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(54) **SILL-PAD**

(57) A load-carrying, vibration-damping and sound-insulating sill-pad (2) for placement between two building elements is in the form of an extruded, preferably co-extruded, profile, comprising a load-carrying base block (4) made of rubber, and at least one sealing lip (6) made of rubber and formed on the base block (4). It may further comprise one or more load-carrying bulges (8) formed on top of the base block (4), the one or more load-carrying bulges (8) being made of rubber. The rub-

ber may be EPDM. The base block (4) may have a U-shaped cross-section, comprising a first load-carrying section (10) and a second load-carrying section (12), the first load-carrying section (10) and the second load-carrying section (12) being transversally spaced, so that a gap (14) for a fire swelling strip (18) or a reinforcement strip (24) is formed between the first load-carrying section (10) and the second load-carrying section (12).

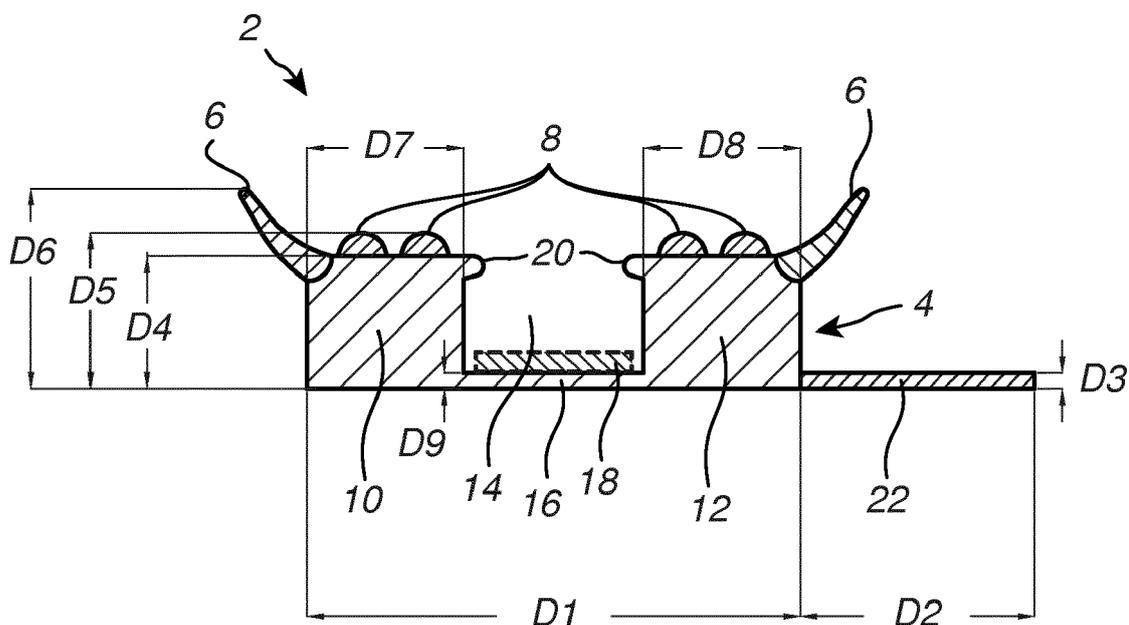


Fig. 1

Description

Field of technology

[0001] The present inventive concept relates to a load-carrying, vibration-damping sill-pad for placement between two building elements and to a method of manufacturing the same.

Background

[0002] Sill-pads are load-carrying, resilient elements placed between building elements, for example between a wall and a floor, between a wall and a ceiling, or between a floor and a supporting structure of the floor. They absorb and dampen vibrations, thereby preventing the vibrations from propagating between the building elements and spreading throughout the building structure of which the building elements form part.

[0003] Conventionally, sill-pads are produced as rectangular blocks of polyurethane.

[0004] As for all building elements, there is always a need to provide an improved sill-pad that may provide additional functionality while still being economical and easy to install.

Summary

[0005] To this end, according to a first aspect, there is provided a load-carrying, vibration-damping and sound-insulating sill-pad for placement between two building elements, in the form of an extruded, preferably co-extruded, profile, comprising a load-carrying base block made of rubber, and at least one sealing lip made of rubber and formed on the base block.

[0006] Since the sill-pad is in the form of an extruded profile, the one or more sealing lips extend longitudinally along the sill-pad.

[0007] With "sealing lip" should be understood a non-load-carrying member configured to provide sealing by pushing against a surface due to being biased through bending.

[0008] Hereby, there is provided a sill-pad which, through the sealing lip, may seal against at least one of the building elements. Thereby, in addition to providing vibration damping between the building elements, the sill-pad provides excellent sound insulation, by reducing transmission of sound through the gap between the building elements - such transmission being a case of so-called flanking transmission - to a degree otherwise not possible without additional sealing arrangements external to the sill-pad. In this way, both vibration damping between the building elements and excellent reduction of flanking transmission is provided by a single element, the sill-pad. Hereby, the amount of construction material needed to provide both vibration damping and sound insulation is reduced, leading to a reduction in material cost and required installation work.

[0009] Further, since the sill-pad is in the form of an elongated extruded profile in one piece, which can be cut to suitable length, the sill-pad is easy to install in comparison to individual, short, polyurethane blocks.

[0010] The rubber may be ethylene propylene diene monomer rubber (EPDM), which is a durable material that has elastic properties and absorption properties that are well suited for vibration damping, as well good sealing properties. Alternatively, the rubber may be any other natural or synthetic rubber such as natural rubber (NR), styrene rubber (SBR), chloroprene rubber (CR), butyl rubber (IIR), silicone rubber (Q), or a mixture thereof, such as a mixture of natural rubber and styrene rubber (NR/SBR).

[0011] The base block may be made of rubber having a first hardness and the at least one sealing lip of rubber having a second hardness, wherein the second hardness is different from the first hardness. This allows optimization of both, on the one hand, the load-carrying and vibration-damping properties of the sill-pad, and, on the other hand, the sealing properties of the sealing lip, thus resulting in a sill-pad with both favorable vibration-damping properties and favorable sealing properties.

[0012] Preferably, the second hardness is lower than the first hardness. The base block being made in a harder-grade rubber allows the base block to provide suitable elasticity properties for vibration damping, while the softer-grade rubber of the sealing lip allows the sealing lip to be soft enough to follow the surface of the building element, improving sealing, and thereby improving the reduction of flanking transmission of sound.

[0013] The sill pad may further comprise one or more load-carrying bulges formed on top of the base block, with the one or more load-carrying bulges being made of rubber. Since the sill-pad is in the form of an extruded profile, the one or more load-carrying bulges extend longitudinally along the sill-pad. Typically, the one or more load-carrying bulges have a curved surface and/or extends outward from a substantially flat main surface of the base block.

[0014] In this way, with the sill-pad in use between two building elements, a building element located on top of the sill-pad will rest on the one or more load-carrying bulges. The existence of one or more load-carrying bulges allow tuning of the vibration-damping properties of the sill-pad, including frequency damping response, independently of the basic stiffness and load-carrying properties provided by the base block of the sill-pad. Due to the one or more load-carrying bulges providing an interface between the building element located on top of the sill-pad and the rest of the sill-pad, the geometry of the one or more load-carrying bulges will be decisive for the vibration-damping properties of the sill-pad. Thus, these properties may be tuned by varying the geometry, for example the cross-section area or surface curvature, of the one or more load-carrying bulges, or, alternatively or additionally, by adjusting the rubber hardness of the one

or more load-carrying bulges. Thus, the one or more load-carrying bulges may be made of rubber having a third hardness different from the first hardness. Typically, the third hardness is lower than the first hardness.

[0015] The first hardness may be a Shore A hardness in the range 40-90 and preferably in the range 60-90. The second hardness and/or the third hardness may be a Shore A hardness in the range 40-90 and preferably in the range 40-60.

[0016] The base block may have a U-shaped cross-section, comprising a first load-carrying section, a second load-carrying section, and a joining section, the first load-carrying section and the second load-carrying section being transversally spaced and joined by the joining section, so that a gap for a fire swelling strip or a reinforcement strip is formed between the first load-carrying section and the second load-carrying section.

[0017] The gap provides space for an optional thermally-expanding fire swelling strip which provides a fire barrier, improving fire safety.

[0018] Alternatively, a reinforcement strip, typically made of hard, such as 90 Shore A hardness, rubber, preferably EPDM, may be placed in the gap, in case a high load-carrying capacity is required.

[0019] Alternatively yet again, a sound-insulating foam strip may be placed in the gap for improving sound insulation and/or thermal insulation. This is advantageous when two sill pads meet at a 90-degree angle, each sill-pad having a 45-degree cut relative to their respective transversal directions, wherein the flexible sound-insulating foam strip may be bent at a 90-degree angle and put in the respective gaps across the interface between the two sill-pads, improving sealing in the gap between the sill pads.

[0020] Thus, the gap formed in the sill-pad may be used for several different applications. The specific application may be chosen on the construction site according to need, using the same basic sill-pad, only supplemented with, e.g., a fire-swelling strip, a reinforcement strip, or a sound-insulating foam strip, according to need. Through the improved flexibility, this is cost saving, as only one kind of sill-pad needs to be ordered and can be used in several different settings.

[0021] The joining section may preferably have a thickness of at most 5 mm and more preferably at most 3 mm. This makes the joining section thin enough to allow the functions of the fire-swelling strip or the reinforcement strip to dominate, while still providing enough sturdiness for keeping the two load-carrying sections together.

[0022] The gap may have snap stops located on either load-carrying section for keeping a reinforcement strip or similar in place.

[0023] The sill-pad may further comprise a substantially flat lateral flange made of rubber, preferably EPDM, for nailing or stapling the sill-pad to one of the two building elements, wherein the lateral flange preferably has a thickness of at most 3 mm. This provides a convenient way of attaching the sill-pad to the lower one of the build-

ing elements by nailing the sill-pad to the lower one of the building elements. As an alternative to placement in the gap, for example if a reinforcement strip is placed in the gap, a fire swelling strip may be placed on the flange.

[0024] According to a second aspect, there is provided a method of manufacturing load-carrying vibration-damping and sound-insulating sill-pad for placement between two building elements, comprising extruding, preferably co-extruding a load-carrying base block made of rubber, and at least one sealing lip made of rubber and formed on the base block.

[0025] Co-extruding the elements of the profile allows for rational and cost-effective manufacturing of the sill-pad.

[0026] The method may further comprise extruding, preferably co-extruding one or more load-carrying bulges formed on top of the base block, the one or more load-carrying bulges being made of rubber.

[0027] Effects and features of this second aspect are analogous to those described above in connection with the first aspect. Embodiments mentioned in relation to the first aspect are compatible with this second aspect.

[0028] According to a third aspect, there is provided a load-carrying, vibration-damping and/or sound-insulating sill-pad for placement between two building elements, in the form of an extruded profile made of rubber, comprising a load-carrying base block made of rubber, and one or more load-carrying bulges made of rubber, the one or more load-carrying bulges being formed on top of the base.

[0029] Effects and features of this third aspect are analogous to those described above in connection with the first aspect. Embodiments mentioned in relation to the first aspect are compatible with this third aspect.

[0030] According to a fourth aspect, there is provided a method of manufacturing a vibration-damping and/or sound-insulating sill-pad for placement between two building elements, comprising extruding, preferably co-extruding a load carrying base block made of rubber, and one or more load-carrying bulges made of rubber, the one or more load-carrying bulges being formed on top of the base.

[0031] Effects and features of this fourth aspect are analogous to those described above in connection with the first aspect and the second aspect. Embodiments mentioned in relation to the first aspect and the second aspect are compatible with this fourth aspect.

[0032] According to a fifth aspect, there is provided a there is provided a load-carrying, vibration-damping sill-pad for placement between two building elements, in the form of an extruded profile, comprising a load-carrying base block made of rubber, wherein the base block has a U-shaped cross-section, comprising a first load-carrying section, a second load-carrying section, and a joining section, the first load-carrying section and the second load-carrying section being transversally spaced and joined by the joining section, so that a gap for a fire swelling strip or a reinforcement strip is formed between the

first load-carrying section and the second load-carrying section, the joining section preferably having a thickness of at most 5 mm and more preferably at most 3 mm.

[0033] Effects and features of this fifth aspect are analogous to those described above in connection with the first aspect. Embodiments mentioned in relation to the first aspect are compatible with this fifth aspect.

[0034] According to a sixth aspect, there is provided a method of manufacturing load-carrying vibration-damping sill-pad for placement between two building elements, comprising extruding a load-carrying base block made of rubber, wherein the base block has a U-shaped cross-section, comprising a first load-carrying section, a second load-carrying section, and a joining section, the first load-carrying section and the second load-carrying section being transversally spaced and joined by the joining section, so that a gap for a fire swelling strip or a reinforcement strip is formed between the first load-carrying section and the second load-carrying section, the joining section preferably having a thickness of at most 5 mm and more preferably at most 3 mm.

[0035] Effects and features of this sixth aspect are analogous to those described above in connection with the first aspect and the second aspect. Embodiments mentioned in relation to the first aspect and the second aspect are compatible with this sixth aspect.

[0036] According to a seventh aspect, there is provided a kit, comprising the sill-pad of the first, third, or fifth aspects, and one or more selected from the following, adapted to fit in the gap: a fire swelling strip, a reinforcement strip and/or a sound-insulating strip.

[0037] Effects and features of this seventh aspect are analogous to those described above in connection with the first aspect. Embodiments mentioned in relation to the first aspect are compatible with this fifth aspect.

Brief description of the drawings

[0038] The above, as well as additional objects, features and advantages of the present inventive concept, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig. 1 shows a cross-sectional view of a sill pad together with an optional fire swelling strip, and Fig. 2 shows a cross-sectional view of the sill pad of Fig. 1 together with an optional reinforcement strip and an optional fire swelling strip.

Detailed description

[0039] Fig. 1 shows a cross-sectional view of a sill-pad 2 in the form of an extruded profile made of rubber. In the present example, the rubber is ethylene propylene diene monomer rubber (EPDM), but other natural or syn-

thetic rubbers such as natural rubber (NR), styrene rubber (SBR), chloroprene rubber (CR), butyl rubber (IIR), silicone rubber (Q) or a mixture thereof, such as a mixture of natural rubber and styrene rubber (NR/SBR) are also possible. The sill-pad 2, when in use, provides vibration damping by absorbing vibrations from one more building elements with which it is in contact. Since the sill-pad 2 is in the form of an extruded profile, it has the same cross-section along the length of the sill-pad. The extruded profile may be cut into suitable lengths either at the point of manufacturing or at the point of use. A typical such length is several meters.

[0040] The sill-pad 2 is mainly formed by a load-carrying base block 4. The outer envelope of the base block 4 is generally rectilinear, having a width D1, which typically may be about 60 mm. The base block 4 has an optional gap 14 which will be further described below.

[0041] The base block 4 has a height D4, which typically is about 17 mm.

[0042] The base block 4 is made from rubber having a first Shore A hardness in the range 40-90 and preferably in the range 60-90. Typically, it may be made from rubber having a Shore A hardness of 70.

[0043] When the sill-pad 2 is in use for damping vibrations between an upper building element (not shown) and a lower building element (not shown), the base block 4 will rest with its lower surface on the lower building element and the upper building element will rest on top of the sill-pad 2.

[0044] At each opposite lateral upper corner of the base block 4, there is a diagonally upward-pointing sealing lip 6. These two sealing lips 6 thus formed extend up to a height D6, which is larger than the height D4 of the base block 4 and the height D5 of the optional load-carrying bulges 8 (see below). Therefore, with the sill-pad 2 in use, the upper building element will push downwards onto the sill-pad on which it is resting, bending the sealing lips 6, biasing the sealing lips 6 through bending so that the sealing lips 6 push back against the building element, sealing against the surface of the upper building element, thereby reducing sound transmission through the gap between the upper building element and the lower building element.

[0045] A typical height D6 is about 26 mm.

[0046] The sealing lips 6 may be made from rubber having a second Shore A hardness in the range 40-90, preferably in the range 40-60. Typically, the sealing lips 6 may be made from rubber having a Shore A hardness of 50.

[0047] If the sealing function is not needed, the sealing lips 6 may be omitted from the sill-pad 2.

[0048] The sill-pad 2 optionally further comprises a set of load-carrying bulges 8 formed on top of the base block 4, which here has the form of an otherwise substantially flat surface. In the depicted example, each bulge 8 has a semicircular cross-section, thus having a curved surface, although other geometries for the bulge 8 are equally possible. Preferably, the diameter of each of the

semicircles forming each bulge 8 may be between 3 mm and 10 mm. Typically, as depicted, the diameter of each bulge 8 semicircle may be about 6 mm. In the depicted example, there are four bulges 8 formed on the base block 4, with two bulges 8 formed on the first load-carrying section 10 (see below) and another two bulges 8 formed on the second load-carrying section 12 (see below).

[0049] With the sill-pad in use, the upper building element will rest on the load-carrying bulges 8, which will slightly compress along with the base block 4. In an uncompressed state, the bulges reach to a height D5, which amounts to the height of the base block 4 plus the radius of the bulges. This height D5 lies between the height D6 of the sealing lip 6, when present, and the height D4 of the base block 4.

[0050] The load carrying bulges 8 may be made from rubber having a third Shore A hardness in the range 40-90, preferably in the range 40-60. Typically, they may be made from rubber having a Shore A hardness of 50.

[0051] Optionally, the base block 4 may, instead of being a solid block having a rectangular cross section, have a U-shaped cross-section, comprising, as depicted in Fig. 1, a first load carrying-section 10 and a second load-carrying section 12, transversally spaced apart from each other and therebetween joined by a thin joining section 16, thereby forming a gap 14 between the first load-carrying section 10 and the second load-carrying section 12. When the sill pad is in use, the joining section 16 will rest on the lower building element.

[0052] The first load-carrying section 10 has a width D7 and the second load-carrying section 12 has a width D8. Preferably, widths D7 and D8 are each between 20% and 40% of the total width D1 of the base block 4. Typically, as depicted, D7 and D8 are each about one third of D1, or about the same as the height D4 of the base block. Preferably each of D7 and D8 are between 10 mm and 30 mm. A typical value for each of D7 and D8 is about 20 mm. The ratios and measurements above allow for a good balance between the load-carrying and vibration-damping properties of the first load-carrying section 10 and the second load-carrying section 12 and leaving enough space in the gap for proper functioning of, e.g., a fire swelling strip or a reinforcement strip (see below).

[0053] The joining section 16 preferably has a height D9 of less than 5 mm and more preferably of less than 3 mm. A typical value of D9 is, as depicted, about 2 mm.

[0054] Alternatively expressed, the gap may preferably have a height D4-D9 of at least 30% of the height D4 of the base block, more preferably least 50% of the height D4 of the base block, and most preferably at least 70% of the height D4 of the base block.

[0055] An optional fire swelling strip 18 (drawn with a dashed line) may be placed in the gap 14. Such a strip is intumescent, *i.e.*, it swells when heated. Thus, in case of fire, the fire swelling strip will expand, forming a fire barrier. The fire swelling strip 18 may for example be glued to the joining section 16. It will typically have a width slightly shorter than the width D1-D7-D8 of the gap 14,

typically about 20 mm.

[0056] The sill-pad 2 may further comprise an optional substantially flat lateral flange 22, which, with the sill-pad in use, will rest on the lower building element. The flange 22 is suitable for attaching the sill-pad to the lower building element, for example through nailing.

[0057] The lateral flange 22 has a width D2. D2 is preferably at least 10 mm and more preferably at least 20 mm, allowing for enough space for nailing the lateral flange 22 to the lower building element. A typical width D2 is about 30 mm, as depicted.

[0058] The lateral flange 22 has a height D3. D3 is preferably not more than 3 mm to allow for easy nailing of the flange 22 to the lower building element. A typical value of D2 is about 2 mm.

[0059] The ratio of the width D2 of the lateral flange 22 to the height D3 of the lateral flange 22 is preferably at least 3:1, more preferably at least 5:1, and even more preferably at least 10:1, and most preferably about 15:1.

[0060] Alternatively expressed, the height D3 of the substantially flat lateral flange may amount to at most 30% of the height D4 of the base block, preferably at most 20% of the height D4 of the base block, and most preferably at most 12% of the height D4 of the base block.

[0061] The lateral flange 22 may be made from rubber having a fourth Shore A hardness in the range 40-90, preferably in the range 40-60. Typically, they may be made from rubber having a Shore A hardness of 50. Making the lateral flange in a relatively softer-grade rubber allows for easy attachment of the sill-pad 2 to the lower building element, since it will be easy to knock down nails through the flange 22 into the lower building element.

[0062] As an alternative to the fire swelling strip 18 depicted in Fig. 1, as depicted in Fig. 2, a reinforcement strip 24 may be placed in the gap 14. This finds use where a high load is to be carried by the sill-pad 2. The reinforcement strip 24 may, as depicted, have one or more, typically two, load-carrying bulges 8, typically of the same kind as the base block 4.

[0063] Optionally, for example if the gap 14 is occupied by the reinforcement strip 24, the fire swelling strip 18 may be placed in the substantially flat flange 22. For allowing the reinforcement strip to be snapped in place, and thereafter to be kept in place, the base block 4 may have, on each side of the gap 14, snap stops 20.

[0064] As a third alternative to the fire swelling strip 18 and the reinforcement strip 22, a sound-insulating foam strip (not depicted) may be placed in the gap 14. Such a foam strip may be made from cellular rubber and preferably have a density in the range 0,4 - 0,8 g/cm³.

[0065] If two sill pads meet at a 90-degree angle, each sill-pad having a 45-degree cut relative to their respective transversal directions, the flexible sound-insulating foam strip may be bent at a 90-degree angle and put in the respective gaps across the interface between the two sill-pads. To make the foam strip more bendable, it may have an internal cavity which may extend along the length of the foam strip.

[0066] The sill-pad 2 may be manufactured by co-extruding the base block 4 and one or more of the sealing lips 6, load-carrying bulges 8, and substantially flat flange 22 using methods known per se.

[0067] In the above the inventive concept has mainly been described with reference to a limited number of examples. However, as is readily appreciated by a person skilled in the art, other examples than the ones disclosed above are equally possible within the scope of the inventive concept, as defined by the appended claims.

Claims

1. A load-carrying, vibration-damping and sound-insulating sill-pad (2) for placement between two building elements, in the form of an extruded, preferably co-extruded, profile, comprising:
 - a load-carrying base block (4) made of rubber, and
 - at least one sealing lip (6) made of rubber and formed on said base block (4).
2. The sill-pad (2) of claim 1, further comprising:
 - one or more load-carrying bulges (8) formed on top of said base block (4), said one or more load-carrying bulges (8) being made of rubber.
3. A method of manufacturing load-carrying, vibration-damping and sound-insulating sill-pad (2) for placement between two building elements, comprising extruding, preferably co-extruding:
 - a load-carrying base block (4) made of rubber, and
 - at least one sealing lip (2) made of rubber and formed on said base block (4).
4. The method of claim 3, further comprising extruding, preferably co-extruding:
 - one or more load-carrying bulges (8) formed on top of said base block (4), said one or more load-carrying bulges (8) being made of rubber.
5. The sill-pad (2) of any one of claims 1 or 2 or the method of any one of claims 3 or 4, wherein said rubber is EPDM.
6. The sill-pad (2) of any one of claims 1, 2, or 5 or the method of any one of claims 3-5, wherein said base block (4) is made of rubber having a first hardness.
7. The sill-pad or the method of claim 6, wherein said at least one sealing lip (2) is made of rubber having a second hardness, wherein said second hardness is different from said first hardness and preferably is lower than said first hardness.
8. The sill pad (2) or the method of any one of claims 6 or 7, wherein said one or more load-carrying bulges (8) are made of rubber having a third hardness different from said first hardness, wherein said third hardness preferably is lower than said first hardness.
9. The sill-pad (2) or the method of any one of claims 6-8, wherein said first hardness is a Shore A hardness in the range 40-90 and preferably in the range 60-90.
10. The sill-pad (2) or the method of any one of claims 6-9, wherein said second hardness is a Shore A hardness in the range 40-90 and preferably in the range 40-60.
11. The sill-pad (2) or the method of any one of claims 8-10, wherein said third hardness is a Shore A hardness in the range 40-90 and preferably in the range 40-60.
12. The sill-pad (2) or the method any one of claims 1-11, wherein said base block (4) has a U-shaped cross-section, comprising a first load-carrying section (10) a second load-carrying section (12), and a joining section (16), said first load-carrying section (10) and said second load-carrying section (12) being transversally spaced and joined by said joining section (16), so that a gap (14) for a fire swelling strip (18) or a reinforcement strip (24) is formed between said first load-carrying section and said-second load-carrying section, said joining section (16) preferably having a thickness of at most 5 mm and more preferably at most 3 mm.
13. The sill-pad (2) of any one of claims 1, 2, or 5-12, further comprising a substantially flat lateral flange (22) made of rubber, preferably EPDM, for nailing or stapling said sill-pad (2) to one of said two building elements, wherein said lateral flange (22) preferably has a thickness of at most 3 mm.
14. The method of any one of claims 3-12, further comprising extruding, preferably co-extruding:
 - a substantially flat lateral flange (22) made of rubber, preferably EPDM, for nailing or stapling said sill-pad (2) to one of said two building elements, wherein said lateral flange (22) preferably has a height of at most 3 mm.
15. A kit, comprising:
 - the sill-pad (2) of any one of claims 12 or 13, and
 - one or more selected from the following, adapt-

ed to fit in said gap: a fire swelling strip (18), a reinforcement strip (24) and/or a sound-insulating foam strip.

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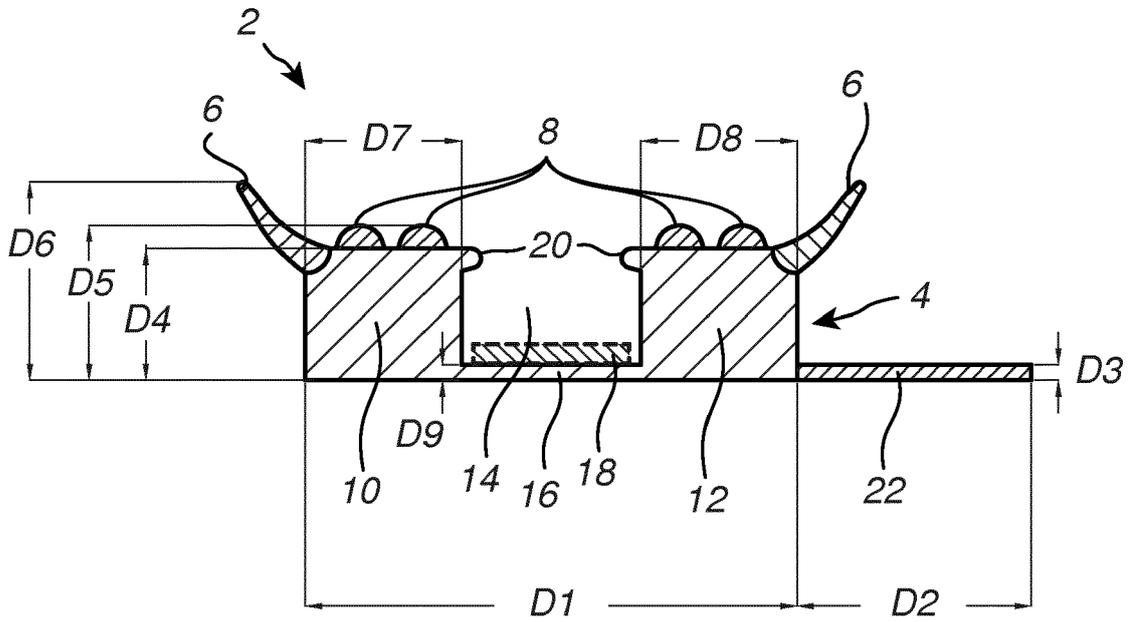


Fig. 1

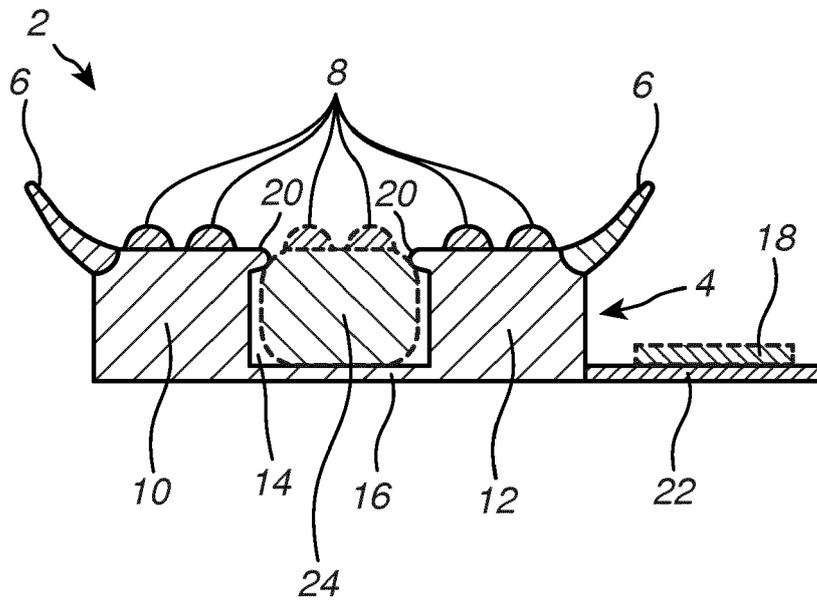


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 18 20 7977

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 23 May 2019	Examiner Couprie, Brice
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 20 7977

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82