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(54) **Self regulating ventilation device**

(57) The invention relates to a self-regulating ventilation device, comprising a housing with an air passage duct having a longitudinal cross section, and a first type of elongate self-regulating valve body which is fitted in the air passage duct so as to be movable for controlling the flow rate of an air stream occurring in the air passage

duct during use. The invention is characterized in that the ventilation device comprises at least a second type of self-regulating valve body which is fitted in the air passage duct so as to be movable.

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## Description

**[0001]** The present invention relates to a self-regulating ventilation device according to the preamble of claim 1. Such a self-regulating ventilation device is known, for example, from Dutch patent NL9102132.

**[0002]** In the case of natural ventilation supply devices for buildings, in particular for residential purposes, it is desirable that above a certain difference in air pressure between the outside and the inside of the building, the flow rate of the air stream through the ventilation system is as constant as possible, independent of the wind pressure on the façade of the building.

**[0003]** In the case of the known ventilation device, a self-regulating valve body is hinge-fitted in the air passage duct of the housing for that purpose. The valve body has a short and a long leg, with the long leg generally extending horizontally in the case of a ventilation device fitted in a façade and the short leg being at right angles to the long leg.

**[0004]** If, as a result of a pressure difference between the inlet side and the outlet side of the air passage duct, a specific air stream occurs in the air passage duct, the valve body will rotate through the effect of the air stream, namely in such a manner that the free edge of the long leg moves upwards and the free edge of the short leg moves along with the air stream, until a new equilibrium is achieved in which the forces exerted on the valve body are balanced.

**[0005]** In this case, the aim generally is that, above a certain small pressure difference between the inlet side and the outlet side of the air passage duct, the air stream through the air passage duct is as constant as possible, independent of the difference in air pressure between the inlet side and the outlet side of the air passage duct.

**[0006]** However, the aim may also be to give the self-regulating ventilation device a different air pressure difference/flow rate characteristic.

**[0007]** In this case, "self-regulating" is understood to mean that the valve body is operated by the air stream which passes through the air passage duct, without additional electrical control or actuating means.

**[0008]** The drawback of the known ventilation device is that the options for adjusting a specific air pressure difference characteristic for the self-regulating valve are limited, as this characteristic is to a large degree determined by the shape and the design of the self-regulating valve body to be used. Generally, a relatively heavy valve body is required in order to achieve, for example, a constant flow rate across a wide range of differences in air pressure. However, such a valve body of relatively heavy design will be less suitable for controlling rapidly changing air streams in the air passage duct caused by rapidly changing differences in air pressure across the façade.

**[0009]** It is an object of the invention to provide a self-regulating ventilation device which allows greater freedom of choice with regard to the pressure difference/flow rate characteristic, such that this ventilation device

can be adjusted more in line with requirements, for example based on the specific characteristics of the location where the ventilation device is used or the wishes of the user.

5 **[0010]** This object is achieved by a ventilation device according to the preamble of claim 1, in which the ventilation device is characterized in that the ventilation device comprises at least a second type of self-regulating valve body which is movably fitted in the air passage duct.

10 **[0011]** In this case, "second type of valve body" is understood to mean that the second valve body is not entirely identical to the first type of valve body. The difference between the two valve bodies may consist of a different shape or dimension of the cross-sectional profile, the material from which the first and second valve bodies are made or in the manner in which the valve body is fitted in the ventilation device, either hinged or otherwise. With respect to the latter, it is possible to position the hinge point at another position relative to the cross-sectional profile of the valve body, or for the valve body to be positioned, for example, at another position in the air passage duct, for example higher or further upstream or downstream. In general, as a result of this difference, the pressure difference/flow rate characteristic of the first valve body will be different from the pressure difference/flow rate characteristic of the second valve body.

20 **[0012]** It should be noted that, in the known ventilation device, a self-regulating valve body consists of two or more parts having a cross section which in each case is identical in shape and size. These parts, which are also made from the same material, are fitted in the air passage duct in the same manner, for example hinged about the same hinge axis, in line with one another, in order to operate as a single self-regulating valve body extending over substantially the entire width of the air passage duct. Such parts which, per se, may be of different length, are not deemed to constitute parts of different types as referred to in the context of the present application.

30 **[0013]** Such an embodiment of a ventilation device with a self-regulating element which consists of two or more substantially identical parts is known, for example, from WO 03/060387.

40 **[0014]** In addition, it is known from EP 0 621 452 to fit two self-regulating valves of the same type, one above the other, in a ventilation duct.

45 **[0015]** By providing a second type of self-regulating valve body which is fitted in the air passage duct such that it can be moved separately, it is possible to adjust the pressure difference/flow rate characteristic of the ventilation device within a greater range, as desired.

50 **[0016]** For example, it is possible to use a first valve body for compensating for rapidly changing differences in air pressure across a narrow range, while the second valve body is designed such that it is suitable for differences in air pressure which occur more slowly and across a wider range of differences in air pressure across the air passage duct. This can be achieved, for example, by designing the first valve body to be lighter than the second

valve body. The combination of the two valve bodies thus results in a better pressure difference/flow rate characteristic across a wide range of differences in air pressure.

**[0017]** Moreover, it is for example possible to use, as the first type of valve body, a valve body which maintains a constant air stream across a specific range of differences in air pressure, while the second valve body remains open across this entire range of differences in air pressure, whereas with differences in air pressure beyond this range (in practice, for example, in case of a storm) it completely closes the air passage duct. The second valve body may, for example, also be provided in order to seal the air passage duct if an air stream flows through the air passage duct in the opposite direction (when the air pressure on the inside is higher than on the outside).

**[0018]** In one embodiment, the first and second type of valve body are fitted in the air passage duct substantially parallel to one another and behind one another in the air flow direction. An air passage duct of a conventional device generally offers sufficient space for the first and second valve body to be positioned in this manner. In this case, it is possible for both the first and second valve bodies to extend over the entire width of the air passage duct, "width of the air passage duct" meaning the dimension of the rectangular cross section in the longitudinal direction, at right angles to the air flow direction. It is also possible that only one of the two valve bodies extends over the width of the air passage duct while the other valve body only partially extends over this width. Likewise, it is possible for both valve bodies to extend over only part of the width of the air passage duct.

**[0019]** In another embodiment, the first and second types of valve body are advantageously positioned in line in the width direction of the air passage duct. With such an arrangement, the air through the air passage duct flows either through the area of the first valve body or through the area of the second valve body. The air pressure difference/flow rate characteristic of the second type of valve body differs from the air pressure difference/flow rate characteristic of the first type of valve body. Thus, a wider adjustment range of the various air pressure difference/flow rate characteristics is possible.

**[0020]** In one embodiment, one or more further self-regulating valve bodies are provided which can be arranged as desired, for example behind one another in the air flow direction or next to one another over the width of the air passage duct, or in combinations thereof in order to achieve an optimum air pressure difference/flow rate characteristic of the self-regulating ventilation device. The one or more further valve bodies may be of a type which is different from the first and second types. It is also possible that one or more of these are of the first or the second type. The one or more further valve bodies may generally have the characteristics which are described in the present document in connection with the first and second types of valve body.

**[0021]** The first and/or second types of self-regulating

valve body may, for example, be designed as disclosed in the abovementioned patent application NL 9102132, in which a self-regulating valve body having an L-shaped cross section is disclosed which is hinge-fitted inside the ventilation duct. Likewise, it is possible to design the self-regulating valve body as a valve body which is hinge-fitted inside the ventilation duct and has a substantially flat cross section, for example as disclosed in the pending Dutch patent application NL 1026034 by the Applicant, or to design it as an element, comprising various materials, which is flexible as it consists of a relatively soft plastic section between two relatively hard sections, in order to be able in this manner to respond to the effects of the air stream through the ventilation duct. The last-mentioned self-regulating valve body has been disclosed, for example, in Belgian patent BE1011044. Likewise, any differently designed self-regulating valve body may according to the invention be used in a ventilation device according to the invention.

**[0022]** Further advantages and features of the invention will be described below by means of a number of embodiments with reference to the attached drawing, in which:

Fig. 1 shows a cross section of a first embodiment of a ventilation device according to the invention;

Fig. 2 shows a top view of the ventilation device from Fig. 1;

Fig. 3 shows a second embodiment of a ventilation device according to the invention; and

Fig. 4 shows a top view of the ventilation device from Fig. 3.

**[0023]** Fig. 1 shows a first embodiment of a ventilation device, which ventilation device is denoted overall by reference numeral 1. The ventilation device comprises a housing 2 through which the ventilation duct 3 extends. The air passage duct 3 has a substantially rectangular longitudinal cross section. Such a ventilation device 1 is for example fitted in the façade of a dwelling in order to provide the interior with fresh air which flows from the outside to the inside through the air passage duct 3 as a result of the difference in air pressure across the façade. The air flow direction inside the air passage duct is indicated by a double-line arrow in Figs. 1 and 2.

**[0024]** In order also to ensure an adequate supply of fresh air, even with a small pressure difference across the façade, the air passage duct has a relatively large cross section. However, this has the drawback that with a relatively large pressure difference across the façade, a considerably larger stream of fresh air enters the interior space through the ventilation device. This is undesirable, as it may lead to an appreciable cooling of the interior space, resulting in undesirable and unnecessary energy costs.

**[0025]** In order to control the amount of air flowing through the air passage duct 3, a first self-regulating valve body 4 of a first type and a second self-regulating valve

body 6 of a second type are arranged in the air passage duct 3. The first self-regulating valve body 4 extends substantially over the entire longitudinal cross section of the air passage duct 3 (see Fig. 2) and is hinge-fitted on a hinge pin 5 which is attached by both its ends to the end sides of the housing 2 of the ventilation device 1. The second self-regulating valve body 6 extends over approximately two-thirds of the width of the cross section of the air passage duct 3 and is hinge-fitted on the hinge pin 7 which is attached by both its ends to two hinge supports 8 which are each arranged in the air passage duct 3.

**[0026]** As a result of this arrangement of the two valve bodies 4, 6, a desired air pressure difference/flow rate characteristic is achieved for the ventilation device. In this case, in the embodiments of Figs. 1 and 2, a first valve body has been designed to be relatively heavy and can thus maintain a constant flow rate through the air passage duct 3 over a wide range of different air pressures across the façade, while the second valve body 6, as a result of its relatively light design, can compensate for rapid changes in air pressure, as a result of which the constancy of the flow rate through the air passage duct 3 is improved further. The resulting air pressure difference/flow rate characteristic of the entire ventilation device could not be achieved with one single self-regulating valve body.

**[0027]** If desired, the arrangement of the first valve body 4 and the second valve body 6 may be modified in order to achieve a desired air pressure difference/flow rate characteristic for the ventilation device. Thus, it is for example possible to place the second self-regulating valve body 6 of relatively light design first in the air passage duct 3, followed by the first self-regulating valve body 4, i.e. in reverse order to that shown in Figs. 1 and 2. Furthermore, it is possible for the second self-regulating valve body 6 to extend over the entire width of the cross section of the air passage duct 3 and/or for the first valve body 4 to extend over only a part of the width of the cross section of the air passage duct 3.

**[0028]** In order to achieve the desired air pressure difference/flow rate characteristic for the ventilation device, self-regulating valve bodies of identical or different types and of identical or different sizes may be used. Various types of self-regulating valve bodies are generally known and will not be described in any more detail here. A possible example of an embodiment in which various types and various sizes of self-regulating valve bodies are used is shown in Figs. 3 and 4.

**[0029]** Figs. 3 and 4 show a second embodiment of a ventilation device which is denoted overall by reference numeral 10. The ventilation device 10 comprises a housing 11 in which an air passage duct 12 is arranged. The air flow direction is likewise indicated by a double-line arrow in Figs. 3 and 4.

**[0030]** In the air passage duct 12, which again has a substantially rectangular and elongate cross section, three self-regulating valve bodies of various types are arranged. A first self-regulating valve body 13 of a first

type and a second self-regulating valve body 15 of a second type are arranged next to one another in the width direction of the cross section of the air passage duct 12. The first self-regulating valve body 13 is hinge-fitted on a hinge pin 14. One end of the hinge pin 14 is mounted in a head end side of the housing 11 and the other end is mounted in a hinge pin support 17.

**[0031]** The second self-regulating valve body 15 is hinge-fitted on a hinge pin 16. One end of the hinge pin 16 is supported by the head end side of the housing 11. The other end of the hinge pin 16 is supported by the hinge pin support 17. As can clearly be seen in Fig. 3, both hinge pins are mounted slightly offset with respect to each other in the vertical direction. It is also possible to mount the hinge pins at the same height, in which case the same hinge pin could be used for both valve bodies 13, 15, if desired. Just as with the embodiment according to Fig. 1, the first self-regulating valve body 13 is heavier than the second self-regulating valve 15, so that each of the two self-regulating valve bodies 13, 15 can execute a specific function with respect to the air pressure difference/flow rate characteristic of the ventilation device.

**[0032]** A third self-regulating valve body 18 of a third type is arranged in the air passage duct 12. This third self-regulating valve body 18 is hinge-fitted on a hinge support 19 which is mounted on the bottom of the air passage duct 12 on the housing 11. The third self-regulating valve body 18 is of a different type than the valve bodies described above, which are substantially L-shaped in cross section. The third valve body 18 is substantially flat in cross section and is hinge-fitted to the hinge support 19 by a longitudinal end. This hinge support 19 is placed on the longitudinal side of the third self-regulating valve body 18 facing the interior space. A supporting element 20 is placed near the opposite longitudinal side of the self-regulating valve body 18 and ensures that the longitudinal side of the third self-regulating valve body 18 facing the exterior is kept at some distance from the bottom wall of the air passage duct 12, so that, as a result of the air pressure building up between the self-regulating valve body 18 and the bottom wall of the air passage duct 12, the third self-regulating valve body 18 can pivot upwards, as indicated by a dashed line, in order in this manner to influence the flow rate of the air passage duct. As can clearly be seen in Fig. 4, the third self-regulating valve body 18 extends substantially over the entire width of the rectangular cross section of the air passage duct 12.

**[0033]** Installing a third self-regulating valve body offers additional freedom when adjusting/influencing the air pressure difference/flow rate characteristic of the ventilation device. With the embodiment of Figs. 3 and 4, it is for example possible for the first and second self-regulating valve body 13, 15 to have substantially the same function as the self-regulating valve bodies 4 and 6 described with reference to Figs. 1 and 2, while the third valve body 18 of Figs. 3 and 4 ensures a complete closing of the air passage duct in the event of very considerable

difference in air pressure across the façade, as is desirable, for example, during severe storms, in which case an automatic closing of the air passage duct 12 is desirable.

**[0034]** The ventilation device 10 thus has an air pressure difference/flow rate characteristic which can be adjusted as desired by selecting the three self-regulating valve bodies 13, 15 and 18, with a first self-regulating valve body 13 ensuring in particular that the flow rate in the air passage duct 12 is kept constant across a relatively wide range of slowly changing differences in air pressure across the façade, while the second valve body 15 ensures that rapidly changing differences in air pressure are eliminated. In this case, the third valve body 18 serves to close the air passage duct 12 completely in case of very considerable differences in air pressure. It will be clear that such an air pressure difference/flow rate characteristic of the ventilation device 10 could not be achieved with one single self-regulating valve body of one of the types shown or of another known type.

**[0035]** From the two embodiments shown, it will be clear that there are many different possible embodiments which enable the adjustment of the air pressure difference/flow rate characteristic of a self-regulating ventilation device by using a plurality of self-regulating valve bodies. Such embodiments are deemed to be covered by the scope of protection of this patent. Depending on the circumstances under which the ventilation device will be used and the wishes of the user, a combination of different types of self-regulating valve bodies will have to be selected.

### Claims

1. Self-regulating ventilation device, comprising a housing with an air passage duct having a longitudinal cross section, and a first type of elongate self-regulating valve body which is movably fitted in the air passage duct for controlling the flow rate of an air stream occurring in the air passage duct during use, **characterized in that** the ventilation device comprises at least a second type of self-regulating valve body which is movably fitted in the air passage duct.
2. Ventilation device according to claim 1, **characterized in that** the shape of a cross-sectional profile of the second type of valve body is identical to the shape of a cross-sectional profile of the first type of valve body, the dimensions of the cross-sectional profile of the first and second type of valve body being different.
3. Ventilation device according to claim 1, **characterized in that** the shape and/or dimensions of a cross-sectional profile of the first and second type of valve body are identical, the position of a hinge point

of the first type of valve body being positioned in a different position from a hinge point of the second type of valve body.

4. Ventilation device according to claim 1, **characterized in that** the shape and/or dimensions of a cross-sectional profile of the first and second type of valve body are identical, the first and the second type of valve body being made of different materials.
5. Ventilation device according to one or more of the preceding claims, **characterized in that** the first and the second type of self-regulating valve body are fitted in the air passage duct substantially parallel to one another and behind one another in the air flow direction.
6. Ventilation device according to one or more of the preceding claims, **characterized in that** the first and the second type of self-regulating valve body are arranged in the air passage duct substantially in line in the air flow direction.
7. Ventilation device according to one or more of the preceding claims, **characterized in that** the first type of self-regulating valve body has a first air pressure difference/flow rate characteristic, and the second type of self-regulating valve body has a second air pressure difference/flow rate characteristic, the first air pressure difference/flow rate characteristic and the second air pressure difference/flow rate characteristic being different.
8. Ventilation device according to one or more of the preceding claims, **characterized in that** the first and/or second type of valve body consists of two or more parts whose cross-sectional profile is identical in shape and size and which are substantially made from the same material, the two or more parts being placed in line in the width direction of the air passage duct and being movable about the same hinge axis.
9. Ventilation device according to one or more of the preceding claims, **characterized in that** the first type of self-regulating valve body and the second type of self-regulating valve body are of different length.
10. Ventilation device according to one or more of the preceding claims, **characterized in that** the hinge axes of the first and second self-regulating valve body, in the assembled state of the ventilation device, are at different heights in the vertical direction.
11. Ventilation device according to one or more of the preceding claims, **characterized in that** the ventilation device comprises one or more further self-regulating valve bodies movably mounted in the air passage duct.

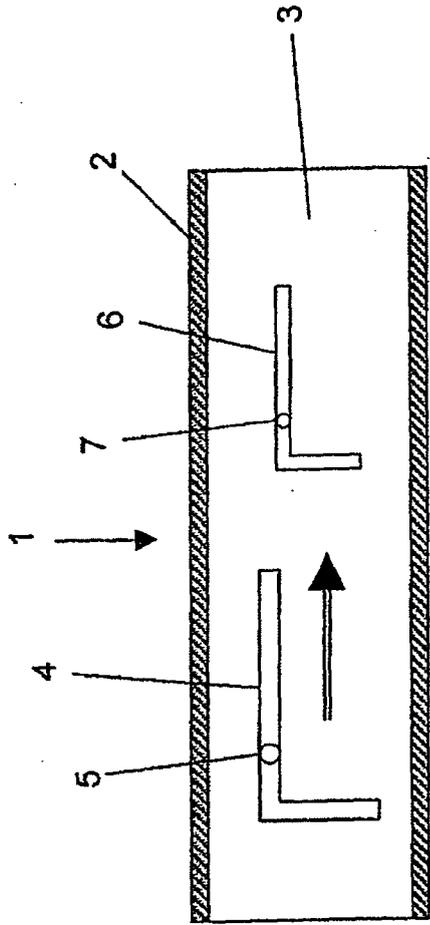


FIGURE 1

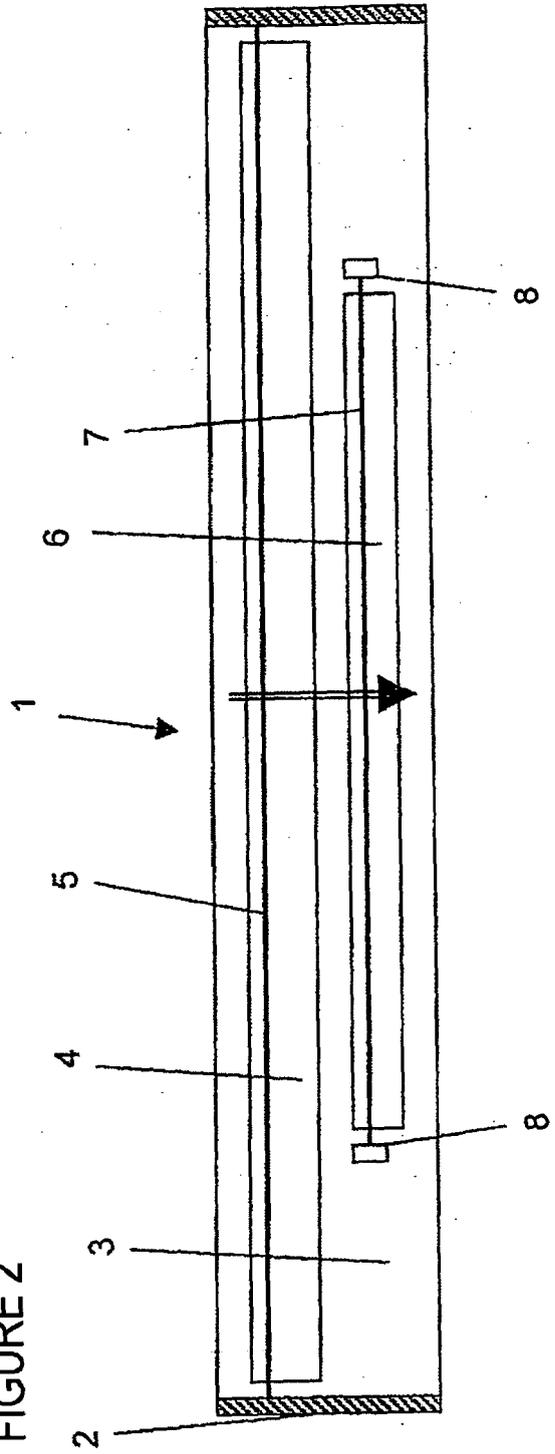


FIGURE 2

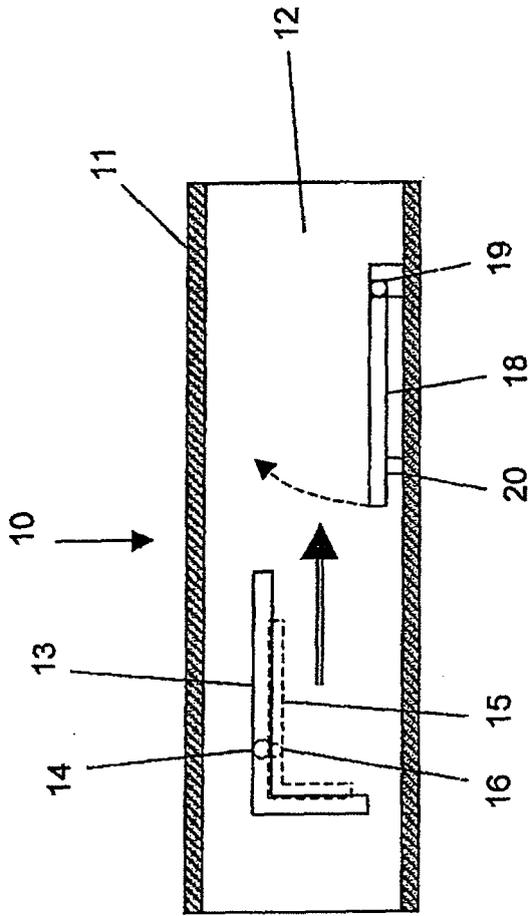


FIGURE 3

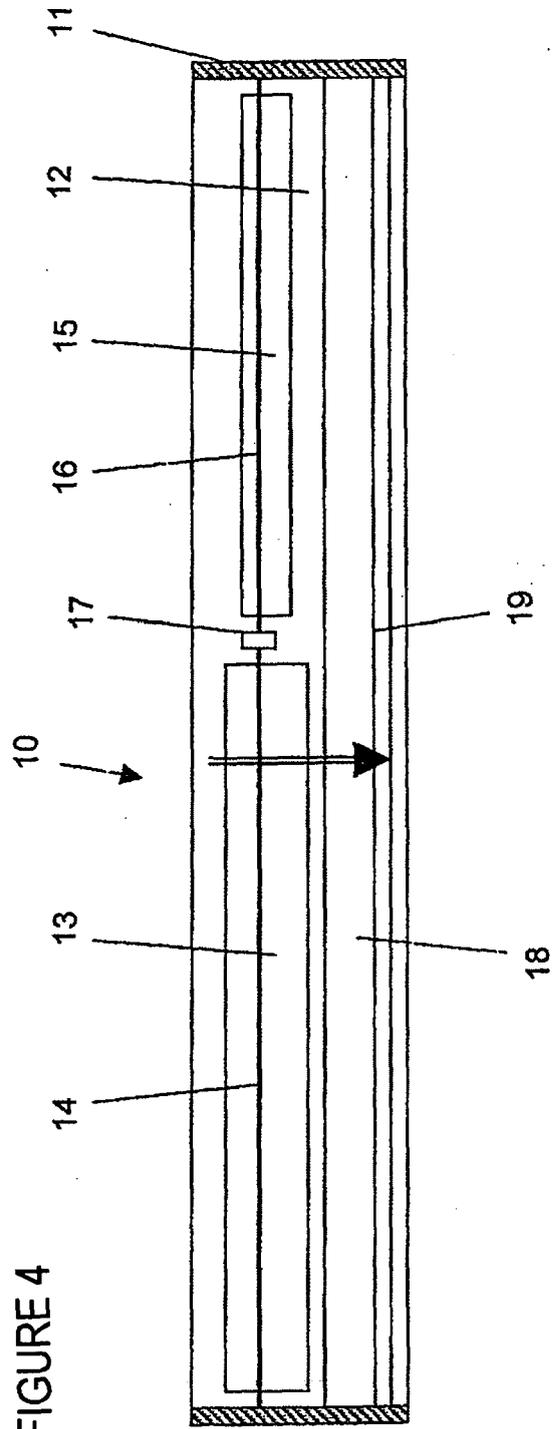


FIGURE 4