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

(11) EP 0 783 164 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.07.1997 Bulletin 1997/28

(51) Int. Cl.^{6}: **G10K 11/162**

(21) Application number: **96120853.5**

(22) Date of filing: **23.12.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FR LI NL SE

(30) Priority: **02.01.1996 DE 19600040**

(71) Applicant: **ISOVER SAINT-GOBAIN**
92400 Courbevoie (FR)

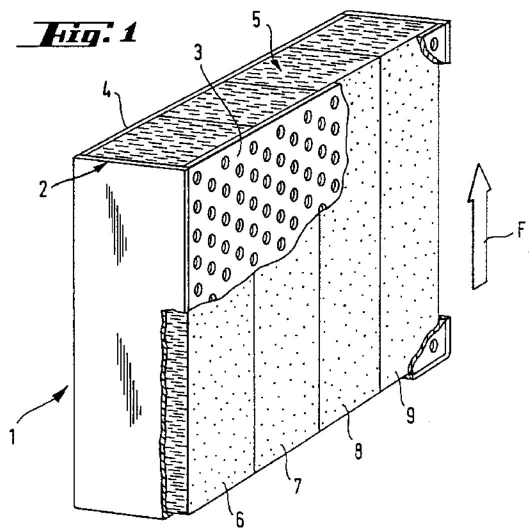
(72) Inventors:
- **Royar, Jürgen, Dr.**
68526 Ladenburg (DE)
- **Sommer, Rolf**
67125 Dannstadt (DE)

(74) Representative: **Bockhorni, Josef, Dipl.-Ing. et al**
Patentanwälte
Herrmann-Trentepohl
Grosse - Bockhorni & Partner,
Forstenrieder Allee 59
81476 München (DE)

(54) Sound damping element, in particular for a panel sound damper

(57) A sound damper element (1), in particular for a panel sound damper, having sound-absorbent filling (5) of preferably mineral wool which is mounted in a frame (2) having acoustically transparent principal surfaces (3,4) for covering the sound-absorbent filling (5), the filling (5) being formed by an absorption layer (6-9) with low flow resistance perpendicular to the direction of sound propagation and a dissipation layer with high flow resistance parallel to the direction of sound propagation.

Fig. 1



EP 0 783 164 A2

Description

This invention relates to a sound damper element according to the preamble of claim 1.

Sound dampers are used for greatly reducing, i.e. damping, the airborne sound propagating through ducts without essentially obstructing the conduction of flowing media. Sound dampers are used in particular for reducing sound propagation in the duct systems of ventilation facilities, reducing the sound radiation of flow machines into the immediate surroundings, for example for ventilators, compressors, turbo jet propulsions, and also for damping openings for transport or airing and deairing between noisy rooms and rooms intended to be quiet, and for damping openings, e.g. for airing and deairing in acoustic capsules.

Sound-absorbent ducts have a wall lining whose damping mechanism removes part of the sound energy from the propagating sound wave. Depending on the type of wall lining one distinguishes between absorption sound dampers, relaxation sound dampers and resonance sound dampers. Panel sound dampers are generally absorption sound dampers, the panel sound damper being formed in the simplest case by a frame receiving a filling of mineral, slag, glass or metal wool, whereby at least the principal surfaces of the panel sound damper, i.e. the surfaces extending parallel to the direction of sound propagation and, in a flow duct, in particular the surfaces limiting the flow duct, are formed as acoustically transparent enveloping surfaces. Such enveloping surfaces are frequently formed by perforated sheets and perforated plates.

Such absorption sound dampers are usually optimized up to now via the dimensioning and formation of the panel as such, usual mineral wool plates and the like being used for the filling. However, since the panel must be adapted to the particular cases of application this optimization is subject to restrictions due to the local conditions of installation for which the panel sound damper is being designed.

The problem of the invention is to use constructionally simple measures to obtain an optimization of sound damping, in particular the sound damping of a panel sound damper, which should expediently be done without impairing the structural conditions of the panel as such.

This problem is solved according to the invention by the features contained in the characterizing part of claim 1.

According to the invention an improvement of sound damping is obtained by a special formation of the sound damper element filling, the layers being determined in such a way that the filling is formed by an absorption layer with low flow resistance perpendicular to the direction of sound propagation and a dissipation layer with high flow resistance parallel to the direction of sound propagation. The absorption layer permits the greater part of the sound energy to penetrate very easily into the panel. This is very favorable for the efficiency of sound damping. In addition, the dissipation layer with high flow resistance parallel to the direction of sound propagation causes the sound energy penetrating into the panel to be damped optimally on its propagation path since the kinetic energy of the vibrating medium particles (vibration energy) is transformed into thermal energy by way of the dissipation. Merely by the special choice of filling one can thus achieve very good sound damping, regardless of the structural conditions of the panel as such, which can be conventionally constructed of a frame and suitable perforated plates.

In this connection it is of particular advantage for the fiber orientation of the filling to extend predominantly perpendicular to the direction of sound propagation and thus perpendicular to the principal surfaces the panel sound damper, so that the absorption and dissipation layers can be integrated into just one layer.

It is especially advantageous to form the filling by so-called plates or mats characterized in that the fiber orientation extends predominantly in directional fashion, namely perpendicular to the plate or mat surfaces. It is especially suitable to use for this purpose so-called lamellar plates or lamellar mats, which are predominantly employed for cases of application where high compressive strength is important. Due to their special fiber orientation, however, these lamellar plates or lamellar mats are especially suitable for use in sound damper elements since with a proper fiber orientation perpendicular to the direction of sound propagation one achieves low flow resistance for the penetrating sound energy but high flow resistance for the sound propagation within the sound damper element.

Moreover, lamellar plates or lamellar mats are characterized by high compressive strength, which in any case increases the stability of the filling material of such sound damper elements, this being of advantage in particular with pulsating sound sources and the accompanying pressure pulses. For practical application it has turned out that bulk densities of the filling material ≥ 25 kg/m^3, in particular ≥ 60 kg/m^3, are especially suitable. With lamellar plates or lamellar mats one can also cover great thickness ranges, in particular approximately from 10 cm to 25 cm.

In the following a preferred embodiment of the invention will be described with reference to the drawing, in which:

Fig. 1 shows a perspective view of a panel element of a panel sound damper in a strictly schematic and partly broken representation,

Fig. 2 shows a schematic representation to illustrate the production process of a lamellar plate, and

Fig. 3 shows a perspective partial view of a further embodiment.

Figure 1 shows a strictly schematic representation of a panel element of a sound damper panel, panel element 1 being formed by frame 2 provided at least on the two principal surfaces 3 and 4 of the panel (i.e. the front shown in Figure 1 and the back not shown) with an acoustically transparent envelope, formed here by perforated plates. Within frame 2 there is sound-absorbent filling 5 of mineral wool. Such panel elements are disposed one on the other and side by side for the purpose of sound damping, being cramped at the joints. The direction of flow and thus the direction of sound propagation is indicated in Figure 1 by arrow F.

As Figure 1 shows by the broken representation of perforated plate 3, filling 5 consists of a lamellar plate with altogether four lamellae 6, 7, 8 and 9, the fiber orientation of the lamellar plate perpendicular to principal surfaces 3 and 4 and thus to the perforated plates being indicated by the dotted representation on the front surface of filling 5 apparent from graphically broken perforated plate 3 and by the short lines on the upper face of the panel element. This special orientation of the lamellar plate fibers results in very low flow resistance perpendicular to the direction of sound propagation and thus perpendicular to principal surfaces 3 and 4 of panel element 1, but very high flow resistance in the direction of propagation and thus parallel to principal surfaces 3 and 4.

The production of such lamellar plates or lamellar mats as used as sound-absorbent filling 5 in Figure 1 is shown schematically in Figure 2. From the fiber formation process a plurality of layers of mineral wool mats or mineral wool plates are guided one above the other to cutting unit 10 and cut there all at once to the desired thickness, then swiveled 90° according to arrow G onto conveyer belt 11 and deposited there to form lamellar plate 12. One can then see, as shown in Figure 2 by corresponding dash lines, the fiber orientation in lamellar plate 12 perpendicular to principal surfaces 13 and 14 of the lamellar plate.

The thickness of the filling and the bulk density value of the filling are of course dependent on the actual case of application, but it has turned out that lamellar plates or lamellar mats are especially suitable with thicknesses in the range of 10 to 25 cm and bulk densities ≥ 25 kg/m^3, in particular ≥ 60 kg/m^3. All thickness ranges usual for acoustics can be covered with lamellar plates or mats.

In the alternative embodiment shown in Figure 3 again strictly schematically, sound-absorbent filling 5 is formed by mineral wool layer 15 wherein the fibers extend perpendicular to perforated plate 3, as shown schematically in Figure 3.

By contrast, mineral wool layer 16 disposed therebehind has a fiber orientation perpendicular thereto so that the fibers of mineral wool layer 16 extend substantially parallel to perforated plate 3. A lamellar plate is expediently used for mineral wool layer 15, whereas a usual mineral wool mat or mineral wool plate of usual bulk density can be used for mineral wool layer 16.

It is noted merely for the sake of completeness that the lamellae are interconnected with a glass mat. This glass mat is marked with reference sign 17 strictly schematically in Figure 3. The lamellar plate of Figure 1 can also be provided with a glass mat.

Claims

1. A sound damper element, in particular for a panel sound damper, having a sound-absorbent filling of preferably mineral wool which is mounted in a frame having acoustically transparent principal surfaces for covering the sound-absorbent filling, characterized in that the filling (5) is formed by an absorption layer with low flow resistance perpendicular to the direction of sound propagation (F) and a dissipation layer with high flow resistance parallel to the direction of sound propagation (F).

2. The sound damper element of claim 1, characterized in that the absorption and dissipation layers are integrated into just one layer through the fiber orientation of the filling (5) substantially perpendicular to the direction of sound propagation (F).

3. The sound damper element of claim 1 or 2, characterized in that the filling (5) is formed at least by a plate or mat with fibers oriented substantially uniformly perpendicular to the plate or mat surface.

4. The sound damper element of claim 3, characterized in that the filling (5) is disposed in the frame (2) of the sound damper element in such a way that the fiber orientation extends perpendicular to the acoustically transparent principal surface (3) or (4).

5. The sound damper element of any of the above claims, characterized in that the filling (5) is formed by a lamellar plate or lamellar mat (12).

6. The sound damper element of claim 1, characterized in that the filling (5) is formed at least by a mineral wool layer (15) with fibers directed perpendicular to the acoustically transparent principal surface (3), a further mineral wool layer (16) whose fibers extend substantially parallel to the plane of the acoustically transparent principal surface (3) preferably being provided behind the mineral wool layer (15).

7. The sound damper element of any of the above claims, characterized in that the bulk density of the lamellar plate or lamellar mat is ≥ 25 kg/m^3.

8. The sound damper element of any of the above claims, characterized in that the thickness of the lamellar plate or lamellar mat is within the thickness ranges usual for acoustics.

Fig. 1

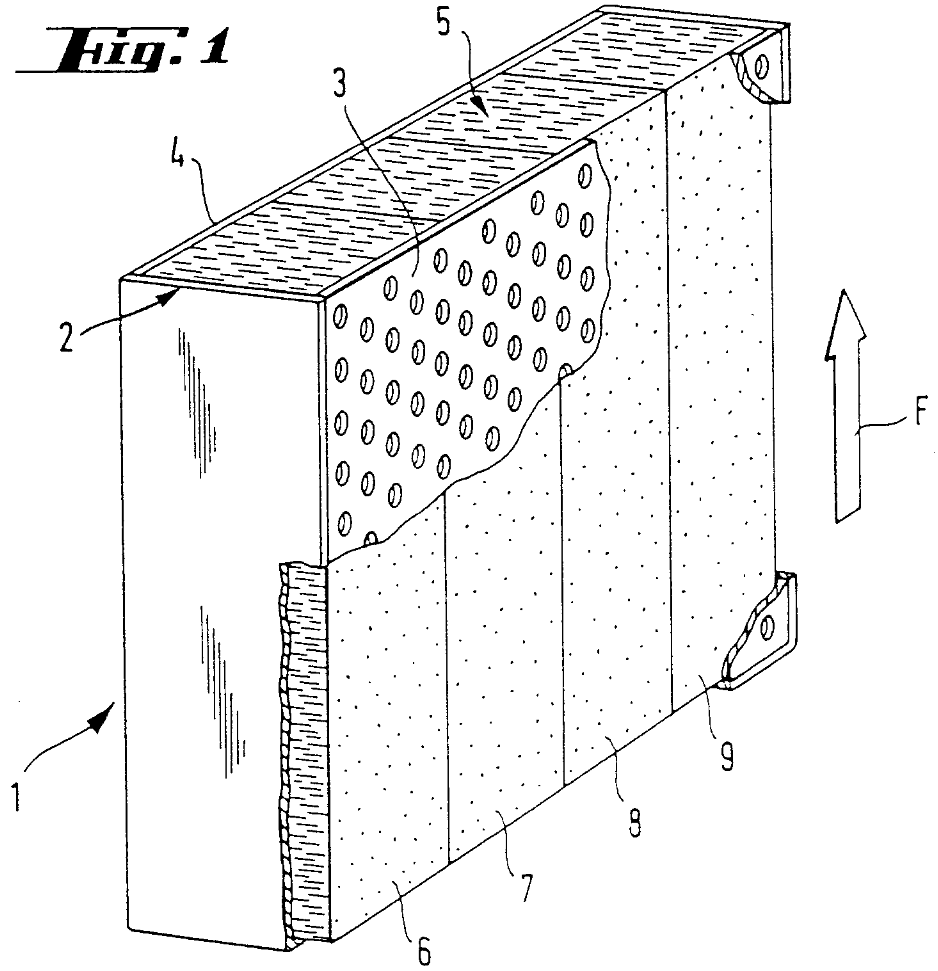
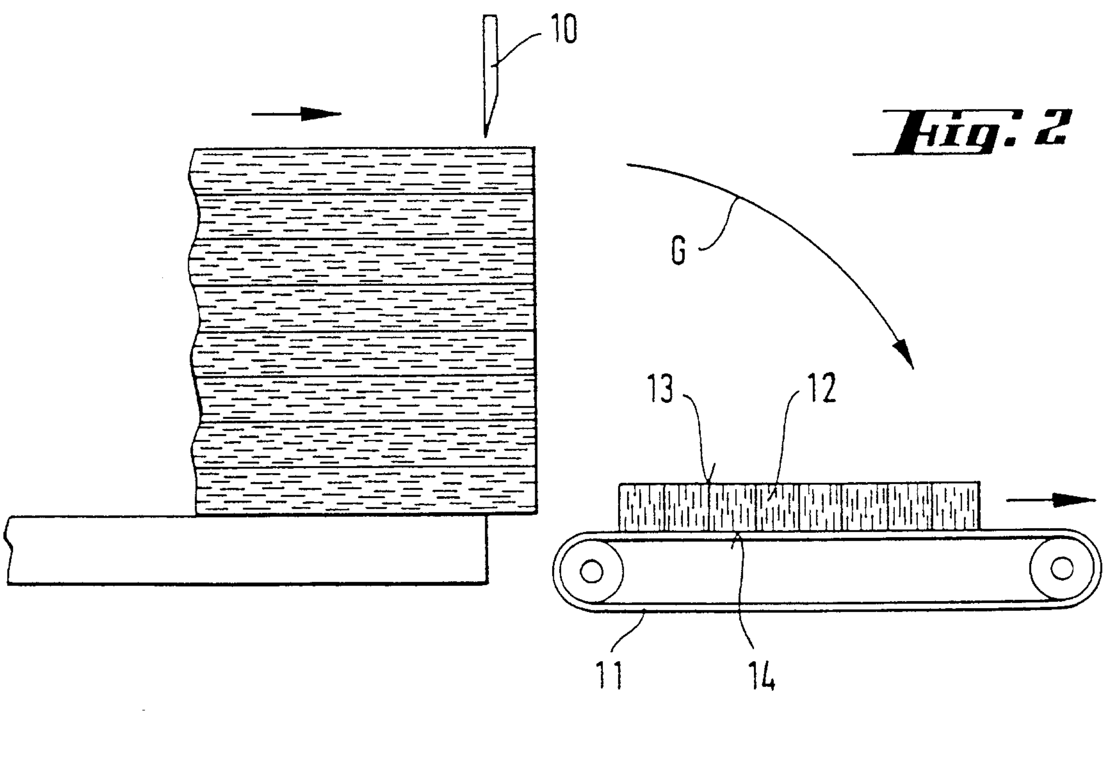


Fig. 2



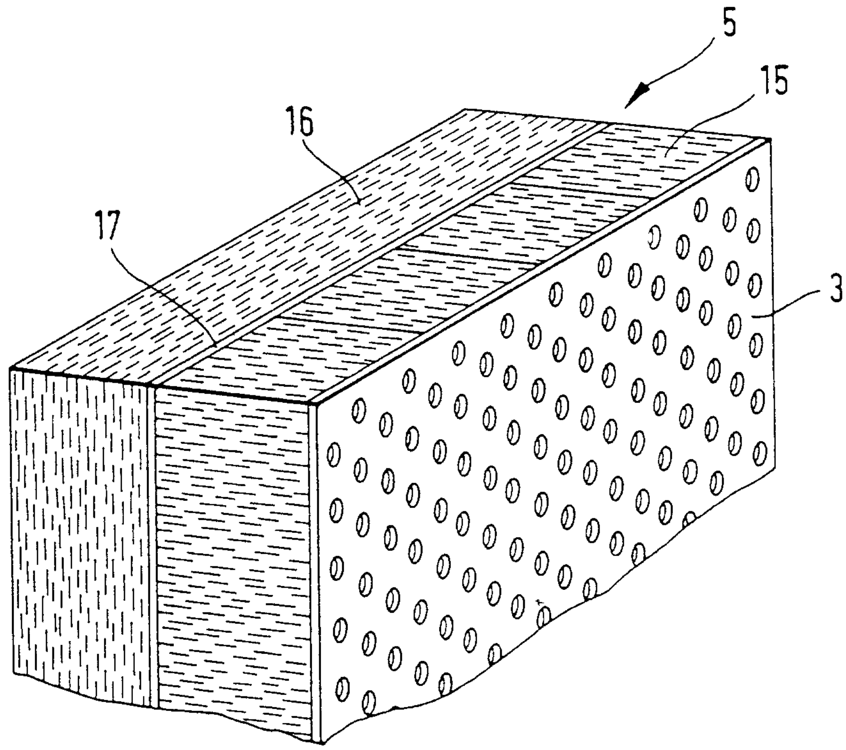


Fig. 3