(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number. 0 013 513
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 79303073.5

(22) Date of filing: 28.12.79

(51) Int. Cl.³: E 04 B 1/84

(30) Priority: 04.01.79 DK 43/79

(43) Date of publication of application: 23.07.80 Bulletin 80/15

(84) Designated Contracting States: AT BE CH DE FR GB IT NL SE

(71) Applicant: DAEMPA A/S
No. 1 Hojlokkevej
DK-5690 Tommerup(DK)

(72) Inventor: Hjelholt, Kurt
Gl. Sognefogedgaard No. 2 Fangel Bygade
DK-5260 Odense Syd(DK)

(72) Inventor: Dyrving, Niels Christian
No. 8 Stenlokkevej
DK-5690 Tommerup(DK)

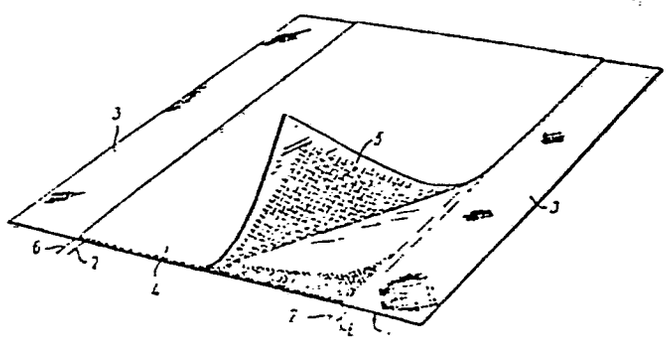
(74) Representative: Smith, Martin Stanley et al,
Stevens, Hewlett & Perkins 5, Quality Court Chancery Lane
London WC2A 1HZ(GB)

(54) **Sound absorbing structure.**

(57) A sound absorbing structure, for instance in the form of a ceiling lining element, consisting of perforated sheet material (3) covered on one side by the foil (4), suitably of plastics, which by means of a netting (5) or in another manner, is spaced a short distance from the sheet material.

EP 0 013 513 A1

./...


3
5
3
6
7
4
7
4

Sound Absorbing Structure

The specification of Danish Patent No. 128 947 discloses a sound absorbing ceiling lining consisting of elements of thin perforated sheet material and an absorption material, such as mineral wool batts, disposed in these elements, and an air and particle intercepting foil inserted between the sheet material and the absorption material, said foil being adhered to the sheet material in a cross pattern consisting of two intersecting sets of continuous glue stripes. The specification states that the foil is preferably a plastic foil having a thickness of about 10μ or less, and that it forms a kind of checkered coating on the upper side of the sheet material, the glue stripes dividing the foil into a large number of generally rectangular, possibly square, sections having normally a side length of the order of one or a few centimetres. The stated purpose is to prevent an air flow along the upper side of the sheet material and thereby also to counteract an air circulation through this perforated sheet material, without substantially reducing the sound absorbing effect, especially in the high frequency range, as would be the case when a tight foil were glued flat to the perforated sheet material.

The known ceiling lining, when applied in practice, has proved not to come up, in all cases, to expectations with regard to the sound absorbing effect. Thus, the plastic foil has turned out to have a reducing effect on the sound absorbing capacity of the mineral wool, to such extent, in some cases, that the mineral wool becomes almost ineffective, irrespective of its thickness. Furthermore, this reducing effect varies substantially dependent on the physical

characteristics of the plastic foil, especially its composition, its melting point, and its thickness and variations in thickness, and it has been found that these factors can vary in one and the same roll of plastic foil to such an extent as to strongly influence the said reducing effect. The glue stripes constitute a further important factor, as it can be difficult to control their thickness and width with sufficient accuracy, and because they must be expected, by providing a direct contact between the foil and the sheet material, to reduce the effective absorption area proportionally to the area of the glue stripes.

Starting from the above known technique, the present invention has for its object to provide a sound absorbing structure consisting also of perforated sheet and foil but having a sound absorbing capacity which even under practical conditions can be controlled adequately.

More specifically, the invention relates to a sound absorbing structure consisting, in a conventional manner, of thin, perforated sheet material, such as aluminium sheet, and a foil secured to one side of said sheet, preferably a plastic foil having af thickness of about 10-50μ. The structure according to the invention differs from the known designs of same type in that between its securing points, the foil is spaced a distance from the sheet material which is optimum as far as sound absorption is concerned. This can in practice be conveniently achieved by the insertion, between the sheet material and the foil, of a netting which by glueing or welding is attached to the sheet material as well as to the foil and which has a mesh size of the order of 1-5 mm.

In spite of comprehensive experiments and

theoretical analyses, it has not been possible to find an unambiguous explanation of the reason why the distance between the foil and the sheet material is of decisive importance to the sound absorbing capacity, but it has been found that in the structure according to the invention, there is such an interaction between the perforated sheet material, the air-filled cavity, and the foil that a satisfactory sound absorption can be achieved without using any mineral wool or other porous material. This is, needles to say, of great interest not only from an economic point of view but also for the quality of environment, as such materials are liable to cause dust nuisances.

It can be regarded as established that the sound absorbing effect, at any rate to a great extent, is due to the fact that the foil is divided into a great number of small areas or small diaphragms, which vibrate or oscillate independently and out of time with the vibrations of the perforated sheet material. A further probable explanation may be that the provision is made between the foil and the sheet material of a layer of air-filled cells to which an access is provided through the perforations of the sheet material. These individual cells have a sound quenching effect. It has also been established that the cavity absorption generally obtained by mineral wool is also obtained by the structure according to the invention, so that additional measures to that effect are reduced to a minimum. When using a netting as stated above, the said diaphragms or cells are given a regular shape, for example a quadratic or hexagonal shape, but this is of minor importance, since a gauze-like material, such as glass fiber gauze, has also proved suitable instead of a netting provided with regular meshes.

An important advantage of the sound absorbing

structure according to the invention is that unintended variations in the applied foil, especially variations in thickness and composition, have practically no importance for the sound absorbing capacity of the finished structure. Said capacity may, on the other hand, be varied within a rather wide range, if so desired, in particular according to the prevailing frequency range, by changing the thickness and perforation ratio of the sheet material, the thickness of the foil and the netting, and the size and shape of the net meshes. This enables an economical manufacture of structures having specific sound absorbing characteristics, in order, for instance, to meet requirements as to tailored sound absorption.

The desired distance between the sheet material and the foil can also be secured in another way than by sandwiching of netting or the like between the parts in question, as the netting may form part of the foil, or said foil and/or the sheet material may be provided with low ribs or protuberances to secure the required spacing.

A preferred embodiment of the sound absorbing structure is illustrated on the accompanying drawing.

In the embodiment of the drawing the structure comprises a rectangular sheet 1 of steel or aluminium which is perforated between the parallel lines 2,2 so that a pair of opposite marginal portions 3,3 are left without perforations.

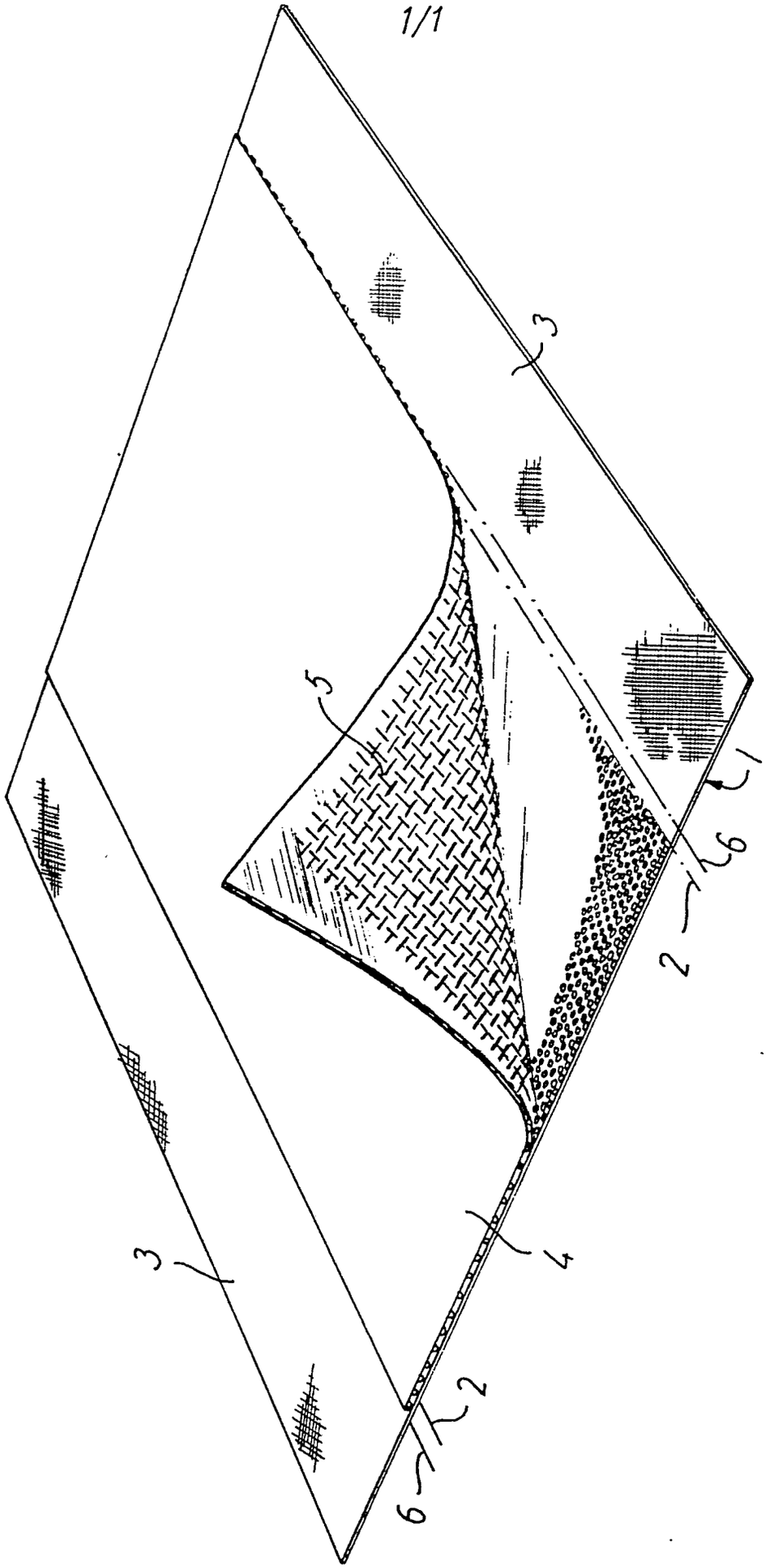
A piece of plastic foil or film 4 having a thickness of e.g. 25μ and provided with a netting 5 on its lower surface, covers the perforated area of the metal sheet 1 and extends slightly therebeyond as indicated by the lines 6,6. The netting 5 is adhesively attached to both the plastic foil 4 and the metal sheet 1 and forms a layer of air-filled cells therebetween

which are closed by the plastic foil or film but communicate with the surrounding air through the perforations of the metal sheet 1.

PATENT CLAIMS

1. A sound absorbing structure consisting of thin, perforated sheet material, such as aluminium or steel sheet, and a foil secured to one side of said sheet, preferably a plastic foil having a thickness of about 10-50μ, characterized in that between its securing points the foil is spaced a distance from the sheet material which is optimum as far as sound absorption is concerned.

2. A structure according to claim 1, characterized in that a netting is sandwiched between the sheet material and the foil and by glueing or welding is attached to the sheet material as well as to the foil, said netting having a mesh size of the order of 1-5 mm.


3
5
1
6
2
4
3
2
6

0013513

European Patent Office

EUROPEAN SEARCH REPORT

EP 79 30 3013

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 3 948 347 (RUTLEDGE) * Column 2, lines 19-62; column 3, lines 5-27; figures 1,2 * --	1,2
	US - A - 2 192 653 (SCHENK) * Page 1, column 1, lines 60-61; column 2, lines 1-28; 41-60; page 2, column 1, lines 1-15; figures 1-4 * --	1
A	US - A - 2 966 954 (SABINE) * Column 2, lines 26-72; column 3, lines 1-12; figures 1-3 * ----	1

CLASSIFICATION OF THE APPLICATION (Int Cl

E 04 B 1/84

TECHNICAL FIELDS SEARCHED (Int.Cl.

E 04 B
G 10 K

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

& member of the same patent family, corresponding document

☒ The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10-04-1980	SCHOLS

EPO Form 1503.1 06.78