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VERIFICATION OF TRANSLATION

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1. I am an Australian Registered Patent Attorney .
2. Attached hereto is a copy of WO 96/34261 being the published English specification of, and hence an English language translation of the specification, of the Swedish International Patent Application No PCT/SE96/00538.

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Arrangement for damping sound and a method for manufacturing
the arrangement

5 The present invention relates to an arrangement for achieving a sound-damping absorbent effect in structures, especially those containing car stereo loudspeakers.

 An arrangement of this kind is characterized
10 in that a damping mass consisting of a visco-elastic polymer is capable of application to one side of a structure by spraying or coating, thereby achieving damping of vibrations and resonances in the structure.

 The present invention also relates to an
15 arrangement for achieving a sound-damping absorbent effect in structures containing car stereo loudspeakers.

 It is customary in the manufacture of bass reflex cabinets, interior door trim panels and other panels intended for the installation of loudspeaker units to make
20 use of so-called MDF board or particle board of a certain thickness, for example up to approx. 25 mm, in order to achieve a sufficiently stable resonance chamber that is as resonance-free as possible. Heavy internal bracing of the structure is also frequently used in addition in order to
25 reduce reverberation inside the cabinet.

 Bitumen matting and various forms of expanded polyethylene sheeting are commonly used in the conventional damping of vibrations, resonances and noise in vehicle bodywork. These are normally installed by applying adhesive
30 on one side and then shaping them piece by piece and gluing them securely to the inside of the bodywork.

 However, the aforementioned previously disclosed method is not associated with a very high
dissipation factor in the materials used, in addition to
35 which the structures are heavy and complicated to produce.

The principal object of the present invention is thus, in the first instance, to make available an arrangement which, amongst other things, solves the aforementioned problems.

5 The aforementioned object is achieved by means of an arrangement in accordance with the present invention, which is characterized essentially in that a visco-elastic polymer exhibiting an adhesive function is applied by spraying, brushing, rolling or spreading between two sheet-
10 formed elements to form a composite sheet which, through the absorbent effect of the visco-elastic polymer on the resulting sandwich structure when the damping layer is subjected to shear deformation during oscillation, brings about a reduction in unwanted vibrations, resonances and
15 reverberations in the structure formed by the sheet.

An alternative arrangement is characterized in that a damping mass consisting of a visco-elastic polymer is capable of application to the inside of a vehicle body by spraying or coating, whereby damping of vibrations and
20 resonances in the body is achieved.

The present invention relates to a method for manufacturing an arrangement for achieving a sound-damping absorbent effect in structures, especially those containing car stereo loudspeakers. Such a method is characterized in
25 that one side of the surface of a structure or vehicle body in question is sprayed or coated by means of a visco-elastic polymer so that damping is achieved of vibrations and resonances in the structure or vehicle body in question.

The methods for producing the previously
30 disclosed structures containing car stereo loudspeakers in order to achieve a sound-damping absorbent effect are complicated and time-consuming and are not so effective.

A further object of the invention is thus, in the first instance, to make available a method which, amongst

other things, solves the aforementioned problems simply and effectively.

Said object is achieved by means of an arrangement in accordance with the foregoing, which is characterized essentially in that two sheet-formed elements are glued together by means of a visco-elastic polymer that is applied by spraying, brushing, rolling or spreading to produce a smooth layer, whereupon the sheet elements are pressed together by exerting uniform pressure in conjunction with drying of said layer, whereupon the resulting sandwich sheet is used for the installation of car loudspeaker units.

An alternative method is characterized in that the inside surface of a vehicle body of the kind in question is sprayed or coated by means of a visco-elastic polymer to achieve damping of vibrations and resonances in the bodywork.

The invention is described below as a number of preferred illustrative embodiments, in conjunction with which reference is made to the accompanying drawings, where:

Fig. 1 shows a sectional view of a sandwich sheet produced in accordance with the invention, and

Fig. 2 shows a sectional view of a vehicle body with damping mass applied.

The function of the invention is as follows: A body in equilibrium requires the input of very little energy to bring it into resonant oscillation and, as such, to radiate unwanted noise. The amplitude of the oscillation is dependent on the dissipation factor of the material (= the ability to transform oscillation energy into heat). Structural materials such as MDF and particle board have a dissipation factor of 0.01-0.03, i.e. very low dissipation. The application of the invention increases the dissipation factor by a factor of 15 to 20, which gives reduced radiation of unwanted noise by approx. 15 dB. The reverberation period of the chamber is also reduced considerably. When working with car audio, it is important to damp any resonances. The invention reduces the

resonances in the chamber structure in a previously entirely unachievable fashion by the simple expedient of reducing the vibrations where they are at their strongest - in the actual material of the chamber. The result is a completely "dead" chamber.

It is possible to stick two sheets together with damping mass instead of using a single thick sheet, and still to obtain a stable sound without reverberation in the chamber disturbing the sound picture.

10 An arrangement 1 for obtaining a sound-damping absorbent effect in structures containing car stereo loudspeakers comprises a sandwich structure formed by a visco-elastic polymer 2 exhibiting an adhesive function which is applied by spraying, brushing, rolling or spreading
15 between two sheet-formed elements 3, 4 to form a composite sheet. The sheet 1 brings about a reduction in unwanted vibrations, resonances and reverberations in the structure formed from the sheet 1 through the absorbent effect of the visco-elastic polymer on the sandwich structure formed when
20 the damping layer is exposed to shear deformation during oscillation.

The visco-elastic damping mass 2 exhibiting an adhesive function consists of an acrylic polymer.

The sheet-formed elements 3, 4 exhibit
25 essentially identical thicknesses T , for example 12 mm.

A distinctly increased dissipation factor is achieved in this way in the material used, which also leads to improved acoustic functions for the structures in which the damping adhesive 2 is used. Significant reductions in
30 resonances and vibrations are also achieved, as well as reduced weight for the finished structure through a reduced requirement for structural stiffening.

An arrangement 5 for obtaining a sound-damping absorbent effect in structures containing car stereo
35 loudspeakers involves a damping mass 6, in the form of a

visco-elastic polymer, being capable of application to the inside 7A of a vehicle body 7 by spraying or coating, whereby damping of vibrations and resonances in the body 7 is achieved. The damping mass 6 in this case consists of a plastic dispersion with inorganic filling agents, preferably polyvinyl propionate.

The effect achieved through the aforementioned arrangement 5 with the visco-elastic damping mass 6 corresponds to the effect achieved with conventional bitumen matting of up to about 10 times the thickness. The mass 6 is also applied in a significantly shorter time than when installing bitumen matting on a corresponding surface.

The cost of the damping mass 6 is also considerably lower than for conventional damping with bitumen matting. Increased fire protection and a lower overall weight are also achieved.

The method for manufacturing an arrangement 1 which exhibits a sandwich construction in order to obtain a sound-damping absorbent effect in structures containing car stereo loudspeakers involves gluing together two sheet-formed elements 3, 4, e.g. MDF sheets, by means of a visco-elastic polymer 2 which is applied by spraying, brushing, rolling or spreading on at least one sheet element 3 or 4 to produce a smooth layer. The sheet elements 3, 4 are then pressed together by exerting uniform pressure in conjunction with drying of said layer 2, for approx. 6-8 hours, whereupon the resulting sandwich sheet 1 is used for the installation of car loudspeaker units.

It is preferable to glue together two sheets 3, 4 which exhibit identical thickness T by means of an acrylic polymer.

The layer thickness t can be varied, although an appropriate value is preferably approx. 1 mm.

The drying time may vary, although an appropriate time is approx. 6-8 hours at room temperature.

A considerable reduction in the reverberation periods of the finished structure is achieved thanks to the absorbent effect of the damping adhesive. Measurements have shown that an undamped sheet has a reverberation period up to
5 approx. 300% longer than the damped version in accordance with the present invention. A resonance-free loudspeaker chamber is thus obtained simply and effectively.

A method for manufacturing an arrangement 5 intended to achieve a sound-damping absorbent effect in
10 structures containing car stereo loudspeakers in the case of body-mounting involves spraying or coating the inside surface 7A of a vehicle body 7 by means of a visco-elastic polymer, so that damping is achieved of vibrations and resonances in the body 7.

15 A damping mass 6 of the intended kind consisting of a plastic dispersion containing inorganic filling agents, namely polyvinyl propionate, is appropriately applied by spraying or brushing to a desired thickness X, preferably approx. 1 mm. Said damping mass 6 is then allowed
20 to dry at room temperature.

More specifically the intended damping mass 6 is applied by spraying with a low-pressure sprayer or compressed air or by brushing onto the surface 7A of the body or other vehicle panel components 7 that have been previously
25 cleaned of grease and dirt.

Drying can continue for 8-12 hours, depending on the temperature, and also following application on vertical surfaces.

The damping mass 6 can be finished, once it
30 has dried, by both sanding and painting.

The invention is not restricted to the illustrative examples described above and shown in the drawing, but may be modified within the scope of the Patent Claims without departing from the idea of invention.



Patent Claims

- 5 1. Arrangement for achieving a sound-damping absorbent effect in structures, especially those containing car stereo loudspeakers, characterized in that a damping mass (6) consisting of a visco-elastic polymer is capable of application to one side (7A) of a structure (7) by spraying
10 or coating, thereby achieving damping of vibrations and resonances in the structure (7).
2. Arrangement in accordance with Patent Claim 1, characterized in that the damping mass (6) consists of a plastic dispersion with inorganic filling agents.
- 15 3. Arrangement in accordance with Patent Claim 2, characterized in that the damping mass (6) consists of polyvinyl propionate.
4. Arrangement for achieving a sound-damping absorbent effect in structures containing car stereo loudspeakers,
20 characterized in that a visco-elastic polymer (20) exhibiting an adhesive function is applied by spraying, brushing, rolling or spreading between two sheet-formed elements (3, 4) to form a composite sheet (1) which, through the absorbent effect of the visco-elastic polymer on the resulting sandwich
25 structure when the damping layer (2) is subjected to shear deformation during oscillation, brings about a reduction in unwanted vibrations, resonances and reverberations in the structure formed by the sheet.
5. Arrangement in accordance with Patent Claim 4,
30 characterized in that the visco-elastic damping mass (2) exhibiting an adhesive function consists of an acrylic polymer.
6. Arrangement in accordance with one or other of Patent Claims 4-5, characterized in that the sheet-formed



elements (3, 4) exhibit essentially identical thicknesses (T), for example 12 mm.

7. Arrangement for achieving a sound-damping absorbent effect in structures containing car stereo loudspeakers,

5 **characterized in that** a damping mass (6) consisting of a visco-elastic polymer is capable of application to the inside (7A) of a vehicle body (7) by spraying or coating, thereby achieving damping of vibrations and resonances in the body (7).

10 8. Method for manufacturing an arrangement (5) for achieving a sound-damping absorbent effect in structures, especially those containing car stereo loudspeakers, in accordance with one or other of Patent Claims 1-3,
characterized in that one side of the surface (7A) of a
15 structure or vehicle body in question is sprayed or coated by means of a visco-elastic polymer (6) so that damping is achieved of vibrations and resonances in the structure or vehicle body (7) in question.

9. Method in accordance with Patent Claim 8,
20 **characterized in that** a damping mass (6) consisting of a plastic dispersion containing inorganic filling agents, namely polyvinyl propionate, is applied by spraying or brushing to a desired thickness (X), preferably approx. 1 mm, which layer (6) is then allowed to dry at room temperature,
25 for example.

10. Method for manufacturing an arrangement (1) for achieving a sound-damping absorbent effect in structures containing car stereo loudspeakers in accordance with one or other of Patent Claims 4-6, **characterized in that** two sheet-
30 formed elements (3, 4) are glued together by means of a visco-elastic polymer (2) that is applied by spraying, brushing, rolling or spreading to produce a smooth layer, whereupon the sheet elements (3, 4) are pressed together by exerting uniform pressure in conjunction with drying of said



layer, whereupon the resulting sandwich sheet (1) is used for the installation of car loudspeaker units.

11. Method in accordance with Patent Claim 10, characterized in that two sheets (3, 4) which exhibit
- 5 identical thickness (T) are glued together by means of an acrylic polymer.