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(54) SOUND-ABSORBING DEVICE FOR A WALL COVERING, CEILING COVERING, OR FLOOR COVERING

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(57) **ABSTRACT**

A sound-absorbing device for a wall covering, ceiling covering, or floor covering has a support that comprises at least one sound-absorbing layer made of polymer foam. The layer constitutes a plurality of protrusions. The protrusions are arranged with a distribution such that a straight line that is continuous over the surface of the support is not projectable through the interstices.

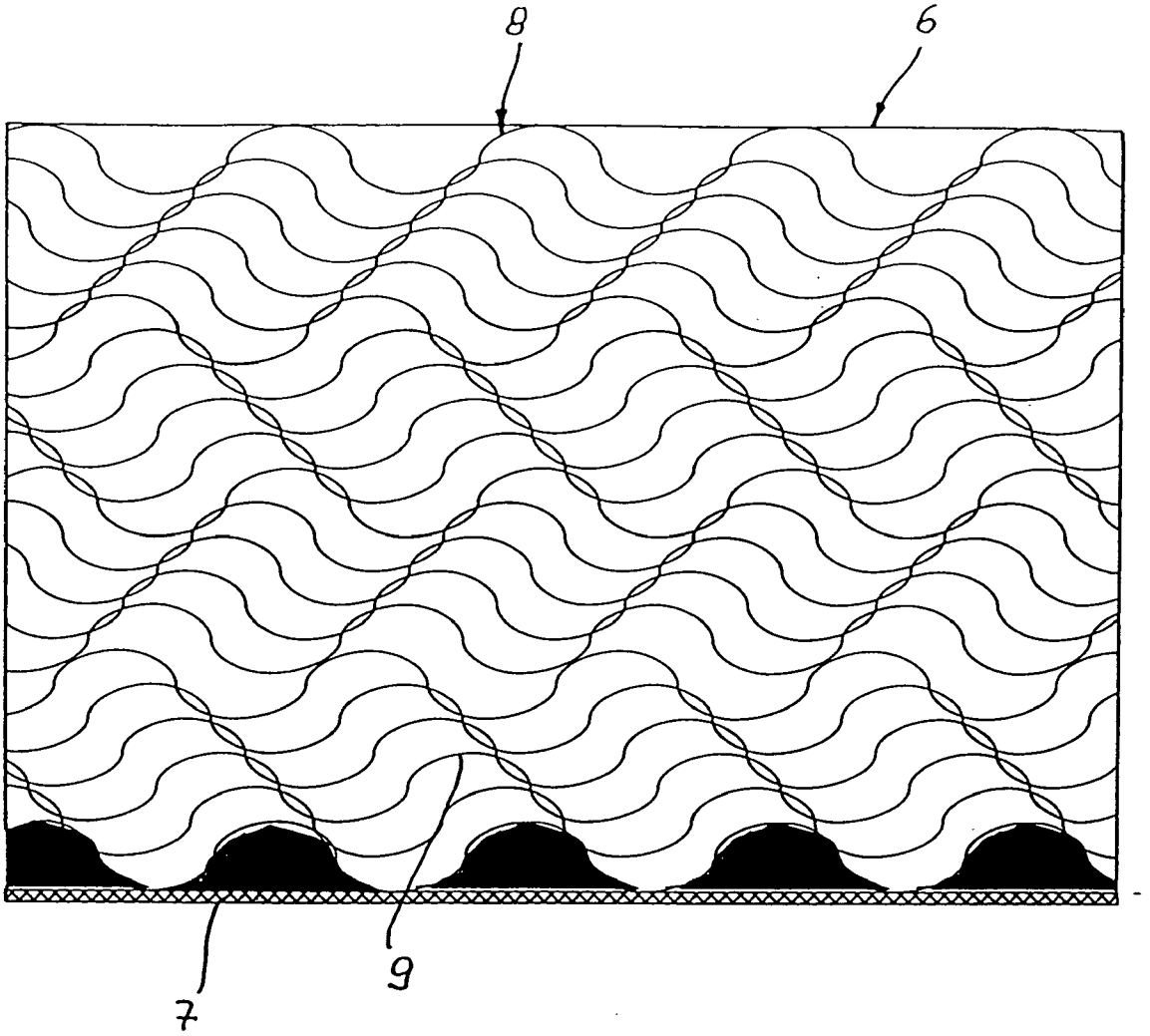


Fig. 1

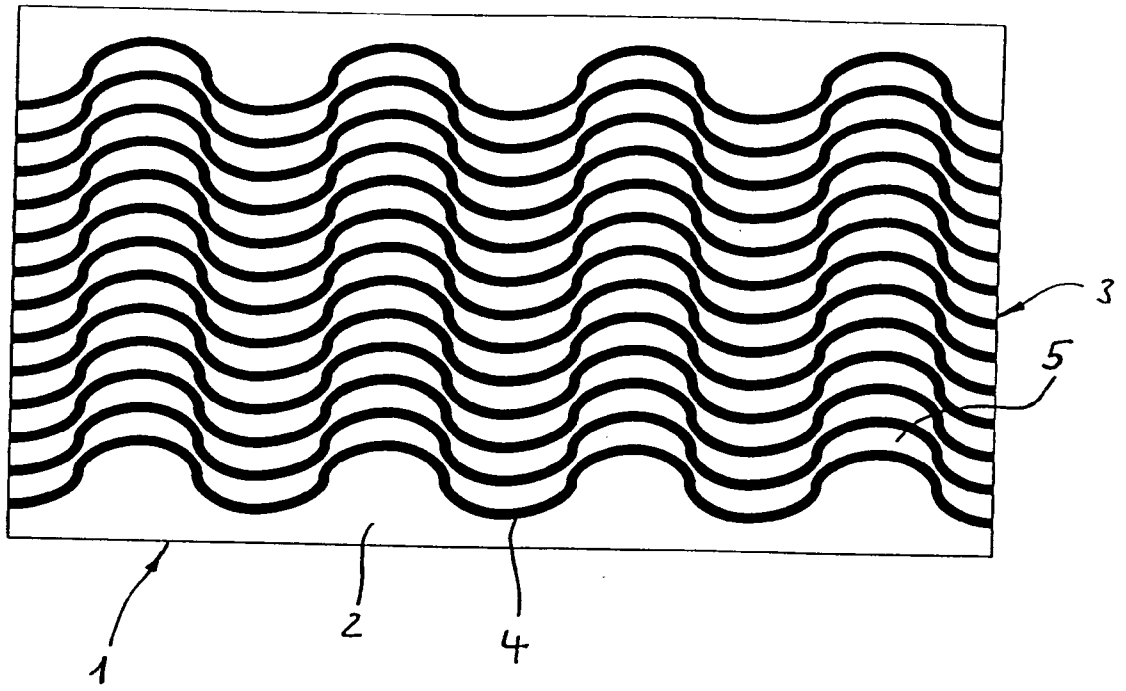


Fig. 2

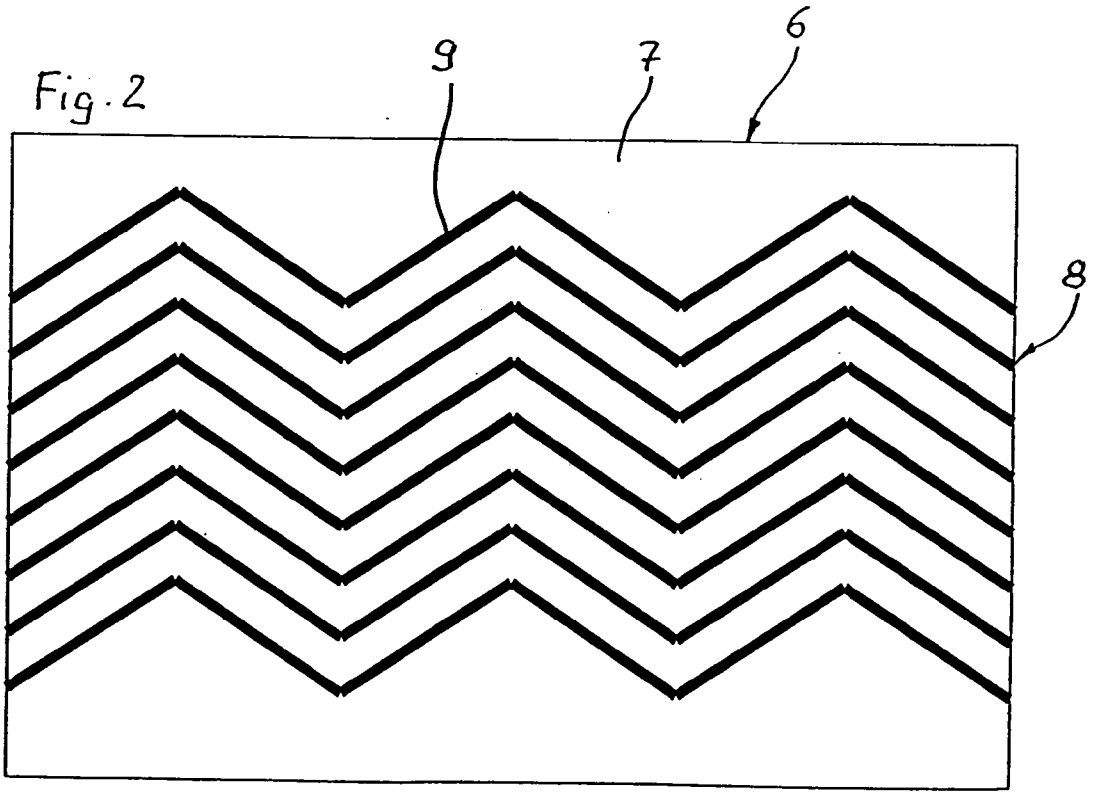


Fig. 3

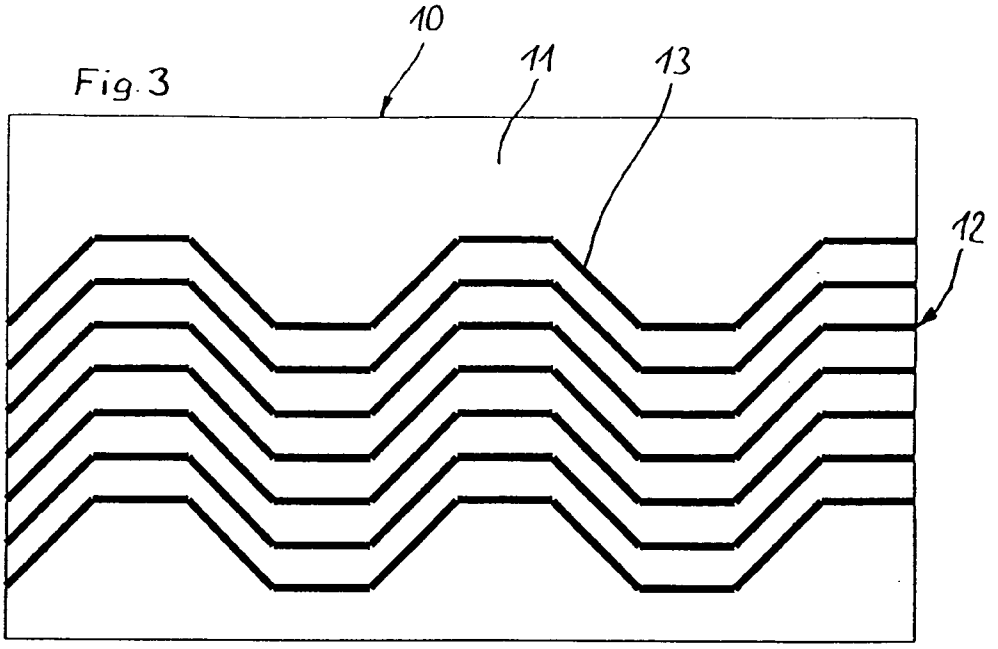


Fig. 4

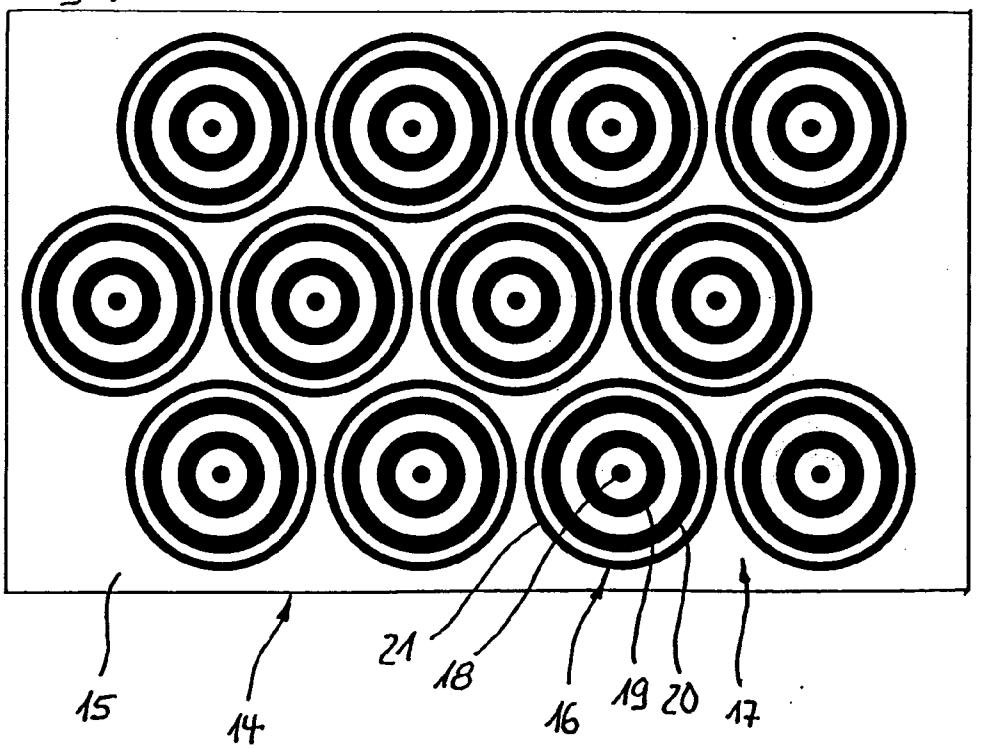


Fig. 5

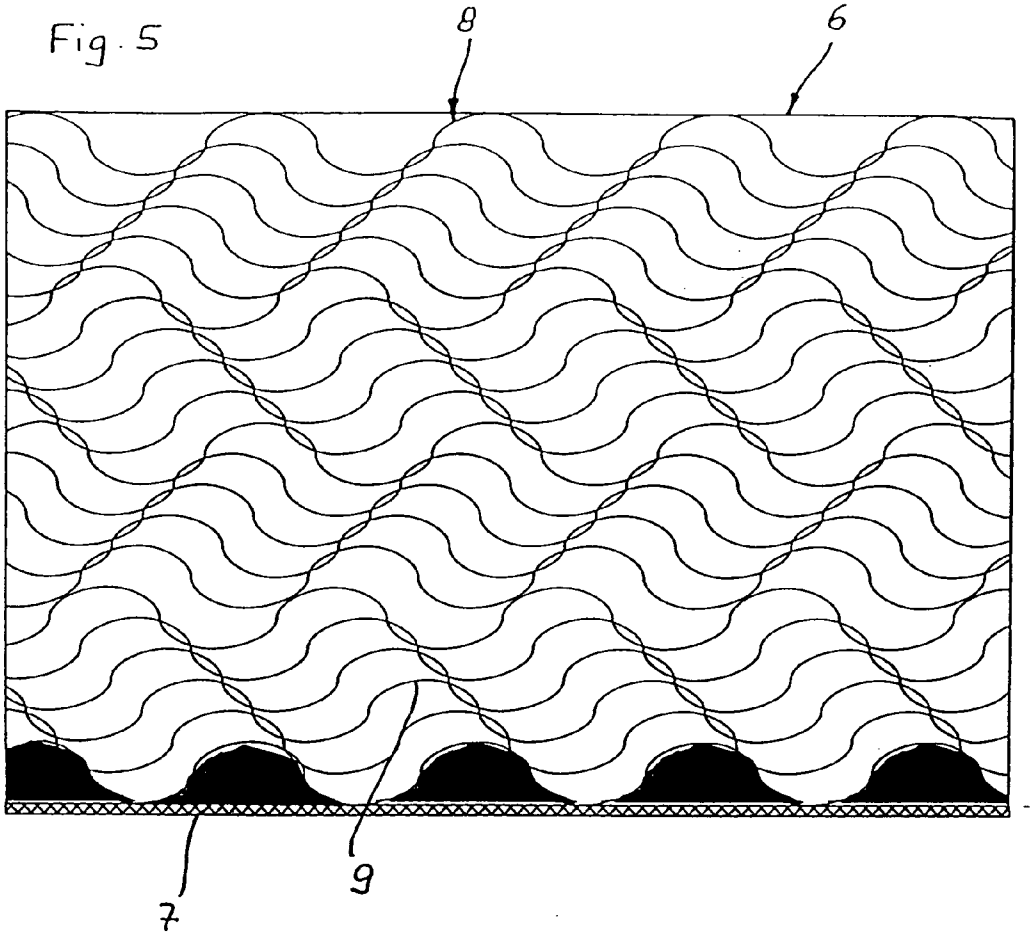


Fig. 6

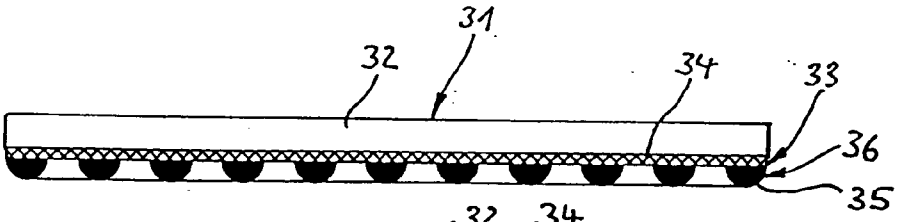


Fig. 7

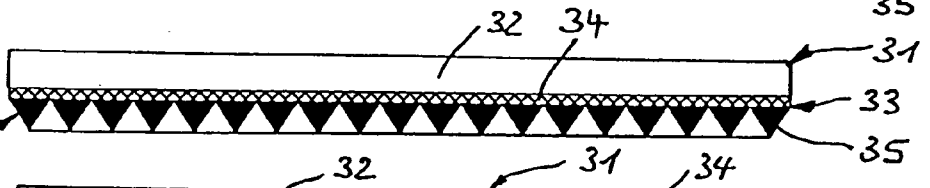


Fig. 8

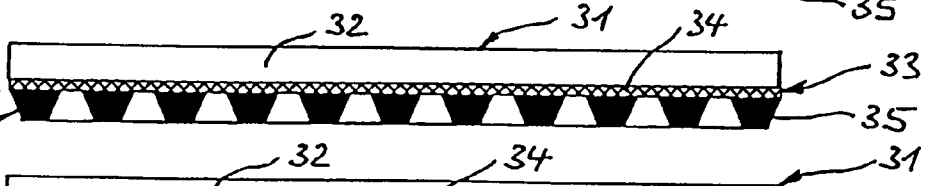
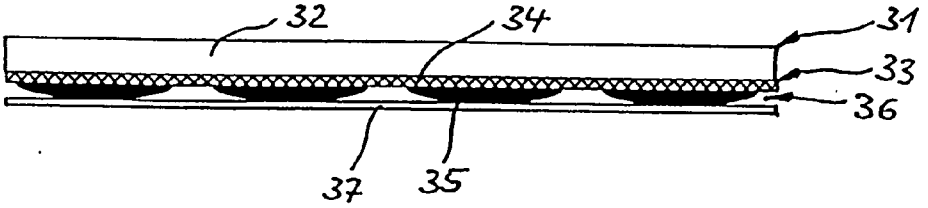


Fig. 9



SOUND-ABSORBING DEVICE FOR A WALL COVERING, CEILING COVERING, OR FLOOR COVERING

CROSS-REFERENCE TO RELATED APPLICATIONS AND CLAIM PRIORITY

[0001] This application is based upon application number 04 014 185.5, filed Jun. 17, 2004 with the European Patent Office, the disclosure of which is incorporated herein by reference and to which priority is claimed.

FIELD OF THE INVENTION

[0002] The invention concerns a sound-absorbing device for a wall covering, ceiling covering, or floor covering, having a support that comprises at least one sound-absorbing layer made of polymer foam, which layer constitutes a plurality of protrusions so as to form interstices between the protrusions. The invention further concerns a wall covering or floor covering that is equipped with the aforesaid sound-absorbing device.

BACKGROUND OF THE INVENTION

[0003] In order to improve sound absorption, in particular footstep sound absorption for floor panels, it is known to equip a panel on the rear side, which is intended for placement onto the floor or wall, with a sound-absorbing device that comprises a sound-absorbing layer. Cork plies, polymer foams, elastomers, or the like have been proposed as sound-absorbing layers (cf. WO 02/053858). The sound-absorbing layer can be immovably joined to the panel, or can be inserted loosely between the panel and the floor or wall. The sound-absorbing layer can also be combined with further layers.

[0004] JP 112 56 802 discloses a plate having a sound-absorbing layer made of a plastic foam. GB 1 103 895 A indicates a plate in which the sound-absorbing layer is made of a multi-layer plastic network. JP 7 102 744 discloses a plate having a sound-absorbing layer that constitutes a plurality of downwardly projecting semicircular ridges. A sound-absorbing layer of this kind is also evident from JP 2 001 050 551 A, the sound-absorbing layer being made of a rigid plastic foam that is covered on the underside with an additional layer.

[0005] DE-A-26 59 551 discloses a sound-absorbing device having a sound-absorbing layer that is made of foamed material, which layer constitutes a lattice made up of foamed material mullions with closed orifices. Production of such a lattice is, however, relatively complicated. EP 1 209 301 A2 presents a sound-absorbing device in which a sound-absorbing layer made of polymer foam is applied onto a support, the sound-absorbing layer being formed from a plurality of protrusions that are spaced apart from one another so as to form interstices. The protrusions are embodied as continuous or interrupted ridges, or as point-like protrusions. The interstices between the protrusions are sufficiently large that straight lines continuing over the surface of the support can be projected through them.

[0006] The previously known sound-absorbing devices bring about a sound absorption that is not entirely satisfactory. It is therefore the object of the present invention to create a sound-absorbing device for a wall covering or floor covering that brings about improved sound absorption.

SUMMARY OF THE INVENTION

[0007] According to the present invention, this object is achieved in that the protrusions are arranged with a distribution such that a straight line that is continuous over the surface of the support is not projectable through the interstices. Experiments have indicated that the radial propagation of sound as a result of the impact of, for example, a foot on the covering is substantially reduced, and sound absorption accordingly is considerably improved. Because the sound waves cannot propagate linearly in any direction without encountering protrusions of the sound-absorbing layer, they are intercepted after a short distance, with the consequence that sound absorption is particularly effective. The sound-absorbing device is characterized by ease of manufacture, for example by extrusion of the protrusions.

[0008] The protrusions can be embodied in point-like fashion, and can constitute circular or polygonal surfaces. Embodiment of the protrusions as ridges is particularly useful, the ridges proceeding in a direction-changing fashion. They can be interrupted, but also continuous.

[0009] An improvement in sound absorption is already achieved even if only some of the ridges proceed in a direction-changing fashion, but other ridges proceed in a straight line. It is preferred, however, for all of the ridges to proceed in a direction-changing fashion. The ridges can also proceed in different direction-changing fashions, so that a tangled structure is achieved. As an alternative thereto or in combination therewith, ridges can also be present that proceed parallel to one another in a direction-changing fashion. This can also be the case for all the ridges.

[0010] According to a further embodiment of the invention, provision is made for ridges to proceed in a direction-changing fashion in repeating patterns. As an alternative thereto or in combination therewith, ridges can be provided that proceed irregularly, in which context the ridges can also intersect one another. Multiple ridges can form ridge groups that proceed in different fashions.

[0011] Concretely, ridges can proceed, individually or in groups, in the shape of a wave, zigzag, or meander. As an alternative thereto or in combination therewith, ridges can also proceed in closed patterns, for example so as to form circles, spirals, or polygons, which also include triangles and rectangles. It is understood that the various embodiments of the ridge paths can also be combined with one another, i.e. wave-shaped, zigzag-shaped, meander-shaped, and/or closed patterns.

[0012] The protrusions should have a height of 0.1 to 8 mm, preferably 0.5 to 6 mm; the base width should be between 5 and 20 mm, preferably 8 mm to 12 mm. At the base, the spacing of the protrusions should be from 0 to a maximum of 10 mm. The protrusions can have any desired cross sections. For example, the protrusions can also have a rectangular shape. Preferably, however, they should taper, for example in a curved, triangular, or trapezoidal shape. The surface coverage of the protrusions at the base should be between 60 and 100%.

[0013] Viscoelastic foams made, for example, of polyurethane, polystyrene, polyether, or silicone elastomer, are suitable as the material for the protrusions. The foam should have a density of 0.2 to 2.5 kg/m^3, preferably 0.5 to 1.5 kg/m^3. The Shore A hardness should be between 20 and 70,

preferably between 30 and 50. Water uptake should be less than 2%, preferably tending toward zero.

[0014] The support for the sound-absorbing layer can be embodied, for example, as at least one support film. This can be made from paper, paperboard, board, plastic such as, for example, PE, PET, PP, or PA, or metal such as, for example, aluminum, tin, and/or copper, or combinations thereof. The support film can also be assembled from film layers of different materials. If more than one support film is provided, it may be useful to enclose the sound-absorbing layer between two support films. The support film can also be embodied as a vapor barrier or liquid barrier.

[0015] The support film(s) should have a weight of between 20 and 200 g/m^3, preferably 35 to 100 g/m^3. The thickness can be between 10 and 500 μm.

[0016] As an alternative thereto, provision can be made for the support to have a rigid or semirigid covering layer, or to be constituted thereby. The combination of sound-absorbing layer and covering layer can simultaneously constitute the wall covering or floor covering.

[0017] The support can, however, also comprise at least one textile support material, or be constituted thereof. Suitable for this, for example, are consolidated nonwoven fabric, spun-bonded fabric, woven fabric, knitted fabric, yarn layers or yarn lattices, or combinations of these materials. Commodity plastics such as PE, PP, PET, PVAc, or PVC, or also glass, can be used for the nonwoven fabric. If a woven fabric, knitted fabric, yarn layer or yarn lattice is used, PE, PP, PA, or PET, or glass, is suitable. These materials can be made of spun, texturized, multifilament, or monofilament yarns or ribbons.

[0018] Also part of the invention is a floor covering or wall covering having a covering layer as well as a sound-absorbing device as described in detail above. The sound-absorbing device can rest loosely against the underside of the covering layer, or can be joined to it, for example by adhesive bonding. The covering layer can be embodied as a panel or as a plastic web.

[0019] The sound-absorbing device according to the present invention can be manufactured in such a way that the sound-absorbing layer is applied onto the support by means of nozzles. As an alternative thereto, however, the sound-absorbing layer can also be configured so that firstly a foam layer is applied in planar fashion onto the support, and then the not-yet-cured foam is embossed with a negative die, preferably so that compressed zones are created in the valleys between the protrusions. This can also be assisted by the fact that the embossing takes place at elevated temperatures, so that the foam melts together in the valleys and thereby becomes even further compressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The invention is illustrated in more detail, with reference to several schematically depicted exemplifying embodiments, in the drawings, in which:

[0021] **FIG. 1** is a plan view of a sound-absorbing device having wave-shaped ridges;

[0022] **FIG. 2** is a plan view of a second sound-absorbing device having ridges proceeding in zigzag fashion;

[0023] **FIG. 3** is a plan view of a third sound-absorbing device having ridges proceeding in trapezoidal fashion;

[0024] **FIG. 4** is a plan view of a sound-absorbing device having groups of concentrically arranged ridges;

[0025] **FIG. 5** is a perspective plan view of the sound-absorbing device according to **FIG. 2**; and

[0026] FIGS. **6** to **9** are cross-sections through panels having sound-absorbing devices that comprise ridges of various cross sections.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0027] The exemplifying embodiment according to **FIG. 1** shows a sound-absorbing device **1** that comprises a support film **2** having a sound-absorbing layer **3** applied thereonto. Sound-absorbing layer **3** is constituted by ridges (labeled **4** by way of example) that follow a wave-shaped path, such that ridges **4** proceed substantially parallel to one another. The path of each ridge **4** is respectively symbolized by a line. The spacing of ridges **4** from one another is so close that interstices (labeled **5** by way of example) into which a continuous straight line cannot be projected are formed. In this fashion, the sound waves moving out from a point encounter ridges **4** after only a short distance, i.e. cannot propagate over the entire surface of sound-absorbing device **1**, but instead are broken up in each case by the particular shape and arrangement of ridges **4**.

[0028] **FIG. 2** shows a second sound-absorbing device **6** having a support film **7** and a sound-absorbing layer **8** applied thereonto. The latter is constituted by ridges (labeled **9** by way of example) that in this instance proceed in zigzag fashion but otherwise parallel to one another. Here as well, the path of each ridge **9** is respectively symbolized by a line. In this sound-absorbing device **6**, the spacing of ridges **9** from one another is likewise so small that a straight line continuing over the surface of sound-absorbing layer **6** could not be projected into the interstices between ridges **9**.

[0029] **FIG. 3** depicts a further sound-absorbing device **10** in which a sound-absorbing layer **12**, comprising ridges (labeled **13** by way of example) proceeding back and forth in trapezoidal fashion, is present on a support film **11**. Ridges **13** are once again symbolized by lines. They extend parallel to one another and have such a small spacing that a continuous straight line could not be placed into the interstices.

[0030] **FIG. 4** shows a sound-absorbing device **14**. In this sound-absorbing device **14**, circle groups (labeled **16** by way of example) separated from one another, which are arranged in offset rows one behind another and together form a sound-absorbing layer **17**, are applied onto a support film **15**. Each circle group **16** comprises one central point-like ridge **18** as well as ridges **19**, **20**, **21** concentric therewith.

[0031] The interstices between ridges **18**, **19**, **20**, **21** form closed rings. Circle groups **16** are offset from one another in such a way that a straight line continuing over the surface of sound-absorbing device **14** could not be projected into the interstices between circle groups **16**.

[0032] **FIGS. 6 through 9** depict examples of various ridge cross section shapes, identical or identically functioning parts being labeled with the same reference numbers. Floor coverings **31**, each comprising a wood panel **32** and a

sound-absorbing device (labeled **33** in its entirety) that is adhesively bonded onto the underside of the respective wood panel **32**, are depicted in cross section. Each sound-absorbing device **33** has on the panel side a support film **34** whose underside is equipped with ridges (labeled **35** by way of example). Ridges **35** in each case form a sound-absorbing layer **36**.

[**0033**] In **FIG. 6**, ridges **35** have a semicircular cross section, in **FIG. 7 a** triangular cross section, in **FIG. 8 a** trapezoidal cross section, and in **FIG. 9 a** lenticular cross section. In the example depicted in **FIG. 9**, ridges **35** are covered with an external film **37**, so that sound-absorbing layer **36** and its ridges **35** are enclosed by support film **34** on one side and by external film **37** on the other side.

1. A sound-absorbing device (**1, 6, 10, 33**) for a wall covering, ceiling covering, or floor covering (**31**), having a support (**2, 7, 11, 15, 34, 37**) that comprises at least one sound-absorbing layer (**3, 8, 12, 17, 36**) made of polymer foam, which layer constitutes a plurality of protrusions (**4, 9, 13, 18-21, 35**),

wherein the protrusions (**4, 9, 13, 18-21, 35**) are arranged with a distribution such that a straight line that is continuous over the surface of the support (**2, 7, 11, 15, 34, 37**) is not projectable through the interstices.

2. The sound-absorbing device as defined in claim 1, wherein the protrusions are embodied in point-like fashion.

3. The sound-absorbing device as defined in claim 2, wherein the protrusions constitute circular or polygonal surfaces.

4. The sound-absorbing device as defined in claim 1, wherein the protrusions are embodied as ridges (**4, 9, 13, 18-21, 35**).

5. The sound-absorbing device as defined in claim 4, wherein ridges (**4, 9, 13, 18-21, 35**) proceed in a direction-changing fashion.

6. The sound-absorbing device as defined in claim 5, wherein ridges (**4, 9, 13, 18-21, 35**) are continuous.

7. The sound-absorbing device as defined in claim 5, wherein all the ridges (**4, 9, 13, 18-21, 35**) proceed in a direction-changing fashion.

8. The sound-absorbing device as defined in claim 5, wherein ridges are present that proceed in different direction-changing fashions.

9. The sound-absorbing device as defined in claim 5, wherein ridges (**4, 9, 13, 18-21, 35**) are present that proceed parallel to one another in a direction-changing fashion.

10. The sound-absorbing device as defined in claim 5, wherein ridges (**4, 9, 13, 18-21, 35**) proceed in a direction-changing fashion in repeating patterns.

11. The sound-absorbing device as defined in claim 5, wherein ridges proceed irregularly in a direction-changing fashion.

12. The sound-absorbing device as defined in claim 5, wherein the ridges do not intersect one another.

13. The sound-absorbing device as defined in claim 5, wherein multiple ridges respectively form ridge groups that proceed in different fashions.

14. The sound-absorbing device as defined in claim 5, wherein ridges (**4, 9, 13**) proceed in the shape of a wave or meander.

15. The sound-absorbing device as defined in claim 5, wherein ridges (**18-21**) proceed in closed patterns.

16. The sound-absorbing device as defined in claim 15, wherein ridges (**18-21**) proceed so as to form circles, spirals, or polygons.

17. The sound-absorbing device as defined in claim 5, wherein the cross section of the protrusions (**4, 9, 13, 18-21, 35**) can be curved, rectangular, triangular, lenticular, or trapezoidal.

18. The sound-absorbing device as defined in claim 1, wherein the protrusions (**4, 9, 13, 18-21, 35**) have a height of 0.1 to 8 mm, preferably 0.5 to 6 mm.

19. The sound-absorbing device as defined in claim 1, wherein protrusions (**4, 9, 13, 18-21**) of different heights are present.

20. The sound-absorbing device as defined in claim 1, wherein the protrusions (**4, 9, 13, 18-21, 35**) have a base width of 5 to 20 mm, preferably 8 to 12 mm.

21. The sound-absorbing device as defined in claim 1, wherein the spacing of the protrusions (**4, 9, 13, 18-21, 35**) ranges from 0 to 10 mm.

22. The sound-absorbing device as defined in claim 1, wherein the surface coverage of the protrusions (**4, 9, 13, 18-21, 35**) at the base of the ridges ranges from 60 to 100%.

23. The sound-absorbing device as defined in claim 1, wherein the protrusions (**4, 9, 13, 18-21, 35**) are made of polyurethane, polystyrene, polyether, or silicone elastomer.

24. The sound-absorbing device as defined in claim 1, wherein the polymer foam has a density of 0.2 to 2.5 kg/m^3, preferably 0.5 to 1.5 kg/m^3.

25. The sound-absorbing device as defined in claim 1, wherein the polymer foam has a Shore A hardness of 20 to 70, preferably 30 to 50.

26. The sound-absorbing device as defined in claims **1**, wherein the polymer foam has a water uptake of less than 2%.

27. The sound-absorbing device as defined in claim 1, wherein the support is embodied as at least one continuous, embossed, or perforated support film (**2, 7, 11, 15, 34**).

28. The sound-absorbing device as defined in claim 27, wherein the support film (**2, 7, 11, 15, 34, 37**) is made from paper, paperboard, board, plastic, or metal, or combinations thereof.

29. The sound-absorbing device as defined in claim 27, wherein the support film (**2, 7, 11, 15, 34, 37**) is embodied as a vapor barrier or liquid barrier.

30. The sound-absorbing device as defined in claim 27, wherein the support film (**2, 7, 11, 15, 34, 37**) is assembled from film layers of different materials.

31. The sound-absorbing device as defined in claim 27, wherein the sound-absorbing layer (**36**) is enclosed between two support films (**34, 37**).

32. The sound-absorbing device as defined in claim 27, wherein the support film(s) (**2, 7, 11, 15, 34, 37**) has or have a weight of between 20 and 200 g/m^2, preferably 35 and 100 g/m^2.

33. The sound-absorbing device as defined in claim 27, wherein the support film(s) (**2, 7, 11, 15, 34, 37**) has or have a thickness of between 10 and 500 μm.

34. The sound-absorbing device as defined in claim 1, wherein the support has a rigid or semirigid covering layer, or is constituted thereby.

35. The sound-absorbing device as defined in claim 1, wherein the support comprises at least one textile support material, or is constituted thereby.

36. The sound-absorbing device as defined in claim 35, wherein the textile support material is embodied as consolidated nonwoven fabric, as spun-bonded fabric, woven fabric, knitted fabric, yarn layers or yarn lattices, or as a combination thereof.

37. The sound-absorbing device as defined in claim 36, wherein the nonwoven fabric is made of PE, PP, PET, PVAc, PVC, or similar commodity plastics, or of glass.

38. The sound-absorbing device as defined in claim 37, wherein the woven fabric, knitted fabric, yarn layer or yarn lattice is made of PE, PP, PA, or PET, or glass.

39. The sound-absorbing device as defined in claim 36, wherein the woven fabric, knitted fabric, yarn layer, or yarn lattice is made of spun, texturized, multifilament, or monofilament yarns or ribbons.

40. The sound-absorbing device as defined in claim 27, wherein the support comprises a combination of support film and textile support material.

41. A floor covering or wall covering **(31)** having a covering layer **(32)**, and having a sound-absorbing device **(33)** as defined in claim 1.

42. The floor covering or wall covering as defined in claim 41, wherein the sound-absorbing device **(33)** rests loosely against the underside of the covering layer **(32)**.

43. The floor covering or wall covering as defined in claim 41, wherein the sound-absorbing device **(33)** is joined to the underside of the covering layer **(32)**.

44. The floor covering or wall covering as defined in claim 41, wherein the covering layer is embodied as a panel **(32)** or as a plastic web.

* * * * *