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(54) A NOISE BARRIER FOR ACOUSTIC DAMPING

(57) A bag for acoustic damping, where shredded material, preferably shredded flakes, is packed into the bag. The bag has a surface wall enabling a mechanical constrainment of the shredded material. The density of the packed shredded material inside the bag is in the range of 200-600 kg/m3. The bag is intended for use in a noise barrier for acoustic damping. The noise barrier comprises a front support element, a rear support element and a number of bags. The front support element and the rear support element are arranged at a suitable distance from each other, and the bags are stacked in at least one row in the vertical direction between the front support element and the rear support element.

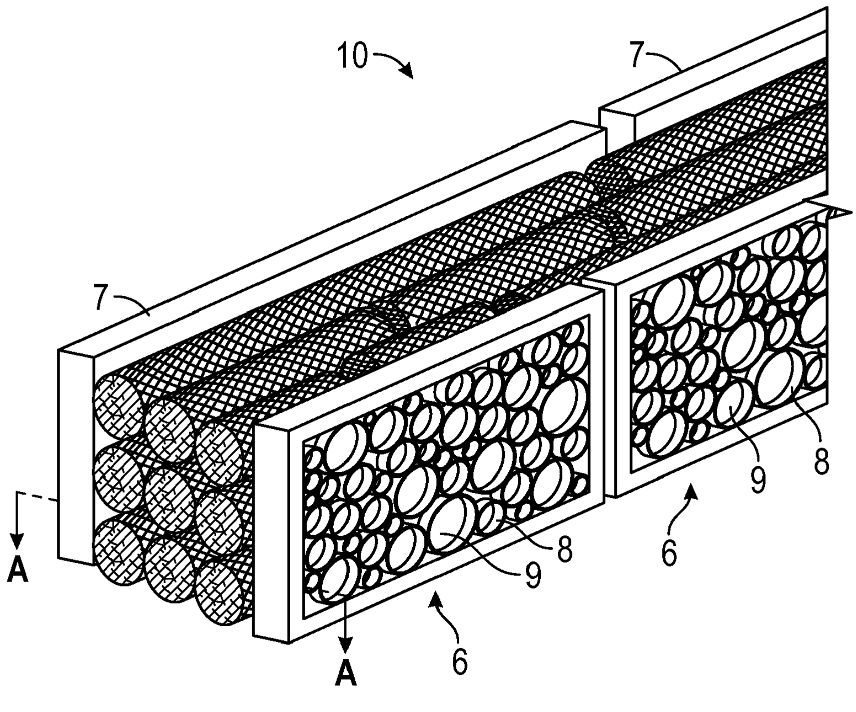

FIG. 4

EP 3 190 231 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to the use of shredded materials for acoustic damping, in particular for noise barrier walls, where materials are shredded into flakes/fibresand packed into damping elements.

BACKGROUND OF THE INVENTION

[0002] A noise barrier forms an obstruction in the landscape, where it causes the sound to follow three possible paths: diffracted over or around the barrier, transmitted through the barrier or reflected by the barrier. A noise barrier would either be an absorptive noise barrier, a reflective noise barrier or a combination hereof. An example of reflective noise barrier is concrete noise barrier walls. The present invention provides a noise barrier, which is a combination of the two types of noise barriers.

[0003] EP2782731 describes a method for using recycled glass fiber for thermal insulation and sound insulation. A method is described where glass fibers are shredded into recycled granulate and mixed with an adhesive to form a coherent element having a porous self-supporting structure.

[0004] The disadvantage of this method is that the shredded glass fiber needs to be mixed with a resin, so that it can be formed into an acoustic or thermal insulating coherent element. The use of a resin reduces the porosity of the damping element and thereby the ability to absorb the sound/noise.

[0005] The general object of the present invention is to provide a damping element formed as a bag for acoustic damping, which effectively absorbs the noise. Materials are shredded into flakes and the shredded materials are packed into damping elements formed as bags, where the bags filled with shredded materials can be stacked into the desired height for the noise barrier. The noise barrier should furthermore be weather resistant.

[0006] It is further an object of the present invention to provide damping elements capable of retaining the shredded material inside the structure in such a way, that the distribution of the shredded material is uniform. The damping elements are formed as bags, which are able to maintain its geometry during the full lifespan. The structure of the bags will also hinder that the shredded materials will be compacted inside the bags.

[0007] It is further an object of the present invention to provide a noise barrier having a front support element, a rear support element and a number of damping elements (bags), where the front support element and the rear support element are arranged at a suitable distance from each other, wherein bags are stacked in the vertical direction between the front support element and rear support element.

[0008] It is further an object of the present invention to provide a noise barrier, where shredded plastic material, preferably shredded wind turbine blades or nacelles, substantially constitutes the acoustic damping elements of the noise barrier.

[0009] In view of these objects, the bag has a surface wall enabling a mechanical constrainment of the shredded material, wherein the density of the packed shredded material inside the bag is in the range of 200-600 kg/m3.

[0010] The term "shredded material" or "waste material" covers many different mixtures of materials. Preferably, the shredded material is a plastic material, e.g. a fiber reinforced composite material made of a fiber embedded in or bonded to a polymer matrix material, also referred to as a fiber-reinforced polymer (FRP) or fiber reinforced epoxy (FRE). The fibers are usually glass, carbon, aramid or basalt. However, it is understood, that fibers like paper or wood or asbestos could also be used. The polymer is usually an epoxy, vinylester, polyurethan (PUR) or polyester thermosetting plastic.

[0011] The term "shredded" or "shredding" should in this context cover any suitable method able to divide the materials into smaller sized pieces or elements, e.g. by cutting, tearing, sawing, grinding and/or milling.

[0012] An example of waste materials, which could be shredded and used, is hawsers used in mooring or towing of ships. Hawsers could be made of polymer materials and/or steel cables are also used for fishing by trawlers. A further waste material, which could be shredded and used, is weather-resistant wood or polyurethan (PUR).

[0013] The materials are shredded into flakes/fibres having a length between 1-200 mm, preferably an average length of 5-50 mm. Tests have shown that the shredded materials have good acoustic damping properties. The shredded materials are transformed into a size, where they are easy to handle. This facilitates transporting the shredded material to the place, where it is intended to be used.

[0014] A shredding mill, flaking mill or portable shredder and/or granulator may be used, which may be transported to the place, whereby the shredding and/or granulation can be carried out at the place of disposal of said material and then transported in shredded and/or granulated form to its place of use or place of further processing.

[0015] By sieving the particles, whereby inevitable dust-particles and smaller debris, formed during the shredding, are removed, it is achieved that a more porous mat may be produced and with less adhesive than would otherwise have to be used, i.e. without sieving.

[0016] The term "front" support element is used to indicate, that the "front" support element is located closest to the noise source, whereas the term "rear" support element indicates that the element is arranged further away from the noise source. The front support element and the rear support element are used for mechanically supporting the damping elements (bags), when they are stacked into the desired height for the noise barrier. The front support element and rear support element can have an open mesh structure allowing sound to be transmitted through the front as well as the rear support element.

[0017] The term "bag" is used to indicate that the "bag" has a flexible outer wall surface. The bag can be made from a continue flexible sheet or flexible tube member, which can be cut into any desired dimension dependent on the intended size of the bag. In one embodiment, the bag is made from a flexible polymer member having a netting structure with one opening, which can be closed off after the shredded materials have be packed into the bag. In another embodiment, a flexible sheet is formed into an elongated element with open ends, Hereafter the shredded material can be packed into the bag and the open ends are closed off. In another embodiment, a flexible tube element is packed with shredded material. Hereafter it is closed off at both ends. The bag is closed off by means like e.g. clip (plastic or metal), by folding, by glueing, etc.

[0018] In one embodiment, the damping element can be formed as individual bags for acoustic damping of highway traffic. The shredded material, preferably shredded plastic material, can be packed into each bag.

[0019] The bag has a surface wall enabling a mechanical constrainment of the shredded material, wherein the density of the packed shredded material is in the range of 200-600 kg/m3. A faster and cheaper manufacturing process is achieved, by the packing of the shredded material in the bag compared to mixing the material with adhesive to form a coherent element.

[0020] In this way, the bag provides a noise damping solution, where the shredded material is constrained inside the bag. By using shredded material packed into the bag, the packed shredded material exhibit cavities, channels or interstices, which enable sound waves to enter through them. The use of a porous shredded material inside the bag is favorable in relation to noise damping, as air molecules at the surface of the shredded material and within the pores of the shredded material are forced to vibrate, thereby losing their initial energy. The energy of the air molecules is converted into heat due to thermal and viscous losses. The use of loose fibrous materials densely packed and randomly arranged is advantageous, as sound waves are forced to follow a longer path, whereby energy is lost by the forcing of a directional change of the sound waves.

[0021] In an embodiment, the shredded material contains between 50-90 weight percent of recycled plastic material. Hereby the recycled material consist of a combination of recycled plastic material and another recycled material, e.g. hawsers.

[0022] In an embodiment, the bag has a flexible and porous structure enabling ambient air to penetrate into the bag; the bag has a netting structure of a material selected from the group belonging to thermoplastic or thermosetting plastic materials. Thereby, the bag features a design with a surface wall, which further facilitates mechanical constrainment of the shredded material inside the bag. Through the use of a bag with a netting structure, the fibers of the shredded material would inevitably partially extend out of the bag, whereby the wall structure of the bag would facilitate the shredded material not to be compacted at the end of the bag.

[0023] The shredded material, especially plastic material, has a characteristic ability for self-packing, which is advantageous as the shredded material will not subside, when it is stored in the bag. The shredded material has a lot of fiber ends, which would interlock themselves within the netting structure of the bag. The shredded material would therefore be hindered in repositioning inside the bag.

[0024] In one embodiment, the average length of the shredded material is between 1-200 mm, and in another embodiment the average length is between 5-50 mm. Through the shredding and/or granulating of the shredded material into the specified average length, a size of the shredded material is achieved, which can be packed into the bag and which according to tests have shown promising acoustic and thermal insulating properties. The bag can be closed off at the ends by the use of different closing means like e.g. a clip (plastic or metal), by folding, by glueing etc.

[0025] The shredded materials are compressed by a machine suitable for the purpose. The shredded material is hereafter packed into the bag. The machine is able to compress the shredded material to a specified density. Hereafter the compressed shredded material is guided into the bag.

[0026] The density of the packed shredded material can be specifically composed for maximizing the absorption and damping of the frequency spectrum. The density of the shredded material is depending upon the frequency spectrum of the sound/noise, as the sound transmission through the noise barrier, and thereby the acoustic energy transmitted through the barrier, is depending upon the barrier material value used, e.g. air tightness, mass, density, surface smoothness, fiber orientation, stiffness, angle of attack of the sound and frequency spectrum of the sound.

[0027] Each bag is packed with a specific density of the shredded material to optimize the acoustic performance to the specific frequency spectrum of noise to which the noise barrier is exposed. The acoustic performance can be optimized by adjusting the density in the individual bag or by a combination of bags packed with different density of the shredded material. The density of the shredded material inside the bag would be within the range of 200-600 kg/m3. The shredded material can consist of two different densities e.g. ranging 200 kg/m3 to 400 kg/m3 and 450 kg/m3 to 600 kg/m3.

[0028] The present invention provides a simpler construction of a damping element, where no adhesive bonding material is used. After the shredding and packing of the recycled material, no further manufacturing process in necessary. The shredded material is therefore unlikely to delaminate or disintegrate due to a physical impact as no additional adhesive bonding material is required.

[0029] The recycled material would not necessary consist of just one type of recycled material. Depending on the material available, the plastic material could be mixed with a weather-resistant wood.

[0030] In one embodiment, the bag can have different geometrical shapes, e.g. tubular, rectangular or triangular made from UV resistant material. Alternatively, the shape of the bag may be slightly modified after filling with shredded material without changing the volume of the bag and hence the density of the filling. The bag may be exposed to sunlight, when it is installed. Therefore, the bag could be made of polymer, which is not sensitive to UV degradation (photo-oxidation). Sensitive polymers include some thermoplastic material like aramids. Through the use of a UV absorber, either added into the material or as a coating, the absorbed UV light, and hereby the polymer degradation, can be limited.

[0031] In an embodiment, the bag is made of an non-elastic woven material or knitted material and said bag is made of a polymer material selected from the group: polyester, polyethylene, polypropylene, nylon etc. Crop cover cloth has a porous structure and it is just one example of a fiber cloth made from polyethylene. Through the use of non-elastic materials, the bag contracts in the radial direction, if the bag is exposed to tension force in the axial direction. An elastic material having a woven structure could also be used; hereby the material would have an incorporated elasticity. In another embodiment, the bag is made of a non-elastic material. Hereby it is required that the amount of shredded materials matches the internal volume of the bag, so that when the shredded materials are packed into the bag, the desired density of the bag is achieved. The bag could also be made of a non-elastic material, which is braided into an open netting structure. A bag with a braided wall structure would contract in the radial direction if the bag is exposed to tension force in the axial direction bag, whereby the contraction would be determining for the density of the shredded materials inside the bag. The material selected for the bag is able to maintain its elasticity during the whole life span, meaning that the elastic creep deformation is neglectable.

[0032] A method for preparing a noise barrier for acoustic damping, which comprises the following steps:

a) erecting the front support element in situ,
b) erecting a rear support element in situ,
c) gathering and sorting the shredded material,
d) filling the shredded waste material into the damping means, e.g. bags,
e) transporting the damping means filled with the shredded waste material to the installation site, and
f) arranging the damping means between the front support element and the rear support element.

[0033] The method described in the above can alternatively be used for the manufacture and assembly of noise barrier elements in a production facility prior to installation of the elements in situ.

[0034] When a noise barrier is designed, several design criteria have to be considered. Diffraction is the most important path when a noise barrier is designed, as it defines the sound, which reaches the receiver located on the other side of the noise barrier. Diffraction is the sound, that bends over the top of the noise barrier and into the noise barrier's shadow, and the frequency content of this noise is important as there is a direct relationship between the wave length and the frequency of the sound, where a lower frequency has a longer wave length and a higher frequency has a shorter wave length, and therefore as a result defraction is not uniform over all frequencies. A longer wave length that approaches the noise barrier top easily bends over the top of the noise barrier and down to the receiver, whereas a shorter wave length just slightly reaches over the top of the barrier and does not reach the recipients on the other side.

[0035] The amount of sound reduction can be referred to as transmission loss, and the transmission loss is influenced by the material used. The sound transmission loss through a noise barrier made of concrete elements is in the range of 20-30 db. The acoustic energy transmitted through the barrier would generally be negligible when it is compared to the diffracted sound over or around the barrier. As a general rule the transmitted sound must be at least 10 db lower than the diffracted sound in order for it to be ignored.

[0036] The present invention is primarily directed towards noise barriers used for damping highway traffic. The noise is generated by the interaction between the vehicle tyres and tarmac, by the engine and by the exhaust system of trucks. Beside for the use in highway traffic, the invention is also suitable for damping noise in playgrounds. Still within the scope of the present invention, one could also use the bags for thermal insulation purposes, as the entrapped air pocket in the bags filled with shredded material will be well suited to limit the heat transfer. Shredded plastic material like glass fibers or mineral fibers have excellent flame-retardant abilities.

DETAILED DESCRIPTION

[0037] The invention will now be explained in more detail by means of examples of embodiment with reference to the schematic drawing.

Figure 1 shows three different geometrical shapes of a bag for acoustic damping.

Figure 2 shows a noise barrier for acoustic damping with two bags stacked on top of one another.

Figure 3 shows a noise barrier for acoustic damping according to a second embodiment.

Figure 4 shows a noise barrier for acoustic damping according to a third embodiment.

Figure 5 shows a perspective view of the noise barrier for acoustic damping in figure 4.

Figure 6 depicts the sound absorption for a recycled glass fiber granulate mixed with an adhesive and recycled glass fiber granulate without an adhesive.

[0038] In figure 1, different embodiments of the damping elements are depicted. The damping elements used for acoustic damping are formed as bags (1, 1’, 1"). The bags (1, 1’, 1") provide a solution, where the shredded material, e.g. recycled plastic materials, is constrained inside the bags due to the wall structure of the bags.

[0039] As indicated in figure 1 the bags (1, 1’, 1") have a flexible and porous structure enabling ambient air to penetrate into the bags and the bags (1, 1’, 1") have a netting structure of a material selected from the group belonging to thermoplastic or thermosetting plastic materials. Only one closing mean is depicted for the bag (1’, 1"). This is done to indicate the cross section of the bag (1’, 1"). A loop is used to show the sealing means for closing of the bag at it ends.

[0040] In figure 1 different geometrically shapes, e.g. tubular, rectangular or triangular, are depicted. Through the use of different shapes, it is possible to avoid incorporating cavities into a noise barrier comprising several bags stacked into the desired height.

[0041] The shredded material is compressed and guided into the bags (1, 1’, 1"). The bags (1, 1’, 1") packed with shredded material are to some extent able to change geometry without changing the density of the bag. When placing the bags (1, 1’, 1") parallel to one another horizontally or vertically, the bags (1, 1’, 1") can by applying a slight pressure be shaped to form relatively large contact surfaces between each other Even though the geometrical shape of the bags is changed, the density of the shredded material inside the bag is maintained.

[0042] Each bag (1, 1’, 1") is designed in such way, that the filled volume and the geometry are maintained over time. The bag (1, 1’, 1") can contract in the radial direction, if the bag is exposed to tension force in the axial direction.

[0043] As shown in figure 1, all bags (1, 1’, 1") have a flexible and porous structure enabling ambient air to penetrate. The bag (1, 1’, 1") has a netting structure (2) made of a thermoplastic material or a thermosetting plastic material. The bag (1, 1’, 1") can be made of elastic or nonelastic material formed into an open netting structure. The bag could also be made from a polymer non-woven, woven or knitted material.

[0044] Figure 2 shows a noise barrier (10) for acoustic damping, comprising two bags (1, 1’, 1") stacked on top of one another. The bags (1, 1’, 1") are retained in their position by the use of retaining means (3) like metal, polymer or wood post. In figure 2, the two bags (1, 1’, 1") are retained by four retaining means (3). Depending on the length of each bag (1, 1’, 1") the number of retaining means (3) can be adjusted. One or more partition elements can be positioned in between the bags. In one embodiment, the noise barrier has three partition elements (11), where the partition elements are positioned at the top, bottom and near the midsection of the noise barrier instead of having several retaining means (3) positioned in front of and behind the bags. In a further embodiment (not depicted) rods are speared through the bags. Figure 2 depicts that the bags (1, 1’, 1") can have different lengths and diameters. The left side of the bags shows the cross section thereof.

[0045] Figure 3 shows a noise barrier (10) for acoustic damping according to a second embodiment. The noise barrier (10) for acoustic damping comprises a number of damping elements (1, 1’, 1") and the damping elements are formed as bags (1, 1’, 1") packed with shredded material, preferably recycled plastic granulate.

[0046] In figure 3, only two bags (1, 1’, 1") are depicted for the sake of simplicity. It is self-evident, that the number of bags stacked is depending on the desired height for the noise barrier and the diameter of the individual bags. It should be noted, that for the sake for simplicity only two bags of the type shown in figure 1 are depicted. The two bags in figure 3 are depicted with round cross sections. The noise barrier comprises several bags stacked into the desired height for the noise barrier.

In one preferred embodiment, the bags (1, 1’, 1") have a tubular shape, but as mentioned above other shapes are also applicable.

[0047] As depicted in figure 3, the bags (1, 1’, 1") are arranged between a front support element (5) and a rear support element (6), which elements are supporting the bags in their stacked position. The front support element (5) has an open structure, e.g. made of an acoustic absorptive material. The rear support element (6) can also be acoustic absorptive, however an acoustic reflective material can also be used, whereby the sound waves reenter the bag (damping element) again.

[0048] In figure 4 and 5, the noise barrier for acoustic damping is shown according to a third embodiment. The noise barrier (10) for acoustic damping comprises a number of damping elements in the shape of bags (1, 1’, 1"), which are arranged between a front support element (6) and a rear support element (7) for supporting the bags (1, 1’, 1") in their stacked position.

[0049] The front support element (6) comprises a number of guidance elements (8) for guiding the sound/noise into the bags (1, 1’, 1"). The guidance elements (8) would constitute a structure made of a plastic waste materials. The plastic waste materials could be used PVC pipes, where the used rigid pipes are cut into the desired length. The guidance elements (8) can be formed as a honeycomb structure or a pattern structure made from waste materials, where the structure consists of a number of interconnected circular pipe sections with varying diameter and/or length. A backing element (9) can be used for supporting the guidance element (8), constituting the pattern structure.

[0050] It is preferred that the front support element (6) has an open structure, e.g. made from an acoustic absorptive material. The rear support has an open structure or would be made of an acoustic reflective material.

[0051] Through the use of damping elements formed as bags (1, 1', 1") made from an elastic material, the size, geometry and number can be varied. The shredded material is mechanically constrained by the elastic netting structure of the bag (1, 1', 1").

[0052] The density of the shredded material inside the bags can also be varied. Instead of just one row of bags, as depicted in figure 2-3, the bags can be arranged in rows beside each other in the horizontal plan, as depicted in figures 4-5.

[0053] Through the arrangement of the bags in this way, the shredded material inside the bags near the front support element (6) gets a relative low density compared to the density of the shredded material inside the bags near the rear support element. Another option can be to vary the density inside the bags, so that the bag at the bottom of the noise barrier has a lower density than the bag at the top, whereby the density is varying in the vertical direction for the noise barrier. As depicted in figures 4 and 5 the number of bags varying in both the horizontal direction and vertical direction.

[0054] In figures 2-5, the damping elements (bags) are stacked in a vertical position on top of one another. In one embodiment, which is not shown, the damping elements (bags) are positioned horizontally beside one another.

[0055] Sound absorption coefficient, also referred to as noise reduction coefficient (NRC), is used to describe the noise barrier ability to absorb sound. A value of zero indicates that the noise barrier is totally reflective and a value of one indicates that the material used for the noise barrier is totally absorptive. Most barriers are ranging from 0,6-0,9, corresponding to 60% - 90%.

[0056] It is not uncommon that residents on the opposite site of the noise barrier walls can experience an increase in sound level by 1-3 db due to the reflective sound and change in frequency content. Parallel barrier degradation occurs when sound is reflected between two reflective barriers and can cause a further increase in the noise level. One solution is simply to tilt the noise barrier.

[0057] In figure 6, the sound absorption for a shredded material is depicted. The recycled glass fiber granulate mixed with an adhesive is depicted by graph (1AB) and the recycled glass fiber granulate without an adhesive is depicted by graph (3 AB). It should be noted that the graph (mineral wool) is used as a reference, when the different measurements are compared. Further tests have shown that the absorption tube measurements correspond closely to full scale diffuse-field absorption measurements.

[0058] Tests have shown that particularly good sound absorption is achieved if shredded material has a density in the range between 200-600 kg/m3.

The sound damping properties of the material have been tested in a so called absorption tube with perpendicular sound incidence. The measurements were conducted in accordance with the standard DS/EN ISO 10534-2. The dimensions of the tube have the effect that only the frequency region between 50 Hz and 2000 Hz can be tested. Traffic noise primarily has frequency components in the region between 500 Hz and 2000 Hz, the measurements would give a fairly good indication of how good traffic noise is dampened.

[0059] The measurements were conducted with a frequency resolution of 2 Hz in the frequency region 50 Hz - 2000 Hz, and the absorption coefficient determined was recalculated into 1/3 octave levels. The test samples were divided into 4 categories:

1 AB denotes samples made from a coherent mat (bonded recycled granulate), where shredded material is mixed with an adhesive, said samples having a diameter of 90 mm and a thickness of 100 mm and a density of 0.29 g per cubic cm.

3 AB denotes samples made from shredded material (none-bonded), said samples having a diameter of 90 mm and a thickness of 100 mm and a density of 0.29 g per cubic cm.

[0060] These graphs can be compared to measurements made on mineral wool (MU) samples having a diameter of 90 mm and a thickness of 100 mm and a density of 0.10 g per cubic cm.

REFERENCE NUMBERS

[0061]

Bag (1, 1', 1")
Netting structure (2)
Retaining means (3)
Rear support element (4)
Front support element (5)
Front support element (6)
Rear support element (7)
Guidance elements (8)
Backing element (9)
Noise barrier (10)
Partition element (11)

Claims

1. A bag for acoustic damping, where shredded material, preferably shredded flakes, can be packed into the bag, wherein said bag has a surface wall enabling a mechanical constrainment of the shredded material, wherein the density of the packed shredded material inside the bag is in the range of 200-600 kg/m3.

2. A bag according to claim 1, wherein said bag has a flexible and porous structure enabling ambient air to

penetrate into the bag, wherein said bag has a netting structure of a material selected from the group belonging to thermoplastic or thermosetting plastic materials.

3. A bag according to claims 1 or 2, wherein the average length of the shredded material is between 1-200 mm.

4. A bag according to claims 1 or 2, wherein the average length of the shredded material is between 5-50 mm.

5. A bag according to any of the preceding claims, wherein said bag can have different geometrical shapes, e.g. tubular, rectangular or triangular shapes, and be made of UV and weather resistant material.

6. A bag according to any of the preceding claims , wherein said bag is made of an non-elastic woven or knitted polymer material selected from the group, polyester, polyethylene, polypropylene, nylon etc.

7. A noise barrier for acoustic damping comprising a front support element, a rear support element and a number of bags formed according to any of the claims 1-6, where the front support element and the rear support element are arranged at a suitable distance from each other, wherein bags are stacked in at least one row in the vertical direction between the front support element and the rear support element.

8. A noise barrier for acoustic damping according to claim 7, wherein the bags are stacked in one row in the vertical direction of the noise barrier,

9. A noise barrier for acoustic damping according to claim 7, wherein the bags are arranged in rows beside each other in the horizontal plan between the front support element and rear support element.

10. A noise barrier for acoustic damping according to any of the preceding claims, wherein the acoustic damping can be changed by the use of at least one bag having a density deviating from the density of the other bags.

11. A noise barrier for acoustic damping according to any of the preceding claims, wherein the shredded material inside the bags near the front support element has a relatively low density compared to the density of the shredded material inside the bags near the rear support element.

12. A noise barrier for acoustic damping according to any of the preceding claims wherein the density of the packed recycled waste material is in the range of 200-600 kg/m3 and/or wherein the average length of the recycled waste material is between 5-50 mm.

13. A noise barrier for acoustic damping according to any of the preceding claims, wherein the front support element has an open mesh structure.

14. A noise barrier for acoustic damping according to any of the preceding claims, wherein the front support element comprises a number of guidance elements for guiding the sound/noise into the bags, wherein the guidance elements would constitute a honeycomb structure of open pipe ends.

15. A noise barrier for acoustic damping according to any of the preceding claims wherein the shredded material comprises a mixture of two composite elements selected from a group covering concrete noise barriers, wind turbines, wind turbine nacelles or hawsers.

16. A noise barrier for acoustic damping according to any of the preceding claims, wherein the bags are arranged in rows beside each other in the horizontal plan.

17. A noise barrier for acoustic damping according to any of the preceding claims, wherein the rear support element is made of a reflective material.

18. A noise barrier for acoustic damping according to any of claims 7-17, wherein the rear support element is made of an acoustic absorptive material.

19. A noise barrier for acoustic damping according to any of claims 7-16, wherein the front support element has an open structure.

20. A noise barrier for acoustic damping according to claims 13-19, wherein the guidance elements would constitute a honeycomb structure of open pipe ends.

21. A method for preparing a noise barrier for acoustic damping, which comprises the following steps:

a) erecting the front support element in situ,
b) erecting a rear support element in situ,
c) gathering and sorting the shredded material,
d) filling the shredded waste material into the damping means, e.g. bags,
e) transporting the damping means filled with the shredded waste material to the installation site, and
f) arranging the damping means between the front support element and the rear support element.

22. A method for preparing a noise barrier for acoustic damping according to claim 21, wherein the shredded material can be filled in between the postals used for supporting the front support element and the rear support element

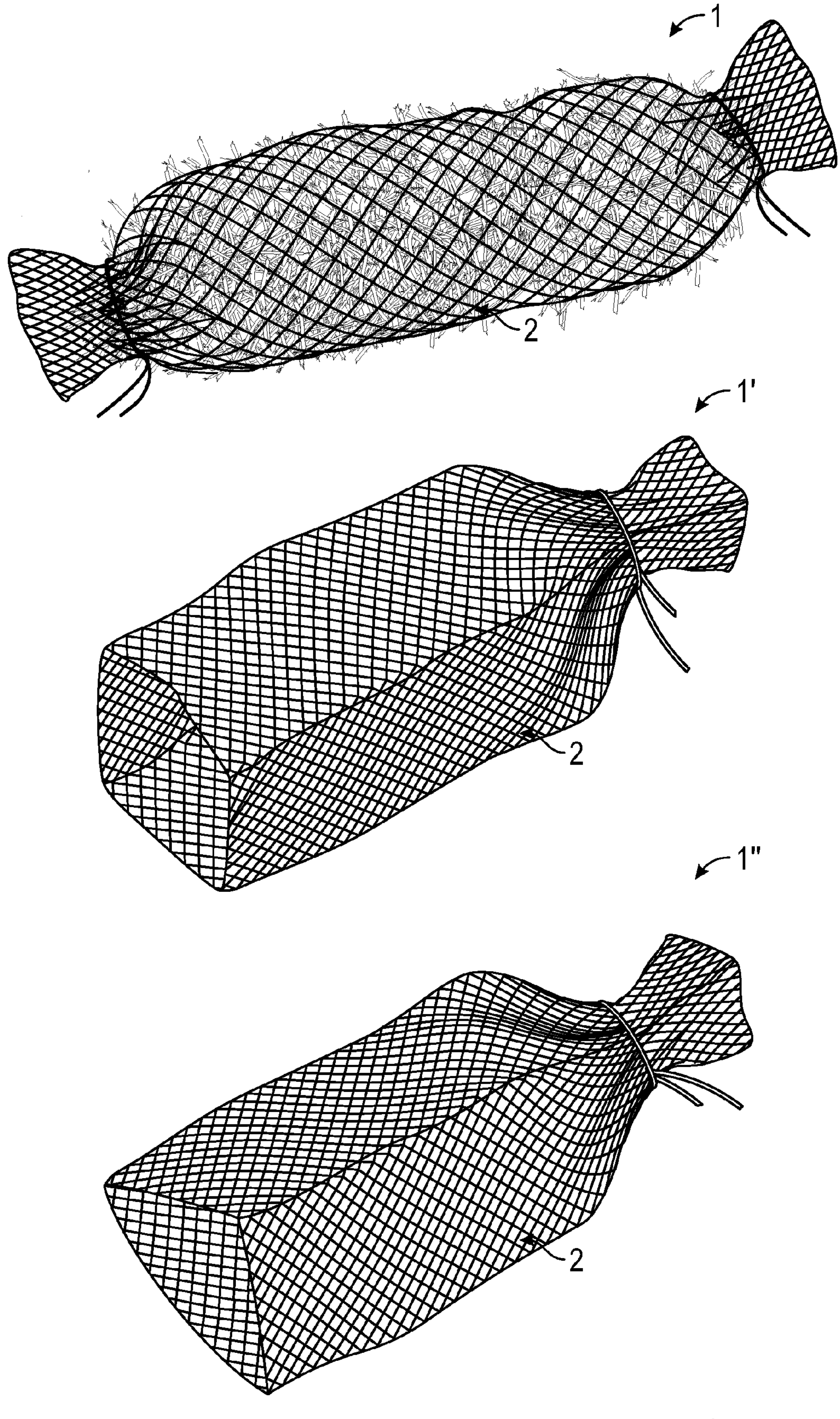

FIG. 1

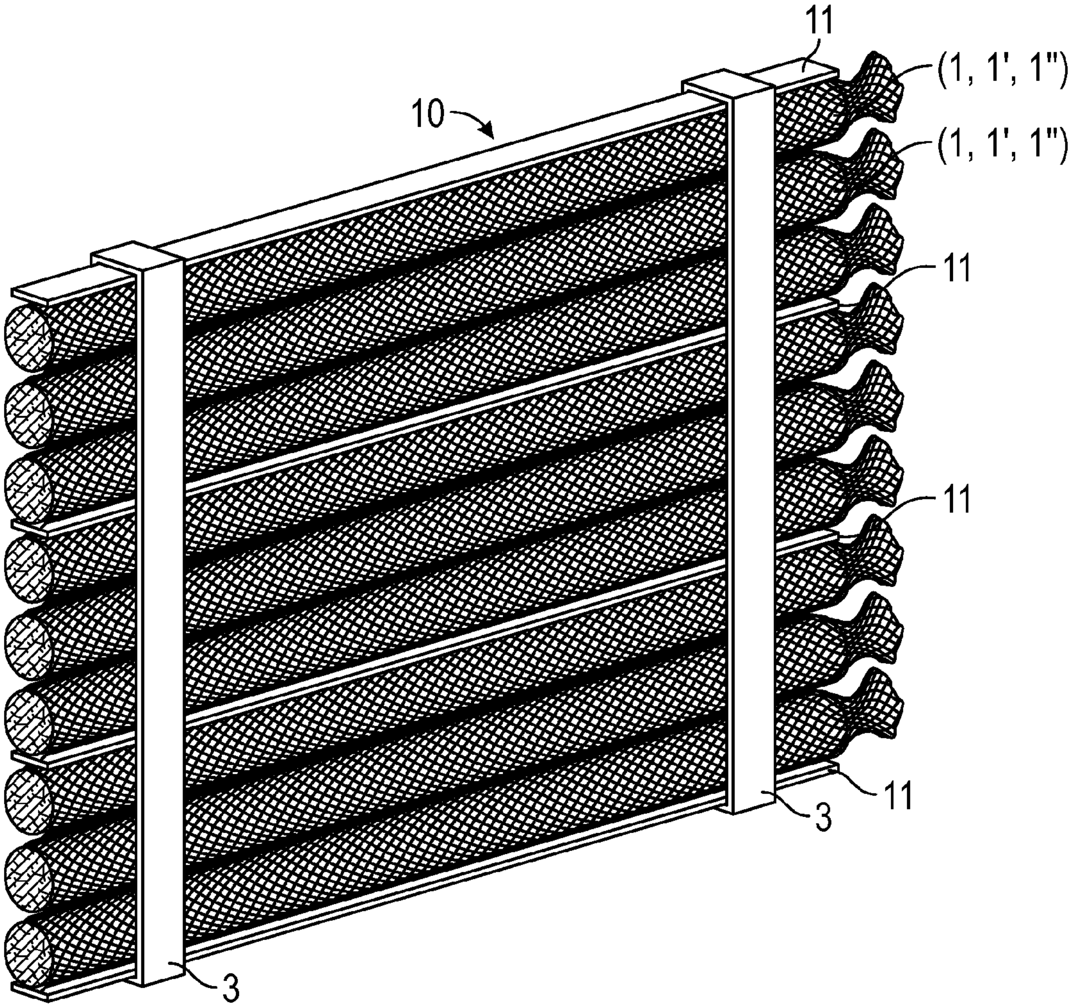

FIG. 2

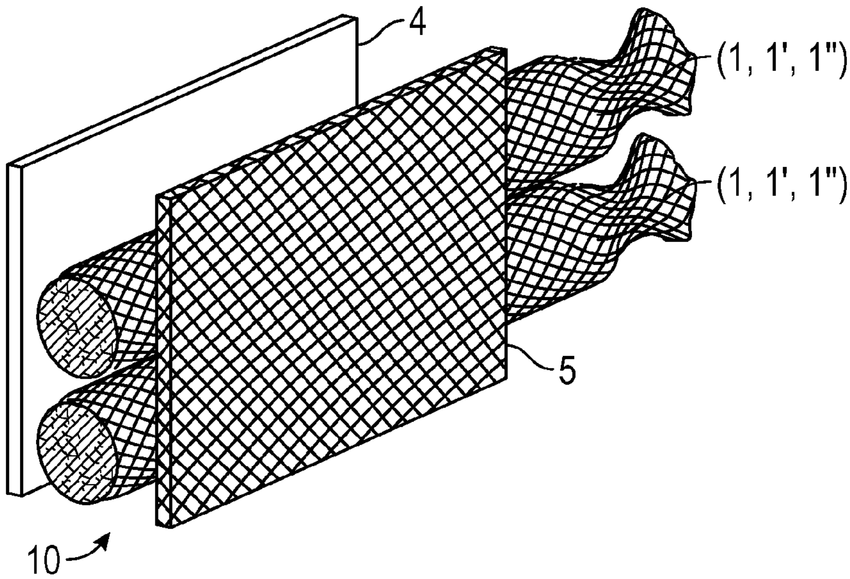

FIG. 3

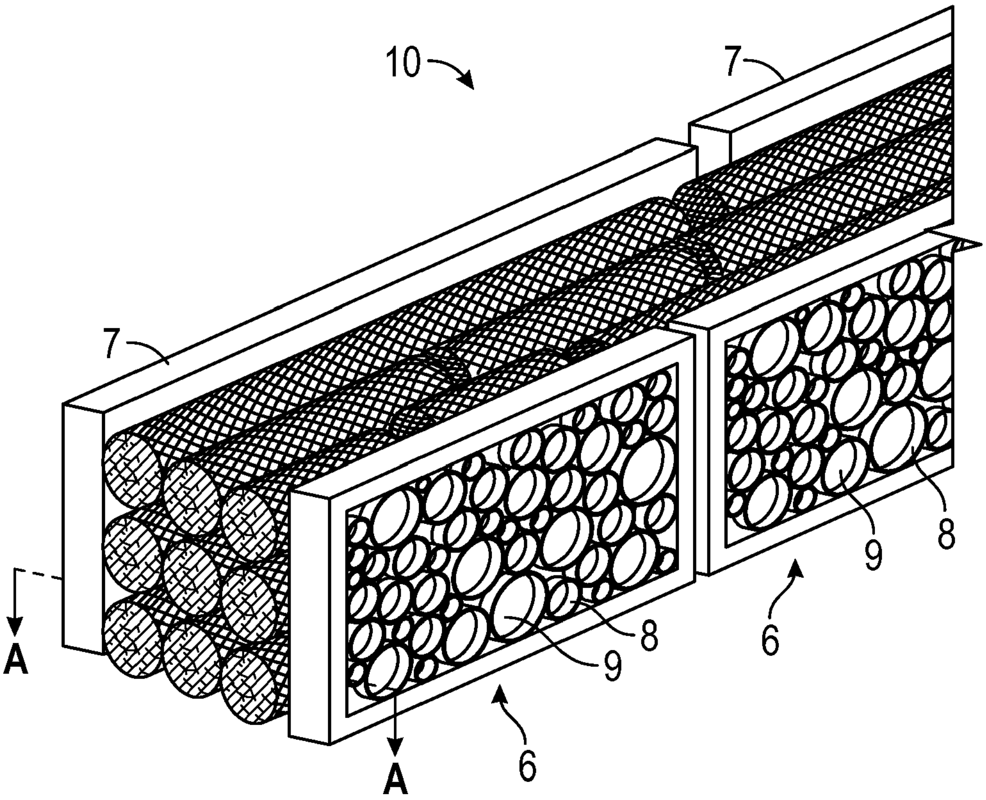

FIG. 4

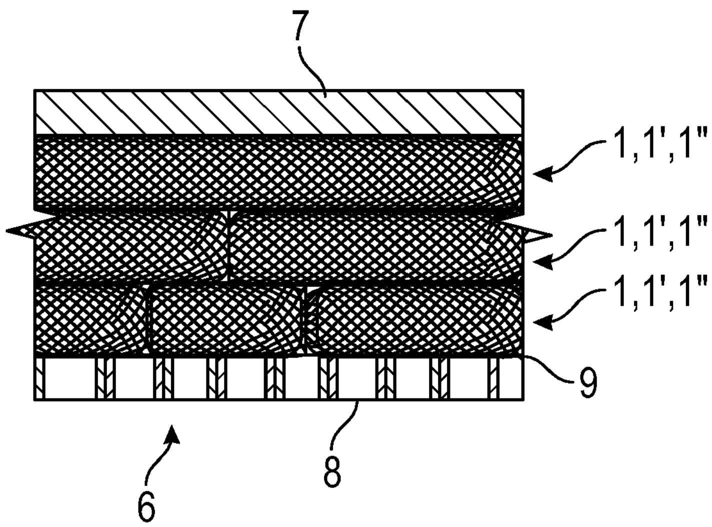

FIG. 5

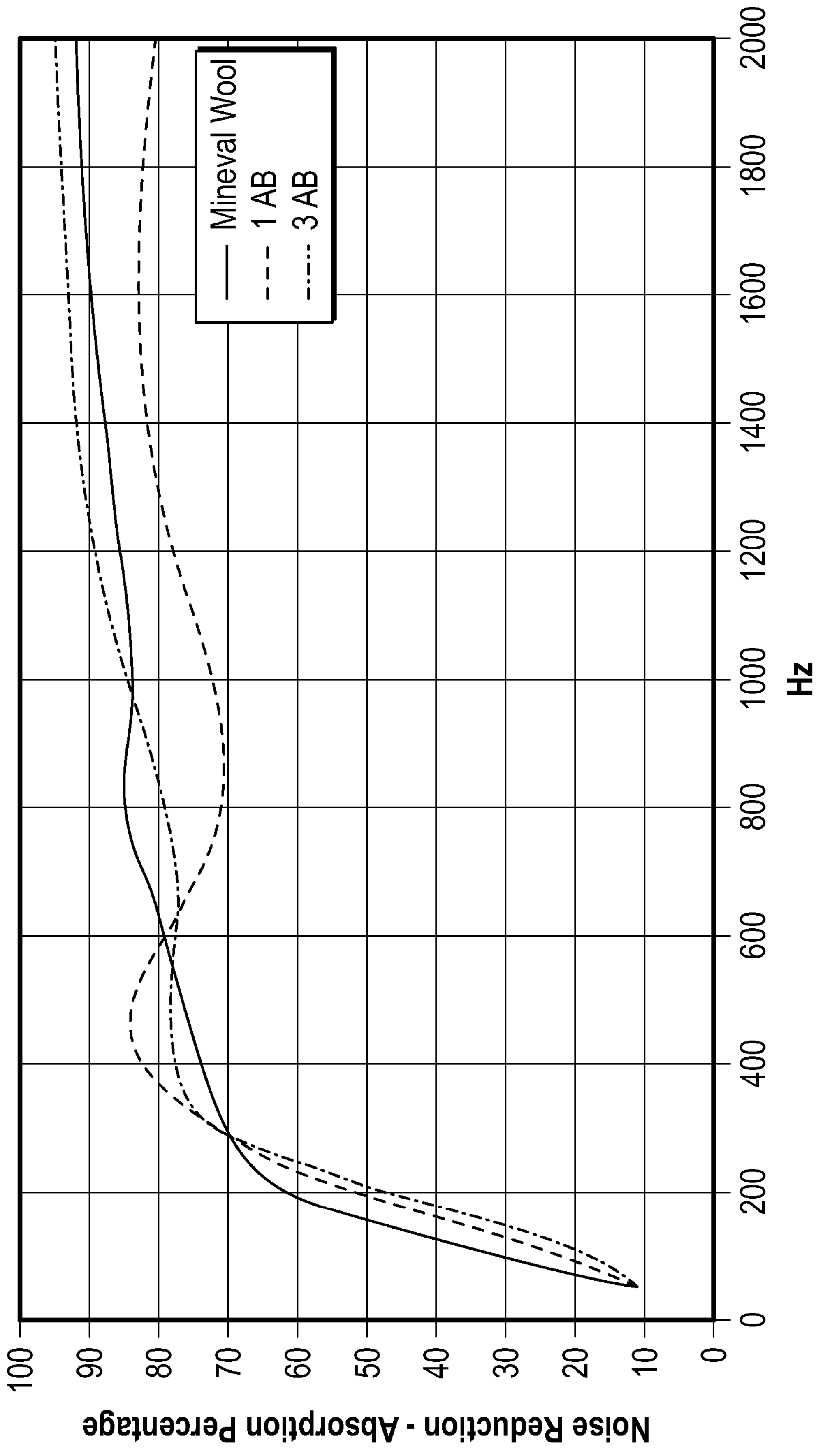
Noise Reduction - Absorption Percentage
0
10
20
30
40
50
60
70
80
90
100
Hz
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Mineval Wool
1 AB
3 AB

FIG. 6

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EUROPEAN SEARCH REPORT

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Place of search	Date of completion of the search	Examiner
Munich	12 May 2017	Kremsler, Stefan

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 May 2017	Kremsler, Stefan

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