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

(11) EP 2 184 417 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.05.2010 Bulletin 2010/19

(21) Application number: **08168711.3**

(22) Date of filing: **10.11.2008**

(51) Int Cl.:
E04B 9/04 *(2006.01)* ***E04B 9/22*** *(2006.01)*
E04B 9/28 *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(71) Applicant: **Deutsche Rockwool Mineralwoll GmbH & Co. OHG**
45966 Gladbeck (DE)

(72) Inventor: **Becker, Bernhard**
24850 Hüsby (DE)

(74) Representative: **Olsen, Lau Lund**
Zacco Denmark A/S
Hans Bekkevolds Allé 7
2900 Hellerup (DK)

(54) Ceiling panel, ceiling panel hanger, suspended ceiling system, method of mounting a ceiling panel in a ceiling structure and method of manufacturing a ceiling panel

(57) The suspended ceiling system comprises a ceiling panel (2) and a hanger (3) comprising two flanges (10, 11) being engaged in a cutout being formed in a top surface (5) of the ceiling panel (2). The flanges are rigidly connected and adapted for suspension in a ceiling structure. The first flange (10) of the ceiling panel hanger (3) forms an angle with the top surface of the ceiling panel of at least approximately 10 degrees, and the second flange (11) of the ceiling panel hanger forms an angle with the first flange (10) of at least approximately 10 degrees. The cutout in the top surface (5) of the ceiling panel (2) is provided in the form of a first groove (8) and a second groove (9). A method of mounting a ceiling panel in a ceiling structure and a method of manufacturing a ceiling panel are also disclosed.

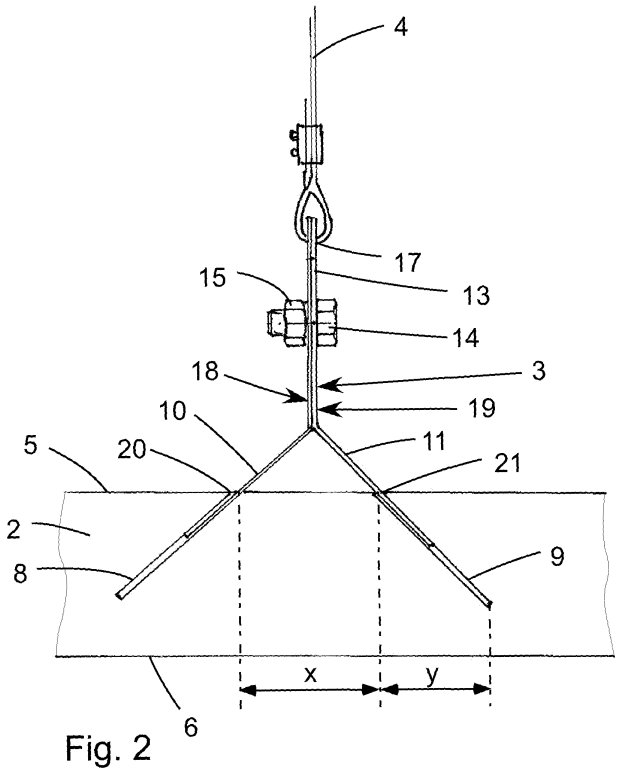

Fig. 2

EP 2 184 417 A1

Description

[0001] The present invention relates to a ceiling panel comprising a top surface, a bottom surface and a surrounding edge extending between the top surface and the bottom surface, wherein at least one cutout extending from the top surface is adapted for engagement with a hanger adapted to be suspended in an overhead structure.

[0002] WO 2007/012077 discusses a prior art ceiling panel in which a channel of inverted-T configuration is formed in the top face from one edge of the panel to another. A hanger in the form of a profile also having inverted-T configuration is inserted into the channel from the end of the channel and displaced in its longitudinal direction until it is positioned at a distance from the edges of the panel. The hanger is suspended from an overhead structure by means of wire. However, a channel of inverted-T configuration is rather complicated to provide in a ceiling panel.

[0003] Typically, a channel of inverted-T configuration could be machined by chip removal, such as milling. However, in this way, quite a lot of material has to be removed, in order to provide space for the chip removing tool itself. Thereby the integrity of the panel is compromised resulting in reduced strength of the panel. Furthermore, in order to simplify the machining operation, it would be preferred to machine the channel from one edge of the panel to another, so that the tool may be introduced from the edge of the panel. This may also be required in order to introduce a tool large enough to provide the channel of inverted-T configuration with sufficient undercut in order to bear on the hanger. However, if the channel extends through the edges of the panel, the integrity of the panel is further compromised resulting in further reduced strength of the panel.

[0004] The object of the present invention is to provide a ceiling panel adapted to be suspended in a ceiling, the ceiling panel having improved integrity and strength and being simple to manufacture.

[0005] In view of this object, the at least one cutout is provided in the form of a first groove and a second groove, in the first groove forms an angle with the top surface of at least approximately 10 degrees, and the second groove forms an angle with the first groove of at least approximately 10 degrees.

[0006] Thereby, less material need to be removed, as the first and second groove may be machined by simple cutting, for instance by means of a circular saw, whereby only material corresponding to the thickness of the saw blade need to be removed. A hanger having flanges fitting the first groove and the second groove, respectively, may lock mechanically when inserted into the grooves. As very little material need to be removed from the ceiling panel, a much stronger panel may be obtained. Also a better integrity between the hanger and the panel may be obtained, as the flanges of the hanger may fit closely into the grooves obtained by cutting.

[0007] In a structurally advantageous embodiment, the second groove forms an angle with the first groove of between 20 and 140 degrees, preferably between 50 and 120 degrees, and more preferred between 80 and 100 degrees.

[0008] In an embodiment, the first groove and the second groove are arranged symmetrically about a plane at right angles to the top surface. In this way, both manufacture of the ceiling panel and mounting of the hanger in the panel may be simplified.

[0009] In an embodiment, the first groove and the second groove are positioned at a distance from the edge of the ceiling panel. Thereby, the integrity and consequently the strength of the ceiling panel may be further improved, as the edges of the panel are intact.

[0010] In an embodiment, the first groove and the second groove are positioned so that they form parallel, longitudinal openings in the top surface. Thereby manufacture of the ceiling panel may be simplified. Furthermore, the configuration of the hanger may be simplified in that it may be composed by two longitudinal profiles that are connected after insertion into the respective grooves.

[0011] In an embodiment, the distance between the first and the second groove increases in the direction away from the top surface of the ceiling panel, the distance between a first longitudinal opening of the first groove and a second longitudinal opening of the second groove is at least 90 per cent, and preferably approximately 100 per cent, of the extent of the first groove or of the second groove in a direction parallel to the top surface and at right angles to the longitudinal opening of the groove. Thereby, a compact hanger may be utilized, and flanges of the hanger adapted to be inserted into the grooves of the panel may project about halfway into the grooves in the mounted position of the hanger, whereby mounting of the second flange of the hanger is possible during a temporary displacement of the first flange all the way into its groove.

[0012] The present invention further relates to a ceiling panel hanger comprising two flanges for engagement with a cutout in a top surface of a ceiling panel, the flanges being rigidly connectable and adapted for suspension in a ceiling structure. The ceiling panel hanger is **characterized in that**, in the connected and suspended state, carrying a ceiling panel, the first flange forms an angle with the horizontal of at least approximately 10 degrees, and the second flange forms an angle with the first flange of at least approximately 10 degrees.

[0013] Thereby, less material need to be removed from the ceiling panel in which the hanger is to be mounted, as a first and second groove may be machined by simple cutting, for instance by means of a circular saw, whereby only material corresponding to the thickness of the saw blade need to be removed. The hanger may lock mechanically when inserted into the grooves. As very little material need to be removed from the ceiling panel, a much stronger panel may be obtained. Also a better integrity between the hanger and the panel may be ob-

tained, as the flanges of the hanger may fit closely into the grooves obtained by cutting.

[0014] In a structurally advantageous embodiment, the second flange forms an angle with the first flange of between 20 and 140 degrees, preferably between 50 and 120 degrees, and more preferred between 80 and 100 degrees, and in that, preferably, in the suspended state, the first flange and the second flange are arranged symmetrically about a plane at right angles to the horizontal.

[0015] In an embodiment, the flanges are releasably connected or adapted to be connected after engagement with a ceiling panel. Thereby, the flanges may be inserted through longitudinal openings in the top surface of the ceiling panel, one after the other, so that it is avoided to introduce the flanges through the edges of the panel. This may be easier, especially if the grooves in the ceiling panel are rather narrow in order to provide a good grip of the flanges, as in this case, longitudinal displacement of the flanges in the grooves would result in rather large friction. In this way, the first groove and the second groove in the ceiling panel may be positioned at a distance from the edge of the ceiling panel. Thereby, the integrity and consequently the strength of the ceiling panel may be further improved, as the edges of the panel are intact.

[0016] In a structurally particularly advantageous embodiment, the ceiling panel hanger comprises two substantially V-formed profiles forming a first part that constitutes one of the flanges of the ceiling panel hanger and a second part that constitutes a connecting flange contacting the connecting flange of the other profile, in that the connecting flanges are connected by means of fasteners, such as screws and nuts, in that at least one of the flanges is adapted to be suspended from an overhead structure, for instance in that it is provided with holes for the connection of suspension wires, and in that each profile is preferably formed from a sheet material, such as steel, which is bent at an angle, thereby forming the first part and the second part.

[0017] The present invention further relates to a suspended ceiling system comprising a ceiling panel and at least one ceiling panel hanger, the ceiling panel having a top surface and a bottom surface and a surrounding edge extending between the top surface and the bottom surface, the at least one ceiling panel hanger comprising two flanges being engaged in a cutout being formed in the top surface of the ceiling panel, the flanges being rigidly connected and adapted for suspension in a ceiling structure. The suspended ceiling system is **characterized in that** the first flange of the ceiling panel hanger forms an angle with the top surface of the ceiling panel of at least approximately 10 degrees, and the second flange of the ceiling panel hanger forms an angle with the first flange of at least approximately 10 degrees, and in that the cutout in the top surface of the ceiling panel is provided in the form of a first groove in which the first flange of the ceiling panel hanger is engaged and a second groove in which the second flange of the ceiling panel hanger is engaged.

[0018] Thereby, less material need to be removed, as the first and second groove may be machined by simple cutting, for instance by means of a circular saw, whereby only material corresponding to the thickness of the saw blade need to be removed. A hanger having flanges fitting the first groove and the second groove, respectively, may lock mechanically when inserted into the grooves. As very little material need to be removed from the ceiling panel, a much stronger panel may be obtained. Also a better integrity between the hanger and the panel may be obtained, as the flanges of the hanger may fit closely into the grooves obtained by cutting.

[0019] In an embodiment, the first groove and the second groove are positioned at a distance from the edge of the ceiling panel, and the flanges of the ceiling panel hanger are releasably connected or adapted to be connected after engagement with a ceiling panel. Thereby, the flanges may be inserted through longitudinal openings in the top surface of the ceiling panel, one after the other, so that it is avoided to introduce the flanges through the edges of the panel, and the above-mentioned advantages may be obtained.

[0020] The present invention further relates to a method of mounting a ceiling panel in a ceiling structure, whereby at least one ceiling panel hanger is engaged in a cutout in a top surface of the ceiling panel, and whereby the at least one ceiling panel hanger is suspended in the ceiling structure. The method is characterized by that a first flange of the ceiling panel hanger is inserted into a first groove through a first longitudinal opening in the top surface of the ceiling panel, and by that a second flange of the ceiling panel hanger is inserted into a second groove through a second longitudinal opening in the top surface of the ceiling panel, and in that, after insertion of the second flange, the first flange and the second flange are connected. Thereby, less material need to be removed from the ceiling panel in which the hanger is to be mounted, and the above-mentioned advantages may be obtained. The hanger may lock mechanically when inserted into the grooves.

[0021] In an embodiment, when the first flange of the ceiling panel hanger is inserted into the first groove through a first longitudinal opening in the top surface of the ceiling panel, the first flange is displaced in a direction inclined to the top surface of the ceiling panel and thereby enabling insertion of the second flange of the ceiling panel hanger into the second groove through the second longitudinal opening in the top surface of the ceiling panel, and, after insertion of the second flange, the first flange of the ceiling panel hanger is retracted partly out of the first groove, thereby enabling connection of the first flange and the second flange. Thereby, a compact hanger may be utilized and at the same time it may be obtained that the flanges of the hanger point away from each other in the direction from the top surface and into the panel. This latter configuration may be advantageous in that the bottoms of the grooves are spaced longer from each oth-

er, thereby improving the integrity of the panel structure.

[0022] The present invention further relates to a method of manufacturing a ceiling panel for suspension in a ceiling structure by means of a ceiling panel hanger, whereby at least one cutout adapted for engagement with the hanger is formed in the top surface of the ceiling panel. The method is characterized by that a first cut is performed in the top surface of the ceiling panel by means of a circular saw, whereby a blade of the circular saw is inclined to the top surface of the ceiling panel as the blade is advanced in its radial direction along the top surface, and by that a second cut is performed in the top surface of the ceiling panel by means of the circular saw, whereby the blade of the circular saw is inclined relative to its orientation during the first cut as the blade is advanced in its radial direction along the top surface. Thereby, less material need to be removed, and the above-mentioned advantages may be obtained. Further, a much simpler and easy method of manufacturing is obtained than it is the case, for instance, by prior art channels of inverted-T configuration.

[0023] The invention will now be explained in more detail below by means of examples of embodiments with reference to the very schematic drawing, in which

Fig. 1 is a cross-section through a part of a ceiling panel according to the invention,

Fig. 2 is a cross-section through a part of the suspended ceiling system in Fig. 3,

Fig. 3 is a perspective view of a suspended ceiling system according to the invention,

Fig. 4 is a side view of a profile of a ceiling panel hanger according to the invention,

Fig. 5 is an end view of the ceiling panel hanger in Fig. 4,

Fig. 6a to 6d illustrate a method of mounting of a ceiling panel hanger in a ceiling panel,

Fig. 7 shows a cross-section through a part of another embodiment of the suspended ceiling system according to the invention,

Fig. 8 is a top view of a part of another embodiment of the suspended ceiling system according to the invention, and

Fig. 9 is a perspective view of another embodiment of a suspended ceiling system according to the invention.

[0024] Fig. 3 shows a perspective view of a suspended ceiling system 1 according to the invention. The suspended ceiling system 1 comprises a ceiling panel 2 that is suspended by means of two ceiling panel hangers 3. However, any suitable number of ceiling panel hangers 3 may be employed. The ceiling panel hangers 3 are suspended from a not shown overhead structure by means of wires 4. The suspended ceiling system 1 is preferably of the so-called island type, wherein separate ceiling panels are suspended at a distance from each other, thereby forming so-called islands hanging from an overhead ceiling structure. The islands may among other things improve the acoustic properties of a room and may have decorative properties.

[0025] The ceiling panel 2 in Fig. 3 comprises a top surface 5 and a bottom surface 6 and a surrounding edge 7 extending between the top surface 5 and the bottom surface 6. The ceiling panel 2 shown is rectangular, but it may have any suitable form, among others square, triangular, oval, round or forms composed by such forms. The ceiling panel 2 may have varying thickness. The ceiling panel 2 is preferably made of mineral wool, such as stone wool, and preferably of a density in the interval of 60-150 kg/m^3, and preferably a thickness of at least 20 mm. The area weight may be, for instance, between about 2-5 kg/m^2, but any suitable material could be used according to the invention. The material is preferably substantially compact and substantially dimensionally stable.

[0026] Fig. 1 shows a cross-section through a part of the ceiling panel 2 in Fig. 3 adapted for engagement with a ceiling panel hanger 3. Two cutouts in the form of a first groove 8 and a second groove 9 are formed in the ceiling panel 2 so that they extend from the top surface 5 and are adapted for engagement with flanges 10, 11 of a ceiling panel hanger 3 as shown in Fig. 2. In the embodiment shown, the first groove 8 forms an angle a with the top surface of 45 degrees, and the second groove 9 forms an angle b with the first groove 8 of 90 degrees. In this case, the first groove 8 and the second groove 9 are arranged symmetrically about a plane at right angles to the top surface 5. However, the first groove 8 may form any suitable angle with the top surface of at least approximately 10 degrees, and the second groove 9 may form any suitable angle with the first groove 8 of at least approximately 10 degrees. The preferred angles a, b may depend on the flexibility and the dimensional stability of the material of the ceiling panel 2. For instance, if the dimensional stability of the material is very good, the angle a and/or the angle b may be rather small.

[0027] In the embodiment shown in Fig. 3, the first and second grooves 8, 9 are positioned at a distance from the edge 7 of the ceiling panel 2, so that they do not penetrate the edge. In this way, the integrity and stability of the ceiling panel is improved, and the grooves are not visible from below the panel which may be preferred for esthetical reasons.

[0028] In the embodiment shown in Fig. 2, the ceiling panel hanger 3 comprises two substantially V-formed profiles 18, 19 forming a first part that constitutes one of the flanges 10, 11 of the ceiling panel hanger and a sec-

ond part that constitutes a connecting flange 13. The two connecting flanges 13 of either profile, respectively, contact each other and are releasably connected by means of screws 14 and nuts 15. Any suitable number of screws 14 are inserted through holes 16 in the connecting flanges 13, see Figs. 4 and 5. Other suitable fasteners or locking means, for instance clips or even glue or soldering may be used. The ceiling panel hanger 3 is suspended by means of the suspension wires 4 inserted through holes 17. Each V-formed profile 18, 19 is preferably formed from a relatively thin sheet material, such as steel, which is bent at an angle, thereby forming the first part and the second part. However, it may also be injection moulded or extruded in plastic material. In this embodiment, the ceiling panel hanger 3 forms an inverted Y, whereby the flanges 10, 11 fits into the grooves 8, 9, respectively, of the ceiling panel shown in Fig. 1 as described above.

[0029] Figs. 6a to 6d illustrate the process of mounting the ceiling panel hanger 3 in the ceiling panel 2, in the embodiment shown in Figs. 1 and 2. Firstly, the first flange 10 of the first V-formed profile 18 is inserted fully into the first groove 8 of the ceiling panel 2, see Fig. 6a. Thereby, space above the top surface 5 is provided for insertion of the second flange 11 of the second V-formed profile 19 into the second groove 9 of the ceiling panel, see Fig. 6b. The second flange 11 is, however, only inserted approximately halfway into the second groove 9, see Fig. 6c. Thereby, space is provided for partly, that is approximately halfway, retraction of the first flange 10 from the first groove 8, whereby the connection flanges 13 of the V-formed profiles 18, 19 contact each other and may be connected to each other as described above, see Fig. 6d. It is noted that, in this case, the second groove 9 does not need to be as deep as the first groove 8, however, assembly and even manufacture may be facilitated when the grooves 8, 9 are of equal depth.

[0030] It is further noted that, in the embodiment shown in Figs. 1 to 3, the first groove 8 and the second groove 9 are positioned so that they form parallel, longitudinal openings 20, 21 in the top surface 5 and that the distance between the grooves increases in the direction away from the top surface of the ceiling panel. In order to allow the mounting process illustrated in Figs. 6a to 6d, the flanges 10, 11 are not inserted fully into the grooves 8, 9 in the final position, as it may be seen in Fig. 6d. However, advantageously, the grooves are not deeper than necessary, as this could influence the integrity of the ceiling panel. Therefore, it may be preferred that the distance X between the first longitudinal opening 20 of the first groove 8 and the second longitudinal opening 21 of the second groove 9 corresponds substantially to the extent Y of the first groove or of the second groove in a direction parallel to the top surface 5 and at right angles to the longitudinal opening of the groove, see Fig. 2. However, in order to take up tolerances, the grooves may be a little deeper, so that, for instance, X is approximately 90 per cent of Y.

[0031] Alternatively, in another embodiment, not shown, the distance X may be equal zero or close to zero. In this embodiment, the flanges 10, 11 have the form of combs, whereby the teeth of the combs may cross each other. Thereby, the connection flanges 13 of the V-formed profiles 18, 19 contact each other oppositely relative to the embodiment shown in Figs. 1 to 3. In this way, referring to Fig. 2, the connection flange 13 of the left-hand V-formed profile 18 would be placed to the right of the connection flange 13 of the righthand V-formed profile 19. The comb-formed flanges 10, 11 could then reach until the bottom of the grooves 8, 9, as no retraction of a flange would be necessary at the mounting procedure.

[0032] The ceiling panel 2 may be manufactured by forming the grooves 8, 9 in the form of cutouts by forming a first cut in the top surface of the ceiling panel by means of a circular saw, whereby a blade of the circular saw is inclined to the top surface of the ceiling panel as the blade is advanced in its radial direction along the top surface. A second cut is then performed in the top surface of the ceiling panel by means of the circular saw, whereby the blade of the circular saw is inclined relative to its orientation during the first cut as the blade is advanced in its radial direction along the top surface. Preferably, the thickness of the grooves corresponds approximately to the thickness of the blade of the circular saw. The grooves may also be produced in other suitable ways, for instance by milling.

[0033] The thickness of the grooves may be slightly smaller than the thickness of the flanges 10, 11 to be introduced into the grooves, thereby ensuring a good grip. However, of course, the grooves may also be thicker than the flanges, as the flanges will still be mechanically locked in the grooves. The depth of the grooves may be a compromise between on the one hand a good grip between the flange and the groove and on the other hand a good integrity of the panel. In other words, if the grooves are too deep, the integrity may be compromised. However, this could be counteracted by gluing the flanges into the grooves. In any way, a good compromise could be that the grooves extend until a depth D of 50 to 85, preferably 60 to 75, and more preferred about approximately 70 per cent of the thickness T of the panel, see Fig. 1, whereby D is measured at right angles to the top surface 5 of the panel 2. In the embodiment shown in Figs. 1 to 3, an advantageous relation between the length of the flanges 10, 11 and the length of the ceiling panel 2 could be between 50 and 90, and preferably between 60 and 70. It is noted that the maximum length of the grooves 8, 9 may have to be longer than the flanges 10, 11 if the grooves are manufactured by means of a circular saw.

[0034] Fig. 7 shows another embodiment of the suspended ceiling system 1 according to the invention. In this embodiment, the distance between the grooves 8, 9 decreases in the direction away from the top surface 5 of the ceiling panel 2. It is noted that in this case, the

flanges 10, 11 may be fully inserted into the grooves 8, 9, respectively, as no retraction of the first flange 10 is necessary after insertion of the second flange 11. Preferably, as seen in the figure, the ceiling panel hanger does not cover much of the surface of the ceiling panel, as this could reduce the insulating effect of the ceiling panel. Therefore, the parts of the ceiling panel hanger extending above the ceiling panel form an angle with the top surface of the ceiling panel.

[0035] Fig. 8 shows yet another embodiment of the suspended ceiling system 1 according to the invention. In this embodiment, one ceiling panel hanger 3 is provided at either corner of the ceiling panel 2. Only one corner of the ceiling panel is shown in the figure. The ceiling panel hanger 3 is composed by a first part 22 and a second part 23 that in the mounted position shown are connected by means of flanges 24 that are suspended by means of wire. A first flange 25 of the first part 22 is partly inserted into a first groove 27 of the ceiling panel 2, and a second flange 26 of the second part 23 is partly inserted into a second groove 28 of the ceiling panel 2. The first groove 27 and the second groove 28 form longitudinal openings 29, 30, respectively, that are at right angles to each other. Any other suitable angle is also possible. In the embodiment shown, the first groove 27 and the second groove 28 each form an angle of 45 degrees with the top surface 5 of the ceiling panel. However, many different configurations are possible. For instance, the first groove 27 may form an angle of 45 degrees with the top surface 5 and the second groove 28 may form an angle of 90 degrees with the top surface 5. The process of mounting the ceiling panel hanger 3 in the ceiling panel 2 in this embodiment is similar to the process illustrated in Figs. 6a to 6d.

[0036] Fig. 9 shows yet another embodiment of the suspended ceiling system 1 according to the invention. In this embodiment, similarly to the embodiment in Fig. 8, one ceiling panel hanger 3 is provided at either corner of the ceiling panel 2. However, in this embodiment, the ceiling panel hangers have a cross-section similar to that of the embodiment shown in Fig. 7, but the length of the hangers is substantially shorter, as it may be seen in Fig. 9.

Claims

1. A ceiling panel (2) comprising a top surface (5), a bottom surface (6) and a surrounding edge (7) extending between the top surface and the bottom surface, wherein at least one cutout extending from the top surface (5) is adapted for engagement with a hanger (3) adapted to be suspended in an overhead structure, **characterized in that** the at least one cutout is provided in the form of a first groove (8) and a second groove (9), **in that** the first groove (8) forms an angle (a) with the top surface (5) of at least approximately 10 degrees, and **in that** the second groove (9) forms an angle (b) with the first groove (8) of at least approximately 10 degrees.

2. A ceiling panel according to claim 1, **characterized in that** the second groove (9) forms an angle with the first groove (8) of between 20 and 140 degrees, preferably between 50 and 120 degrees, and more preferred between 80 and 100 degrees.

3. A ceiling panel according to claim 1 or 2, **characterized in that** the first groove (8) and the second groove (9) are arranged symmetrically about a plane at right angles to the top surface (5).

4. A ceiling panel according to any one of the preceding claims, **characterized in that** the first groove (8) and the second groove (9) are positioned at a distance from the edge (7) of the ceiling panel (2).

5. A ceiling panel according to any one of the preceding claims, **characterized in that** the first groove (8) and the second groove (9) are positioned so that they form parallel, longitudinal openings (20, 21) in the top surface (5).

6. A ceiling panel according to claim 5, **characterized in that** the distance between the first and the second groove (8, 9) increases in the direction away from the top surface (5) of the ceiling panel (2), **in that** the distance between a first longitudinal opening (20) of the first groove (8) and a second longitudinal opening (21) of the second groove (9) is at least 90 per cent, and preferably approximately 100 per cent, of the extent of the first groove (8) or of the second groove (9) in a direction parallel to the top surface (5) and at right angles to the longitudinal opening of the groove.

7. A ceiling panel hanger (3) comprising two flanges (10, 11) for engagement with a cutout in a top surface of a ceiling panel, the flanges being rigidly connectable and adapted for suspension in a ceiling structure, **characterized in that**, in the connected and suspended state, carrying a ceiling panel (2), the first flange (10) forms an angle with the horizontal of at least approximately 10 degrees, and the second flange (11) forms an angle with the first flange (10) of at least approximately 10 degrees.

8. A ceiling panel hanger according to claim 7, **characterized in that** the second flange (11) forms an angle with the first flange (10) of between 20 and 140 degrees, preferably between 50 and 120 degrees, and more preferred between 80 and 100 degrees, and **in that**, preferably, in the suspended state, the first flange (10) and the second flange (11) are arranged symmetrically about a plane at right angles to the horizontal.

9. A ceiling panel hanger according to claim 7 or 8, **characterized in that** the flanges (10, 11) are releasably connected or adapted to be connected after engagement with a ceiling panel (2).

10. A ceiling panel hanger according to any one of the claims 7 to 9, **characterized in that** the ceiling panel hanger (3) comprises two substantially V-formed profiles (18, 19) forming a first part that constitutes one of the flanges (10, 11) of the ceiling panel hanger (3) and a second part that constitutes a connecting flange (13) contacting the connecting flange (13) of the other profile, **in that** the connecting flanges are connected by means of fasteners, such as screws (14) and nuts (15), **in that** at least one of the flanges is adapted to be suspended from an overhead structure, for instance **in that** it is provided with holes (17) for the connection of suspension wires (4), and **in that** each profile (18, 19) is preferably formed from a sheet material, such as steel, which is bent at an angle, thereby forming the first part and the second part.

11. A suspended ceiling system comprising a ceiling panel (2) and at least one ceiling panel hanger (3), the ceiling panel having a top surface (5) and a bottom surface (6) and a surrounding edge (7) extending between the top surface and the bottom surface, the at least one ceiling panel hanger (3) comprising two flanges (10, 11) being engaged in a cutout being formed in the top surface (5) of the ceiling panel (2), the flanges being rigidly connected and adapted for suspension in a ceiling structure, **characterized in that** the first flange (10) of the ceiling panel hanger (3) forms an angle with the top surface of the ceiling panel of at least approximately 10 degrees, and the second flange (11) of the ceiling panel hanger forms an angle with the first flange (10) of at least approximately 10 degrees, and **in that** the cutout in the top surface (5) of the ceiling panel (2) is provided in the form of a first groove (8) in which the first flange (10) of the ceiling panel hanger is engaged and a second groove (9) in which the second flange (11) of the ceiling panel hanger is engaged.

12. A suspended ceiling system according to claim 11, **characterized in that** the first groove (8) and the second groove (9) are positioned at a distance from the edge (7) of the ceiling panel (2), and **in that** the flanges (10, 11) of the ceiling panel hanger (3) are releasably connected or adapted to be connected after engagement with a ceiling panel (2).

13. A method of mounting a ceiling panel in a ceiling structure, whereby at least one ceiling panel hanger (3) is engaged in a cutout in a top surface (5) of the ceiling panel (2), and whereby the at least one ceiling panel hanger (3) is suspended in the ceiling structure, **characterized by** that a first flange (10) of the ceiling panel hanger (3) is inserted into a first groove (8) through a first longitudinal opening (20) in the top surface (5) of the ceiling panel (2), and by that a second flange (11) of the ceiling panel hanger is inserted into a second groove (9) through a second longitudinal opening (21) in the top surface (5) of the ceiling panel (2), and in that, after insertion of the second flange (11), the first flange (10) and the second flange (11) are connected.

14. A method of mounting a ceiling panel according to claim 13, **characterized by** that, when the first flange (10) of the ceiling panel hanger (3) is inserted into the first groove (8) through a first longitudinal opening (20) in the top surface (5) of the ceiling panel (2), the first flange (10) is displaced in a direction inclined to the top surface (5) of the ceiling panel and thereby enabling insertion of the second flange (11) of the ceiling panel hanger into the second groove (9) through the second longitudinal opening (21) in the top surface (5) of the ceiling panel, and in that, after insertion of the second flange (11), the first flange (10) of the ceiling panel hanger (3) is retracted partly out of the first groove (8), thereby enabling connection of the first flange (10) and the second flange (11).

15. A method of manufacturing a ceiling panel (2) for suspension in a ceiling structure by means of a ceiling panel hanger (3), whereby at least one cutout adapted for engagement with the hanger is formed in the top surface (5) of the ceiling panel, **characterized by** that a first cut is performed in the top surface (5) of the ceiling panel (2) by means of a circular saw, whereby a blade of the circular saw is inclined to the top surface (5) of the ceiling panel as the blade is advanced in its radial direction along the top surface, and by that a second cut is performed in the top surface of the ceiling panel by means of the circular saw, whereby the blade of the circular saw is inclined relative to its orientation during the first cut as the blade is advanced in its radial direction along the top surface (5).

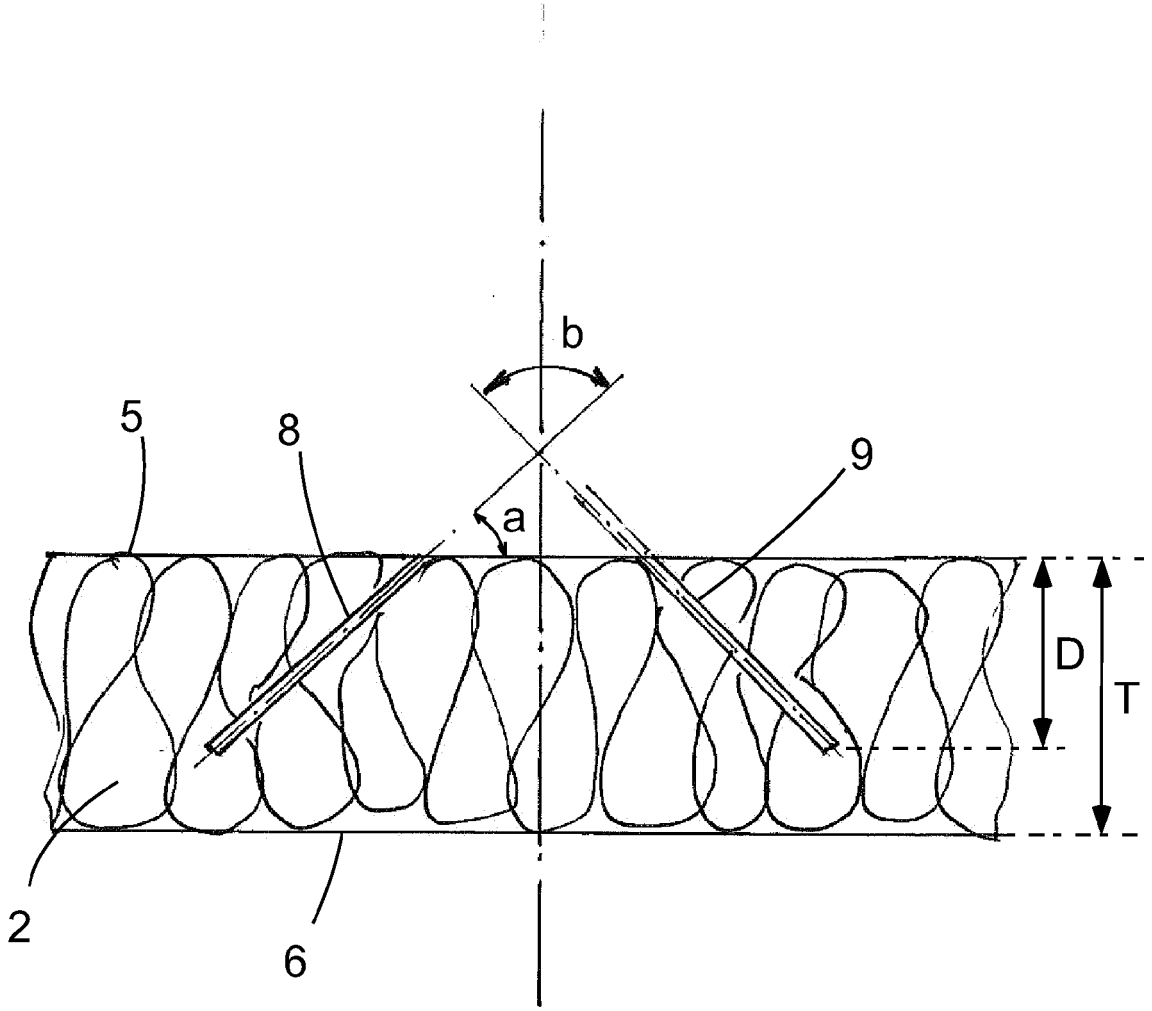

Fig. 1

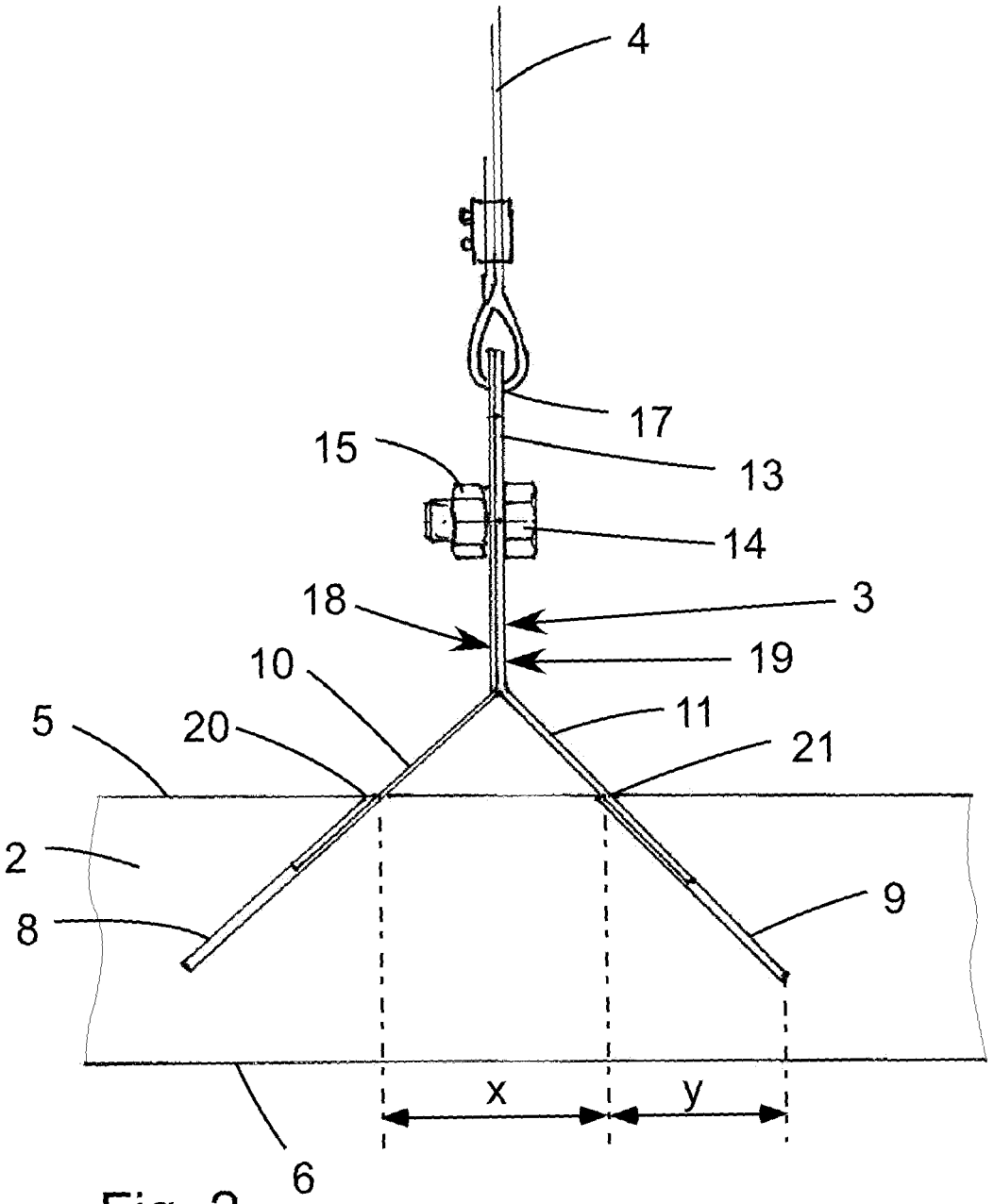

Fig. 2

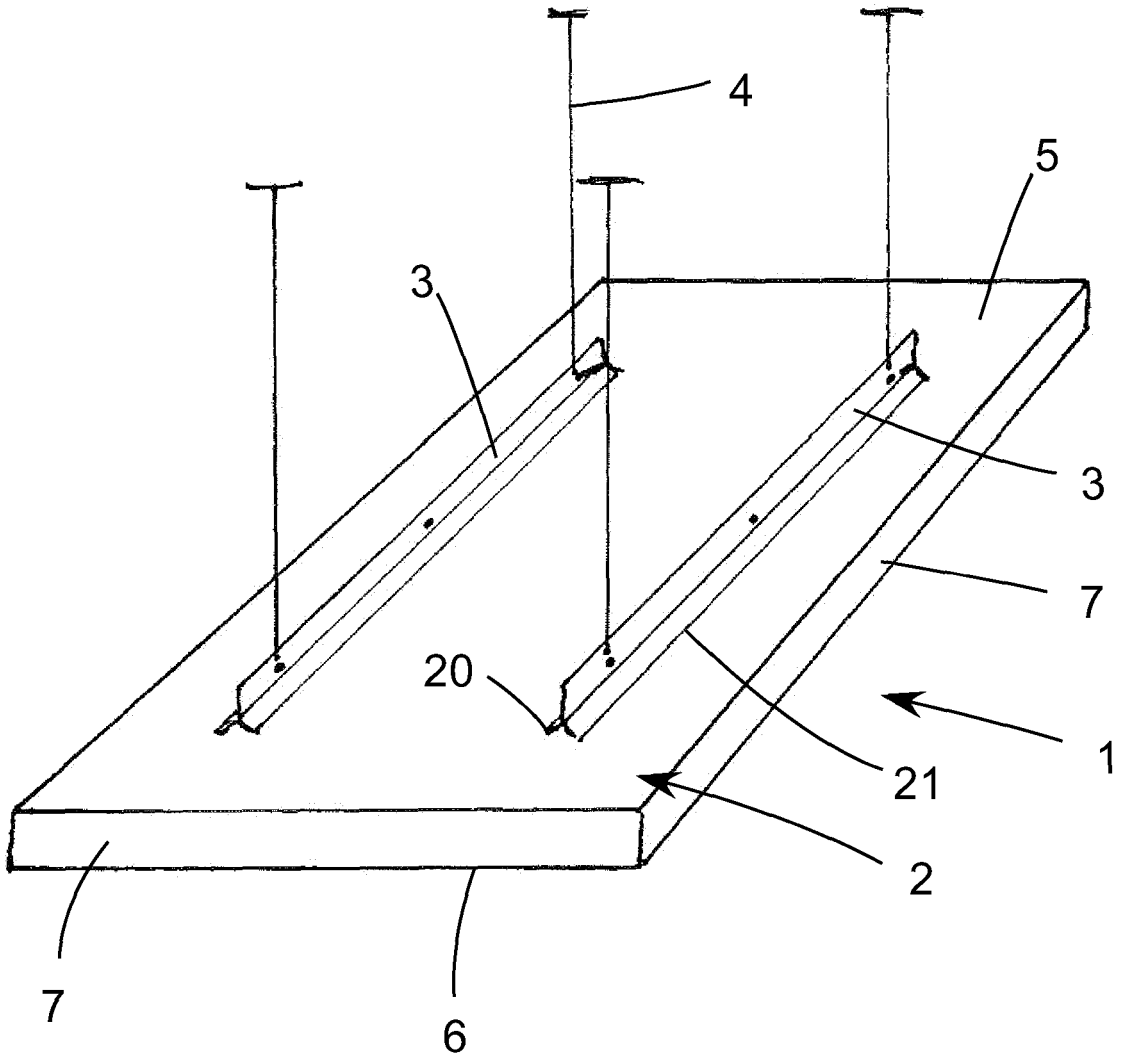

Fig. 3

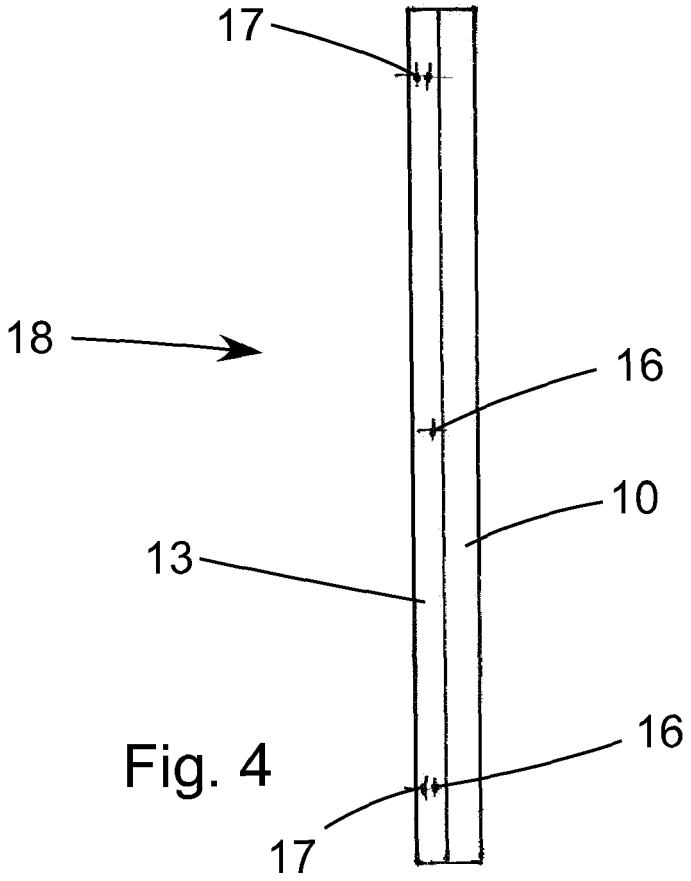

Fig. 4

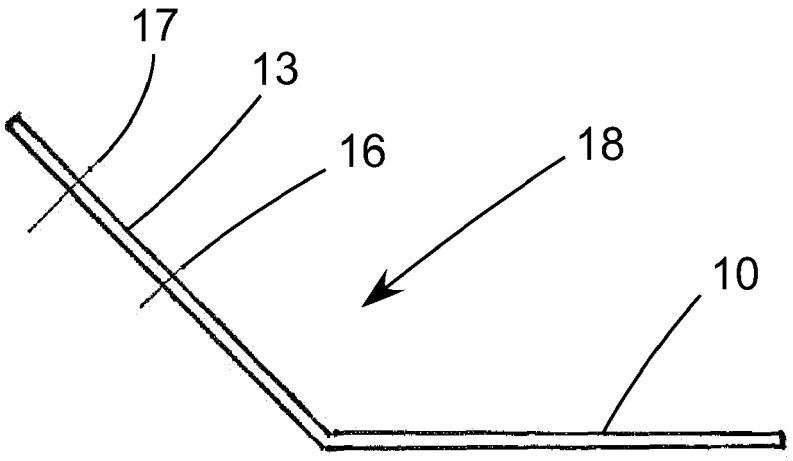

Fig. 5

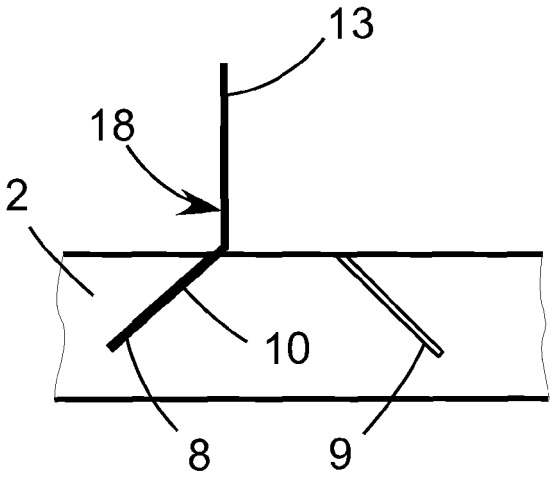

Fig. 6a

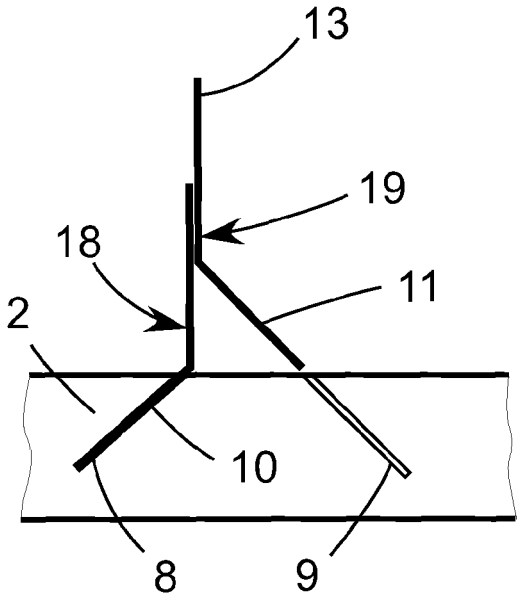

Fig. 6b

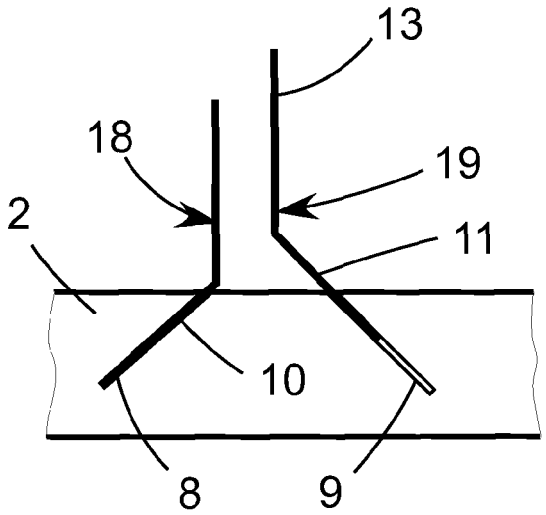

Fig. 6c

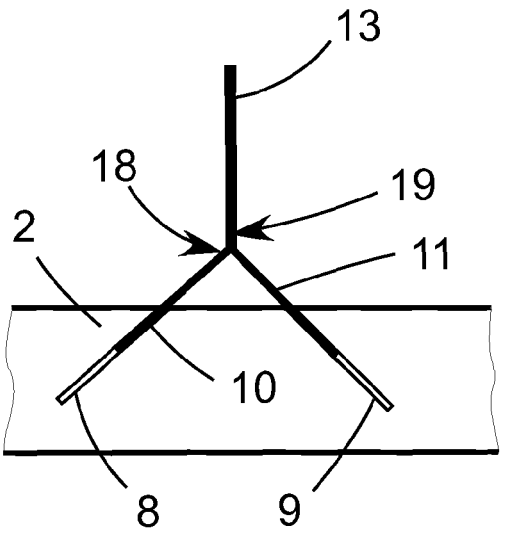

Fig. 6d

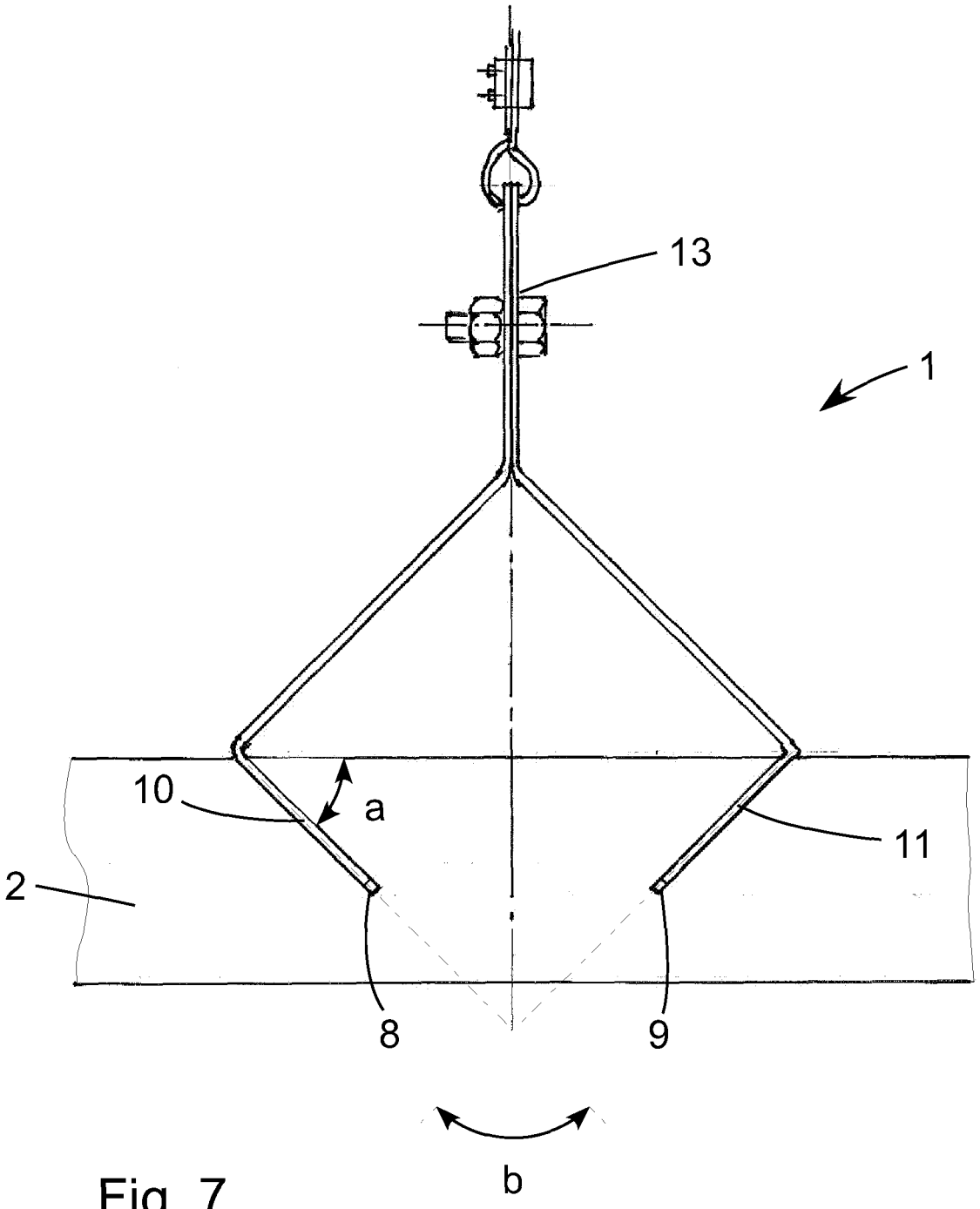

Fig. 7

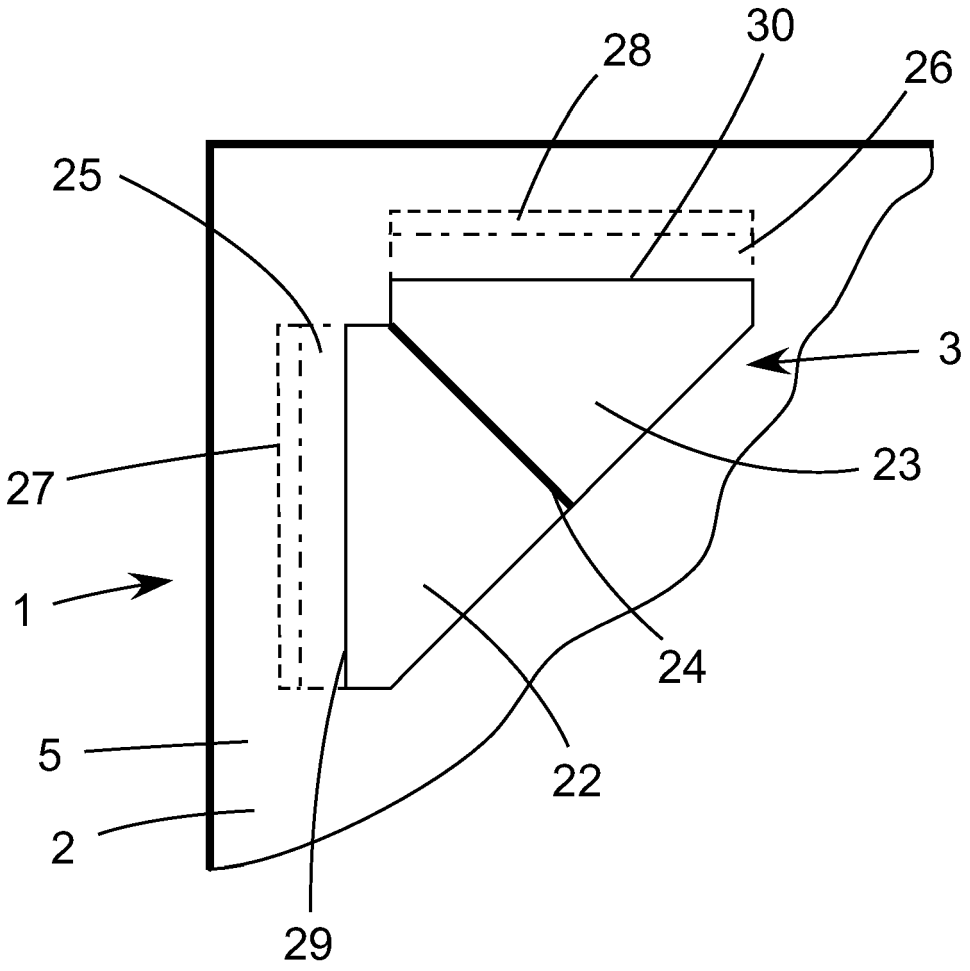

Fig. 8

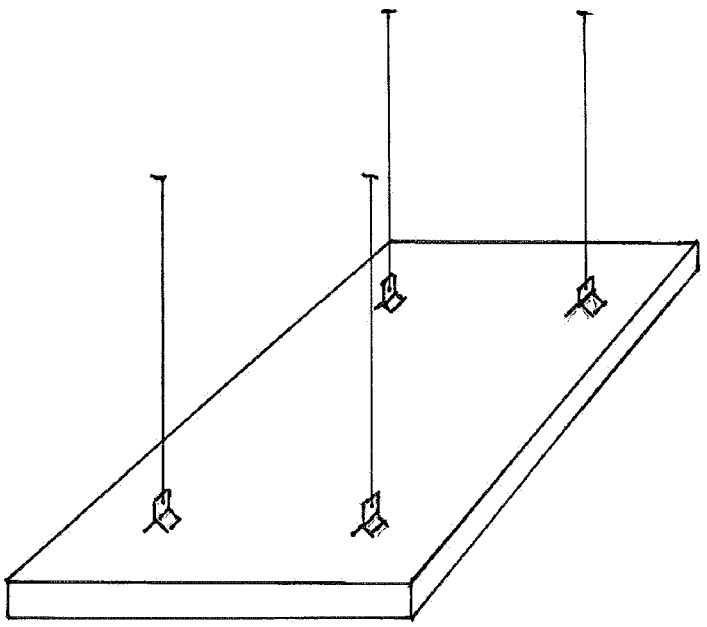

Fig. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 08 16 8711

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 033 083 A (FRITZ THOMAS W ET AL) 5 July 1977 (1977-07-05) * the whole document *	1-9, 11-13,15	INV. E04B9/04 E04B9/22 E04B9/28
A	BE 520 542 A (J PORTAIL) 30 June 1953 (1953-06-30) * the whole document *	1,11,13, 15	
A	BE 484 286 A (J CAUVERT) 14 September 1942 (1942-09-14) * the whole document *	1,11,13, 15	
A	US 2003/145547 A1 (KLIEGLE DENNIS ROBERT [US] ET AL) 7 August 2003 (2003-08-07) * figures 8b,10a,10b,10c *	1,11,13, 15	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 March 2009	Stern, Claudio

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 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 16 8711

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-03-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4033083 A	05-07-1977	NONE	
BE 520542 A		NONE	
BE 484286 A		NONE	
US 2003145547 A1	07-08-2003	CA 2415487 A1	04-08-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2007012077 A **[0002]**