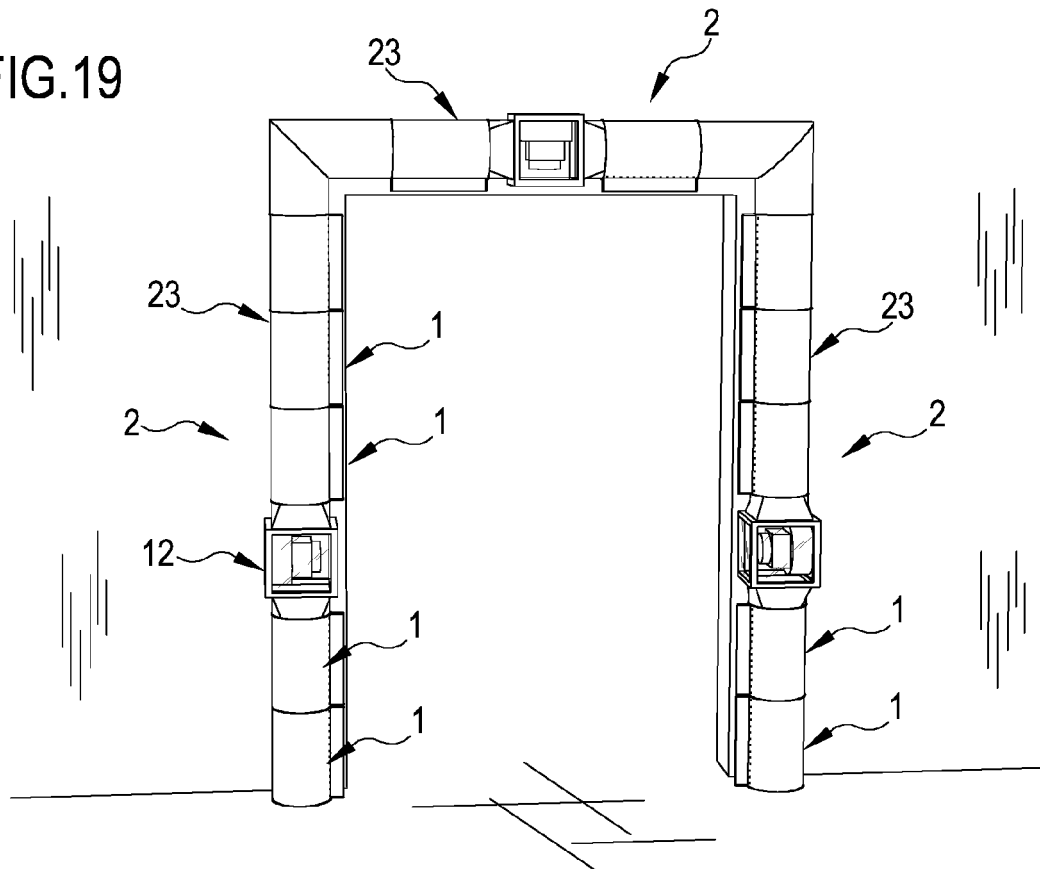


FIG.20

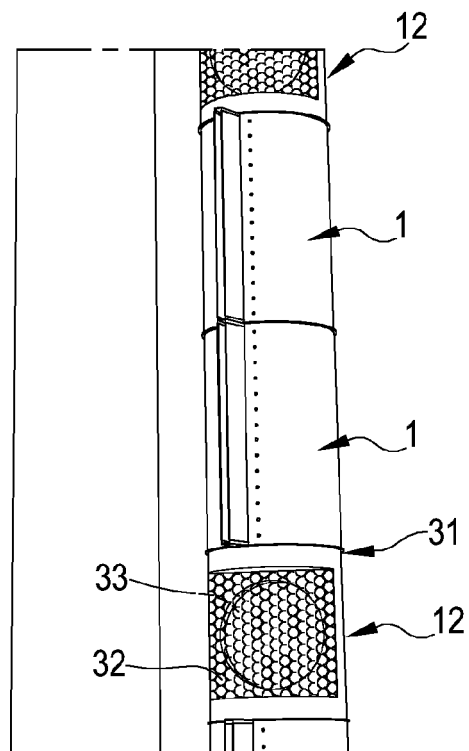


FIG.21

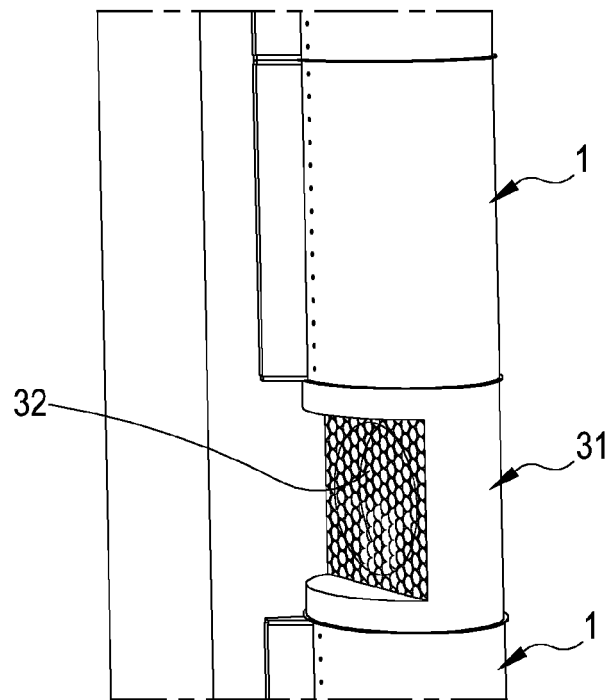


FIG.22

