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(54) Sound-absorbing module, sound-absorbing screen or wall and method for producing the sound-absorbing module

(57) The invention relates to a sound-absorbing module, comprising a sound-absorbing material which is framed by a frame of sheet material, wherein a protective plastic casing is arranged round the frame.

The invention likewise relates to a sound-absorbing screen or sound-absorbing wall formed from a number of mutually stacked sound-absorbing modules according to the invention.

The invention also relates to a method for manufacturing a sound-absorbing module as claimed in any of the foregoing claims, which method comprises the steps of:

1) manufacturing a frame of sheet material for framing the sound-absorbing material; and
2) arranging a protective plastic casing round the frame

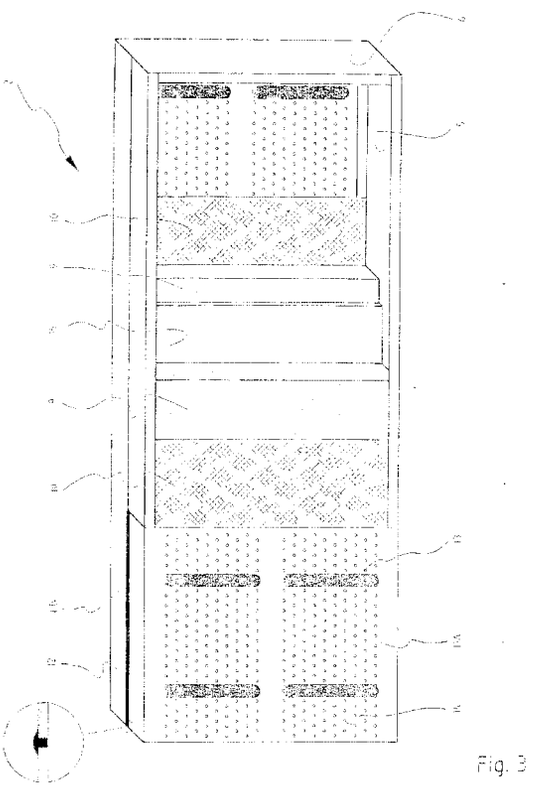

Fig. 3

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Description

[0001] The present invention relates to a sound-absorbing module, comprising a sound-absorbing material which is framed by a frame of sheet material, wherein a protective plastic casing is arranged round the frame.

[0002] In order to prevent noise nuisance noise barriers are being placed to an increasing extent, for instance along motorways and railway lines. The known noise barriers can be divided into sound-reflecting and sound-absorbing screens.

[0003] It is known in the field to construct a sound-absorbing screen from a number of mutually stacked sound-absorbing modules and to clamp the modules on either side between posts with for instance an H-shaped profile.

[0004] The choice of the combination of sheet material and plastic in the sound-absorbing module according to the invention has a number of significant advantages. The framing by means of sheet material gives the module sufficient strength and load bearing capacity to be able to withstand, without deformation, the force of the modules lying above in the stack. The choice of a frame of sheet material with an additional casing of plastic gives the module a low weight, which is advantageous for instance during transport and placing of the module. With a suitable choice of the plastic, which can optionally undergo a number of additional treatments, the plastic can moreover be made fire-retardant and dirt-repellent.

[0005] In an elegant preferred embodiment of the sound-absorbing module according to the invention the casing comprises two generally U-shaped parts. These parts preferably cover the front and rear side of the module. There is consequently a minimal overlap between the sheet material and the plastic, which results in material-saving and therefore cost reduction and weight reduction. The parts are preferably welded to each other.

[0006] In a practical embodiment of the sound-absorbing module according to the invention the casing is provided with a profiling which substantially takes up expansion of the module in longitudinal direction. The profiling preferably comprises a number of ribs running at some mutual distance from each other. In the case of placing outside, the expansion resulting from weather conditions can only lead to a minimal bulge between two adjacent ribs.

[0007] In a first variant of this preferred embodiment the ribs run substantially vertically. In a second variant hereof the ribs run obliquely. The second variant has the advantage that it takes up the expansion in both height direction and longitudinal direction.

[0008] To allow passage of sound waves for absorption by the sound-absorbing material, the casing is provided on at least one side thereof with a number of openings.

[0009] In a further preferred embodiment the plastic is polypropylene (PP) or polyethylene (PE), for instance of high density. These plastics have the property of being graffiti-proof, which is exceptionally advantageous in outside applications.

[0010] In another practical preferred embodiment the frame comprises a number of U-shaped profiles. When a module form is chosen with straight surfaces as peripheral edges, as in the common rectangular module form, these are eminently suitable to form a frame for the sound-absorbing material. The U-shaped profiles preferably overlap each other partly in pairs and are fixed to each other by means of fixing means at the position of the overlapping parts in order to form a continuous frame. The number of fixing points, which also form sound contact points, is hereby limited in advantageous manner to a minimum, as a result of which the acoustic insulating value of the module improves. An example of particularly suitable fixing means are pop rivets.

[0011] In yet another preferred embodiment the sound-absorbing material is mineral wool, for instance rock wool. This material readily allows manufacture to size in a desired, for instance rectangular form, and is also known for its good sound-insulating properties.

[0012] The present invention also relates to a sound-absorbing screen or a sound-absorbing wall formed from a number of mutually stacked sound-absorbing modules according to the invention.

[0013] The present invention further relates to a method for manufacturing a sound-absorbing module according to the invention, which method comprises the steps of:

1) manufacturing a frame of sheet material for framing the sound-absorbing material; and
2) arranging a protective plastic casing round the frame.

[0014] In a first elegant preferred embodiment of the method according to the invention, step 1) comprises the steps of:

a) manufacturing a number of U-shaped profiles of sheet material;
b) positioning the U-shaped profiles such that they form a continuous frame by causing the profiles to partially overlap each other in pairwise manner; and
c) fixing the U-shaped profiles to each other in pairwise manner by means of fixing means. A frame is thus manufactured quickly and with little sheet material and which is light and yet sufficiently sturdy for the intended use.

[0015] In a further preferred embodiment the method according to the invention comprises the steps of:

a) manufacturing a protective plastic casing having a form corresponding with the frame, which casing consists of at least two generally U-shaped parts;
b) positioning the parts round the frame, and

c) fixing the parts to each other. The parts are preferably welded to each other in step c). The plastic casing preferably covers only the front and rear side of the module, whereby there is a minimal overlap between sheet material and plastic. The U-shaped parts can moreover be fixed to each other quickly and simply.

[0016] According to a further preferred embodiment there is arranged in the casing a profiling which substantially obviates expansion of the module in longitudinal direction. According to a practical embodiment the casing is for this purpose first heated locally sufficiently to enable pressing of a number of ribs at some mutual distance into the plastic. The surface of the plastic is preferably heated locally for a time to a temperature of approximately 80 to 110 C.

[0017] According to another preferred embodiment the method comprises the further step of arranging a number of openings on at least one side of the casing to allow passage of sound waves This can take place for instance by means of perforating techniques.

[0018] The invention will now be discussed in more detail with reference to the drawings, in which

Figure 1 shows a schematic view of a sound-absorbing screen constructed from a number of sound-absorbing modules according to the invention;

Figure 2 shows a schematic view of the frame of a module according to the invention; and

Figure 3 shows a partly cut-away view of a module according to the invention.

[0019] It is noted that the figures are not drawn to scale

[0020] Figure 1 shows in schematic view a sound-absorbing screen 1 according to the invention. Screen 1 is constructed from a number of sound-absorbing modules 2 according to the invention stacked onto each other. Modules 2 have a generally rectangular form and are clamped on either side between posts 3 with an H-shaped profile.

[0021] Figure 2 shows frame 4 of a sound-absorbing module 2 according to the invention. Frame 4 is constructed from a number of U-shaped longitudinal beams 5 running parallel to each other at some mutual distance. Longitudinal beams 5 are mutually connected by means of U-shaped cross beams or uprights 6, which likewise run parallel to each other at some mutual distance.

[0022] Frame 4 forms a continuous frame for receiving sound-absorbing material 9 (see figure 3). In the shown preferred embodiment frame 4 consists of five mutually separated compartments, each forming a frame for a piece of sound-absorbing material.

[0023] The U-shaped beams or profiles are partly overlapping and mutually connected on the overlapping parts by means of fixing means 7 In the shown preferred embodiment the fixing means are pop rivets 7.

[0024] For further strengthening frame 4 can optionally be provided with strengthening elements 8.

[0025] One of the characteristic aspects of frame 4 is that the front side and the rear side thereof are largely open. The frame therefore comprises relatively little sheet material.

[0026] An example of a suitable sheet material is galvanized steel.

[0027] Figure 3 shows a module 2 according to the invention in partly cut-away view. Rock wool 9, which serves as sound-absorbing material, is arranged inside the frame formed by longitudinal beams 5 and cross beams 6 In this example this consists of two rectangular mats 9 which are mutually separated by a plate 15, for instance of plastic.

[0028] Rock wool 9 is protected in per se known manner by means of glass fibre 10 in order to protect it against dirt and damage by animals, such as insects or birds.

[0029] Arranged round the frame is a plastic casing consisting of plates 11A and 11B, both with a generally U-shaped profile. The plastic plates connect together and are fixed to each another by means of a welded seam 12.

[0030] In this embodiment the plates 11A and 11B cover the top side and bottom side at the position of longitudinal beams 5 as well as the front and rear side of the module. There is no casing at the position of cross beam 6.

[0031] Several examples of suitable plastics are polypropylene (PP) or polyethylene (PE), preferably of high density. If desired, the plastic can be further subjected to diverse treatments, for instance to make it dirt-repellent and/or fire-retardant.

[0032] A profiling is arranged in casing 11A and 11B in the form of ribs 13 arranged at some mutual distance.

[0033] Part 11A is perforated to create openings 14 for passage of sound waves. In a double-sided sound-absorbing embodiment part 11B is also perforated.

[0034] The sound-absorbing module can be manufactured as follows according to the invention.

[0035] A frame is formed by fixing a number of generally U-shaped profiles of sheet material continuously to each other. This is carried out for instance by positioning these profiles in partly overlapping pairs and then connecting them at the position of the overlapping parts by means of fixing means, such as pop rivets.

[0036] The frame serves as frame for a sound-absorbing material which is received therein. In the shown preferred embodiment the frame is for the greater part open on the front and rear side.

[0037] The sound-absorbing material is preferably mineral wool, such as rock wool, one or two plates of which are made to size and inserted in the frame. The frame can be constructed for this purpose around the rock wool plates. It will however be apparent that many

other suitable sound-absorbing materials can be applied in the module according to the invention. The choice for a particular type of material will have some influence on the performing of the method. An example of a suitable alternative is possible injection into the module.

[0038] For the purpose of protecting the sound-absorbing material there are, if necessary, protecting means arranged, for instance in the form of sheets of glass fibre or any other type of suitable material

[0039] A protective plastic casing is then arranged round the frame. This is preferably manufactured from two substantially identical parts with a generally U-shaped profile. The parts are locally heated sufficiently to enable pressing of ribs therein at some mutual distance. A surface heating is preferably applied at the position of each intended rib. When HDPE is applied as plastic material, it has been found in practice that a brief heating to a temperature of 80 to 110 C is sufficient. Pressing of the plastic at low temperatures, thus "cold", introduces a prestress into the material. The material hereby shrinks slightly and loses resilience, with the result that deformations of the casing, for instance due to environmental influences, will be hardly visible.

[0040] One or both parts are also perforated in order to create openings 14 for passage of sound waves.

[0041] The plastic parts are wrapped round the front respectively rear side of the frame and then connected to each other. A suitable connection method is welding with a suitable welding material, for instance the same plastic or a material related thereto or at least compatible therewith. The welding can be performed extremely well using the welding device as described in the non pre-published patent application 1010957 of applicant.

[0042] The module according to the invention is generally suitable for applications in noise barrier structures, for both inside and outside. The module can for instance serve as component of a sound-absorbing screen for outside applications, such as along motorways or railway lines or at other locations where noise nuisance can occur, such as construction sites. In addition, the module is also suitable for application as component of a sound-absorbing wall in a building, for instance a system wall. Due to its light weight the module is also extremely useful in temporary facilities. It is on the other hand sufficiently sturdy to guarantee a long lifespan.

[0043] It is further noted that the module can take many different forms in addition to the rectangular form shown in the present patent application. Nor is the method according to the invention limited in respect of shape, in the sense that for a skilled person in the field it is universally applicable in the manufacture of the module in other forms, such as square, triangular and so on. The peripheral edges of the chosen form are preferably straight for the purpose of the desired stacked placing. However, this is not absolutely essential either.

[0044] The invention is of course not limited to the shown and described embodiment, but extends generally to any embodiment which falls within the scope of the appended claims as considered in the light of the foregoing description and drawings.

Claims

1. Sound-absorbing module, comprising a sound-absorbing material which is framed by a frame of sheet material, wherein a protective plastic casing is arranged round the frame.

2. Sound-absorbing module as claimed in claim 1, wherein the casing comprises two generally U-shaped parts.

3. Sound-absorbing module as claimed in claim 2, wherein the parts are welded to each other.

4. Sound-absorbing module as claimed in claim 1, 2 or 3, wherein the casing is provided with a profiling which substantially obviates expansion of the module in longitudinal direction.

5. Sound-absorbing module as claimed in claim 4, wherein the profiling comprises a number of ribs running at some mutual distance from each other.

6. Sound-absorbing module as claimed in claim 5, wherein the ribs run substantially vertically.

7. Sound-absorbing module as claimed in claim 5, wherein the ribs run obliquely.

8. Sound-absorbing module as claimed in any of the foregoing claims, wherein the casing is provided on at least one side thereof with a number of openings for passage of sound waves.

9. Sound-absorbing module as claimed in any of the foregoing claims, wherein the plastic is polypropylene (PP) or polyethylene (PE), preferrably of high density.

10. Sound-absorbing module as claimed in any of the foregoing claims, wherein the frame comprises a number of U-shaped profiles.

11. Sound-absorbing module as claimed in claim 10, wherein the U-shaped profiles partly overlap each other in pairwise manner and are fixed to each other by means of fixing means at the position of the overlapping parts in order to form a continuous frame.

12. Sound-absorbing module as claimed in claim 11, wherein the fixing means are pop rivets.

13. Sound-absorbing module as claimed in any of the foregoing claims, wherein the sound-absorbing material is mineral wool. for instance rock wool.

14. Sound-absorbing screen or sound-absorbing wall formed from a number of mutually stacked sound-absorbing modules as claimed in any of the foregoing claims.

15. Method for manufacturing a sound-absorbing module as claimed in any of the foregoing claims, which method comprises the steps of:

1) manufacturing a frame of sheet material for framing the sound-absorbing material; and
2) arranging a protective plastic casing round the frame

16. Method as claimed in claim 15, wherein step 1) comprises the steps of:

a) manufacturing a number of U-shaped profiles of sheet material;
b) positioning the U-shaped profiles such that they form a continuous frame by causing the profiles to partially overlap each other in pairwise manner; and
c) fixing the U-shaped profiles to each other in pairwise manner by means of fixing means.

17. Method as claimed in claim 15 or 16, wherein step 2) comprises the steps of:

a) manufacturing a protective plastic casing having a form corresponding with the frame, which casing consists of at least two generally U-shaped parts;
b) positioning the parts round the frame; and
c) fixing the parts to each other.

18. Method as claimed in claim 17, wherein in step c) the parts are welded to each other.

19. Method as claimed in any of the foregoing claims 15-18, wherein there is arranged in the casing a profiling which substantially obviates expansion of the module in longitudinal direction.

20. Method as claimed in claim 19, wherein the casing is heated locally sufficiently to enable pressing of a number of ribs at some mutual distance into the plastic.

21. Method as claimed in claim 20, wherein the surface of the plastic is heated locally for a time to a temperature of approximately 80 to 110 C.

22. Method as claimed in any of the foregoing claims 15-21, wherein the method comprises the further step of arranging a number of openings on at least one side of the casing to allow passage of sound waves.

Fig. 1

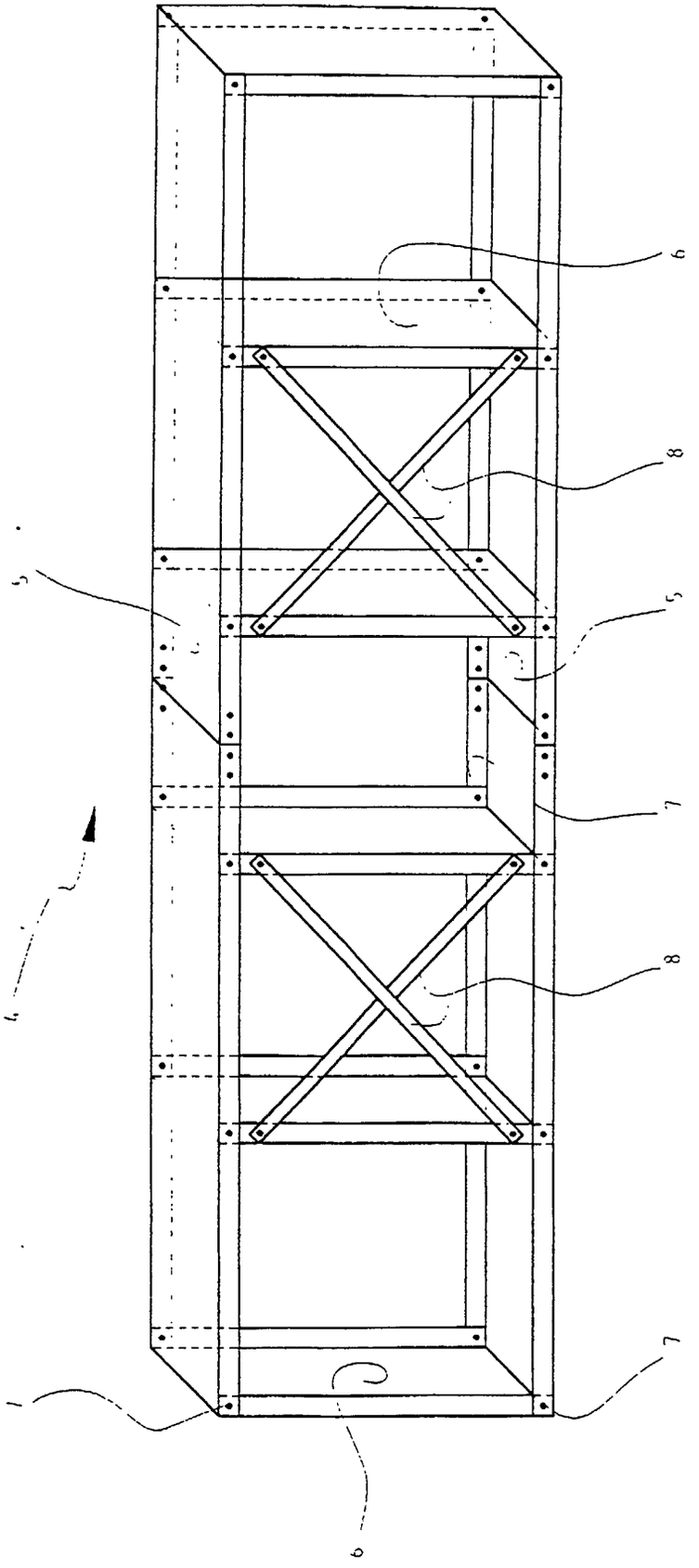

Fig. 2

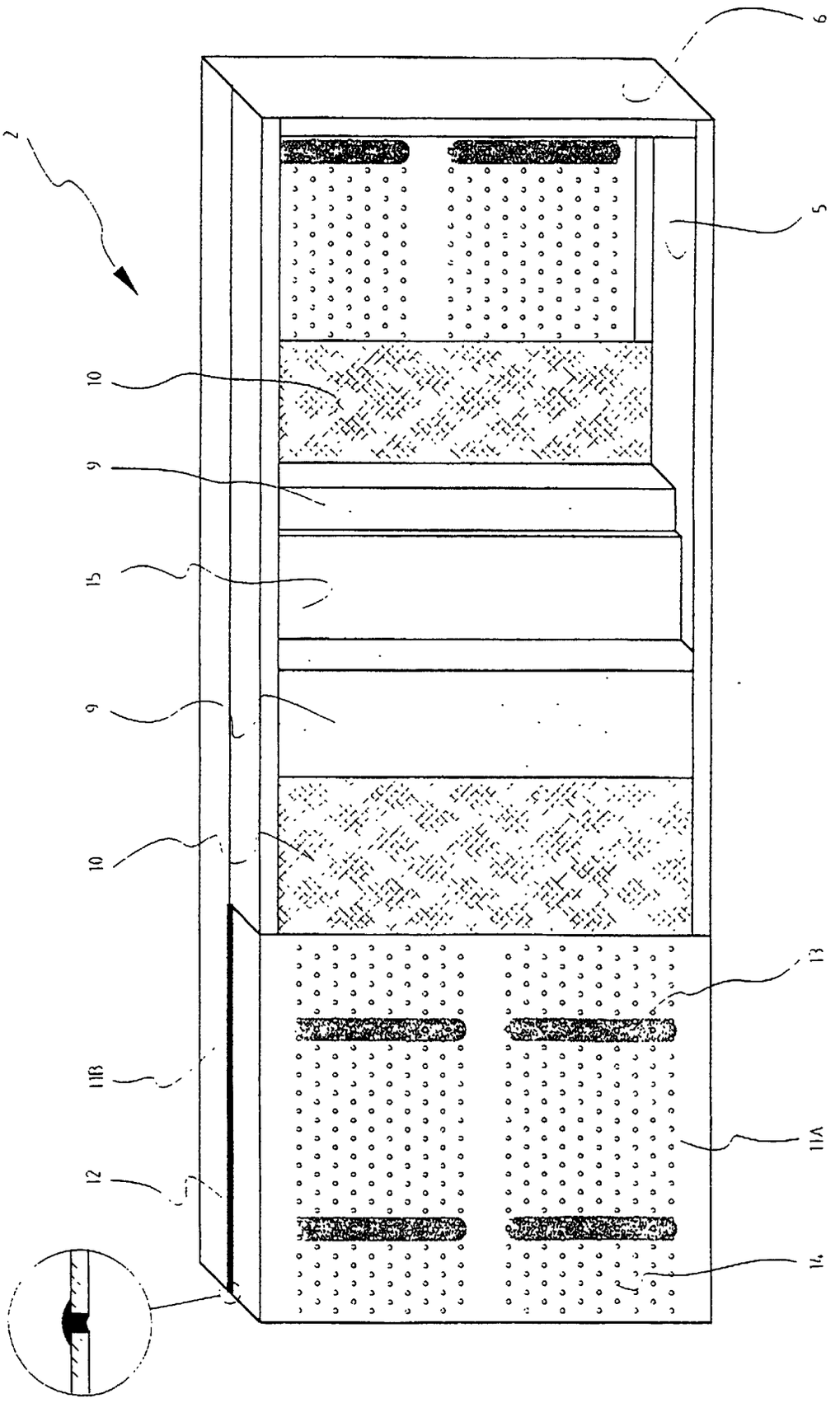

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 20 3499

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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
THE HAGUE	31 January 2001	Verveer, D

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EUROPEAN SEARCH REPORT

Application Number
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