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(54) **Sound-damping ventilating device with an elongated, block-shaped housing and a slotted ventilating channel.**

(57) A sound-damping ventilating device comprising an elongated block-shaped housing with a slotted ventilating channel terminating (8,27,27',27") at both ends in a mouth (9,10) forming a gap in a housing wall. The ventilating channel (8,27,27',27") and the mouths (9,10) extend substantially throughout the width of the housing, the slot walls of the ventilating channel (8,27,27',27") being partly bounded by sound-damping material and, at least in the vicinity of one mouth (9), by a wall (1a,2a,25,26,26a-d) of water-resistant material, whilst the other mouth (10) is covered by a valve element (11,28) with closable planar apertures. The ventilating channel (8,27,27',27"), over a part of its length, starting from one mouth (9) in the direction of the other mouth (10), extends slantingly upwards and may or may not be bent. The apertures are directed substantially perpendicularly to the direction of passage of the ventilating channel (8,27,27',27"). Standardization of parts with different heights and lengths is possible by adjusted dimensioning and design.

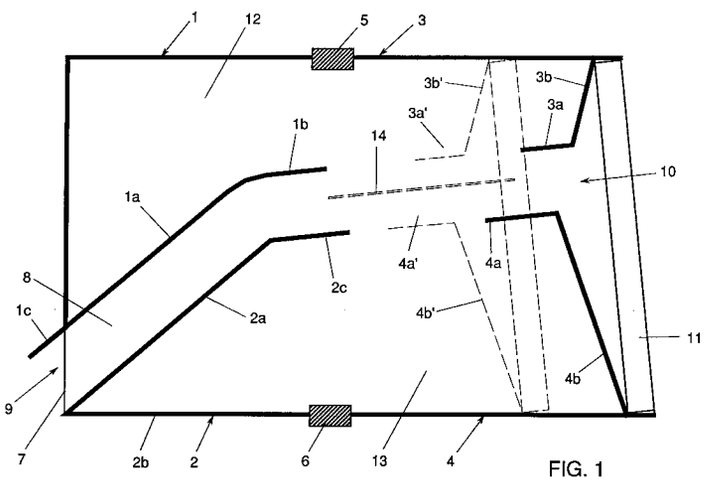

FIG. 1

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This invention relates to a sound-damping ventilating device comprising a block-shaped housing which is substantially elongated in the direction of its width and has a slotted ventilating channel terminating at both ends in a mouth forming a gap in a housing wall, this ventilating channel and these mouths extending substantially throughout the width of the housing, the slot walls of the ventilating channel being partly bounded by sound-damping material and, at least in the vicinity of one mouth, by a wall of water-resistant material, whilst the other mouth is covered by a valve element with closable planar apertures.

In such known sound-damping ventilating devices as disclosed in NL-A-8702464, the ventilating channel, as viewed in cross-section, has an L-shaped configuration, one leg of the L-shape extending substantially horizontally and the other extending substantially vertically through the elongated, block-shaped housing. The other mouth is located in line with the free end of the horizontal part of the ventilating channel, whilst the one mouth is located at the free end of the vertical part of the ventilating channel. In this manner, a good sound-damping ventilating device can be obtained, which in practice has an adequate watertightness in the open position of the valve element, it being noted that in the closed position of the valve element, in principle no flow of air is present in the ventilating channel, so that then the chances of entry of water are very small, if not zero. A disadvantage of such a known construction, however, is the right angle in the ventilating channel, which calls forth a resistance such that the air passage is considerably smaller than would be expected on the ground of the cross-section of the ventilating channel.

The object of the present invention is to improve a ventilating device of the above-described type, while maintaining the sound-damping and watertightness properties, such that the air resistance in the ventilating channel is reduced.

According to the invention, this is accomplished if the ventilating channel, at least over a part of its length between the two mouths and starting from one mouth in the direction of the other mouth, extends slantingly upwards in the substantially elongated, block-shaped housing and the planar apertures extend substantially perpendicularly to the direction of passage of the ventilating channel in the area adjacent to the valve element. By these features, a sound-damping ventilating device is obtained which exhibits a considerably lower air resistance than the known devices, on the one hand in that the right-angled bend has, so to speak, been straightened, and, on the other hand, in that the planar apertures at the other mouth have been brought into an optimum position relative to the ventilating channel. The adequate watertightness in the open position of the valve element has thus been retained by the portion slanting upwards from one mouth, which, to that end, like the vertical part of the ventilating channel of known construction, must be provided with a wall of water-resistant material throughout the height over which penetrating water may be driven up, for instance by the pressure of wind.

On the ground of considerations of resistance, a straight, horizontally extending channel would be preferable. In that case, however, the protection against penetration of water is zero in the open position of the valve element. Arranging rain shields is not a solution, since this results in the above-discussed L-shaped configuration of the ventilating channel again. To arrive in practice at a slant which offers an optimum between, on the one hand, an adequate height of the ventilating channel in view of rain being driven up and, on the other, the depth dimensions of the block-shaped housing of the ventilating device, it is preferred that, viewed in cross-section, the portion of the ventilating channel that extends slantingly from the one mouth includes an angle of the order of 40° with a horizontal plane or a part of the sound-damping ventilating device to be arranged horizontally.

In practice, under different circumstances, different values will be desirable with respect to ventilating and sound-damping capacity. Accordingly, in many cases, different types of the same kind of sound-damping ventilating device are available, the different types having the same overall height but a different overall depth. In addition, the length is variable. In the manufacture of different types, however, the aim is nevertheless to work with standard parts as much as possible. In the present sound-damping ventilating device, the valve element can always be a standard part. Of further interest from the point of view of manufacturing technique is the part of the housing comprising the portion of the ventilating channel that slants upwards from one mouth. If possible, this should be standard as well. This is possible with different overall depths when, in accordance with a further embodiment of the invention, the portion of the ventilating channel that extends slantingly from the one mouth merges into a less slanting portion. By taking this measure, it is possible, with regard to the dimensions of the housing of the sound-damping ventilating device that are relevant in practice, to always give the same slant, for instance the preferred value of approximately 40°, to the portion of the ventilating channel slanting upwards from the one mouth, independently of the overall depth. Then both faces are provided with a mouth to be made of a standard design for all types and the intermediate piece is to be chosen depending on the desired type. It may be noted here, that from the point of

view of heat insulation, a gap should be present between the two faces provided with a mouth. The steps required therefor can be taken without problems at one of the ends of an intermediate piece.

Experiments have shown that it is preferable that, viewed in cross-section, the less slanting portion of the ventilating channel includes an angle of the order of 35° with the portion of the ventilating channel that extends slantingly from the one mouth. It may be observed that a bent channel has a greater resistance than a straight channel. In the present case, however, by opting for the slight bend and a slightly higher air resistance, an optimum is achieved as regards costs, operations, sound-damping and ventilation for the entire range of sound-damping devices of the present type. In other words, in a given case, a ventilating device of a slightly larger passage will have to be chosen than would have been the case if a straight ventilating channel had been opted for; the attendant additional costs, however, are amply outweighed by the advantages obtained by the standardization as a result of the choice of the slight bend in the ventilating channel.

If, in accordance with a further embodiment of the invention, openings have been formed in the ventilating channel by assembling the ventilating device from:

- a first part, comprising the one mouth and walls, starting from that mouth, of a relatively stiff material, these walls each forming a part of the upper and lower walls of the ventilating channel;
- a second part, comprising the other mouth and walls, starting from that mouth, of a relatively stiff material, these walls having free ends remote from the other mouth and each forming a part of the upper and lower walls of the ventilating channel; and
- an intermediate part, interconnecting the first and the second parts in such a manner that the free end of the upper and the lower wall, respectively, of the first part is spaced from and located in the same plane as the free end of the upper and lower wall, respectively, of the second part, then an extension of the ventilating device can be effected by modifying the intermediate part, whilst the first and the second parts can remain unchanged at least as regards their basic shape. The passage of the ventilating channel can be modified as required, if the lower and/or upper wall in the first part is replaceable by a lower and/or upper wall which can be arranged at a different distance from the upper and/or lower wall than the replaced wall and the lower and/or upper wall in the second part is replaceable by a lower and/or upper wall which can be arranged at a different distance from the upper and/or lower wall than the replaced wall, the arrangement being such that for modifying the passage of the ventilating channel the height of the ventilating channel is variable, but that varied height is substantially constant from the one mouth to near the other mouth.

An embodiment offering particular advantages can then be realized if both the height and the length of the ventilating channel are stepwise variable, whilst, by an appropriate choice of the angle included by the ends of the lower walls starting from the one mouth and the other mouth, located in the same plane, a lower wall starting from the other mouth matches each stepwise extended intermediate part and unchanged first part, this lower wall being identical to a lower wall starting from the other mouth, that matches a ventilating channel with a height smaller by one step and a length of the intermediate part shorter by one step. Thus, a far-reaching extent of standardization of parts has been obtained, in that a large number of those parts can be used with different embodiments regarding length and passage of the ventilating channel.

With the present device, a low air resistance has been obtained *inter alia* by arranging the valve element perpendicularly to the slanting ventilating channel. To keep the air resistance small and to utilize the apertures in the valve element as well as possible, it is preferred, in accordance with a further embodiment of the invention, that the ventilating channel, adjacent the other mouth, widens flaringly to the height of the apertures in the valve element.

The space within the housing that is not occupied by the ventilating channel is filled up with sound-damping material. A continuous wall will have to be present throughout the height over which rain water may be driven up into the ventilating channel. In that area, the sound-damping material cannot form the wall of the ventilating channel. In the slightly bent embodiment of the sound-damping ventilating device according to the invention, it is preferred that the portion of the ventilating channel that extends slantingly from the one mouth is bounded by continuous walls of a relatively stiff material, such as a metal, and the less slanting portion is bounded by walls of a relatively stiff material, such as a metal, provided with openings, typically forming a continuous gap in the relatively stiff wall of that channel in a direction transverse to the ventilating channel, so that the channel wall is formed by sound-damping material. In such a case, the part of the housing that comprises the part of the ventilating channel that extends slantingly from the one mouth as well as the part of the less

slanting portion as far as the opening, may be standardized.

In such an embodiment, the openings in the less slanting portion of the ventilating channel may be located opposite each other, which may adversely affect the sound-damping effect. In such cases, it is possible, in accordance with the proposal in applicant's Dutch patent application 9101182, to provide that oppositely located openings in the oppositely located walls of the less slanting portion are covered relative to each other by a plate-shaped member of an acoustically hard material, arranged in the ventilating channel at a distance from the two openings.

To prevent entry of rain water, it is not possible, as noted previously, to provide a generally known rain shield, at any rate not without appreciable increase of the air resistance. However, a reduction of the amount of penetrating rain water is possible within the teaching of the present invention when, in accordance with a further embodiment of the invention, the upper wall, bounding the portion of the ventilating channel that extends slantingly upwards from the one mouth, projects from the housing over some distance. Thus, the portion of the ventilating channel that extends slantingly from the one mouth remains straight, whilst, by virtue of the projecting wall portion, there is a lesser chance that rain drops, falling at a slant, will end up on the lower wall bounding the ventilating channel, so that the amount of water that may be driven up is appreciably reduced.

With reference to exemplary embodiments schematically shown in cross-section in the accompanying drawings, the sound-damping device according to the invention will now be further discussed and elucidated. In the drawings:

Fig. 1 shows a first embodiment;

Fig. 2 shows a second embodiment in which the possibility of modifying the passage of the ventilating channel is schematically indicated; and

Figs 3 and 4 each show an extended variant of the embodiment according to Fig. 2, the two ends having been kept substantially equal for reasons to be discussed hereinafter.

Fig. 1 shows a sound-damping ventilating device, the housing of which is composed of a plurality of elongate sections 1-4. It is already noted here that these sections may each be composed of a plurality of separate parts and that the sections are shown in an extremely schematic and elementary form. Shown equally schematically in block-shape are a thermally insulating connection 5 between the sections 1 and 3 and a thermally insulating connection 6 between the sections 2 and 4. At the longitudinal ends, the sections are coupled by means of end partitions, one being indicated by reference numeral 7.

Formed between the sections 1 and 2 is a ventilating channel 8 with a mouth 9, to which end section 2 comprises a section part 2a, which includes an angle of the order of 40° with a section part 2b to be arranged horizontally, and merges into a section part 2c, which includes an angle of the order of 35° with the section part 2a, whilst the section 1 comprises a section part 1a and an adjoining section part 1b, extending parallel to section parts 2a and 2c, respectively. Extending in line with the section part 1a is a section part 1c, which serves as a shield against rain for the ventilating channel 8.

Extending in line with section part 1b is a section part 3a and extending in line with section part 2c is a section part 4a, the section parts 3a and 4a forming a continuation and at the same time the other end of the ventilating channel 8 terminating in a mouth 10. Via slanting section parts 3b and 4b, the mouth 10 has been widened to the height of the housing formed by the sections 1-4, the mouth being covered by a valve element 11, which is arranged substantially perpendicularly to the direction of the ventilating channel as defined by the section parts 1b, 2c, 3a and 4a and comprises closable apertures. Here, typically use is made of a valve element of the plate-shaped type, with a plurality of apertured plates arranged so as to be movable over and along each other, such that the apertures in the plates can be brought into alignment with each other or the apertures in one plate are covered by portions of the plate between the apertures in the other plate. In the former condition of the plates, the valve element is in the fully opened position; in the latter condition of the plates, the valve element is in the closed position, whilst any position between the open and the closed position can be set in stepless manner by moving the plates relative to each other to a corresponding degree. In most cases, an insect screen is arranged behind the apertures in the valve element 11. By virtue of the perpendicular position of the valve element relative to the ventilating channel 8, with an air stream being accordingly directed substantially perpendicularly to the insect screen, the resistance generated by the insect screen, in particular when it is arranged so as to bulge in the direction of the ventilating channel 8, has also been reduced in comparison with a situation where the air stream would strike the screen at an angle.

Defined by the sections 1 and 3 is a space 12, which is filled with a sound-damping material, forming the wall of the ventilating channel 8 between the free ends of the section parts 1b and 3a. The sections 2 and 4 define a space 13 which is likewise filled with sound-damping material, again forming the wall of the ventilating channel 8 be-

tween the free ends of the section parts 2c and 4a.

The spaces 12 and 13 at the same time function as resonator compartments, with the wall portions of the ventilating channel 8 consisting of sound-damping material forming the access openings to those resonator compartments. From a sound-damping point of view, it is less advantageous if the entrances of two resonator compartments are located opposite each other. Should it be important for the present sound-damping ventilating device that the resonator compartments operate as effectively as possible, then a plate-shaped member 14 of an acoustically hard material, indicated by broken lines, may be arranged in the ventilating channel 8 between the two openings so as to shield the two openings relatively to each other.

As noted before, it is common practice to market a given kind of sound-damping ventilating device in several types of different sound-damping values and characteristics, the differences between the different types being visually manifest through a greater or lesser overall depth of the ventilating device. In the drawing it is indicated by a broken line how the overall depth of the embodiment shown in solid lines could be reduced by displacing the valve element and the mouth. It should be noted here that the direction and the length of the section part 3a' and 4a', respectively, is equal to that of the section part 3a and 4a, respectively, and the angle included by the section parts 3a' and 3b' is equal to the angle included by the section parts 3a and 3b, which also applies to the angle included by the section parts 4a', 4b' and 4a, 4b, respectively; only the lengths of 3b' and 4b' differ from those of 3b and 4b. In view of the similarities, it could be considered, with regard to section parts 3 and 4, to standardize a number of parts of those sections with a number of substantially straight adapter pieces for realizing different types of sound-damping ventilating devices. It need not be further explained that the section parts 1 and 2 can remain unchanged for different types.

Fig. 2 shows a ventilating device comprising a first part 21, a second part 22 and an intermediate part 23, which parts are coupled to each other by means of insulating elements 24.

The first part 21 comprises an upper wall element 25 and a lower wall element 26, together bounding a part of the ventilating channel 27. Thinner lines indicate lower wall elements 26a-d, with which the height, and hence the passage, of the ventilating channel can be varied as required, the use of the upper wall element 25 and the lower wall element 26d yielding the smallest passage of the ventilating channel 27.

The second part 22 comprises a valve element 28, an upper wall element 29 and a lower wall element 30. Again, thinner lines indicate lower wall elements 30a-d, with which the height, and hence the passage, of the ventilating channel can be varied as required, the dimensions of both the upper wall elements 25 and 29 and of the lower wall elements 26 and 30 being matched such that at all times a ventilating channel 27 is obtained which has a constant passage substantially throughout its length.

Fig. 3 shows an extended variant of the embodiment according to Fig. 2. The first part 21 has been maintained in unchanged form, as is the second part 22 in its basic form. The intermediate part 23' has been extended relative to the intermediate part 23 in Fig. 2, so that the ventilating channel 27' has a greater length than the ventilating channel 27 and, accordingly, extends to a higher level in the second part 22, which calls for adjustment of upper wall element 29', which has a shorter vertical part than the upper wall element 29 in Fig. 2. Similar adjustments are required for the lower wall element 30'. Now, by appropriately dimensioning the extension of the intermediate part 23' depending on the slant of the ventilating channel between the first part and the second part, the lower wall element 30a in Fig. 2 can be chosen for the lower wall element 30'. To clarify this in the drawings, the lower wall elements of Fig. 2 are shown in Fig. 3 in unchanged form as regards shape and dimensions. For the sake of clarity, lower wall element 30 from Fig. 2, no longer usable, is shown as well, though now by means of a thin line, whilst for the same reason a lower wall element located in line with lower wall element 26d, to be arranged in the second part 28 in the case where the smallest channel passage is desired, has been omitted. From Fig. 3 it is further clear that the elements 30a', 30b' and 30c' in Fig. 3 are identical to the elements 30b, 30c and 30d, respectively, in Fig. 3.

Fig. 4 shows a still further extended embodiment of the ventilating device, obtained by means of a further extended intermediate part 23'', the extension having been selected such that the lower wall element 30'' is identical to lower wall element 30a' in Fig. 3, and hence lower wall element 30b in Fig. 2. Also, the lower wall elements 30a'', 30b' and 30c are identical, as are lower wall elements 30b'', 30c' and 30d. Upper wall element 29'' has again been adjusted in vertical direction as a consequence of the extension of ventilating channel 27''.

It will be clear from Figs 2-4 that through appropriate dimensioning and design, a far-reaching extent of standardization of parts can be obtained, since the first part 21 is the same in each case, as is the basic shape of the second part 22 and the valve element 28. Further, a plurality of lower wall elements to be arranged in the second

part can be used in various embodiments, whilst the upper wall element to be arranged in the second part can also remain substantially unchanged in design because only the dimension of the vertical part changes, which may optionally be realized with straight adapter pieces. Similarly, it would also be possible to start from a standard intermediate part 23, which can be expanded by means of adapter pieces so as to be extended to form intermediate parts 23' and 23''.

It will be clear that within the framework of the invention as set forth in the appended claims, many further modifications and variants are possible. For example, the valve elements used may be of any other suitable type. Further, the housing of the sound-damping ventilating device may additionally comprise further separate resonator compartments which are not filled or only partly filled with sound-damping material and are thus attuned to a specific frequency or frequency range to be damped. In Figs 2-4, the upper wall of the ventilating channel has not been changed whilst the lower wall thereof has been varied. Naturally, it is also possible to vary the upper wall or both walls, so that with designs of the ventilating device of different lengths, identical upper wall parts can be used in the second element, so that by appropriately choosing dimensions and design of the various parts, a still further standardization can be obtained.

Claims

1. A sound-damping ventilating device comprising a block-shaped housing which is substantially elongated in the direction of its width and has a slotted ventilating channel (8; 27; 27'; 27'') terminating at both ends in a mouth (9, 10) forming a gap in a housing wall, said ventilating channel and said mouths extending substantially throughout the width of the housing, the slot walls of the ventilating channel being partly bounded by sound-damping material and, at least in the vicinity of one mouth (9), by a wall (1a,2a; 25,26,26a-d) of water-resistant material, whilst the other mouth (10) is covered by a valve element (11; 28) with closable planar apertures, characterized in that the ventilating channel (8; 27; 27'; 27''), at least over a part of its length between the two mouths and starting from one mouth (9) in the direction of the other mouth (10), extends slantingly upwards in the substantially elongated, block-shaped housing and the planar apertures extend substantially perpendicularly to the direction of passage of the ventilating channel in the area adjacent to the valve element (11; 28).

2. A ventilating device according to claim 1, characterized in that the portion of the ventilating channel (8; 27; 27'; 27'') that extends slantingly from the one mouth (9) merges into a less slanting portion.

3. A ventilating device according to claim 1 or 2, characterized in that, viewed in cross-section, the portion of the ventilating channel (8; 27; 27'; 27'') that extends slantingly from the one mouth (9) includes an angle of the order of 40° with a horizontal plane or a part of the sound-damping ventilating device to be arranged horizontally.

4. A ventilating device according to claim 2 or 3, characterized in that, viewed in cross-section, the less slanting portion of the ventilating channel (8; 27; 27'; 27'') includes an angle of the order of 35° with the portion of the ventilating channel that extends slantingly from the one mouth (9).

5. A ventilating device according to any one of the preceding claims, characterized in that the ventilating channel (8; 27; 27'; 27''), adjacent the other mouth (10), widens flaringly essentially to the height of the apertures in the valve element (11; 28).

6. A ventilating device according to any one of claims 2-5, characterized in that the portion of the ventilating channel (8; 27; 27'; 27'') that extends slantingly from the one mouth is bounded by continuous walls (1a,2a) of a relatively stiff material, such as a metal, and the less slanting portion is bounded by walls (1b,2c,3a,4a) of a relatively stiff material, such as a metal, provided with openings.

7. A ventilating device according to any one of the preceding claims, characterized in that openings have been formed in the ventilating channel (8; 27; 27'; 27'') by assembling the ventilating device from:
   - a first part (21), comprising the one mouth and walls (25,26,26a-d) starting from that mouth, of a relatively stiff material, these walls each forming a part of the upper and lower walls of the ventilating channel;
   - a second part (22), comprising the other mouth and walls (29,30,30a-d; 29',30',30a'-30c'; 29'',30'',30a'',30b'') starting from that mouth, of a relatively stiff material, these walls having free ends remote from the other mouth and each forming a part of the upper and

lower walls of the ventilating channel; and

- an intermediate part (23; 23'; 23''), interconnecting the first and the second parts in such a manner that the free end of the upper and the lower wall, respectively, of the first part is spaced from and located in the same plane as the free end of the upper and lower wall, respectively, of the second part.

8. A ventilating device according to claim 7, characterized in that the lower and/or upper wall (25,26,26a-d) in the first part (21) is replaceable by a lower and/or upper wall which can be arranged at a different distance from the upper and/or lower wall than the replaced wall and the lower and/or upper wall (29,30,30a-d; 29',30',30a'-30c; 29'',30'',30a'',30b'') in the second part (22) is replaceable by an upper and/or lower wall which can be arranged at a different distance from the upper and/or lower wall than the replaced wall, the arrangement being such that for modifying the passage of the ventilating channel (27; 27'; 27'') the height of the ventilating channel is variable, but that varied height is substantially constant from the one mouth as far as near the other mouth.

9. A ventilating device according to claim 8, characterized in that the length of the ventilating channel (27; 27'; 27'') is variable by modifying the length of the intermediate part (23; 23'; 23'').

10. A ventilating device according to claim 9, characterized in that both the height and the length of the ventilating channel (27; 27'; 27'') are stepwise variable, whilst, by an appropriate choice of the angle included by the ends of the lower walls starting from the one mouth and the other mouth, located in the same plane, a lower wall (30',30a',30b',30c'; 30'',30a'',30b'') starting from the other mouth matches each stepwise extended intermediate part (23', 23'') and unchanged first part (21), said lower wall being identical to a lower wall (30a,30b,30c,30d; 30a',30b',30c') starting from the other mouth, that matches a ventilating channel (27; 27') with a height smaller by one step and a length of the intermediate part (23; 23') shorter by one step.

11. A ventilating device according to claim 10, characterized in that both the height and the length of the ventilating channel (27; 27'; 27'') are variable in a number of mutually equal steps.

12. A ventilating device according to any one of claims 6-11, characterized in that oppositely located openings in the oppositely located walls (1b,2c,3a,4a) of the less slanting portion are covered relative to each other by a plate-shaped member (14) of an acoustically hard material, arranged in the ventilating channel (8) at a distance from the two openings.

13. A ventilating device according to any one of claims 6-12, characterized in that the upper wall (1a,1c; 25), bounding the portion of the ventilating channel (8; 27; 27'; 27'') that extends slantingly from the one mouth (9) projects from the housing over some distance.

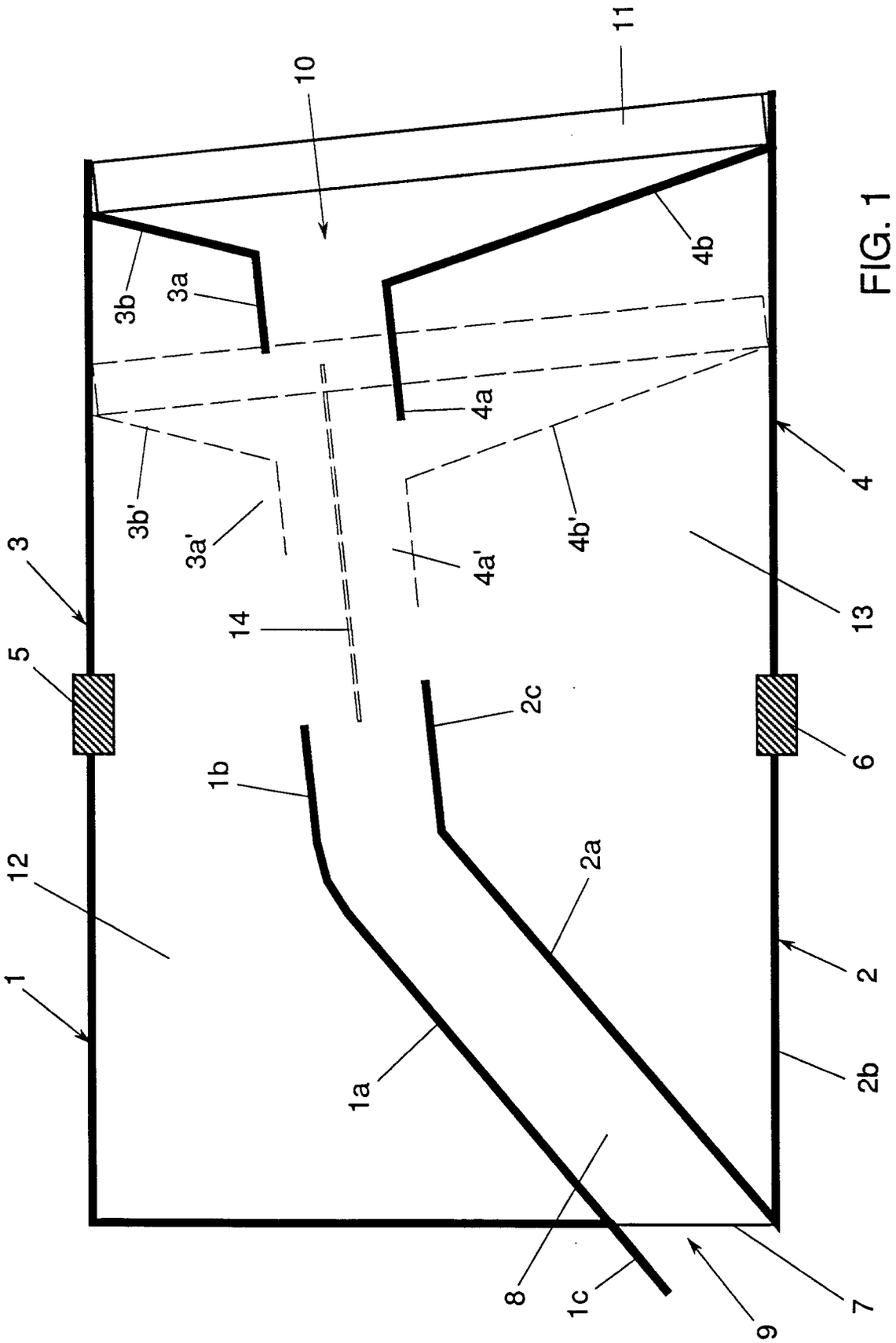

FIG. 1

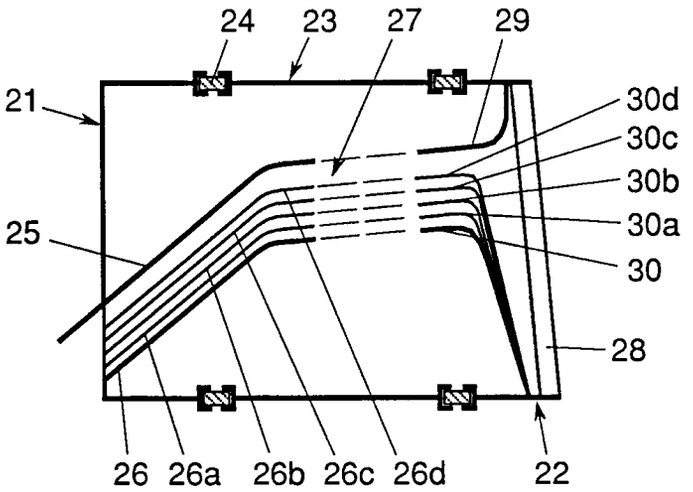

FIG. 2

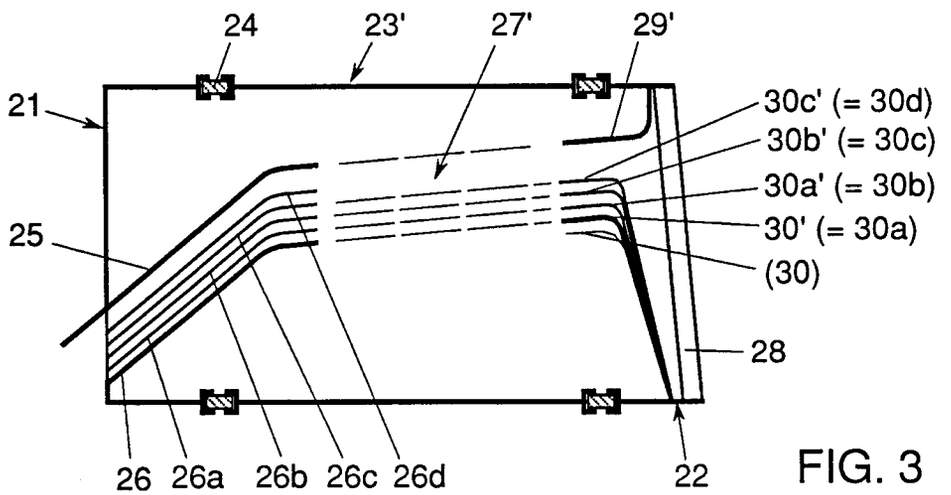

FIG. 3

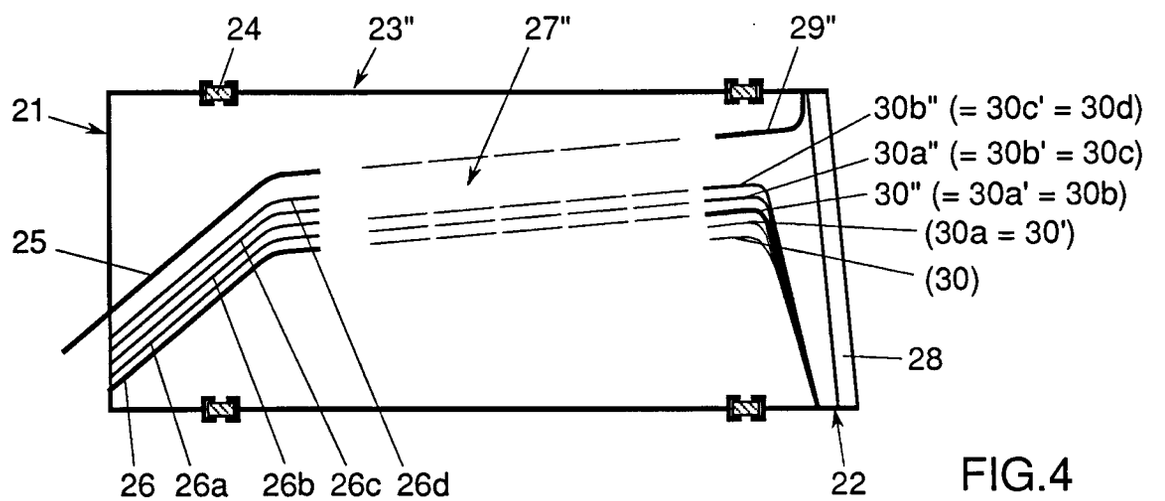

FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 1102

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	NL-A-8 702 464 (ADRIANUS JACOBUS ZWAAN) * figure 1 *	1	E06B7/02 F24F13/24
A	NL-A-8 301 801 (UBBINK)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
E06B F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 JULY 1993	PESCHEL G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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