



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.05.2009 Bulletin 2009/19

(51) Int Cl.:
E01F 8/00 (2006.01)

(21) Application number: **07119652.1**

(22) Date of filing: **30.10.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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(54) **Sound barriers**

(57) A sound barrier (1) arranged to improve the air quality comprises a wall element (10), an air filter element (11) and an air guiding element (12). The air guiding element (12) is arranged to define, together with the wall element (10), an opening (15) which tapers towards the

air filter element (11) so as to concentrate wind-propelled air at the air filter element, and force the wind-propelled air through the air filter element. To this end, the air guiding element (12) is preferably curved. The sound barrier is particularly useful alongside major roads and highways, but may also be used at airports.

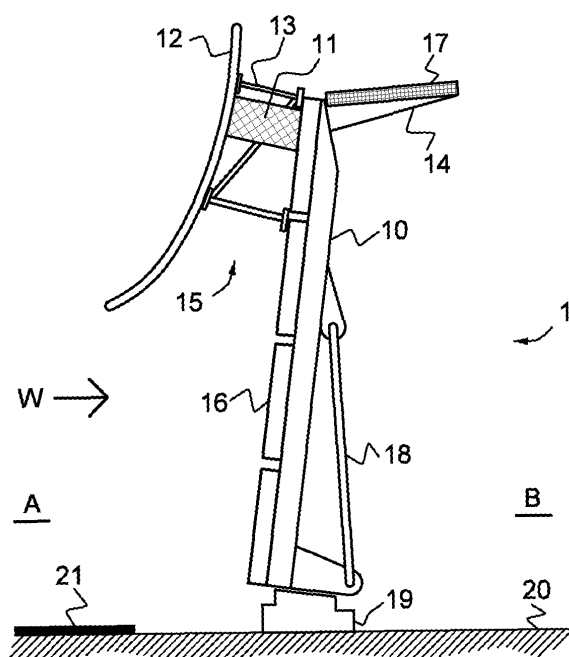


FIG. 2

Description

[0001] The present invention relates to sound barriers. More in particular, the present invention relates to sound barriers arranged to improve the air quality near highways and runways.

[0002] Sound barriers have been used for many years to reduce the sound levels near highways, railroads, and airports. Various types of sound barriers or sound walls exist, for example earthworks, brick walls, and wooden structures. The mere presence of a sound barrier already reduces the sound levels behind the barrier, but to provide an additional reduction sound barriers may be clad with sound-absorbing materials.

[0003] Some sound sources, such as roads and runways, not only produce sound (that is, noise) but also pollution: exhaust fumes from cars or airplanes which typically spread and reach residential neighbourhoods and office buildings. For this reason, some sound barriers are provided with air filters to improve the air quality.

[0004] European Patent Application EP 1 632 607 discloses a sound barrier provided with air filters. This known sound barrier is designed in such a way that the air pressure caused by large vehicles driving past the sound barrier causes the polluted air to flow through an air filter. However, the filtering of this known sound barrier will be less effective when smaller vehicles drive past, or when large vehicles drive past at a relatively large distance from the sound barrier, as in those cases the pressure caused by the moving vehicles will be relatively small. Accordingly, the air purifying effect of this known sound barrier is limited. In addition, the sound barrier of EP 1 632 607 is not suitable for use with runways, as the distance between the sound barrier and the airplanes will typically be too large to generate sufficient air pressure.

[0005] It is an object of the present invention to overcome these and other problems of the Prior Art and to provide a sound barrier including an air filter which is also effective when vehicles are further removed from the sound barrier, or which is even effective in the absence of vehicles.

[0006] Accordingly, the present invention provides a sound barrier comprising a wall element, an air filter element, and an air guiding element, characterised in that the air guiding element is arranged to define, together with the wall element, an opening which tapers towards the air filter element so as to concentrate wind-propelled air at and force it through the air filter element.

[0007] By providing an air guiding element which concentrates (polluted) wind-propelled air at or near the air filter element and then forces this wind-propelled air through the air filter element, any kind of air displacement can be used to purify the air. In other words, the air pressure caused by the (natural) wind is the primary cause of filtering the air, instead of the air pressure generated by vehicles as in the Prior Art. As a result, the size of any vehicles or their proximity to the sound barrier no longer determines the effectiveness of the air filter element.

[0008] In a preferred embodiment, the air guiding element is curved. A curved air guiding element provides a better air flow and a better air filtering action. The curvature is preferably convex when viewed from the opening defined by the air guiding element and the wall element, that is, the rate at which the width of the opening decreases towards the air filter also decreases. Such a convex curvature results in a suitable pressure gradient in the opening between the wall element and the air guiding element. A particular preferred curvature is elliptical.

[0009] An optimal efficiency is achieved when the air filter element extends substantially perpendicularly from both the wall element and the air guiding element. That is, the air filter element extends at an angle of approximately 90 degrees, for example an angle between 70 and 120 degrees, preferably between 80 and 110 degrees and more preferably between 85 and 105 degrees from at least one of the wall element and the air guiding element. In this way, the air filter element will be positioned at approximately 90 degrees relative to the air flow.

[0010] Both the filter element and the air guiding element are preferably arranged adjacent the air filter element. More in particular, the air filter element extends across the opening defined by the wall element and the air guiding element, the air filter element preferably extending across the entire width of the opening at approximately the point where its width is smallest. This ensures that substantially all the air forced into the opening passes through the air filter element.

[0011] The distance between the air guiding element and the wall element, and hence the width of the opening, may be determined by a support element arranged for spacing the wall element and the air guiding element apart. In such an embodiment, the weight of the air guiding element is carried by the support element, thus avoiding using the filter element for this purpose.

[0012] It is particularly preferred that the air guiding element extends above the wall element. In this way, a relatively low pressure is generated at the leeward side of the air guiding element, thus increasing the air pressure drop across the air filter element.

[0013] In an advantageous embodiment the wall element has sound-absorbing properties, so that sound is not only reflected by the wall element but is also (partially) absorbed.

[0014] The sound barrier according to the present invention may further comprise a board element mounted on the wall element and extending away from the air guiding element, the board element preferably being mounted at the top of the wall element. It has been found that a surface extending from wall element further dampens the sound. This surface is most effective when it extends substantially horizontally. In the preferred embodiments, this surface is constituted by a board element extending away from the air guiding element.

[0015] The board element may advantageously have sound-absorbing properties and preferably is provided with a dark upper surface. In this way, the sound is further

dampened. The dark upper surface causes the air above it to heat up and thus to rise, resulting in a further dampening of the sound.

[0016] Although the wall element could be mounted exactly vertically, it is preferred that the wall element is slanted. The slant is preferably away from the air guiding element. This slant or inclination, which may amount to an angle relative to the horizon of between 60 and 90 degrees, for example 80 degrees, reflects the sound upwards. This slant may additionally assist in guiding the wind towards the air filter element.

[0017] The sound barrier according to the present invention may advantageously comprise a plurality of wall elements, air filter elements and/or air guiding elements. That is, the sound barrier may be modular and the wall of the sound barrier may consist of a plurality of wall elements (modules), while the air filter may consist of a plurality of air filter elements (modules) and/or the air guide may consist of a plurality of air guide elements (modules). These constituent elements which together form the complete sound barrier allow a relatively simple construction of the sound barrier.

[0018] The present invention also provides a kit-of-parts for forming a sound barrier as defined above. Such a kit-of-parts may comprise at least one wall element, at least one air filter element and/or at least one air guiding element.

[0019] The present invention additionally provides a highway section provided with a sound barrier as defined above.

[0020] The present invention will further be explained below with reference to exemplary embodiments illustrated in the accompanying drawings, in which:

Fig. 1 schematically shows a preferred embodiment of a sound barrier according to the present invention in perspective.

Fig. 2 schematically shows the embodiment of Fig. 1 in a cross-sectional view.

[0021] The sound barrier 1 shown merely by way of non-limiting example in Fig. 1 comprises a wall element 10, an air filter element 11, an air guiding element 12, and base elements 19. As will be explained in more detail with reference to Fig. 2, the air guiding element 12 is spaced apart from the wall element 10 so as to leave a gap or opening (15 in Fig. 2) in which the filter element 11 is positioned.

[0022] The sound barrier 1 of Fig. 1 constitutes a section of a larger sound barrier comprising a plurality of wall elements 10, (air) filter elements 11 and air guiding elements 12. The modular structure of the sound barrier of the present invention makes it possible to provide a sound barrier of almost any desired length.

[0023] The sound barrier 1 of the present invention is shown in more detail in Fig. 2, where its base elements 19 rest on the ground 20 next to a road surface 21.

[0024] In Fig. 2, the opening 15 between the wall ele-

ment 10 and the air guiding element 12 is clearly visible. The air guiding element 12 is supported by a support element 13 which is mounted on the wall element 10. The support element 13, which may be constituted by a metal frame, determines the distance between the wall element 10 and the air guiding element 12, and hence the minimum width of the opening 15. The filter element 11 is mounted in the opening at or near its smallest width and is, in the embodiment shown, located within the frame of the support element 13.

[0025] As can be seen in Fig. 2, the width of the opening 15 decreases towards the filter element 11. This narrowing of the opening 15 is further enhanced by its curved shape (convex as seen from the wall element 10). This tapering opening assists in concentrating any wind near the filter element and forcing the wind through the filter element 11. If wind W blows in the direction indicated by the arrow (side wind), air is forced from the windward side A through the filter element 11 to the leeward side B of the sound barrier 1. As the air at the windward side may be polluted due to vehicles driving on the road surface 21, it will be filtered by the sound barrier and be cleaner (that is, less polluted) when it reaches the leeward side B.

[0026] Accordingly, at the leeward side B the sound produced by the road is reduced while the air pollution is reduced. It is noted that if the wind blows in the opposite direction, that is from the right to the left in Fig. 2, both the sound and the polluted air are carried away from side B by the wind. It is, of course, preferred that the sound barrier of the present invention is placed on both sides of a road such that the air guide elements face each other.

[0027] As can be seen in Fig. 2, the wall element 10 slants towards the leeward side B. This serves both to direct the sound from the road slightly upwards, and to assist in guiding the air through the opening 15 into the filter element 11. In this particular slanting embodiment strut element 18, which is part of wall element 10, provides structural support. In other slanting or non-slanting embodiments, the strut element 18 may be omitted.

[0028] As shown in the embodiment of Figs. 1 and 2, the air guiding element 12 should not protrude too far from the wall element 10 so as not to hinder the traffic on the road. A slanting embodiment, as shown, offers the additional advantage of reducing the effective extent to which the air guiding element protrudes.

[0029] The wall elements may be made of concrete, steel or wood, while the sound absorbing material 16 and 17 which may be applied on the wall elements and the board elements respectively may be constituted by glass wool or any other suitable damping material. The board elements may be made of concrete, metal, wood, glass or plastic, while the air guide elements are preferably made of plastic, although they may also be made of metal (e.g. aluminium, steel), wood or possibly concrete. The support elements are preferably made of metal, for example steel or aluminium. The base elements 19 are preferably made of concrete.

[0030] A kit-of-parts for producing a sound barrier 1 according to the present invention may comprise a wall element 10, a air filter element 11 and an air guiding element 12. Preferably, the kit-of-parts also comprises a support element 13, a board element 14 and/or base elements 19, and may further comprise damping material 16 and/or 17.

[0031] The present invention is based upon the insight that the wind may be used to feed polluted air through an air filter. The present invention is also based upon the insight that a tapered opening may be used to concentrate polluted air near the air filter, and to force the polluted air through this air filter. The present invention benefits from the further insight that an air filter may be mounted in a sound barrier to achieve air purification.

[0032] The sound barrier of the present invention may be used near roads, highways, runways and railroad tracks.

[0033] It is noted that any terms used in this document should not be construed so as to limit the scope of the present invention. In particular, the words "comprise(s)" and "comprising" are not meant to exclude any elements not specifically stated. Single elements may be substituted with multiple elements or with their equivalents.

[0034] It will be understood by those skilled in the art that the present invention is not limited to the embodiments illustrated above and that many modifications and additions may be made without departing from the scope of the invention as defined in the appending claims.

Claims

1. A sound barrier (1) comprising a wall element (10), an air filter element (11), and an air guiding element (12), **characterised in that** the air guiding element (12) is arranged to define, together with the wall element (10), an opening (15) which tapers towards the air filter element (11) so as to concentrate wind-propelled air at and force it through the air filter element.
2. The sound barrier according to claim 1, wherein the air guiding element (12) is curved.
3. The sound barrier according to any of the preceding claims, wherein the air filter element (11) extends substantially perpendicularly from both the wall element (10) and the air guiding element (12).
4. The sound barrier according to any of the preceding claims, further comprising a support element (13) for spacing the wall element (10) and the air guiding element (12) apart.
5. The sound barrier according to any of the preceding claims, wherein the air guiding element (12) extends above the wall element (10) so as to cause an air

pressure drop across the air filter element (11).

6. The sound barrier according to any of the preceding claims, wherein the wall element (10) has sound-absorbing properties.
7. The sound barrier according to any of the preceding claims, further comprising a board element (14) mounted on the wall element (10) and extending away from the air guiding element (12), the board element (14) preferably being mounted at the top of the wall element (10).
8. The sound barrier according to any of the preceding claims, wherein the board element (14) has sound-absorbing properties and preferably is provided with a dark upper surface (17).
9. The sound barrier (1) according to any of the preceding claims, wherein the wall element (10) is slanted, preferably away from the air guiding element (12).
10. The sound barrier according to any of the preceding claims, comprising a plurality of wall elements (10), air filter elements (11) and/or air guiding elements (12).
11. A kit-of-parts for producing a sound barrier (1) according to any of the preceding claims.
12. A highway section provided with a sound barrier (1) according to any of claims 1-10.

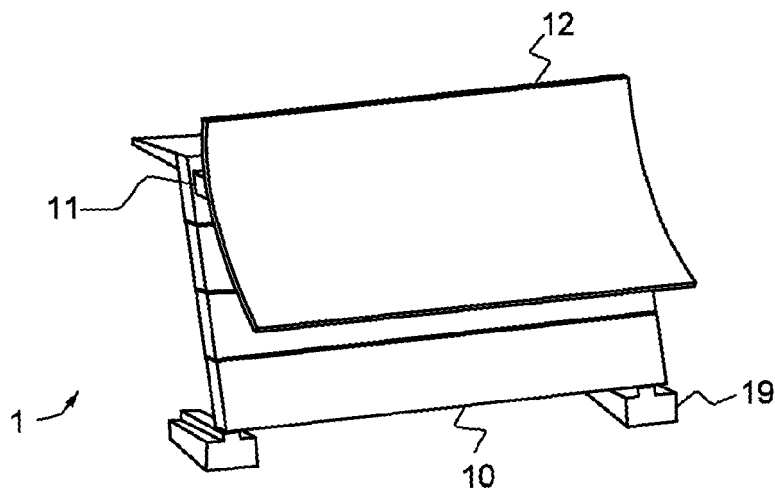


FIG. 1

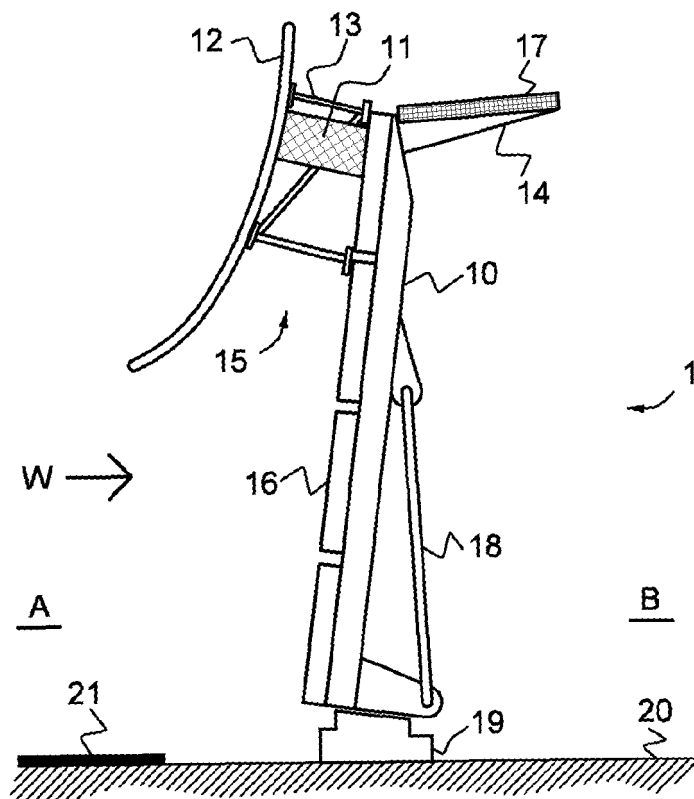


FIG. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 11 9652

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 February 2008	Examiner Tran, Kim-Lien
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 11 9652

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