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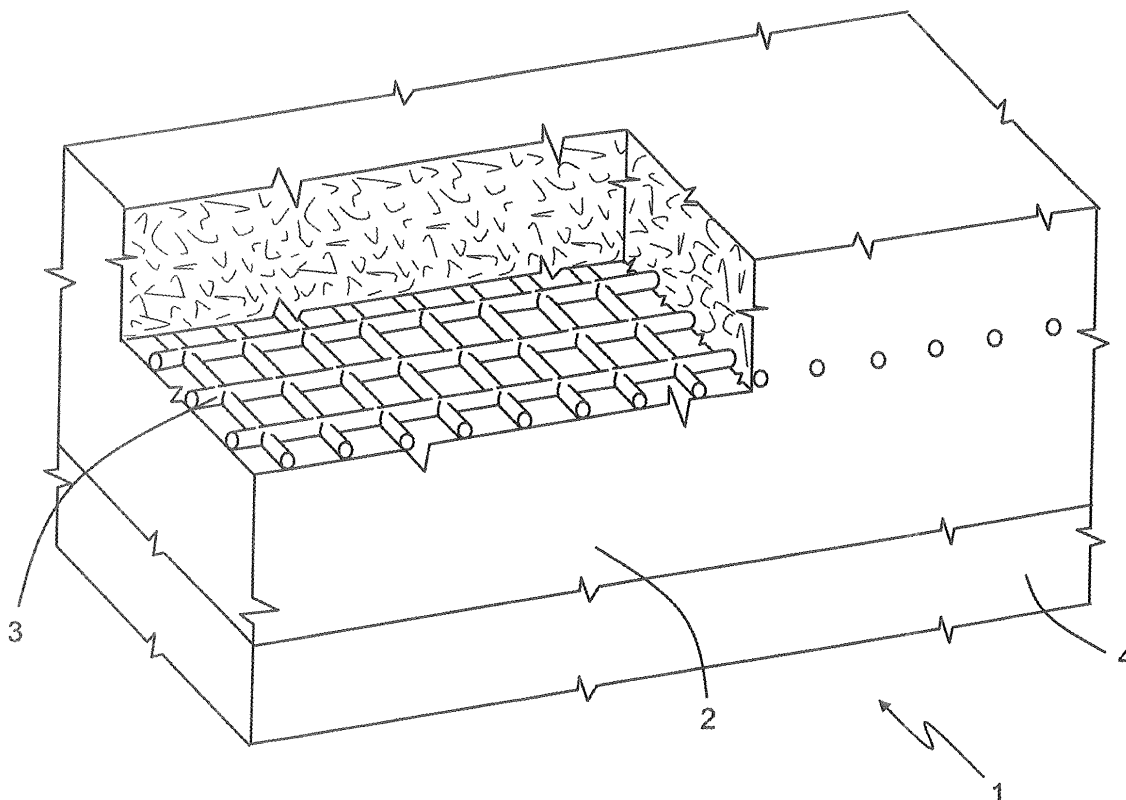
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(54) **Acoustically insulating material, acoustically absorbing material, acoustically damping material**

(57) A material (1) comprising at least a first polymer-ic sound insulating, sound proofing or sound damping

element (2) and at least one second metallic reticulated element (3) characterised in that said first element (2) has a density higher than 1.3.



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Description

[0001] The present invention relates to a sound insulating, sound proofing or sound damping material.

[0002] Hereinafter, the word "sound" or alternatively "sound wave" will mean a perturbation of oscillatory nature produced by a sound source which, by propagating in elastic means, causes a variation of pressure such to be perceived by the human ear.

[0003] Hereinafter, the word "vibration" will mean an oscillatory movement of minor amplitude which can generate in a body on which a sound wave strikes.

[0004] A sound may be transmitted in the environment through the air, for example the traffic noise or the sound of a radio, or through structures, such as for example the noise of steps or objects falling on the floor.

[0005] It is known that the exposure to sounds of high intensity may be harmful for an individual's health. Furthermore, it may be dangerous in situations in which attention must be devoted to potential dangers, such as for example in industrial environments, where the noise generated by machinery makes it difficult to hear the acoustic alarm signals emitted by the machinery itself. The prolonged exposure to high intensity sounds may also cause the total or partial loss of auditory capacity.

[0006] Also in homes or offices, the presence of sounds from the outside may be cause of high discomfort and induce stress in the people who live or work there.

[0007] It has indeed been demonstrated that sound, may cause inefficiencies at work and decrease productivity, even when its intensity is not particularly high.

[0008] In particular, intermittent or low frequency sounds, such as for example the noise of office apparatuses, traffic and maintenance works, are capable of altering the concentration capacity of individuals.

[0009] Similarly, prolonged and high frequency sounds, such as for example those generated by air conditioning systems or fans, may cause physical fatigue and reduce personal performance.

[0010] Very annoying may be, for example, the transmission of sound along tubes and pipes, for example water drain pipes, or through all the elements which, inserted inside a wall, may modify its sound insulating, sound proofing and sound damping properties, such as for example electrical junction boxes and switches.

[0011] Hereinafter, the word "sound insulating property" will mean the capacity of material to reflect a sound wave; a material provided with such property will be called in turn "sound insulating".

[0012] Hereinafter, the word "sound proofing property" will mean the capacity of material to dissipate a sound wave; a material provided with such property will be called in turn "sound proofing".

[0013] Hereinafter, the words "sound damping property", "damping" or "antinoise" will mean the capacity of a material to reduce the amplitude of a sound wave or to reduce the amplitude of a vibration; a material provided with such property will be in turn called "sound damping".

[0014] It is known the reduction of noise transmitted through air or water tubes and pipes with an appropriate insulation of the same using sleeves made of multilayer sound insulating materials which, in addition to ensuring thermal insulation, also reduce the sound caused by the forced passage of air or liquids.

[0015] A type of multilayer material widely used heretofore for this purpose consists of an insulating material structure containing inside a lead plate or a bituminous septum layer. Since lead is a malleable metal and therefore provided with a plastic behaviour, the material may be modelled around a structure to be insulated thus maintaining the assumed shaped unchanged in time. For example, the material may be wrapped around a tube and therefore keep the shape of the tube contour itself.

[0016] However, as it is well known, lead is a very polluting material and is highly toxic for the people responsible for working it and those who live in environments where the lead levels are high.

[0017] It is therefore the object of the present invention to find a material for insulating, proofing or damping sound and vibrations which solves the problems described above.

[0018] In particular, it would be desirable to find a material which, though being mouldable around the structure to be covered and therefore being plastically deformable, does not present the toxicity of lead.

[0019] According to the present invention, such object is achieved by a material comprising at least one first polymeric sound insulating, sound proofing or sound damping element and at least one second metallic reticulated element characterised in that said first polymeric element has a density higher than 1.3.

[0020] The material will now be described with reference also to the accompanying figure, which shows a non-limitative example of embodiment and shows a cross section of the material itself.

[0021] In the figure, it is indicated as a whole by 1 a material comprising a first polymeric sound insulating, sound proofing or sound damping element 2 and a second metallic reticulated element 3.

[0022] The first element 2 is intimately connected to the second element 3. For example, the second element 3 can be embedded, superficially coupled, glued or fitted in.

[0023] According to the present invention, the first element 2, to have an appropriate sound insulating, sound proofing or sound damping power, presents a density higher than 1.3.

[0024] The first element 2 has an appropriate thickness to maintain a suitable flexibility of the material 1.

[0025] Preferably, the first element 2 is an elastomeric polymer selected from the group consisting of natural rubber, synthetic rubber selected from the group consisting of EPM, EPDM, butyl polymers, or mixtures of the same also vulcanised or reticulated.

[0026] Alternatively, the first element 2 is a plastic or thermoplastic polymer, preferably selected from the group consisting of polyolefins, polyamides, polyurethanes, polycarbonates, silicones, acrylate polymers, methacrylate polymers, styrenic polymers, vinyl chloride polymers, vinyl acetate polymers. In particular, , for example, LDPE (or low density polyethylene), HDPE (or high density polyethylene), PP (or polypropylene), PU (or polyurethane), EVA (or ethylene vinyl acetate), PVAC (or polyvinylacetate), SBS and SEBS, PVC (or polyvinylchloride) and CPE (or polyethylene chloride) or mixtures of the same can be used.

[0027] Alternatively, the first element 2 may also consist in a mixture of elastomeric, plastomeric, plastic or thermoplastic polymers.

[0028] According to a preferred embodiment, the first element 2 is filled by means of fillers.

[0029] Preferably, the fillers are present in a percentage from 5 to 95%.

[0030] Preferably, the fillers are selected from the group consisting of calcium carbonate, kaolin, barium sulphate, talc, dolomite, metal oxides, silica and silicates, slate, metallic powders, mica, graphite, aluminium hydroxide hydrate, magnesium hydroxide hydrate, zinc borate, titanium dioxide, carbon black, bitumen. The second element 3 comprises at least one metal or metal alloy.

[0031] Preferably, the metal is selected from the group consisting of aluminium, iron, zinc, copper, nickel, titanium, tin.

[0032] Preferably, the metal alloy is selected from the group composed of monel, bronze, steel, brass.

[0033] The second element 3 may consists in, for example, a metallic plate, for example a perforated or stretched plate, of suitable thickness to allow to be moulded around a structure to be insulated and therefore maintaining the assumed shape unchanged in time.

[0034] Preferably, the perforated or stretched plate has a thickness from 0.5 mm and 1.5 mm.

[0035] Preferably, the stretched plate presents a mesh selected from the group consisting of square, rhomboid or hexagonal mesh.

[0036] Preferably, the square mesh stretched plate presents a mesh opening from 3x3 mm to 40x40mm.

[0037] Preferably, the rhomboid mesh stretched plate presents a mesh opening from 2x1 mm to 110x40.

[0038] Preferably, the hexagonal mesh stretched plate presents a mesh opening from 2x1 mm to 110x40.

[0039] Alternatively, the second element 3 can be composed of, for example, a metallic net or cloth.

[0040] For example, the metallic nets may be electrically welded or braided.

[0041] The net and the cloth comprise wires having a diameter suitable to allow moulding the material around a structure to be insulated and therefore maintaining the assumed shaped unchanged in time, but also to make the material resistant to possible physical agents to which it may be subjected.

[0042] Preferably, the net consists of wires of diameter lower than or equal to 1.20 mm.

[0043] Preferably, the metallic net presents a mesh opening from 5x5 mm to 50x50 mm.

[0044] Preferably, the metallic cloth consists of wires of diameter lower than or equal to 3 mm.

[0045] Preferably, the metallic cloth presents a mesh number per cm² from 0.13 to 1050.

[0046] Optionally, the material 1 may also comprise at least one third sound insulating, sound proofing or sound damping element 4 to increase the insulation, proofing or damping provided by the material 1.

[0047] Preferably, the third element 4 is selected from the group consisting of non-woven fabric, felt, natural cloth or fibres, for example jute or agave based, synthetic cloth or fibres, metallic fibres or films, mineral fibres, glass wool, mineral wool, expanded or closed or open cell foamed polyurethane, expanded or closed or open cell foamed melamine, closed or open cell expanded reticulated polyethylene, plasterboard.

[0048] The material 1 according to the present invention may be advantageously used for the insulation, proofing or damping of sound and vibrations which are generated inside tubes. Indeed, such material, thanks to the presence of a metallic reticulated element, is capable of being easily moulded around the tubes therefore maintaining its shape in time.

[0049] The reticulated element allows to avoid or limit the use of devices suitable to maintain the shape of the material itself and therefore facilitates the assembly or application of the material itself.

[0050] The material according to the invention can be also advantageously used in the civil, residential and industrial building sectors for the insulation, proofing or damping of sound, for example in walls, floors and partitioning elements in general or to damper the vibrations generated by running machinery.

[0051] Furthermore, the material according to the present invention may be advantageously used also in the railway sector, for example for the insulation of railway cars, in the yachting, cruise ship and military naval sector, for example for the insulation of cabins and bulkheads, in the industrial farming sector and in the public transport sector.

[0052] Examining the features of the material according to the present invention the advantages that the material allows to obtain are evident.

[0053] In particular, such material presents excellent insulating, proofing or damping properties of sounds and vibrations

which propagate both through the air and through structures.

[0054] Furthermore, the presence of the metallic reticulated element allows to obtain an easily mouldable material, with excellent plastic behaviour and therefore capable of deforming permanently without undergoing structural modifications and without breaking, resisting also to lacerations or perforations.

5 **[0055]** Finally, the choice of suitable polymeric elements may confer to the material, in addition to the sound insulating, sound proofing and sound damping properties, also an excellent resistance to fire, water, vapour, humidity, chemical substances of various nature, impermeability to air and also heat insulating properties.

[0056] Obviously, the material may be varied by adding further elements so as to increase the sound insulating, sound proofing and sound damping properties or the resistance to chemical and physical agents.

10 **[0057]** Additional features of the present invention will be apparent in the description that follows only by way of purely illustrative and non-limitative examples.

EXAMPLES

15 **[0058]** In table 1 the features of materials made according to the present invention are indicated in detail.

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Table 1

Example nr.	First element (layer 1)	Second element (layer 2)	Third element (layer 3)	Possible additional elements (layer n)	Connection between the first element and the second element	Sequence of layers	Diameter of net wires or plate thickness	Mesh opening
1	Filled EPDM	Square mesh stretched plate	Expanded PE	-	Gluing	Layer 1 -layer 2 -layer 3	0.8 mm	20x20
2	Filled EPM	Square mesh stretched plate	Embossed expanded PE	-	Gluing	Layer 1 -layer 2 -layer 3	0.8 mm	20x20

3	Filled EPDM	Square mesh stretched plate	Open cell PU	-	Gluing	Layer 1 -layer 2 -layer 3	0.8 mm	20x20
4	SBS/SEBS	Square mesh stretched plate	PVC	-	Gluing	Layer 1 -layer 2 -layer 3	0.8 mm	20x20
5	CPE	Square mesh stretched plate	Expanded melamine	-	Layer 2 embedded in layer 1	Layer 3 -layer 1 -layer 2 -layer 3	0.8 mm	20x20
6	SBS filled with bitumen	Square mesh stretched plate	Expanded PE	Expanded PE (layer 4)	Layer 2 embedded in layer 1	Layer 4 -layer 1 -layer 2 -layer 3	0.8 mm	20x20

7	EPDM/EPM	Zinc-plated electrically welded net	Expanded PE	-	Gluing	Layer 1 -layer 2 -layer 3	0.63 mm	5 mm
8	SBS filled with bitumen	Zinc-plated electrically welded net	Open cell PU	-	Gluing	Layer 1 -layer 2 -layer 3	0.63 mm	5 mm
9	EVA	Zinc-plated electrically welded net	PVC	-	Gluing	Layer 1 - layer 2 - layer 3	0.63 mm	5 mm
10	PE/PP	Zinc-plated electrically welded net	Melamine	-	Gluing	Layer 1 - layer 2 - layer 3	0.63 mm	5 mm
11	EPDM/EPM	Epoxy coated steel cloth	Expanded PE	-	Gluing	Layer 1 - layer 2 - layer 3	0.28 mm	12x10

12	EVA	Epoxy coated steel cloth	Non-woven PES	Expanded PU (layer 4 and 5)	Gluing	Layer 5 - layer 3 - layer 2 - layer 1 - layer 4	0.28 mm	12x10
13	Filled PVC	Zinc-plated electrically welded net	Expanded PVC	Expanded PVC (layer 4)	Layer 2 embedded in layer 1	Layer 4 - layer 1 - layer 2 - layer 3	0.63 mm	5 mm
14	SBS	Epoxy coated steel cloth	Melamine	-	Gluing	Layer 1 - layer 2 - layer 3	0.28 mm	12x10
15	PE/PP	Steel net	PE/PP	-	Layer 2 embedded in layer 1	Layer 1 - layer 2 - layer 3	0.5 mm	20 mm

16	EPDM/EVA/P E	Zinc-plated electrically welded net	Non-woven fabric - PES	-	Gluing	Layer 1 - layer 2 - layer 3	0.63 mm	5 mm
17	EPDM/EVA/P E	Epoxy coated steel cloth	-	-	Gluing	Layer 1 - layer 2	0.28 mm	12x10
18	EPM/EVA	Steel net	Expanded PU	Expanded PE (layer 4)	Gluing	Layer 4 - layer 1 - layer 4 - layer 2 - layer 4	0.8 mm	40 mm
19	EVA/PE/PP	Zinc-plated triple twisted net	PP/PA/PP 20/20/20 film	-	Layer 2 embedded in layer 1	Layer 1 - layer 2 - layer 3	0.70 mm	13 mm
20	PVC	Zinc-plated electrically welded net	Expanded PVC	-	Gluing	Layer 1 - layer 2 - layer 3	0.65 mm	13 mm

21	Butyl rubber	Zinc-plated electrically welded net	-	-	Embedded	Layer 1 - layer 2	0.65 mm	13 mm
22	EPDM/EVA/P E	Square mesh stretched plate	Non-woven fabric - PES	Embossed expanded PE (layer 4)	Embedded	Layer 1 - layer 2 - layer 3 - layer 4	0.8 mm	20x20

Claims

- 5 1. Material (1) comprising at least one first polymeric sound insulating, sound proofing or damping element (2) and at least one second metallic reticulated element (3) **characterised in that** said polymeric element has a density higher than 1.3.
2. Material (1) according to claim 1, **characterised in that** said first element (2) is intimately connected to said second element (3).
- 10 3. Material (1) according to claim 2, **characterised in that** said second element (3) is embedded in said first element (2).
4. Material (1) according to claim 2, **characterised in that** said second element (3) is superficially coupled to said first element (2).
- 15 5. Material (1) according to any of the preceding claims, **characterised in that** said first element (2) is an elastomeric polymer selected from the group consisting of natural rubber, synthetic rubber selected from the group consisting of EPM, EPDM, butyl polymers, or mixtures of the same also vulcanised or reticulated.
- 20 6. Material (1) according to any of the claims from 1 to 4, **characterised in that** said first element (2) is a plastic or thermoplastic polymer selected from the group consisting of polyolefins, polyamides, polyurethanes, polycarbonates, silicones, acrylate polymers, methacrylate polymers, styrenic polymers, vinyl chloride polymers, vinyl acetate polymers or mixtures of the same.
- 25 7. Material (1) according to any of the preceding claims, **characterised in that** said first element (2) is a mixture of elastomeric, plastomeric, plastic or thermoplastic polymers.
8. Material (1) according to any of the preceding claims, **characterised in that** said first element (2) is filled by means of fillers.
- 30 9. Material (1) according to claim 8, **characterised in that** said fillers are present in a percentage from 5 to 95%.
10. Material (1) according to claims 8 or 9, **characterised in that** said fillers are selected from the group consisting of calcium carbonate, kaolin, barium sulphate, talc, dolomite, metal oxides, silica and silicates, slate, metallic powders, mica, graphite, aluminium hydroxide hydrate, magnesium hydroxide hydrate, zinc borate, titanium dioxide, carbon black, bitumen.
- 35 11. Material (1) according to any of the preceding claims, **characterised in that** said second element (3) comprises a metal selected from the group consisting of aluminium, iron, zinc, copper, nickel, titanium, tin.
- 40 12. Material (1) according to any of the claims from 1 to 10, **characterised in that** said second element (3) comprises a metal alloy selected from the group consisting of monel, bronze, steel, brass.
13. Material (1) according to any of the claims 11 or 12, **characterised in that** said second element (3) is a net or a cloth.
- 45 14. Material (1) according to claim 13, **characterised in that** said net consists of wires of diameter lower than or equal to 1.20 mm.
15. Material (1) according to claim 14, **characterised in that** said net presents a mesh opening from 5x5 mm to 50x50 mm.
- 50 16. Material (1) according to claim 13, **characterised in that** said cloth consists of wires of diameter lower than or equal to 3 mm.
17. Material (1) according to claim 16, **characterised in that** said cloth presents a mesh number per cm² from 0.13 to 1050.
- 55 18. Material (1) according to any of the claims 11 or 12, **characterised in that** said second element (3) is a stretched or perforated plate.

19. Material (1) according to claim 18, **characterised in that** said plate presents a thickness from 0.5 mm to 1.5 mm.
20. Material (1) according to claims 18 or 19, **characterised in that** said stretched plate presents a mesh selected from the group consisting of square, rhomboid and hexagonal mesh.
21. Material (1) according to claim 20, **characterised in that** said square mesh stretched plate presents a mesh opening from 3x3 mm to 40x40 mm.
22. Material (1) according to claim 20, **characterised in that** said rhomboid mesh stretched plate presents a mesh opening from 2x1 mm to 110x40 mm.
23. Material (1) according to claim 20, **characterised in that** said hexagonal mesh stretched plate presents a mesh opening from 2x1 mm to 110x40 mm.
24. Material (1) according to any of the preceding claims, **characterised in that** it comprises at least one third sound insulating, sound proofing or sound damping element (4).
25. Material (1) according to claim 24, **characterised in that** said third element (4) is selected from the group consisting of non-woven fabric, felt, natural cloth or fibres, synthetic cloths or fibres, metallic fibres or films, mineral fibres, glass wool, mineral wool, expanded or closed or open cell foamed polyurethane, expanded or closed or open cell foamed melamine, closed or open cell expanded reticulated polyethylene, plasterboard.
26. Use of the material (1) according to any of the claims from 1 to 25 for sound insulation, proofing or damping.

