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(71) Applicant: **JEVEN OY**
SF-50170 Mikkeli (FI)

(72) Inventor: **VARTIAINEN, Seppo**
FI-50190, Mikkeli (FI)

(74) Representative: **Tanhua, Pekka Vilhelm**
Berggren Oy Ab,
P.O. Box 16
00101 Helsinki (FI)

(54) Device for adjusting and dampening air flow

(57) The invention relates to a device for adjusting and dampening air flow, to be fitted in connection with the air duct of an air ventilation system. According to the invention, said adjusting damper (1) comprises: an elongate housing element (2) made of porous, sound-absorbing and flexible material, having a transversal area that is essentially constant, but smaller than the transversal area of the air duct, which housing element (2) is provided with at least one aperture (3) that is arranged to pass through the housing element (2), transversally against the lengthwise direction (A - A) of the housing element, and a restrictor element (4) having a length that is larger than the width of the housing element (2) in the direction of the aperture (3); said device (1) can be arranged in the air duct (5), in which case the restrictor element (4) is placed in the aperture (3), so that it extends to outside the housing element, and the housing element (2) with its restrictor element can be arranged in the lengthwise direction (A - A) in the air duct (5), so that it leaves the air duct partly open outside the restrictor element and the housing element, in which case the flow resistance of the air flow in the air duct grows owing to the device.

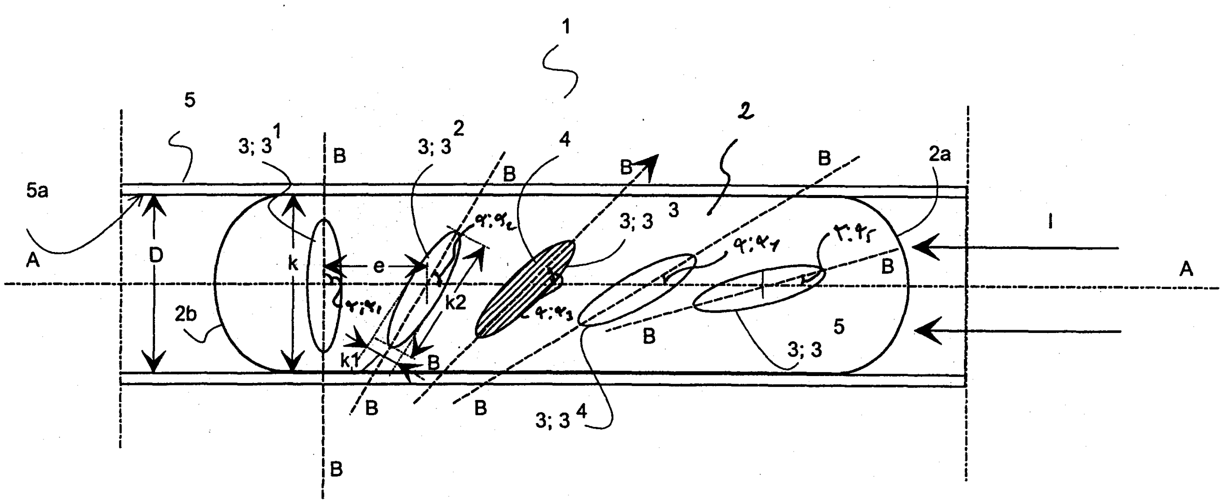

FIG. 1

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Description

[0001] The invention relates to a device for adjusting and dampening air flow as defined in the preamble of claim 1. The device is mainly meant to be used in air ventilation systems, and particularly on the air distribution side.

[0002] In the prior art there is known, from the international patent application WO-9734115, an adjusting damper for an air ventilation system, arranged in connection with the connecting box of the air ventilation duct. The adjusting damper comprises a control device that is movably installed in parallel with the axis of a tubular envelope made of a porous material, so that gas has free access to flow through it. The inside of the damper envelope is in connection with the air ventilation duct, and the outside is in connection with the connecting box. The area of the gas-permeable envelope is adjusted by moving the control device, and at the same time there is adjusted the pressure over the control valve as well as the air flow rate from the duct to the connecting box.

[0003] In the prior art there is known, from the Finnish patent FI-921731, a device for attenuating sound and controlling air flow. The device comprises a wall structure for restricting the flow duct, which wall structure is movable towards the center axis of the duct and is located near the sound attenuation chamber. The device can be used for restricting the transversal duct area, for increasing the flow resistance of the air flow and for improving sound attenuation.

[0004] The problem with the prior art devices is that they are attached to connecting boxes or so-called pressure-drop boxes. The supply air duct is connected to the box, from where it is distributed to the room space either directly or via ducts. One drawback is that the distribution of air is generally realized at one spot, which fact alone restricts the placing of the air distribution points proper in the room space, particularly in a large room space. Another drawback is that the size of the connecting boxes is fairly large, and they take up a lot of space. The connecting boxes must be fitted in the ceiling structures, and this may prove problematic, owing to the general demand of space.

[0005] Another problem with the known devices is their structure; they include several mechanical elements that must be precisely matched. The manufacturing expenses of such devices are fairly high.

[0006] In the prior art there is known an air ventilation duct damper from the earlier Finnish patent application FI-19992394 by the same applicant. The damper comprises a housing that is realized of porous, sound-absorbing and flexible material. The housing is provided with a number of flow apertures that run in parallel with the housing envelope. The shape and measures of the housing cross-section are arranged to correspond to the cross-section of the air ventilation duct where the damper should be installed, so that the housing envelope is extended and pressed against the inner surface of the air ventilation duct. The damper also includes a number of plugs. The shape and measures of the cross-section of each plug essentially correspond to the respective flow aperture in the housing, in which aperture the plug can be fitted when adjusting the quantity of air flow in the air ventilation duct.

[0007] A problem with the above described damper is that the adjusting range and pressure difference range of the air flow is limited.

[0008] The object of the invention is to eliminate the drawbacks connected to the above described known air flow adjusting and dampening devices. Another object of the invention is to realize a novel adjusting damper that is suited to be installed in an air duct.

[0009] The adjusting and dampening device according to the invention is characterized by what is set forth in claim 1. The dependent claims describe preferred embodiments of the invention.

[0010] The air flow adjusting damper according to the invention can be fitted in connection with the air duct of an air ventilation system. According to the invention, the adjusting damper comprises:

- an elongate housing element, which is made of porous, sound-absorbing and flexible material, the transversal area of which is essentially constant, but smaller than the transversal area of the air duct, provided with at least one aperture that is arranged to pass through the housing element, transversally against the lengthwise direction of the housing element, and

- a restrictor element, the length whereof is larger than the width of the housing element in the direction of the aperture,

which device can be arranged in an air duct, in which case the restrictor element is installed in the aperture, so that it extends outside the housing element, and the housing element with its restrictor element can be arranged lengthwise in the duct, so that it leaves the air duct partly open outside the restrictor element and housing element, in which case the flow resistance of the air flow in the air duct grows owing to the device.

[0011] The most important advantage of the invention is that it can be installed in an air duct, particularly a supply air duct, without any connecting or attenuating boxes.

[0012] Another important advantage of the invention is that it is simple in structure, and the number of included elements is small. Consequently, the device according to the invention is economical to manufacture.

[0013] A further advantage of the invention is that it can be installed in an air duct with a rigid envelope without any separate installation elements. The diameter of the housing element of the device can be defined so that it can be attached by friction, without separate fasteners, in the duct.

[0014] An advantage of the invention is that represents a versatile and easy-to-use device that can, with simple installation steps and without any particular changes in the duct, be fitted in many locations in an air ventilation system.

[0015] Yet another advantage of the invention is that it efficiently dampens the noises coming through the air duct to the space to be ventilated.

[0016] Yet another advantage of the invention is that by means of it, the adjusting of an air flow, particularly the fresh air flow conducted through a supply air duct to the space to be ventilated, is arranged in a simple and easy way.

[0017] Yet another advantage of the invention is that the space occupied by it is minimal. A device according to the invention is primarily installed directly in the air duct, which means that a separate pressure-drop box and/or sound dampening box is not needed.

[0018] Yet another advantage of the invention is that by means of it, the distribution of supply air is realized in a simple and easy manner at several locations of the space to be ventilated.

[0019] Yet another advantage of the invention is that it can be used with supply and exhaust air valves.

[0020] In a preferred embodiment of the invention, the housing element is realized of one of the following materials or combinations thereof: open-cell and/or closed-cell foam plastic, such as polyether or polyesther foam plastic; milled plastic, such as PET (polyethene tereftalate), mineral wool or glass wool, pressed rag and felt.

[0021] In a preferred embodiment of the invention, the restrictor element is realized of the same materials as the housing element.

[0022] In a preferred embodiment of the invention, the housing element aperture is realized as an elongate, preferably slot-like aperture, such as a narrow rectangle, a narrow ellipse, or a combination or modification of these.

[0023] In a preferred embodiment of the invention, the restrictor element is a flat and advantageously blade-like element.

[0024] In the most preferred embodiment of the invention, the housing element includes a number of apertures that are arranged in succession and spaced apart, when observed in the lengthwise direction of the housing element, and further arranged to pass through the housing element transversally against the lengthwise direction of the housing element, in which apertures the restrictor element can be fitted. In addition, the apertures are advantageously identical and in shape preferably elongate, and they are arranged in the housing element so that their positions with respect to the flowing direction of the air contained in the air duct, and thus also with respect to the lengthwise direction of the housing element, are different. In that case the volume of the air flow can be easily adjusted by fitting the restrictor element in a suitable aperture in the aperture group.

[0025] The invention and its further advantages are explained in more detail below, with reference to the appended drawing, where

figure 1 illustrates an adjusting damper as installed in an air duct and viewed from one direction,

figure 2 illustrates a corresponding adjusting damper, viewed from a direction that is turned by 90 degrees with respect to the first direction, and

figure 3 illustrates a corresponding adjusting damper, viewed at the front, and

figures 4A and 4B illustrate the restrictor element of the adjusting damper, shown in cross-section and respectively in side view.

[0026] Like numbers for like parts are used in the drawings.

[0027] An air flow adjusting damper 1 according to the invention can be fitted in an air duct of an air ventilation system, particularly a supply air duct. The adjusting damper 1 comprises an elongate housing element 2, provided with at least one aperture 3, and a restrictor element 4 that is arranged in the aperture 3 when using the device.

[0028] The housing element 2 is made of porous, sound-absorbing, flexible and at the same time ductile material. Preferably the housing element 2 is realized of one of the following materials or combinations thereof: open-cell and/or closed-cell foam plastic, such as polyether or polyesther foam plastic; milled plastic, such as PET (polyethene tereftalate), mineral wool or glass wool, pressed rag and felt.

[0029] One or several apertures 3 in the housing element 2 are arranged to pass through the housing element 2, transversally in the lengthwise direction thereof, described and represented by the center axis A - A. The transversal area A1 (width x height) of the housing element 2 is essentially constant, but smaller than the transversal area A2 of the air duct 5. The length p of the restrictor element 4 is longer than the diameter of the housing element 2, such as the width d, in the direction of the aperture 3. The restrictor element 4 is fitted in the aperture 3, so that it extends at least to one side of the housing element 2, advantageously to both sides of the housing element 2.

[0030] The adjusting damper 1 is installed directly in the air duct 5 without separate installation means. First the adjusting damper 1 is assembled, i.e. the restrictor element 4 is set in the aperture 3, so that it extends to outside the housing element 2. Then the adjusting damper 1 is installed in the lengthwise direction A - A in the air duct 5. The adjusting damper 1 leaves the air duct 5 partly open outside the restrictor element 4 and the housing element 2, between them and the inner surface of the air duct. Owing to the device 1, the flow resistance of the air flow I in the air duct 5 grows.

[0031] The adjusting damper 1 is installed in the air duct 5 for example by pushing the housing element 2 with the provided restrictor element 4 in the duct through its outlet end that is open. Now the housing element 2 is first collapsed, whereafter it is allowed to expand, which means that the housing element 2 and at the same time the whole device is expanded and pressed in place in the duct 5, against the inner walls thereof. Now the device remains in place in the duct primarily owing to friction between the inner surface 4 of the housing element 2 and the duct 5, and it does not need any particular fastening elements.

[0032] In a preferred embodiment of the invention, the housing element 2 is made of layers of different materials with different sound dampening properties, such as porosity, and/or flexibility properties. In that case the housing element is realized for instance of three layers 21, 22, 23. The outer layers 21, 23 are made of porous material with a good sound dampening capacity, such as felt. The inner layer 22 is made of material that is more rigid than the outer layers and at the same time keeps the housing element together, such as grain extruded foam plastic. The advantage of this kind of multilayer housing element 2 is that its outer layers 21, 23 and also the surface element are highly absorbent to noise and sounds proceeding in the air duct in general, whereas the inner layer 22 makes the housing element 2 rigid, so that it is easy to be treated in the installation step. It is pointed out that those surfaces of the housing element that are arranged to rest against the inner surface of the air duct 5 must also be at least somewhat flexible, in order to make the installation in the air duct succeed in the above described way, particularly by directly pushing in the duct.

[0033] In another preferred embodiment of the invention, the transversal area A1 of the housing element 2 is no more than 50% of the transversal area A2 of the air duct 5. This ensures a certain basic circulation of air through the device. The transversal area A2 of the air duct 5 is restricted, and the air flow is further adjusted to be smaller by the restrictor element 4.

[0034] In a third preferred embodiment of the invention, the cross-section A1 of the housing element 2 is essentially a rectangle. In that case the height k of the housing element 2 is advantageously at least somewhat larger than the diameter D of the air duct 5, in order to make it attached in place in the air duct by friction in the installation step, as was described above. The width d of the housing element 2 is part of the diameter D of the air duct 5. The width d of the housing element 2 is for example within the range 1/2 - 1/4 of the diameter D of the air duct 5.

[0035] Naturally the cross-section and diameter of the air duct 5 can vary: in cross-section the air duct 5 can be round, as in the examples of the drawings, but it can also be a square, a parallelogram or a polygon. Thus the cross-sectional shape of the housing element 2 of the device 1 can also vary, but from the practical point of view, the rectangle is the most practical cross-sectional shape for the housing element, with measures depending on the air duct and the application in general.

[0036] The length L of the housing element 2 can be chosen freely, but it is advantageous that it is at least twice the diameter D of the supply air duct 5. In a preferred embodiment of the invention, the length L of the housing element 2 is at least 50 cm. The longer the housing element is, the more efficiently particularly low sound frequencies are dampened by the device 1.

[0037] In a fourth preferred embodiment of the invention, at least it that end 2a of the housing element 2 that is placed against the flowing direction I is designed to be a narrowing end element, such as a tapered or rounded end. Moreover, the ends are preferably designed in this way only in one direction of the cross-section of the housing element, although they naturally can be designed according to the same principle in two perpendicular directions or even in several different directions. However, it is advantageous to shape both ends 2a, 2b of the housing element 2 to be narrowed in similar fashion, and preferably even to be narrowed symmetrically on one plane.

[0038] In a fifth preferred embodiment of the invention, the transversal area of the restrictor element 4 essentially corresponds to the transversal area of the aperture 3 of the housing element 2 or is somewhat larger than that. The restrictor element 4 is meant to be fitted in the aperture 3, which means that at least at the aperture 3, this condition must be fulfilled. The transversal area of the restrictor element 4 outside the aperture can be larger than the transversal area of the aperture, but in that case the restrictor element 4 is composed either of two mutually connectable parts (at the aperture 3), or the restrictor element 4 can be temporarily compressed in a space that is so small, that it can be pushed in the aperture 3 and advantageously at least partly therethrough.

[0039] In a sixth embodiment of the invention, the restrictor element 4 is made of porous, sound-absorbing, flexible and often also ductile material. Thus the restrictor element 4 can be made of the same material as the housing element 2. The advantage is that a suitably designed restrictor element 4 is easy to be fitted in the aperture 3, where it remains due to friction.

[0040] In a seventh embodiment of the invention, the length p of the restrictor element 4 is defined on the basis of the diameter D of the air duct 5; it is essentially equal to the diameter D of the air duct 5. Now the housing element 2 is fitted in the middle of the air duct 5, and the restrictor element 4 is fitted in the aperture 3, so that it preferably extends symmetrically to both sides of the housing element 2, as far as the inner surface 5a of the air duct 5.

[0041] In an eight embodiment of the invention, the aperture 3 of the housing element 2 is realized as an elongate, preferably slot-like aperture, as is illustrated in the drawings. The slot-like aperture can be a narrow rectangle, a flat or narrow ellipse, or alternatively a combination or modification thereof. In that case the maximum width k1 of the aperture 3 is advantageously 10 - 15 mm, and the height k2 of the aperture 3 is advantageously within the range 60 - 80% of the height k of the housing element 2, but naturally it can be even shorter than that. In case the height of the aperture 3 is large, it mechanically weakens the housing element 2, which is not desirable from the point of view of practical operation.

[0042] In a ninth embodiment of the invention, the aperture 3 of the housing element 2, particularly a slot-like aperture, is arranged against the air flowing direction I and at the same time at an angle α with respect to the center axis A - A of the housing element (on a perpendicular plane). Now the position of the aperture 3 is observed with respect to the lengthwise center plane B - B of its cross-section. The angle α of the widthwise plane of the housing element, passing via said center plane B - B and the center axis A - A, is preferably within the range 90 - 0 degrees. Above all, the size and selection of the angle α depends on the desired pressure difference over the device 1, and on the reduction of the air flow rate.

[0043] In a tenth embodiment of the invention, the restrictor element 4 is a flat and advantageously blade-like element. It is obvious that when the aperture 3 in the housing element 2 is designed to be slot-like, there is fitted a matching restrictor element 4 that has a corresponding transversal surface. In addition, the restrictor element 4 is, when viewed from a direction perpendicular to its transversal surface and thus from above, a rectangular object. As an alternative, the restrictor element 4 is an object modified of a rectangular shape, advantageously conforming to the shape of the cross-section of the air duct 5 and of the inner surface 5a.

[0044] In an eleventh embodiment of the invention, the restrictor element 4 is made of porous, sound-absorbing, flexible and at the same time ductile material. Thus the restrictor element 4 is advantageously realized of one or several materials, of which also the housing element 2 is realized. Hence, the restrictor element 4 can be manufactured for example of one of the following materials, or combinations thereof: open-cell and/or closed-cell foam plastic, such as polyether or polyesther foam plastic; milled plastic, such as PET (polyethene tereftalate), mineral wool or glass wool, pressed rag and felt.

[0045] In a twelfth embodiment of the invention, the restrictor element 4 is made in layers of different materials, with different sound dampening properties, such as porosity, and/or different flexibility properties. Thus the restrictor element 4 can include material layers in similar fashion as an embodiment of the housing element 2. Now the restrictor element 4 is realized for instance of two layers: a core part or layer 41 and a top part or outer layer 42 (cf. figures 4A and 4B). The topmost layer 42 is made of a porous material with a good sound dampening capacity, such as felt. The core part 42 is made of a material that is more rigid than the topmost layer and that also holds the restrictor element together, such as grain extruded foam plastic. The advantages of this kind of multilayer restrictor element 4 are the same as the advantages of a multilayer housing element 2: the topmost layer 42 and also the surface part are well absorbent to noise and sounds proceeding in the air duct in general, whereas the core part 41 makes the restrictor element 41 more rigid, in which case it is easy to handle when assembling and installing the device. It is pointed out that the edge area of the restrictor element 4, which is arranged to rest against the inner surface of the air duct 5, must also be at least somewhat flexible, in order to make the installation in the air duct succeed in the way described above, particularly by pushing directly in the duct.

[0046] In the most preferred embodiment of the invention, the housing element 2 is provided with a number of apertures 3; 31, 32, 33, 34, 35, which are arranged, when viewed in the lengthwise direction A - A of the housing element 2, in succession and spaced apart, as is apparent particularly from figure 1. The apertures 3; 31, 32, 33, 34, 35 are arranged to pass through the housing element 2 transversally, against the lengthwise direction A - A of the housing element. The restrictor element 4 can be fitted in at least one of the apertures 3; 31, 32, 33, 34, 35 for restricting the air flow rate and for adjusting the air flow.

[0047] The apertures 3 are preferably identical and preferably elongate in shape. They are arranged in the housing element 2 so that their positions are proportionally different with respect to the air flow direction I in the air duct, and consequently to the lengthwise direction A - A of the housing element. Now the positions of successive apertures 3 are arranged to change in a predetermined way when proceeding from the first aperture 3; 31 to the last 3; 35. The essential thing is that when projected on a plane perpendicular to the air flow direction, and thus also to the lengthwise direction A - A of the housing element, the diameters of the apertures 3 change. However, as the apertures are most preferably similar in shape and size, an identical restrictor element 4 can be fitted in each aperture, which is a clear advantage from the point of view of using the device 1. The position of the aperture 3 defines how a restrictor element 4 fitted therein affects the air flow passing through the device 1, particularly the air flow rate and the pressure difference over the device 1.

[0048] As an alternative, the apertures 3 in the housing element 2 can be different in size, and even in shape. In that case various different restrictor elements 4 can be fitted in the apertures 3. The cross-section of a restrictor element 4 depends on the aperture 3, in which it should be fitted. However, this kind of aperture group is not as advantageous to manufacture and use as the above described aperture group consisting of identical apertures with different positions.

[0049] In a preferred variation of the most preferred embodiment of the invention, the apertures 3; 31, 32, 33, 34, 35 of the housing element 2 are realized as identical elongate, particularly slot-like apertures, which are arranged in succession at a mutual distance e in the housing element 2, and so that the lengthwise center plane B - B of each aperture 3 is placed at a defined angle α; α1, α2, α3, α4, α5, with respect to the lengthwise direction A - A of the housing element, said angles being mutually different and preferably within the range 90 - 0 degrees. In the most preferred embodiment, the angles α; α1, α2, α3, α4, α5 of the center planes B - B of the apertures 3 s are arranged to change gradually, starting from one critical angle, such as an angle of 90 degrees, and ending with another critical angle, such as an angle of zero or 5 degrees. In addition, it is particularly advantageous that the angles α are arranged to change stepwise with suitable defined steps, for example steps of 10 - 30 degrees. In shape the restrictor element 4 that can be fitted in the slot-like aperture 3 is a flat, blade-like element, illustrated in figures 4A and 4B.

[0050] The angle α of the slot-like aperture 3 defines how the restrictor element 4 fitted therein affects the air flow proceeding through the device 1, particularly its flow rate and the pressure difference over the device 1. In general, the air flow has access to proceed past the housing element 2 and via the gaps 6 left between the restrictor element 4 and the inner surface 5a of the air duct. When the restrictor element 4 is fitted in the first aperture 3; 31, it is in the application illustrated in figures 1 - 3 placed at right angles to the air flow direction I, i.e. the angle of the restrictor element corresponds to the angle α; α1 = 90 degrees of the lengthwise center plane B - B of the aperture. Now the effect of the restrictor element 4 on the air flow I is remarkable; it slows down the air flow rate and creates a high pressure difference over the device. When the location of the restrictor element 4 is changed to another 3; 32 or in successive order to any of the following apertures 3; 33, 34, 35, the angle of the restrictor element 4 changes along with the aperture angle α; α2, α3, α4, α5. Now, in the arrangement according to said embodiment, the angle of the restrictor element 4 and the aperture angle α become smaller, and simultaneously the effect of the restrictor element 4 on the air flow I is reduced; the restrictor element 4 slows the air flow rate down less and less, and also the pressure difference over the device 1 is reduced. The size of the aperture 3, particularly the height k1, and the angles α; α1, α2, α3, α4, α5 of successive apertures 3; 31, 32, 33, 34, 35 can be designed so that the air flow rates and pressure differences over the device can be stepped in a desired way, and thus the adjusting properties of the device 1 can be defined in advance.

[0051] The invention is not restricted to the above described embodiment only, but many modifications are possible within the scope of the inventive idea defined in the appended claims.

Claims

1. A device for adjusting and dampening air flow, to be fitted in connection with the air duct of an air ventilation system, **characterized in that** said adjusting damper (1) comprises:

    - an elongate housing element (2) made of porous, sound-absorbing and flexible material, having a transversal area (A1) that is essentially constant, but smaller than the transversal area (A2) of the air duct, which housing element (2) is provided with at least one aperture (3) that is arranged to pass through the housing element (2), transversally against the lengthwise direction (A - A) of the housing element, and

    - a restrictor element (4) having a length (p) that is larger than the width (d) of the housing element (2) in the direction of the aperture (3),

    which device (1) can be arranged in the air duct (5), in which case the restrictor element (4) is placed in the aperture (3), so that it extends to outside the housing element, and the housing element (2) with its restrictor element can be arranged in the lengthwise direction (A - A) in the air duct (5), so that it leaves the air duct partly open outside the restrictor element and the housing element, in which case the flow resistance of the air flow in the air duct grows owing to the device.

2. An adjusting damper according to claim 1, **characterized in that** the housing element (2) is realized of one of the following materials or combinations thereof: open-cell and/or closed-cell foam plastic, such as polyether or polyesther foam plastic; milled plastic, such as PET (polyethene tereftalate), mineral wool or glass wool, pressed rag and felt.

3. An adjusting damper according to claim 1 or 2, **characterized in that** the housing element (2) is made in layers (21, 22, 23) of at least two different materials.

4. An adjusting damper according to claim 1, 2 or 3, **characterized in that** the length (L) of the housing element (2) is at least twice as long as the diameter (D) of the air duct (5).

5. An adjusting damper according to claim 4, **characterized in that** the length (L) of the housing element (2) is at least 50 cm.

6. An adjusting damper according to any of the pre-

ceding claims, **characterized in that** the transversal area (A1) of the housing element (2) is no more than 50% of the transversal area (A2) of the air duct (5).

7. An adjusting damper according to any of the preceding claims, **characterized in that** the cross-section (A1) of the housing element (2) is essentially a rectangle.

8. An adjusting damper according to any of the preceding claims, **characterized in that** at least that end (2a) of the housing element (2) that is placed against the flowing direction (I), is narrowed in shape, for example tapered or rounded.

9. An adjusting damper according to any of the preceding claims, **characterized in that** the transversal area (A4) of the restrictor element (4) essentially corresponds to the transversal area (A3) of the aperture (3) of the housing element (2).

10. An adjusting damper according to any of the preceding claims, **characterized in that** the length (p) of the restrictor element (4) is essentially equal to the diameter (D) of the air duct (5).

11. An adjusting damper according to any of the preceding claims, **characterized in that** the aperture (3) of the housing element (2) is realized as an elongate, preferably slot-like aperture, such as a narrow rectangle, a narrow ellipse, or a combination or modification thereof.

12. An adjusting damper according to claim 11, **characterized in that** the maximum width (k1) of the aperture (3) is 10 - 15 mm.

13. An adjusting damper according to claim 11 or 12, **characterized in that** the lengthwise center plane (B - B) of the aperture (3) with respect to the lengthwise direction (A - A) of the housing element (2) is placed at a defined angle (α), which is within the range 0 - 90 degrees.

14. An adjusting damper according to claim 11, 12 or 13, **characterized in that** the restrictor element (4) is a flat and preferably blade-like element.

15. An adjusting damper according to any of the preceding claims, **characterized in that** the restrictor element (4) is made of porous, sound-absorbing and flexible material.

16. An adjusting damper according to claim 15, **characterized in that** the restrictor element (4) is realized of one of the following materials or combinations thereof: open-cell and/or closed-cell foam plastic, such as polyether or polyesther foam plastic; milled plastic, such as PET (polyethene tereftalate), mineral wool or glass wool, pressed rag and felt.

17. An adjusting damper according to claim 15 or 16, **characterized in that** the restrictor element (4) is made in layers (41, 42) of different materials.

18. An adjusting damper according to any of the preceding claims, **characterized in that** the housing element (2) is provided with a number of apertures (3; 31, 32, 33, 34, 35) that are placed, as viewed in the lengthwise direction (A - A) of the housing element (2), in succession at a mutual distance (e) and arranged to pass through the housing element (2) transversally to the lengthwise direction (A - A) of the housing element, and that the restrictor element (4) can be fitted in said apertures.

19. An adjusting damper according to claim 18, **characterized in that** the apertures (3; 31, 32, 33, 34, 35) are advantageously identical and in shape preferably elongate, and that they are arranged in the housing element (2) so that their positions with respect to the flowing direction (I) of the air in the air duct (5), and thus also with respect to the lengthwise direction (A - A) of the housing element, are different.

20. An adjusting damper according to claim 19, **characterized in that** the apertures (3) of the housing element (2) are realized as slot-like apertures that are placed in the housing element (2) so that the lengthwise plane (B - B) of each aperture (3) is placed at a defined angle (α; $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$, $\alpha 5$) with respect to the lengthwise direction (A - A) of the housing element, said angles being mutually different and having a size within the range 90 - 0 degrees.

21. An adjusting damper according to claim 20, **characterized in that** the angles (α; $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$, $\alpha 5$) of the center axes (B - B) of the apertures (3) are arranged to change gradually between the given angle values.

22. An adjusting damper according to claim 21, **characterized in that** the angles (α; $\alpha 1$, $\alpha 2$, $\alpha 3$, $\alpha 4$, $\alpha 5$) of the center axes (B - B) of the apertures (3) are arranged to change in a stepwise fashion, by steps of 30 -10 degrees.

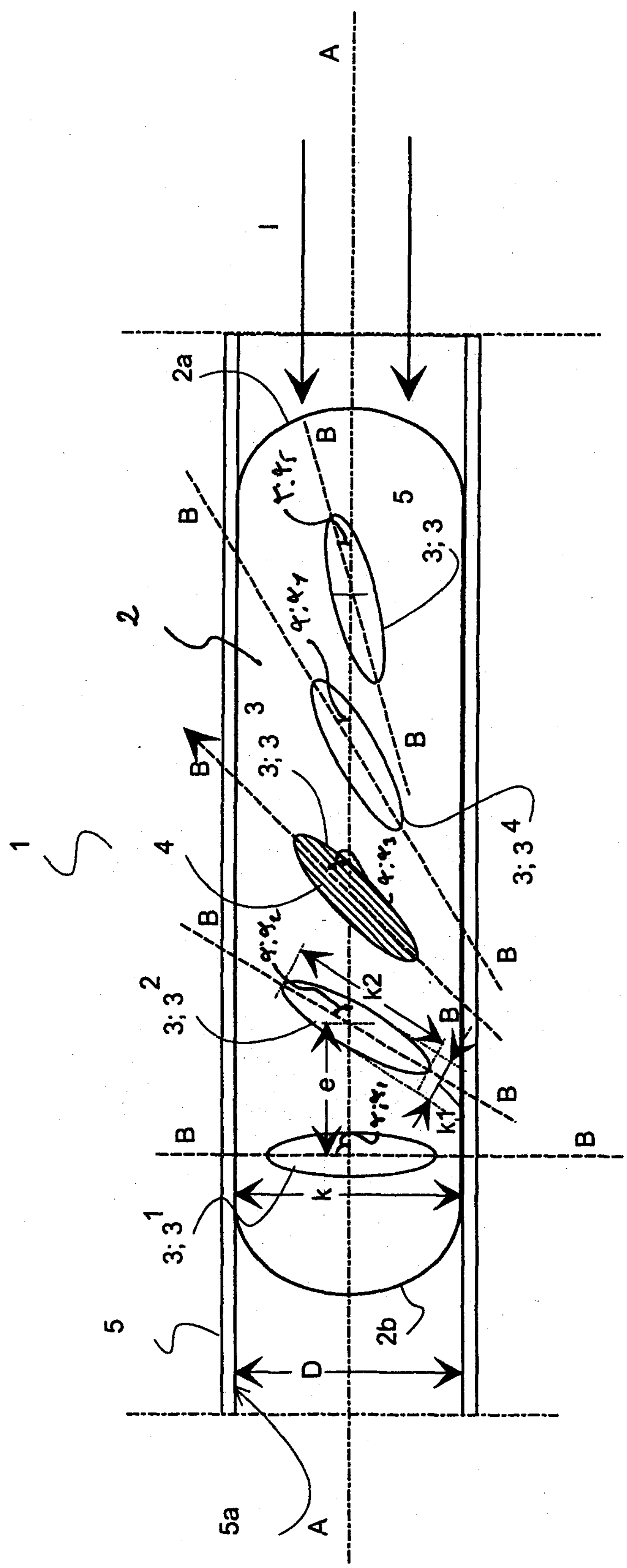

FIG. 1

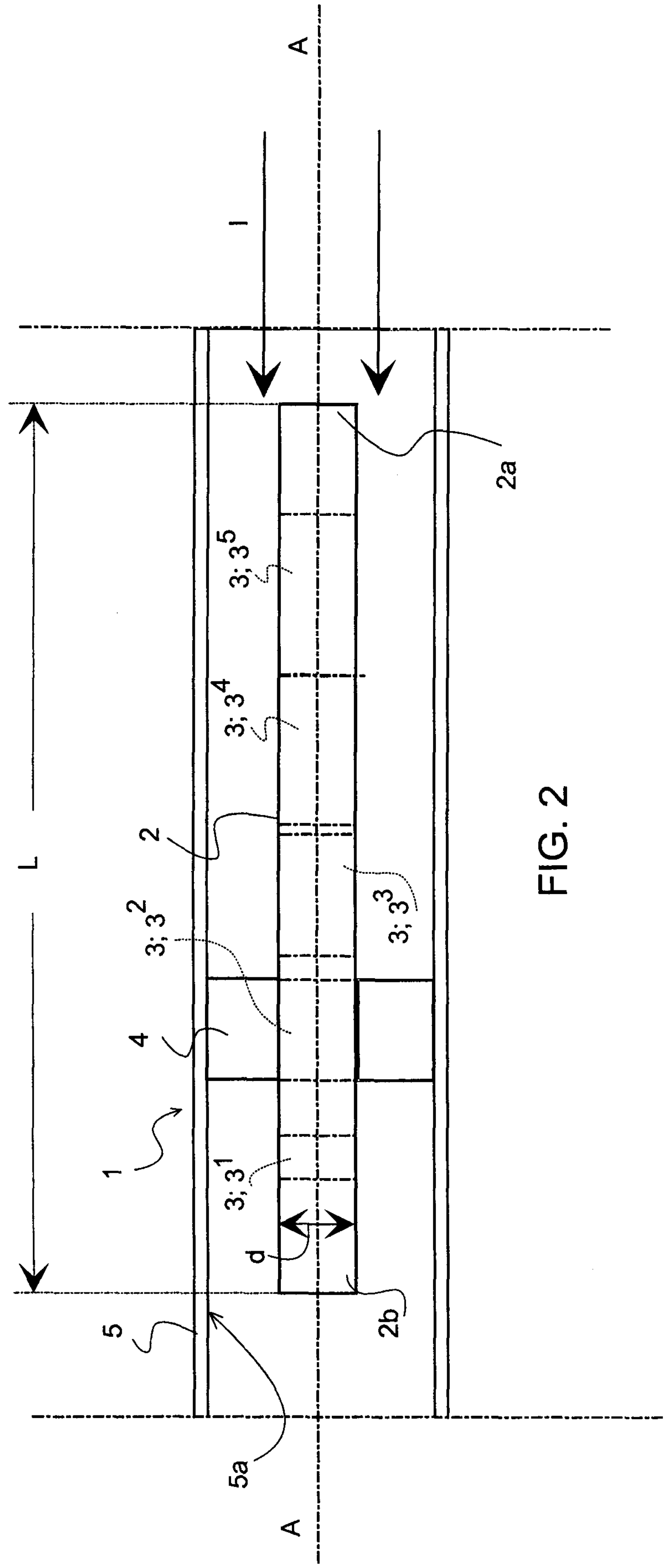

FIG. 2

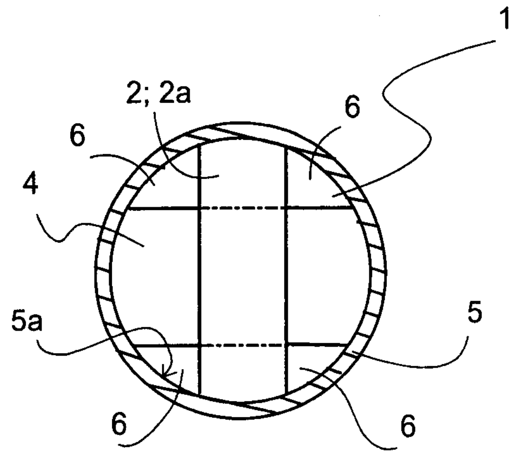

FIG. 3

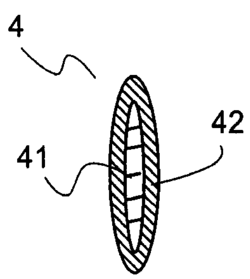

FIG. 4A

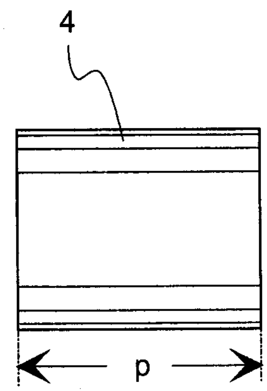

FIG. 4B