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(54) **A silencing ventilating device, in particular for a ventilating passage in a wall or partition.**

(57) A silencing ventilating device, in particular for a ventilating passage in a wall or partition, and comprising a tubular casing (11) and at least one tubular inner pipe (12) having at least one opening in its wall constituting a communication between a continuous ventilating passage (15) and an enclosed space (14) formed by transverse baffles (17) extending from the inner pipe (12) and/or the casing (11). The total area of passage of the opening(s), depending on the volume of the enclosed space, is tuned, in the manner of a Helmholtz resonator to a given frequency to be damped. Said enclosed space (14), consequently, may have a circular or an annular cross section. A plurality of enclosed spaces may be provided by employing at least two inner pipes and/or by installing further transverse baffles.

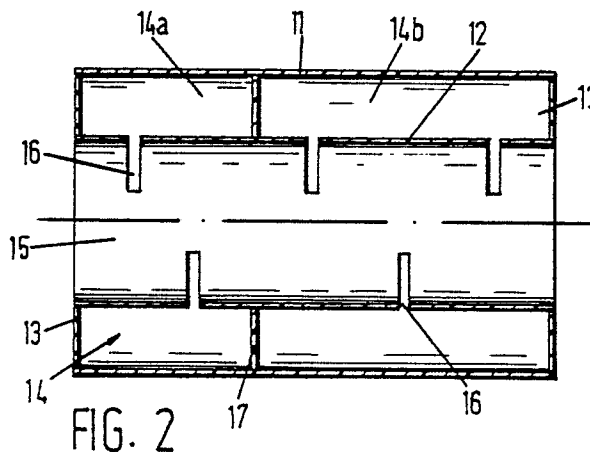


FIG. 2

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A silencing ventilating device, in particular for a ventilating passage in a wall or partition

This invention relates to a silencing ventilating device, in particular for a ventilating passage in a wall or partition and provided with a tubular casing and at least one tubular inner pipe having at least one opening in its wall, connecting a continuous ventilating passage to an enclosed space formed by transverse baffles originating from the inner pipe and/or the casing.

Such silencing ventilating devices are known from the brochure Gebr. Trox GmbH "Silencers, silencing coulisses, sound absorbing elements, series M.X.Z.", 1979, page No. 5-SD2, pages 1, 2, 16, 17, and have the form of duct silencers, round silencers and silencing coulisses. The silencing effect of these devices is based on sound-absorbing material filling up the enclosed space. For that reason, said material, at the location of the partition between the enclosed space and the continuous ventilating passage, is surrounded by a maximally porous envelope, e.g. a wall with a multiplicity of perforations therein or a glass fabric. In many cases, the damping to be obtained with these known silencing ventilating devices is insufficient with respect to the sound-absorbing effect to be achieved, or will be insufficient at the anticipated higher sound insulation standards to be set by the authorities.

It is an object of the present invention to improve a silencing ventilating device of the above described type in such a manner that it has substantially enhanced silencing properties.

This is achieved, according to the present invention, when the total area of passage of the opening(s), is tuned to a given frequency to be damped, depending on the volume of the enclosed space, in the manner of a Helmholtz resonator. These features considerably increase the sound-absorbing effect by tuning the silencing ventilating device to a given frequency. True, the frequency range over which the damping is realized is not only amplified but also narrowed, but this will mostly not be a drawback in practice, since in a given situation, noise is mostly experienced as a nuisance in a limited frequency range only, so that in spite of a narrowed damping frequency range, an appreciably higher overall silencing effect is obtained to such an extent that the desired reduction of the noise pollution is realized over the total frequency spectrum.

In cases where damping is desired in more than one frequency range, it is possible with a silencing ventilating device in which the inner pipe is shut off at its ends by means of transverse end baffles, according to a further embodiment of the

present invention, that the inner pipe contains further transverse baffles which divide the inner pipe into various compartments, each having a different volume.

5 In a silencing ventilating device wherein an enclosed space is created by means of transverse end baffles between the casing and the inner pipe, the same effect can be obtained when this enclosed space is subdivided by further transverse baffles into a plurality of compartments, each having a different volume.

10 By combining several of the proposed features, the number of frequency ranges in which optimum damping according to the present invention can be obtained, can be increased still further where, in a silencing ventilating device in which at least two inner pipes of different diameter are present and the innermost inner pipe is shut off at its ends by transverse end baffles, and further transverse end baffles are provided at the ends adjacent inner pipe and possibly between two adjacent inner pipes, according to a further embodiment of the present invention, there is provided within the enclosed spaces at least one further transverse baffle subdividing an enclosed space into compartments of different volume. In this manner, it is possible to arrange Helmholtz resonators having different frequency ranges within the innermost inner pipe, between the casing and the outermost inner pipe and/or between any further inner pipes, that may be present.

Highly important for obtaining the desired silencing effect is that the total area of passage to an enclosed space or a compartment is given the desired size. This can be realized in a comparatively simple but highly accurate manner when, according to still a further embodiment of the present invention an opening in the wall is formed by a saw cut. Depending on the required area of passage, one or a plurality of saw cuts of accurately determined length and width, and hence having a total area of passage that can be determined exactly, can be provided within an inner pipe otherwise having a closed cylindrical circumferential surface.

45 Depending on the desired silencing effect, it may be preferable in certain cases to amplify the frequency range and take a slight weakening of the silencing effect into the bargain. This can be realized, according to a further embodiment of the present invention, when at least one of the enclosed spaces is filled up at least partly, with sound absorbing material. Even in that case, due to the

Helmholtz resonator effect created according to the present invention a more effective silencing effect is obtained than is possible with silencing ventilating devices of the prior art.

Some embodiments of the silencing ventilating device according to the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal section of a first embodiment having a sealed inner pipe;

Fig. 2 is a longitudinal section of a second embodiment having a seal between the inner pipe and the casing;

Fig. 3 is a longitudinal section of a third embodiment having a sealed innermost inner pipe and a seal between the casing and an adjacent inner pipe; and

Fig. 4 is a longitudinal section of a fourth embodiment which can be used as a silencing wall passage for a wall-mounted heater.

Fig. 1 is a longitudinal section of a silencing ventilating device composed of a tubular casing 1 and a tubular inner pipe 2 arranged concentrically within casing 1 in a manner not shown. Both casing 1 and inner pipe 2 may have any cross-sectional configuration, with a preference for a circular cross-section. The ends of inner pipe 2 are shut off by a transverse baffle 3, thereby producing an enclosed space 4. Between inner pipe 2 and casing 1 there is provided a free, annular ventilating passage 5. Within inner pipe 2 there are provided a plurality of holes in the form of saw cuts 6. The lengths and widths of saw cuts 6 connecting the ventilating passage 5 to the enclosed space 4 are chosen in such a manner that the total area of passage thereof renders the enclosed space a Helmholtz resonator tuned to a predetermined frequency so that a highly effective damping in the range around said frequency is obtained. In order to amplify this range, if desired, thereby slightly reducing the silencing effect, depending on the purposes for which the silencing ventilating device is designed, the enclosed space may be filled at least partly with sound-absorbing material.

The silencing ventilating device shown in Fig. 2 comprises a casing 11 and an inner pipe 12. At the ends, there are provided between casing 11 and inner pipe 12 annular transverse baffles 13, thereby creating between the casing and the pipe a space 14 that is enclosed with respect to the surroundings. The internal passage of the inner pipe forms the free ventilating duct 15. Inner pipe 12 has holes in its wall in the form of saw cuts 16, forming an open connection between duct 15 and the enclosed space. 14. The latter is divided into two compartments 14a, 14b by an annular transverse baffle 17, with the lengths and widths of the saw cuts 16 being chosen for each compartment in

such a manner that two Helmholtz resonators are produced, each tuned to a different damping frequency range. If desired, sound-absorbing material can also be provided in the compartments 14a, 14b.

Fig. 3 shows a silencing ventilating device composed of a casing 21 and two inner pipes, the innermost being designated by reference numeral 22 and the outermost by 23. By means of transverse baffles 24 provided at the ends of inner pipe 22, there is created an enclosed space 25 which is subdivided into two compartments 25a, 25b by a further transverse baffle 26. Between casing 21 and inner pipe 23 there are disposed at the ends annular transverse baffles 27, thereby forming an enclosed space 28 which is subdivided into three compartments 28a, 28b, 28c by further annular transverse baffles 29, 30. Transverse baffles 24 and 27 leave the annular space between the two inner pipes 22, 23 clear, thereby creating a free ventilating passage 31. The latter is in open communication with the enclosed compartments 25a, 25b, 28a, 28b and 28c by means of saw cuts 32 in inner pipe 22 and saw cuts 33 in inner pipe 23. The lengths and widths of the various saw cuts 32, 33, in relation to the compartments to which they provide access, are chosen in such a manner that each compartment forms a Helmholtz resonator tuned to a different frequency. Here too one or a plurality 20 of compartments can be filled, if desired, with sound-absorbing material.

Fig. 4 shows a silencing ventilating device which may serve as a wall passage for a wall-mounted heater. To that end, there is provided a casing 41 and three inner pipes, the innermost being designated at 42a, the central one at 42b, the outermost at 42c. Inner pipe 42a is open at its ends thus forming a first free passage 43. Between inner pipes 42a and 42b, there are provided at the end annular transverse baffles 44, thereby forming an enclosed space 45, which is subdivided into two compartments 45a, 45b by a further annular transverse baffle 46. Openings in the form of saw cuts 50 again bring the free passage 43 in communication with compartments 45a, 45b. Between casing 41 and inner pipe 42c, there are provided annular transverse baffles 47 at the ends, thereby forming an enclosed space 48. This enclosed annular space 48 accommodates heat-insulating material 49 so as to form an insulation between the wall passage for conducting hot gases and the wall or partition itself. Naturally, also the enclosed space 48 can again be subdivided into compartments by annular transverse baffles and can be brought in communication with the free passage 52 by open-

ings in inner pipe 42c. An adapter 51 is provided for connection to a known double concentric supply and discharge pipe for fresh air and combustion gases.

It stands to reason that many modifications and variants are possible within the scope of the present invention. For instance, the perforations may have any other form than that of a saw cut, which is preferred. The only important feature is that the total area thereof is tuned, in the manner of a Helmholtz resonator, to the volume of the compartment to which access is provided from a ventilating passage. Besides, starting from the embodiment shown in Fig. 3, the number of enclosed spaces can be increased by providing one or a plurality of pairs of additional inner pipes. Moreover, it is naturally possible, depending on the desired damping pattern, e.g. in the embodiment shown in Fig. 3, to provide one of the enclosed spaces with a known, porous circumferential wall. Furthermore, the design of the silencing ventilating device at the two ends has not been described herein. These may be provided in a known manner with mounting means, seepage covers, insect grids and shut off means. Although a circular cross section is preferred, any other form, in particular a square or rectangular form is also possible. Although the casing and inner pipe are shown herein as single-piece elements, it is also possible to compose these of sections, e.g. having the size of one compartment.

Claims

1. A silencing ventilating device, in particular for a ventilating passage in a wall or partition, and comprising a tubular casing and at least one tubular inner pipe having at least one opening in its wall constituting a communication between a continuous ventilating passage and an enclosed space formed by transverse baffles extending from the inner pipe and/or the casing, characterized in that the total area of passage of the opening(s), depending on the volume of the enclosed space, is tuned in the manner of a Helmholtz resonator to a given frequency to be damped.

2. A silencing ventilating device as claimed in claim 1, wherein the inner pipe is shut off at its ends by transverse end baffles, characterized in that the inner pipe accommodates further transverse baffles which divide the inner pipe into a plurality of compartments, each having a different volume.

3. A silencing ventilating device as claimed in claim 1, wherein an enclosed space is created by means of transverse end baffles between the casing and the inner pipe, characterized in that said

enclosed space is subdivided by further transverse baffles into a plurality of compartments, each having a different volume.

4. A silencing ventilating device as claimed in claim 1, wherein at least two inner pipes of different diameter are provided and the innermost inner pipe is shut off at its ends by transverse end baffles, there being also provided transverse end baffles between the casing and the adjacent inner pipe and possibly between two adjacent inner pipes at the ends thereof, characterized in that within the enclosed spaces there is provided at least one further transverse baffle which subdivides an enclosed space into compartments of different volume.

5. A silencing ventilating device as claimed in any one of the preceding claims, characterized in that an opening in the wall is formed by a saw cut.

6. A silencing ventilating device as claimed in any one of the preceding claims, characterized in that at least one of the compartments is filled, at least partly, with sound absorbing material.

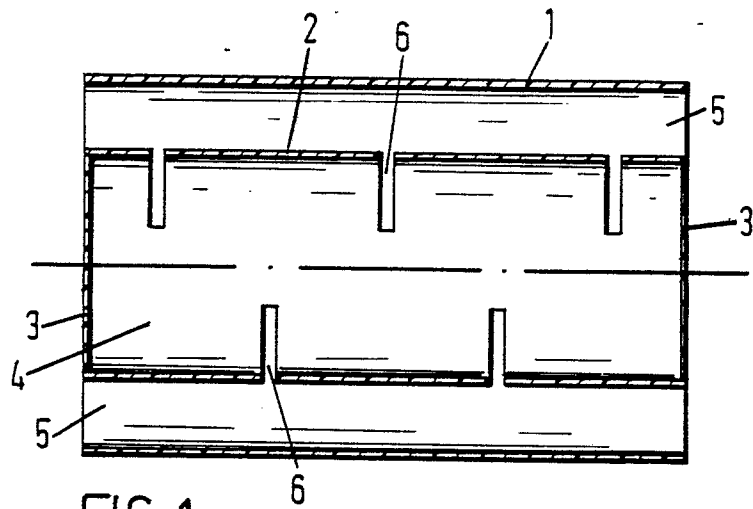


FIG. 1

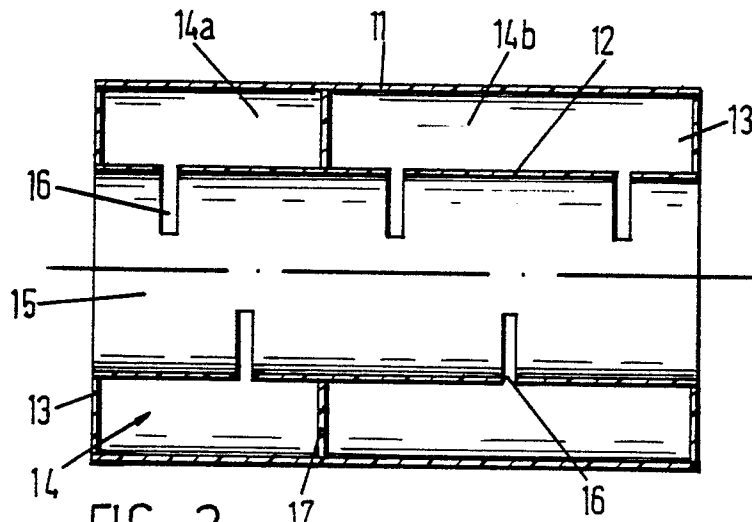


FIG. 2

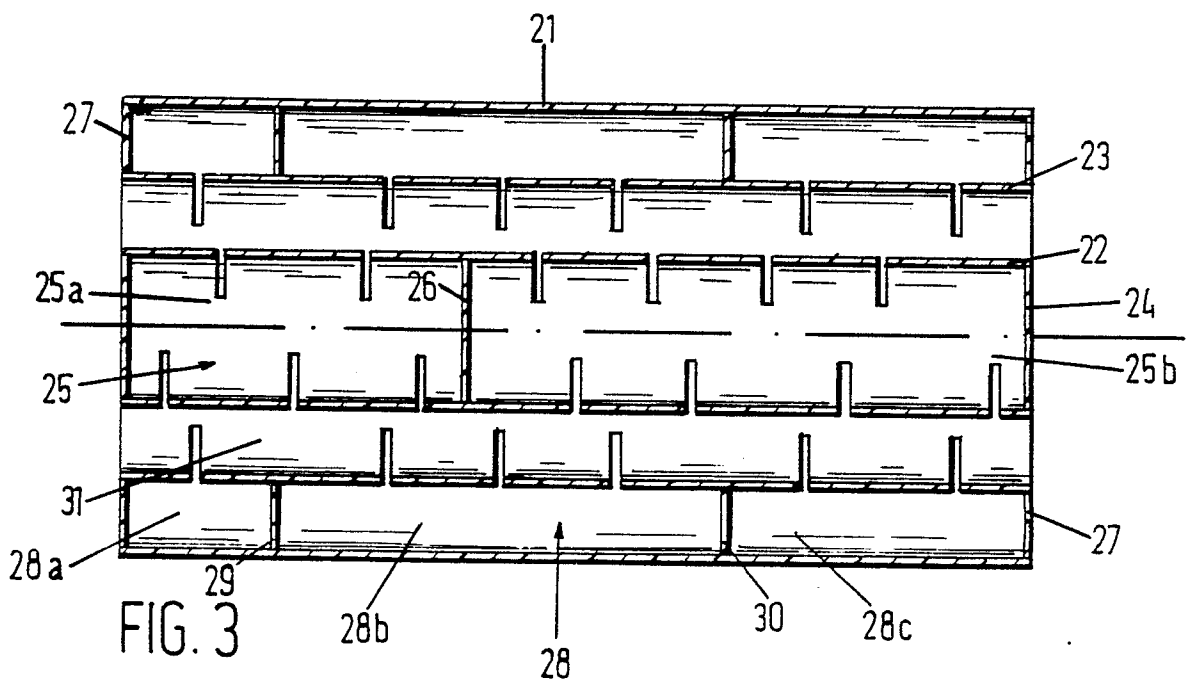


FIG. 3

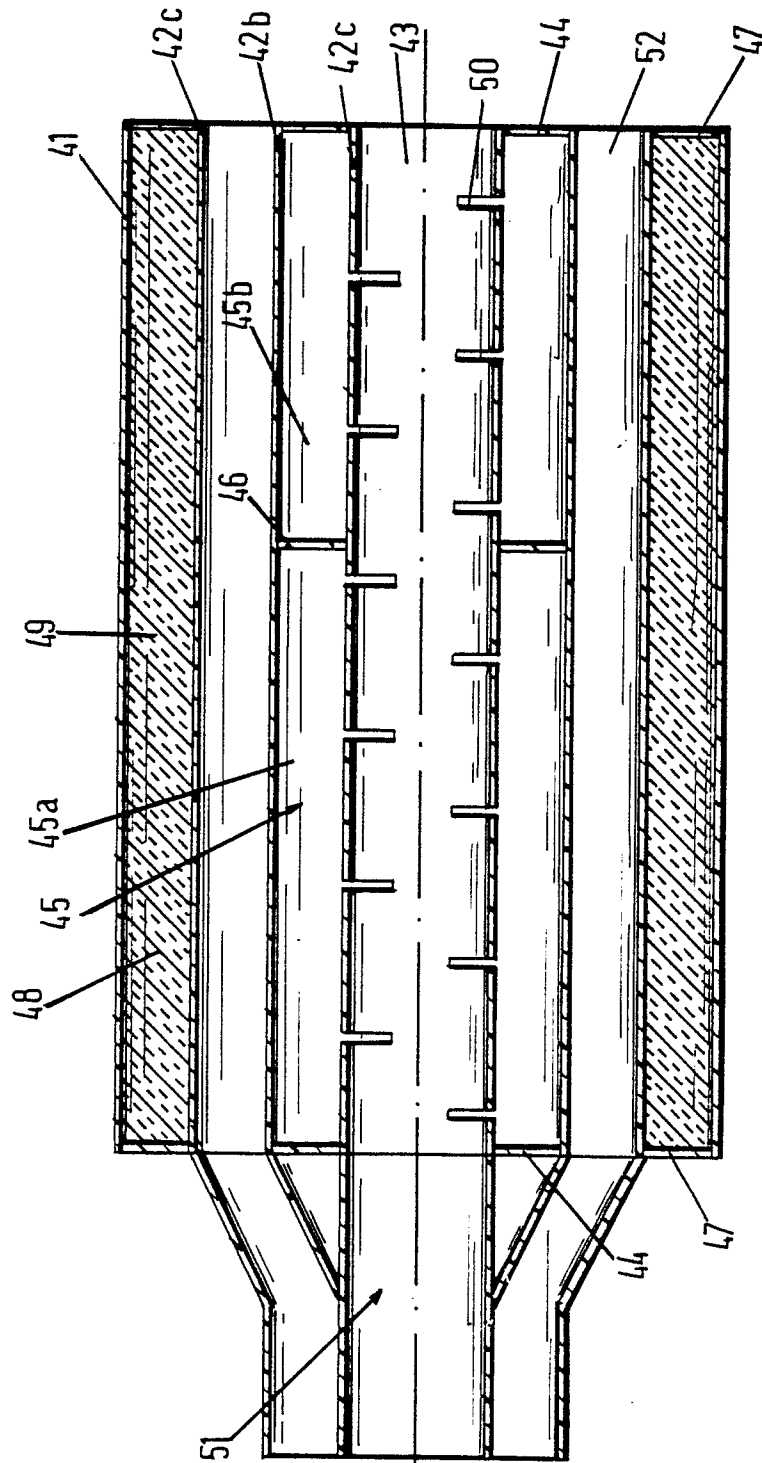


FIG. 4



European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 87 20 1922

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. 4)
D,A	BROCHURE GEBR. TROX GmbH, no. 5, SD 2, 1979, pages 1,2,16,17; "Geluiddempers, geluiddempende koelissen, geluidabsorptie elementen, serie M.X.Z" * Page 16, type "Ronde geluiddemper ZFK" *	1-4,6	F 24 F 13/00 G 01 K 11/16 F 01 N 1/02
A	US-A-4 167 986 (CONWAY) * Column 4, lines 37-47; figures 2,4 *	1,6	
A	FR-A-1 283 147 (WOODS OF COLCHESTER) * Figure 2 *	1,2,6	
A	FR-A-2 321 590 (PLESSY) * Page 1, line 39 - page 2, line 2; figures 1,2 *	1,5	
A	US-A-2 580 564 (LUDLOW)		
A	GB-A- 610 000 (FREEDMAN)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 24 F G 10 K F 01 N F 02 M F 16 L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-01-1988	Examiner 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 O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			