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(54) **FASTENING SYSTEM FOR FASTENING SANDWICH-STRUCTURED COMPOSITE PANELS TO A SUPPORT STRUCTURE**

(57) A fastening system for fastening sandwich-structured composite panels (1) to a support structure (2) comprises a sandwich-structured composite panel (1) and a fastener (6) for fastening the sandwich-structured composite panel (1) to the support structure (2). The fastening system comprises an installation hole (7) formed through the first face skin (3) and the core (5), and an elongated sleeve (8) insertable into the installation hole (7). The sleeve (8) is made of non-metallic, galvanically isolating and thermally insulating material. The sleeve (8) comprises a tubular portion (9) a hollow interior (12) defined by a side wall (13) of the tubular portion (9), a bottom wall (14) at a second end (11) and a collar flange (15) encircling an open mouth (16) at the first end (10).. The sleeve (8) has a length (L1, L2) extending in the installation hole (7) from the first face skin (3) towards the second face skin (4). The sleeve (8) forms an installation guide for the fastener (6) which is insertable into the interior (12) and fastenable through the bottom wall (14). When the sleeve (8) is in the installation hole (7), the collar flange (15) abuts against an outer surface (18) of the first face skin (3) and the fastener (6) fastened to the support structure (2) pressing the second face skin (4) against the support structure (2).

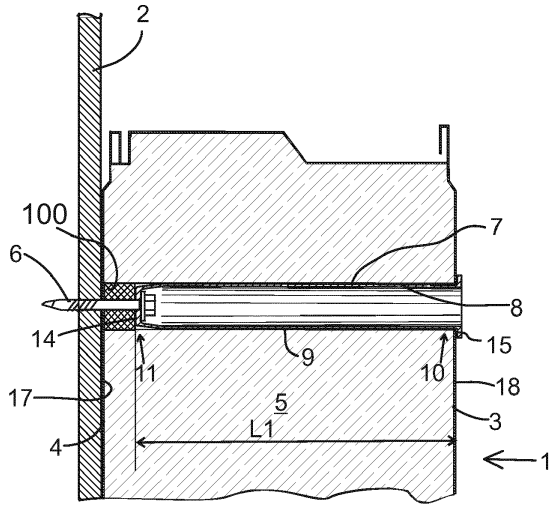

Fig. 2a

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a fastening system for fastening sandwich-structured composite panels to a support structure.

BACKGROUND OF THE INVENTION

[0002] In prior art is known a fastening system for fastening sandwich-structured composite panels to a support structure. Sandwich-structured composite panels are fastened to the support structure by screws. Typically, thick sandwich-structured composite panels are used as thermally insulated façade cladding panel elements, partition wall panel elements or ceiling panel elements. In some examples, the thickness of the panel may be e.g. 230 mm. The length of the screw is usually about 30...40mm longer than the thickness of the panel. Long screws are needed for fastening the panels to the support structure since the screw extends through and beyond the whole thickness of the panel, and when tightened, the screwhead abuts against the outer surface of the panel. Long screws have a drawback that they are costly. Also very often careless screwing with overtightening causes local buckling failures to the outer face skin of the sandwich panel and thus limits re-usability of the panels. Also very broad flashings are needed to hide possible failures. Current system of installing flashings may require several working phases and needs several installation parts and connectors. Re-usability is also limited due to many screw holes from flashing connectors. Long panel screws also cause local thermal bridges to the building envelope.

OBJECTIVE OF THE INVENTION

[0003] The objective of the invention is to alleviate the disadvantages mentioned above.

SUMMARY OF THE INVENTION

[0004] According to a first aspect, the present invention provides a fastening system for fastening sandwich-structured composite panels to a support structure. The fastening system comprises a sandwich-structured composite panel comprising a first face skin of sheet metal, a second face skin of sheet metal, and a core made of thermally insulating material arranged between the first face skin and the second face skin. The first and second face skins are attached to the core. The fastening system further comprises a fastener for fastening the sandwich-structured composite panel to the support structure. According to the invention the fastening system comprises an installation hole formed through the first face skin and the core, and an elongated sleeve insertable into the installation hole. The sleeve is made of non-metallic, galvanically isolating and thermally insulating material. The sleeve comprises a tubular portion having a first end and a second end. The sleeve has a hollow interior defined by a side wall of the tubular portion. The sleeve further comprises a bottom wall at a second end and a collar flange encircling an open mouth at the first end. The sleeve has a length extending in the installation hole from the first face skin towards the second face skin. The sleeve forms an installation guide for the fastener which is insertable into the interior and fastenable through the bottom wall. When the sleeve is in the installation hole, the collar flange abuts against an outer surface of the first face skin. The fastener being fastened to the support structure presses the second face skin against the support structure.

[0005] The technical effect of the invention is that the fastening system enables easy and fast panel installation with short and cheap screws. The sandwich-structured composite panel can be provided by factory-made installation holes. The sleeve can be installed into the installation hole either in the factory or on the site. A short fastener is attached through a pre-manufactured hole in the bottom of the sleeve into the support structure. The pre-manufactured hole may be drilled or punched, for example. The sleeve is equipped with a collar flange round the outer face skin in order to enable wind suction load transfer to the support structure. Because the length of the sleeve may match exactly with the panel thickness, there is no risk for failures in the outer face skin during fastening.

[0006] In an embodiment of the fastening system, the sleeve has a length corresponding to a combined thickness of the core and the first face skin, whereby when the sleeve is in the installation hole, the bottom wall abuts against an inner surface of the second face skin.

[0007] In an embodiment of the fastening system, the fastener is at least one of a metal screw, a wood screw, a self-drilling screw, a self-tapping screw, a concrete fastener.

[0008] In an embodiment of the fastening system, the sleeve is made of plastic-based material.

[0009] In an embodiment of the fastening system, the core comprises foamed polyurethane.

[0010] In an embodiment of the fastening system, the core comprises polyisocyanurate (PIR).

[0011] In an embodiment of the fastening system, the core comprises mineral wool.

[0012] In an embodiment of the fastening system, the core may be a board of foamed polyurethane, polyisocyanurate or mineral wool or any combination thereof.

[0013] In an embodiment of the fastening system, the sandwich-structured composite panel is a façade cladding panel element, or a partition wall panel element, or a ceiling panel element.

[0014] In an embodiment of the fastening system, the fastening system comprises a flashing to cover a seam between two sandwich-structured composite panels which are adjacently next to each other, the flashing hav-

ing two parallel longitudinal edges both of the edges having an overbent portion forming a U-shaped groove.

[0015] In an embodiment of the fastening system, the flashing is attached by the aid of the collar flanges of the sleeves.

[0016] In an embodiment of the fastening system, the collar flange comprises a stepped flange portion insertable to said U-shaped groove for attaching the flashing.

[0017] In an embodiment of the fastening system, the fastening system comprises a cap attachable to the mouth of the sleeve. The cap has a cap flange portion extending over and beyond the periphery of the collar flange of the sleeve. The flashing is attached by the aid of the cap flange portions, the cap flange portions being insertable to said U-shaped groove for attaching the flashing.

[0018] According to a second aspect, the present invention provides use of the fastening system according to the first aspect for fastening of sandwich-structured composite façade cladding panel elements or partition wall panel elements or ceiling panel elements to a support structure

[0019] It is to be understood that the aspects and embodiments of the invention described above may be used in any combination with each other. Several of the aspects and embodiments may be combined together to form a further embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

Figure 1 schematically shows an elevation plan view of a plurality of sandwich-structured panels fastened to a support structure by a fastening system according to an embodiment of the invention,

Figure 2a shows section II-II from Figure 1,

Figure 2b shows an alternative section II-II from Figure 1,

Figure 3 shows a longitudinal section of the sleeve,

Figure 4 shows section IV-IV from Figure 3,

Figure 5 shows section V-V from Figure 1, and

Figure 6 shows an alternative for the attachment of the flashing of Figure 5.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Figures 1, 2a and 2b show a fastening system for fastening sandwich-structured composite panels 1 to a support structure 2. The sandwich-structured composite panel 1 may be a façade cladding panel element, or a partition wall panel element, or a ceiling panel element. The fastening system comprises a sandwich-structured composite panel 1 comprising a first face skin 3 of sheet metal, a second face skin 4 of sheet metal, and a core 5 made of thermally insulating material arranged between the first face skin 3 and the second face skin 4. The core 5 may comprise foamed polyurethane or foamed polyisocyanurate (PIR) or mineral wool. The core 5 may be a board of foamed polyurethane or foamed polyisocyanurate (PIR) or mineral wool or a combination thereof. The first face skin 3 and the second face skin 4 are attached to the core 5. As shown in Figure 2, the fastening system further comprises a fastener 6 for fastening the sandwich-structured composite panel 1 to the support structure 2. The fastener 6 may be a a metal screw, a wood screw, a self-drilling screw, a self-tapping screw or a concrete fastener. The type of the fastener is chosen suitably depending on the structure and material of the support structure 2 (e.g. metal, wood or concrete). The fastening system comprises an installation hole 7 formed through the first face skin 3 and the core 5. An elongated sleeve 8 is insertable into the installation hole 7. The sleeve 8 is made of non-metallic, galvanically isolating and thermally insulating material. Preferably the sleeve is made of plastic-based material. The sleeve 8 comprises a tubular portion 9 having a first end 10 and a second end 11. A hollow interior 12 is defined by a side wall 13 of the tubular portion 9. A bottom wall 14 is at a second end 11. A collar flange 15 encircles an open mouth 16 at the first end 10.

[0022] In the embodiment of Figure 2a the sleeve 8 has a length L1 extending in the installation hole 7 from the first face skin 3 towards the second face skin 4 to a shorter distance than the thickness of the panel 1. The sleeve 8 forms an installation guide for the fastener 6 which is insertable into the interior 12 of the sleeve 8 and fastenable through the bottom wall 14 of the sleeve 8. When the sleeve 8 is in the installation hole 7, the collar flange 15 abuts against an outer surface 18 of the first face skin 3 and the fastener 6 being fastened to the support structure 2 pressing the second face skin 4 against the support structure 2. In Figure 2a there is a member 100 of resilient material installed between the bottom wall 14 of the sleeve and the inner surface 17 of the second face skin 4.

[0023] In the embodiment of Figure 2b the sleeve 8 has a length L2 corresponding to a combined thickness of the core 5 and the first face skin 3. The sleeve 8 forms an installation guide for the fastener 6 which is insertable into the interior 12 and fastenable through the bottom wall 14. When the sleeve 8 is in the installation hole 7, the bottom wall 14 abuts against an inner surface 17 of

the second face skin 4 and the collar flange 15 abuts against an outer surface 18 of the first face skin 3. When the fastener 6, in this example self-drilling screw 6, is screwed through the second face skin 4 to the support structure 2, the screwhead of the screw 6 becomes pressed against the wall bottom 14, and the wall bottom 14 presses the second face skin 4 firmly against the support structure 2.

[0024] Figure 3 shows that in one embodiment the sleeve 8 is equipped with a fastener 6 which is pre-installed in the interior 12 of the sleeve 8, so that the fastener 6 is readily fastenable after the sleeve 8 has been installed into the installation hole 7 of the panel 1 at the building site. The sleeve 8 may be either factory installed in the installation hole 7, or the sleeve 8 can be installed therein at the building site. The installation holes 7 are factory made in the panel 1. The diameter of the installation hole 7 is of the order 20 ... 25 mm, for example. Respectively, the outer diameter of the tubular portion 9 of the sleeve 8 is 20 ... 25 mm, for example. The first face skin and the second face skin may be made of aluminum or steel. The thickness of the first face skin and the second face skin is less than 1 mm, preferably 0,5 ... 0,6 mm. The thickness of the panel 1 may be e.g. 100 ... 230 mm.

[0025] As shown in Figure 1, right-hand side, the fastening system may comprise a flashing 19 to cover a seam 20 between two sandwich-structured composite panels 1 which are adjacently next to each other. Reference is also made to Figures 5 and 6. The flashing 19 has two parallel longitudinal edges 21, 22 both of the edges having an overbent portion 23 forming a U-shaped groove 24.

[0026] In the embodiment of Figure 5 the flashing 19 is attached by the aid of the collar flanges 15 of the sleeves 8. The collar flange 15 comprises a stepped flange portion 25 insertable to said U-shaped groove 24 for attaching the flashing 19.

[0027] In another embodiment shown in Figure 6, the fastening system comprises a cap 26 attachable to the mouth 16 of the sleeve 8. The cap 26 has a cap flange portion 27 extending over and beyond the periphery of the collar flange 15 of the sleeve 8. The flashing 19 is attached by the aid of the cap flange portions 27 which are insertable to the U-shaped groove 24 for attaching the flashing 19.

[0028] Figure 6, on the left-hand side, shows an example wherein the cap 16 may be attached onto the mouth 16 of the sleeve 8 by an annular snap-fit joint. Figure 6, on the right-hand side shows another example wherein the cap 16 may be attached onto the mouth 16 of the sleeve 8 by a threaded joint.

[0029] The attachment of the flashing with the aid of the sleeves or caps enables that no screw holes need to be made to the panels. Thus, re-usability of the panel is not limited.

[0030] The fastening system has at least the following benefits:

- Easier, faster and cheaper installation of sandwich panels & flashings
- Less handling of screws on building site
- No more bucking failures in outer face due to overtightening of screws
- Savings in screws (shorter screws, no or less screws for flashings)
- Usually no need for stainless steel screws because no contact to outdoor conditions
- No thermal bridges due to screws
- Better shear resistance of screw connection because the screw contacts with internal sheet, also easier to use thicker screws if needed
- No extra screw holes needed for panels causing better re-usability
- Galvanic contact between external and internal sheeting is prevented. The interior of the sleeve provides a

[0031] space, for example, for condition monitoring sensors which can be installed into the interior - screw self-drilling and tapping waste metal is found less on the panel outer surface. This is likely to improve the outlook of assembly in some cases (possible rusting stains caused from water and drilled metal waste which is sometimes visible at least with white or light color surfaces).

[0032] Although the invention has been the described in conjunction with a certain type of fastening system, it should be understood that the invention is not limited to any certain type of fastening system. While the present inventions have been described in connection with a number of exemplary embodiments, and implementations, the present inventions are not so limited, but rather cover various modifications, and equivalent arrangements, which fall within the purview of prospective claims.

Claims

1. A fastening system for fastening sandwich-structured composite panels (1) to a support structure (2), the fastening system comprising

   - a sandwich-structured composite panel (1) comprising a first face skin (3) of sheet metal, a second face skin (4) of sheet metal, and a core (5) made of thermally insulating material arranged between the first face skin and the second face skin, the first and second face skins being attached to the core, and
   - a fastener (6) for fastening the sandwich-structured composite panel (1) to the support structure (2), **characterized in that** the fastening system comprises an installation hole (7) formed through the first face skin (3) and the core (5), and an elongated sleeve (8) insertable into the installation hole (7), the sleeve (8) being made of non-metallic, galvanically isolating and ther-

mally insulating material, the sleeve (8) comprising a tubular portion (9) having a first end (10), a second end (11), a hollow interior (12) defined by a side wall (13) of the tubular portion (9), a bottom wall (14) at a second end (11) and a collar flange (15) encircling an open mouth (16) at the first end (10), the sleeve (8) having a length (L1, L2) extending in the installation hole (7) from the first face skin (3) towards the second face skin (4), whereby the sleeve (8) forms an installation guide for the fastener (6) which is insertable into the interior (12) and fastenable through the bottom wall (14) whereby, when the sleeve (8) is in the installation hole (7), the collar flange (15) abuts against an outer surface (18) of the first face skin (3) and the fastener (6) being fastened to the support structure (2) pressing the second face skin (4) against the support structure (2).

2. The fastening system according to claim 1, **characterized** in that the sleeve (8) has a length (L) corresponding to a combined thickness of the core (5) and the first face skin (3), whereby when the sleeve (8) is in the installation hole (7), the bottom wall (14) abuts against an inner surface (17) of the second face skin (4).

3. The fastening system according to claim 1 or 2, **characterized in that** the fastener (6) is at least one of a metal screw, a wood screw, a self-drilling screw, a self-tapping screw, a concrete fastener.

4. The fastening system according to any one of the claims 1 to 3, **characterized in that** the sleeve (8) is made of plastic-based material.

5. The fastening system according to any one of the claims 1 to 4, **characterized in that** the core (5) comprises foamed polyurethane.

6. The fastening system according to any one of the claims 1 to 5, **characterized in that** the core (5) comprises polyisocyanurate (PIR).

7. The fastening system according to any one of the claims 1 to 6, **characterized in that** the core (5) comprises mineral wool.

8. The fastening system according to any one of the claims 1 to 7, **characterized in that** the core (5) is a board of foamed polyurethane or a board of polyisocyanurate or a board of mineral wool or any combination thereof.

9. The fastening system according to any one of the claims 1 to 8, **characterized in that** the sandwich-structured composite panel (1) is a façade cladding panel element, or a partition wall panel element, or a ceiling panel element.

10. The fastening system according to any one of the claims 1 to 9, **characterized in that** the fastening system comprises a flashing (19) to cover a seam (20) between two sandwich-structured composite panels (1) which are adjacently next to each other, the flashing (19) having two parallel longitudinal edges (21, 22) both of the edges having an overbent portion (23) forming a U-shaped groove (24).

11. The fastening system according to any one of the claims 1 to 10, **characterized in that** the flashing (19) is attached by the aid of the collar flanges (15) of the sleeves (8).

12. The fastening system according to claim 11, **characterized** in that the collar flange (15) comprises a stepped flange portion (25) insertable to said U-shaped groove (24) for attaching the flashing (19).

13. The fastening system a according to any one of the claims 1 to 10, **characterized in that** the fastening system comprises a cap (26) attachable to the mouth (16) of the sleeve (8); the cap (26) having a cap flange portion (27) extending over and beyond the periphery of the collar flange (15) of the sleeve (8); and that the flashing (19) is attached by the aid of the cap flange portions (27), the cap flange portions being insertable to said U-shaped groove (24) for attaching the flashing (19).

14. Use of the fastening system according to any one of the claims 1 to 13 for fastening of sandwich-structured composite façade cladding panel elements or partition wall panel elements or ceiling panel elements to a support structure.

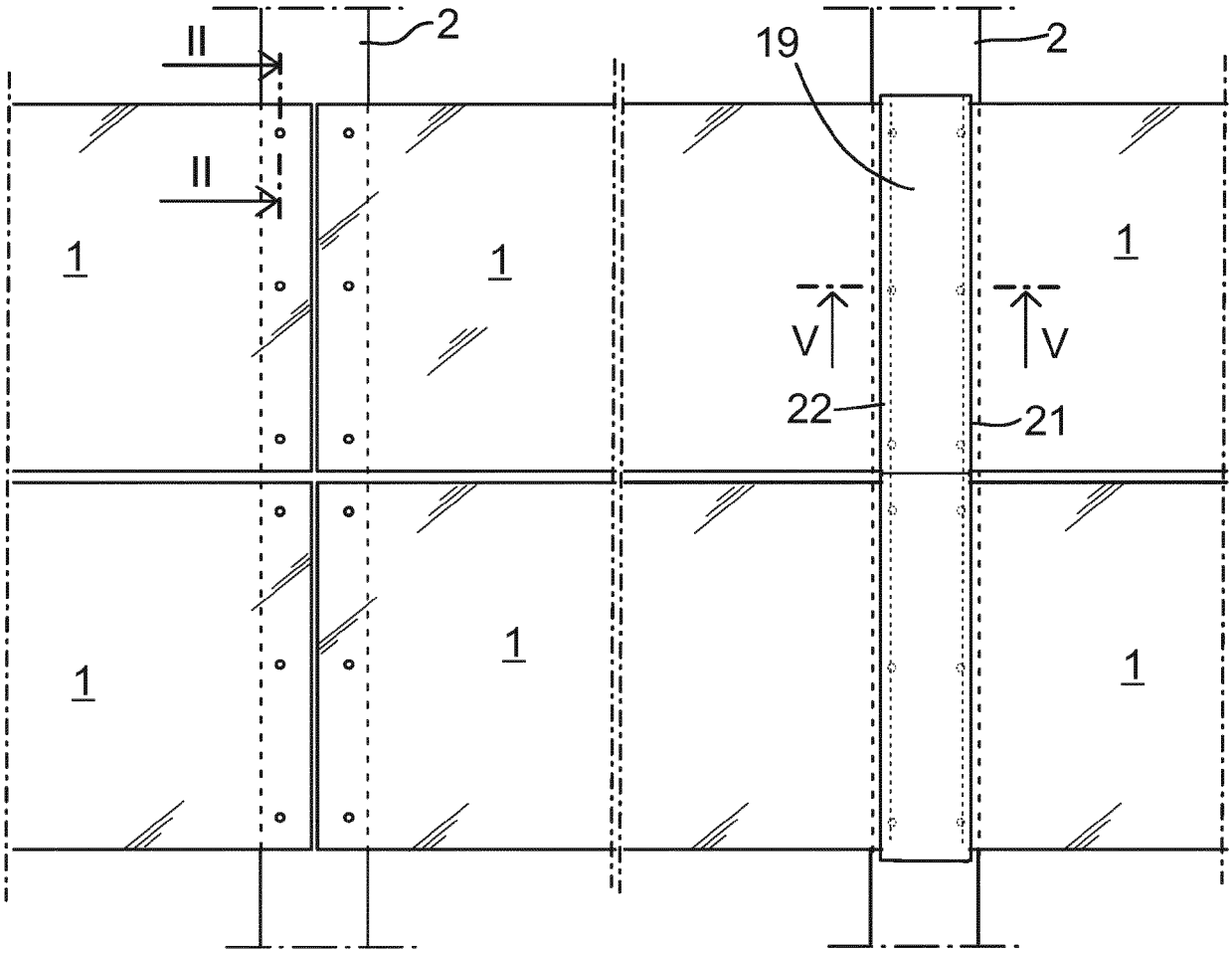

Fig. 1

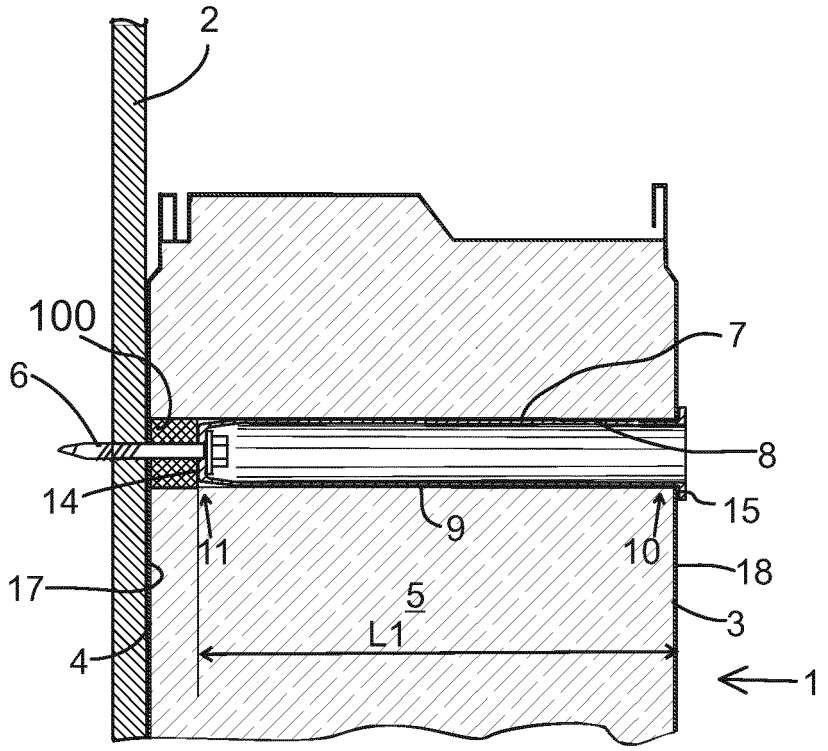
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Fig. 2a

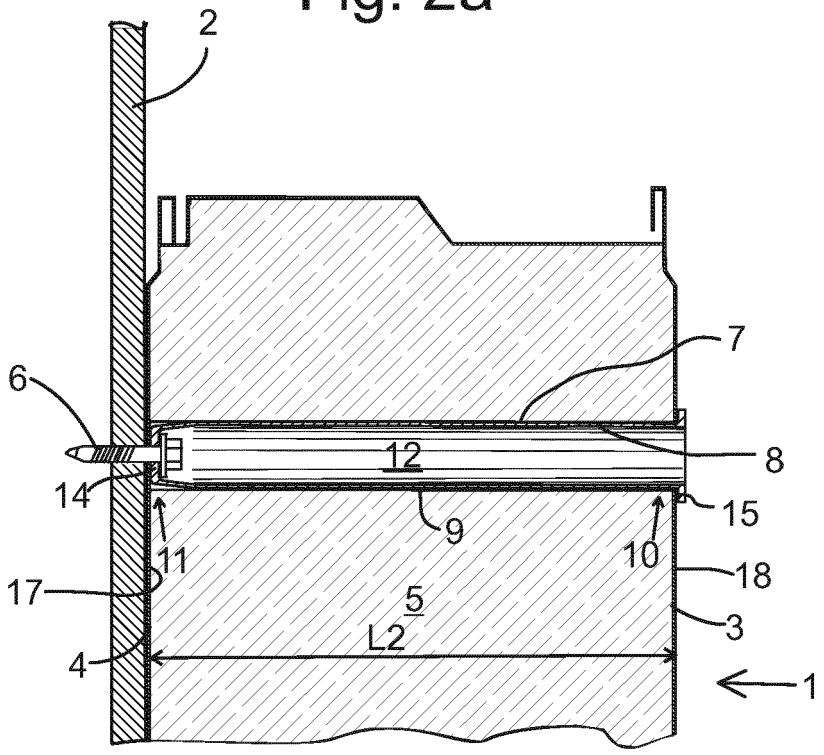
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Fig. 2b

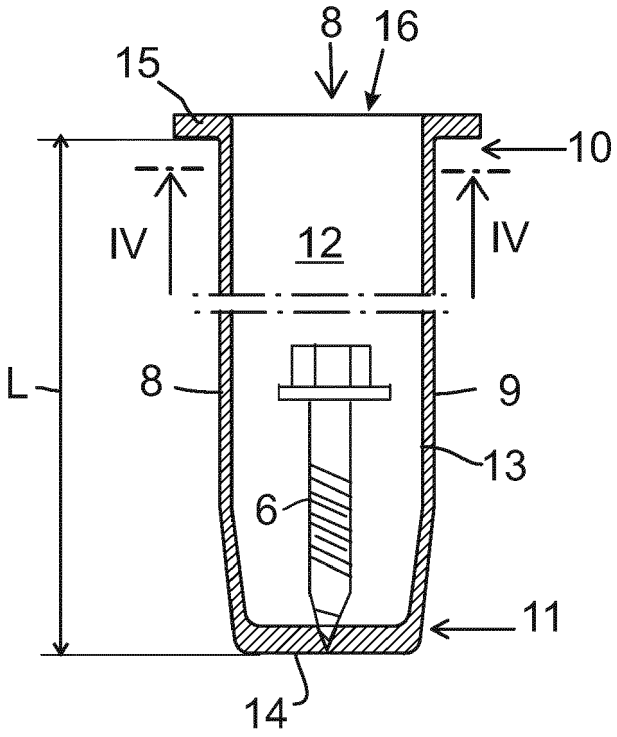

Fig. 3

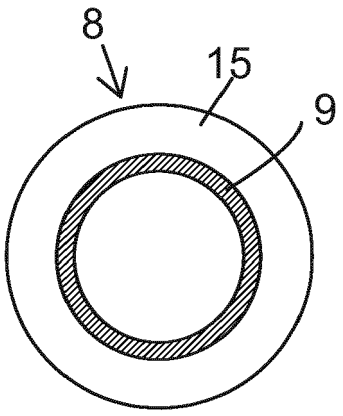

Fig. 4

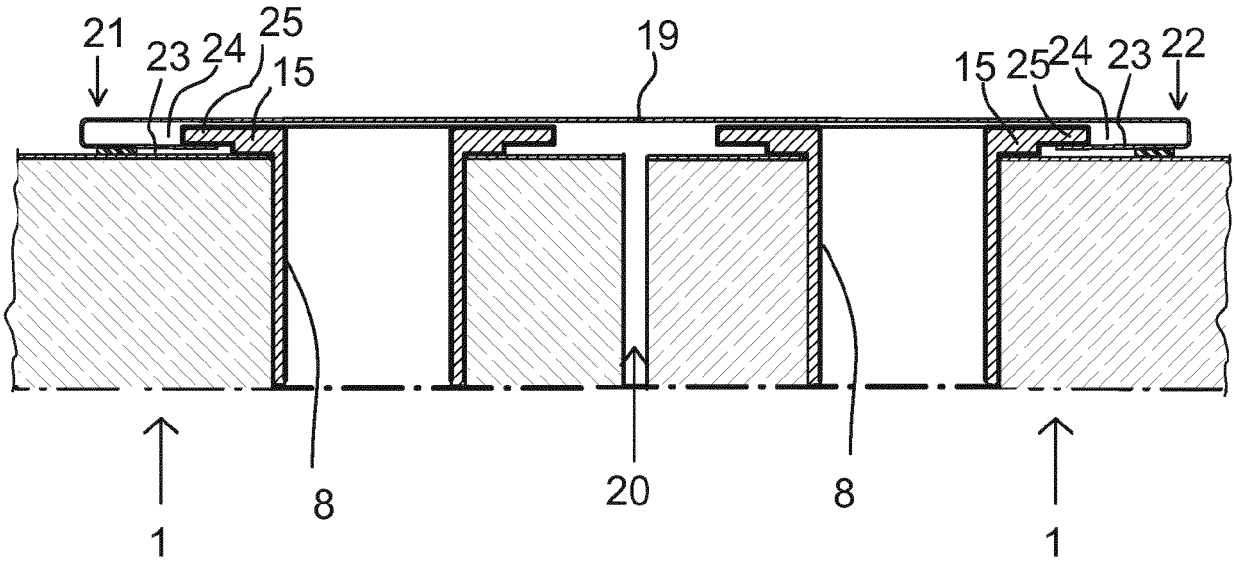
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Fig. 5

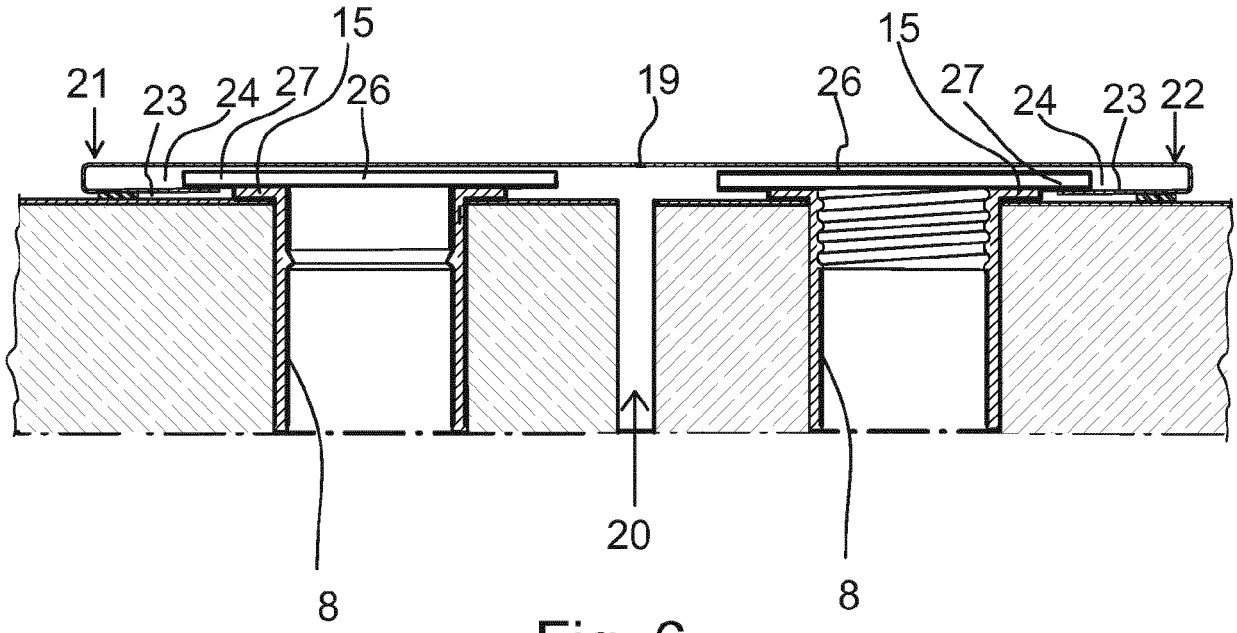
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Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 9936

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E04B
E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 November 2019	Estorgues, Marlène

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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28-11-2019

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