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(54) **A suspended ceiling and a method for dismounting a suspended ceiling**

Hängedecke und Verfahren zum Abbau einer Hängedecke

Plafond suspendu et procédé pour démonter un plafond suspendu

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EP 2 546 429 B1

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Description

Field of the invention

[0001] The present invention relates to a suspended ceiling comprising at least one ceiling tile, at least one profile comprising a flange and a web having a bulb, and a fixing member adapted for engagement with said at least one ceiling tile. The present invention also relates to a method for dismounting a suspended ceiling.

Technical background

[0002] Suspended ceilings can be installed in many different types of buildings for various reasons, for example to absorb sound, to reflect light, to lower the ceiling height or to conceal installations such as cable arrangements, ventilation equipment, lighting installations and other devices arranged in the space between the suspended ceiling and the ceiling structure of a building.

[0003] A suspended ceiling usually comprises a plurality of ceiling tiles and a supporting structure in form of a grid. The grid comprises profiles which support the ceiling tiles. The grid often comprises main runners which are suspended to the ceiling structure of the building and transverse or cross runners which are supported by the main runners. The profiles usually have an inverted T-shape or L-shape. The ceiling tiles may have sound-absorbing and/or sound-insulation properties in order to improve the acoustic environment of the room. In order to obtain a relatively lightweight ceiling with satisfactory sound absorption, the ceiling tiles, for instance, may be made of a compressed fibre material such as mineral wool and especially glass wool.

[0004] Occasionally, installations concealed by the suspended ceiling may require inspection or maintenance. Therefore, at least some portions of the suspended ceilings must be dismountable. A solution to this problem is to install inspection panels or to arrange ceiling tiles that are dismountable.

[0005] However, it also desirable that ceiling tiles supported by a grid of inverted T-shaped profiles are not displaced or lifted when subjected to force in a vertical direction, for example when the ceiling tiles are cleaned. Additionally, there is also a risk that ceiling tiles, especially light-weight ceiling tiles, are lifted or displaced during a sudden increase of pressure in the room. This may occur when a door is rapidly opened to a small room, for instance a bathroom or toilet. It may also be desirable in some circumstances, for instance at schools, prisons etc, to prevent persons not being authorized to gain access to the space above the suspended ceiling.

[0006] In order to hold down the ceiling tiles such that displacement or lifting of ceiling tiles is prevented, a hold down clip may be arranged for securing ceiling tiles to inverted T-shaped profiles. Conventional holds down clips are to be mounted from the rear surface of the ceiling tiles, i.e. from the surface facing the ceiling structure of the building. These conventional hold down clips are fixed to the web of the inverted T-shaped profile and are extending over a top portion of web. Hold down clips of this type are disclosed for example in US 7,062,886, US 4,858,408, and US 4,408,428. Another types of clips for suspended ceilings are shown in GB 861,322, US 4,833,854, US 6,260,325, FR 2 581 680 and GB 2 104 567.

[0007] GB 1 245 084 A discloses a spring clip for securing a panel supported by profiles in a suspended ceiling. The spring clip comprises a first leg which engages the edge of the panel, and a second leg which bears against a panel arranged on the other side of the profile. The spring clip further comprises a portion enclosing the bulb of the profile from above and engaging the bulb on both sides of the profile.

[0008] US 4 033 079 A discloses a hold-down clip for securing a panel supported by profiles in a suspended ceiling. The clip comprises a prong insertable into a peripheral edge of the panel. The clip further comprises a gripping means enclosing the bulb of the profile from above and engaging the bulb on both sides of the profile

[0009] US 2 780 850 A discloses a construction clip for securing panels supported by profiles in a suspended ceiling. The clip comprises an anchor plate with terminal flanges insertable in a rear surface of the panels. The clip further comprises a U-shaped stirrup member connected to the anchor plate and having downwardly extending legs. The legs are provided with inwardly extending resilient lugs. In order to secure the panels, the clip is pushed downward over the bulb of the profiles such that the resilient lugs are pressed outwardly and subsequently snapped back under the bulb, thereby anchoring the clip to the profile.

[0010] However, hold down clips of this type makes inspection of the space between the suspended ceiling and the ceiling structure of the building difficult, since the hold down clips only can be dismounted from above the suspended ceiling, i.e. from the rear side of the suspended ceiling. Thereby, the ceiling tiles are not easily dismountable. An inspection panel is in this case often required in order to get easily access to the space above the suspended ceiling. As an alternative, one of the ceiling tiles may be mounted without any hold down clip, thus resulting in the above mentioned problems.

[0011] There are examples of prior art hold down clips which are dismountable from below the suspended ceiling. However, these clips are partly visible from the interior of the room, which is undesirable due to aesthetic reasons.

Summary of the invention

[0012] It is an object of the present invention to provide an improvement over the above described techniques and prior art.

[0013] A further object is to provide an improved suspended ceiling wherein a conventional profile may be

used.

[0014] At least some of these and other objects and advantages that will be apparent from the description have been achieved by a suspended ceiling comprising at least one demountable ceiling tile made of a compressed fibre material, which is non-rigid and flexible, having a front surface, a rear surface opposite the front surface and one or more edge surfaces extending between the front and rear surfaces, and at least two profiles adapted to support said at least one ceiling tile, wherein at least one of said profiles comprises a flange and a web having a bulb, and a fixing member adapted to fixedly engage with said at least one ceiling tile. At least a fixing portion of the fixing member is adapted to be inserted into said at least one ceiling tile via an edge surface of the said at least one ceiling tile. The fixing member has a retaining portion adapted for engagement with the bulb from beneath relative the bulb and only on a sid of the profile facing said_at least one ceiling tile into which the fixing portion is adapted to be inserted. The retaining portion of the fixing member may be adapted to release the engagement with the bulb when said at least one profile is twisted such that at least a portion of the profile is angled about a longitudinal axis of said at least one profile.

[0015] An advantage of the present invention is that the fixing member prevents displacement of the ceiling tile upwards in a vertical direction. Thereby, the ceiling tile will not lift due to sudden increase of pressure in a room and will remain in place. Further, it is possible to apply pressure on the front surface of the ceiling tile without lifting the ceiling tile in an upward direction. Thereby, the ceiling tile will remain in place when it is for example cleaned.

[0016] When mounting the ceiling tile, the fixing member is inserted into the ceiling tile. The ceiling tile is then mounted to the grid formed of the profiles in conventional way. When the ceiling tile is supported by the profiles, the retaining portion of the fixing member engages with the bulb from beneath. Since the retaining portion of the fixing member is adapted to engage with the bulb from beneath, and not as in prior art solutions extending over the top portion of the bulb, the fixing member does not have to be mounted from above the grid but from below the grid. The mounting of the fixing member is thereby facilitated. Additionally, the problem associated with mounting of fixing members to the last ceiling tile in a suspended ceiling is overcome. Such problems arise when fixing members are to be mounted from above the grid, often resulting in that no fixing member is arranged for fixing the last ceiling tile.

[0017] When the ceiling tile is to be dismounted, a force or torque is applied to the profile such that the profile is twisted. Thereby, at least a portion of the profile is angled about a longitudinal axis of the profile. Consequently, the bulb is displaced from the retaining portion of the fixing member thereby releasing the engagement with the retaining portion. Thereafter, the ceiling tile may be dismounted. The fixing member does not have to be dismounted from above the grid. Thereby, dismounting of the ceiling tile is facilitated.

[0018] Further, the fixing member is not visible from beneath the suspended ceiling. Thereby, the visual appearance of the suspended ceiling is approved and is not affected by the fixing members.

[0019] A further advantage is that the fixing member may be used together with a conventional profile for forming the grid for the suspended ceiling. The profile does not have to a have a special design adapted to suit the fixing member, a conventional profile also suitable for other utilizations may be used. The fixing portion of the fixing member is adapted to be inserted into the ceiling tile in order to fixedly engage with the ceiling tile. No portion of the fixing member is abutting the flange of the profile. Thereby, a profile having a planar flange may be used together with the fixing member. Consequently, no gap is formed between the flange of the profile and the ceiling tile.

[0020] A further advantage is that for a person not intended to get access to the space above the suspended ceiling, the ceiling tile seems fixed to the grid not moveable in a vertical direction, thereby preventing access to the space above the suspended ceiling. However, for a person having permission to this space, the ceiling tile is easily dismountable from the suspended ceiling.

[0021] By twisting at least a portion of the profile about the longitudinal axis, the engagement between the retaining portion and the bulb is released. The rotational movement of the profile about the longitudinal_axis moves the bulb away from the retaining portion of the fixing member. Thereby, the retaining portion can pass at the side of the bulb such that the ceiling tile can be moved and removed from the grid. In this manner, the suspended ceiling is easily dismountable.

[0022] The engagement of the retaining portion with the bulb may prevent displacement of the fixing member in a horizontal direction. Thereby, the fixing member prevents movement of the ceiling tile in both upwards in a vertical direction and in the horizontal direction.

[0023] The retaining portion is adapted to engage with a surface of the bulb facing the flange. Consequently, the retaining portion engages with the bulb from beneath.

[0024] The surface of the bulb may form a transition between the bulb and the web. Thereby, the bulb may be formed when forming the profile, for example by roll forming.

[0025] The surface of the bulb may be inclined towards the web in a direction away from the flange. As the surface may be inclined toward the web away from the flange, the inclined surface prevents the retaining portion of the fixing member from releasing its engagement with the bulb. The inclination of the surface of the bulb in the direction away from the flange prevents displacement of the fixing member in a horizontal direction away from the profile. Consequently, the inclined surface locks the position of the retaining portion of the fixing member when the profile is in its normal upright position.

[0026] The bulb may be integrally formed with the web. Thereby, the bulb may be formed during the same operation as the rest of the profile, for example by roll forming a sheet into a profile. The bulb may increase the strength of the profile.

[0027] Said at least one profile may be twistable by elastic deformation of said at least one profile. The properties of the profile are such that the profile may be twisted to some extent, for instance 3-10°, by being elastically deformed. By allowing such elastic deformation, the profile may be twisted such that the engagement between the bulb and the retaining portion of the fixing member is released.

[0028] Said at least one profile may be adapted to be elastically deformed when a force or torque to said at least one profile while the fixing member is adapted to remain in its original shape and position. Thereby, the engagement between the bulb and the retaining portion of the fixing member may be released without the fixing member starts to deform.

[0029] A modulus of elasticity of the fixing member may be larger than a modulus of elasticity of said at least one profile. This implies that when a person affects the profile for dismounting the ceiling tile, for example by twisting the profile, it is the profile that deforms and not the fixing member.

[0030] The yield point $R_{p0,2}$ of the fixing member may be more than 400 N/mm^2, preferably more than 500 N/mm^2. The fixing member is formed of a material, for instance steel, having a high yield point, since the fixing member may be exposed to large impacts and since it is desirable to reduce the thickness of the material for the profile in order to reduce the required space for the installation. The yield point of the fixing member may be higher than the yield point of the profile.

[0031] The yield point $R_{p0,2}$ of said at least one profile may be 200-400 N/mm^2, preferably 300 N/mm^2. Even if the yield point of the profile is low, twisting of the profile is possible within the elastic region of the material since the profile is suspended at suspension points arranged at a large distance from each other, for example at least 600 mm, and since the torque is applied to the profile at a position corresponding to the centre of the ceiling tile along the profile 10.

[0032] At least a portion of said at least one profile may be twistable 3-10°, preferably 5-7°, about a longitudinal axis of said at least one profile. By twisting the profile 3-10°, preferably 5-7°, about the longitudinal axis of the profile, the engagement of the retaining portion with bulb is released. By twisting the profile, the bulb is moved away from the retaining portion of the fixing member, Thereby, the retaining portion of the fixing member may pass beside the bulb such that the ceiling tile can be lifted, tilted and then removed from the grid.

[0033] An edge portion of the front surface of said at least one ceiling tile may be adapted to rest on the flange. The flange may have a planar surface.

[0034] According to another aspect of the present invention, a method for dismounting a suspended ceiling is provided. The method comprises

- providing a suspended ceiling comprising
  at least one demountable ceiling tile made of a compressed fibre material, which is non-rigid and flexible having a front surface, a rear surface opposite the front surface and one or more edge surfaces extending between the front and rear surfaces,
  at least two profiles adapted to support said at least one ceiling tile, wherein at least one of said profiles comprises a flange and a web having a bulb, and
  a fixing member adapted to fixedly engage with said at least one ceiling tile, wherein at least a fixing portion of the fixing member is adapted to be inserted into said at least one ceiling tile via an edge surface of said at least one ceiling tile,
  the fixing member having a retaining portion adapted for engagement with the bulb from beneath relative the bulb and only on a side of the profile facing said at least one ceiling tile into which the fixing portion is adapted to be inserted,
- releasing the engagement between the retaining portion of the fixing member and the bulb by applying a force or torque to said at least one profile such that said at least one profile is twisted such that at least a portion of said at least one profile is angled about a longitudinal axis of said at least one profile thereby moving the bulb away from the retaining portion of the fixing member.

[0035] By twisting at least a portion of the profile about the longitudinal axis, the engagement between the retaining portion and the bulb is released. The rotational movement of the profile about the longitudinal axis moves the bulb away from the retaining portion of the fixing member. Thereby, the retaining portion can pass at the side of the bulb such that the ceiling tile can be moved and removed from the grid. Consequently, the ceiling tiles in the suspended ceiling are easily dismountable.

[0036] By the inventive method, it is possible to release the fixing member and thereby dismount the ceiling tile from beneath. Dismounting of the fixing member such that the ceiling tile may be removed from the grid is further facilitated. The fixing member does not have to be removed from above the level of the suspended ceiling but from beneath.

[0037] Further, for a person not supposed to have access to the suspended ceiling, the ceiling tiles of the suspended ceiling seem locked. If a person tries to lift a ceiling tile, it will not be possible to move the ceiling tile. No part of the fixing member is visible and, consequently, no clue is given to how to dismount the ceiling tile. However, for a person having access to the suspended ceiling and space above, the ceiling tiles are easily dismountable by applying a force or torque to the profile for twisting the profile. Additionally, a tool may be used to grip, for example the flange of the profile, for further increase the

impression that the ceiling tiles are locked and that a special tool must be used to dismount the ceiling tile from the suspended ceiling. Such a tool may also further facilitate dismounting of the ceiling tile, since the tool facilitates gripping the flange of the profile.

[0038] Additionally, the advantages described above for the suspended ceiling are applicable also for the inventive method.

[0039] The method may further comprise lifting said at least one ceiling tile upwards at least at the fixing member side while applying said force or torque to the profile. Thereby, the ceiling tile may be tilted such that it may be removed from the grid.

[0040] The step of applying a force or torque to said at least one profile may comprise applying a force or torque to the flange of said at least one profile. Preferably, a force or torque is applied to the profile at a position located at the centre of the ceiling tile along the profile. By applying a force or torque to the flange of the profile, the flange acts as a torque arm. Thus, the torque required for achieving the twisting of the profile is reduced.

[0041] According to a further aspect of the invention, a fixing member adapted to fixedly engage with a ceiling tile is provided, comprising a first fixing portion adapted to be inserted into a ceiling tile via an edge surface of the ceiling tile, a second fixing portion adapted to abut a rear surface of the ceiling tile, and a retaining portion adapted to engage with a bulb of a profile from beneath relative the bulb.

Brief description of the drawings

[0042] The present invention will by way of example be described in more detail with reference to the appended schematic drawings, which show embodiments of the present invention.

Fig. 1 shows a portion of a suspended ceiling.
Fig. 2a shows a perspective view of a fixing member.
Fig. 2b shows a cross section of the fixing member in fig. 2a.
Fig. 3 shows a perspective view of a section of the suspended ceiling including the fixing member.
Fig. 4 shows the section of the suspended ceiling in fig. 2 in cross-section.
Figs. 5a-b schematically disclose a method for dismounting the suspended ceiling.

Detailed description

[0043] Fig. 1 shows a portion of a suspended ceiling 1 comprising profiles 10, 11 forming a grid, ceiling tiles 2 and fixing members 20. The profiles 10, 11 are adapted to support the ceiling tiles 2. The profiles 10, 11 may be main runners 10, cross runners 11 and/or wall runners (not shown). At least one of the profiles is of the type described in more detail below. The main runners 10 are commonly suspended from the structural ceiling or building frame work or the like. The suspension may e.g. be provided using hangers 3 formed of wires or interconnected plate shaped members or the like. The main runners 10 are commonly arranged equidistantly and parallel to each other. The grid further comprises a plurality of cross runners 11 extending between the main runners 10. The cross runners 11 are provided with connecting members at their respective ends and engage with the main runners 10. They may also be supported by the main runners 10. The cross runners 11 are commonly arranged equidistantly and parallel to each other, and commonly transverse to the main runners 10. Cross runners 11 may also be arranged parallel to the main runners 10. The grid thus formed provides a plurality of quadratic or rectangular openings into which the ceiling tiles 2 are adapted to be placed.

[0044] The ceiling tiles 2 have a front surface 2a, a rear surface 2b opposite the front surface 2a and one or more edge surfaces 2c extending between the front and rear surfaces 2a, 2b. The front surface 2a may be provided with a surface layer. The rear surface 2b may also be provided with a surface layer. The front and/or the rear surface 2a, 2b may be painted.

[0045] The ceiling tiles 2 have sound-absorbing and/or sound-insulation properties in order to improve the acoustic environment of a room. The ceiling tile 2 may be made of man-made mineral fibre. In order to obtain a relatively lightweight ceiling with satisfactory sound absorption, the ceiling tiles are made of a compressed fibre material such as mineral wool and especially glass wool.

[0046] Figs. 2a-b show a fixing member 20 adapted to fixedly engage with a ceiling tile 2 in more detail. The fixing member 20 is in form of a clip. The fixing member 20 comprises a first fixing portion 21, a second fixing portion 22, an intermediate portion 23 and a retaining portion 24. In the shown embodiment, the fixing member 20 comprises a pair of the first fixing portions 21 a, 21 b. However, a person skilled in the art appreciates that the fixing member 20 may be designed with one first fixing portion.

[0047] The fixing member 20 is adapted to fixedly engage the ceiling tile 2 by means of the first and the second fixing portions 21, 22.

[0048] The first fixing portion 21 is adapted to be inserted into a ceiling tile 2 via an edge surface 2c of the ceiling tile 2. The first fixing 21 portion is adapted to extend into the ceiling tile 2. When the first fixing portion 21 is inserted into the ceiling tile 2, the position of the fixing member 20 is fixed in relation to the ceiling tile 2.

[0049] The second fixing portion 22 is adapted to extend along a rear surface of the ceiling tile 2. The second fixing portion 22 is adapted to abut the rear surface of the ceiling tile 2.

[0050] In order to improve the strength of the fixing member 20, the shown embodiment of the fixing member 20 comprises two first portions 21a, 21 b adapted to be inserted into an edge surface 2c of the ceiling tile 2.

[0051] As seen in cross-section in fig. 2b, the first and

second fixing portions 21, 22 extend in a horizontal direction. When the fixing member 20 is engaging a ceiling tile 2, the first and second fixing portions 21, 22 extends in a direction parallel to the plane of the ceiling tile 2.

[0052] An intermediate portion 23 of the fixing member 20 is connecting the first fixing portion 21 with the retaining portion 24 and the second fixing portion 22.

[0053] The retaining portion 24 is extending upwardly. The retaining portion 24 is angled away from the second fixing portion 22. The retaining portion 24 is adapted to engage with a profile 10 when forming a part of the grid for a suspended ceiling 1.

[0054] The fixing member 20 may be formed from a sheet. Three tongues are cut out from the sheet. The tongues are bent such that the tongues form the first and second fixing portions 21 a, 21 b, 22. An upper part of the fixing member 20 is upwardly angled such that the retaining portion 24 is formed.

[0055] The fixing member 20 may be formed of steel. The yield point $R_{p0,2}$ of the material used for forming the fixing member is more than 400 N/mm^2, and preferably more than 500 N/mm^2. Preferably, the thickness of the sheet is less than 0,5 mm. The fixing member 20 is required to resist impacts without deforming.

[0056] Fig. 3 discloses a section of the suspended ceiling 1 shown in fig. 1. The suspended ceiling 1 comprises at least two profiles 10, 11, at least one ceiling tile 2 and at least one fixing member 20. Said at least two profiles 10, 11 are adapted to support the ceiling tiles 2.

[0057] The profiles 10, 11 comprise a flange 12 and a web 13. At least one of the profiles has a bulb 14. The bulb 14 is integrally formed with the web 13. The bulb 14 is symmetrical about a vertical axis. The bulb 14 has a pointed top portion. The bulb 14 has a lower portion having a surface 15 on each side of the web 13. The surface 15 forms a transition between the bulb 14 and the web 13. The surface 15 is inclined towards the web 13 in a direction away from the flange 12.

[0058] The profiles 10, 11 are adapted to support a ceiling tile 2. More specifically, an edge portion of the front surface 2a of the ceiling tile 2 is adapted to rest on the flange 12 of the profile 10, 11.

[0059] The profiles 10, 11 may be an inverted T-profile or an L-shaped profile. The flange 12 of the profile may be provided with a capping 16.

[0060] The profiles 10, 11 can be formed of a sheet of for instance steel. The thickness of the sheet may be 0,25 - 0,5 mm. The capping 16 can be formed of a sheet of aluminium or steel. The thickness of the sheet for forming the capping may be approximately 0,2 mm.

[0061] Said at least one ceiling tile 2 is of the type described in more detailed above in connection with fig. 1

[0062] The fixing member 20 is of the type described in more detailed above in connection with figs.2a-b.

[0063] As seen in figs. 3 and 4, the fixing member 20 is fixedly engaging the ceiling tile 2. The pair of first fixing portions 21 a, 21 b is inserted into the ceiling tile 2 via an edge surface 2c of the ceiling tile 2. The second fixing portion 22 is extending along the rear surface 2b of the ceiling tile 2. The second fixing portion 22 is abutting the rear surface 2b of the ceiling tile 2. Thereby, the fixing member 20 fixedly engages the ceiling tile 2.

[0064] The retaining portion 24 of the fixing member 20 engages with the profile 10. More specifically, the retaining portion 24 engages with the bulb 14 from beneath. The retaining portion 24 engages with the inclined surface 15 of the lower portion of the bulb 14. The engagement between the retaining portion 24 and the bulb 14 restricts movements of the ceiling tile 2 in the vertical direction. Thereby, the ceiling tile 2 can not be lifted and moved in the vertical direction. Further, due to the surface 15 being inclined towards the web 13 in a direction away from the flange 12, movement of the ceiling tile 2 in the horizontal direction is also restricted. Consequently, the engagement between the retaining portion 24 and the bulb 14 locks the ceiling tile 2 in position.

[0065] An edge portion of the front surface 2a of ceiling tile 2 is directly abutting the flange 12 of the profile 10. The edge portion of the ceiling tile 2 rests on the flange 12 of the profile 10. The upper surface of the flange 12 forms a plane surface on which the edge portion of the front surface 2a of the ceiling tile 2 is resting.

[0066] Preferably, a fixing member 20 is arranged on opposite side surfaces of the ceiling tile 2. Thereby, two fixing members 20 are attached to each ceiling tile 2. Preferably, the fixing members 20 are arranged at a centre portion of each ceiling tile 2.

[0067] When mounting the suspended ceiling 1, the fixing member 20 is attached to the ceiling tile 2 as described above. A supporting structure is formed by said at least two profiles 10, 11. The supporting structure is suspended to the ceiling structure of the building. The ceiling tile 2 is then mounted to the supporting structure, i.e. the grid. The ceiling tile 2 angled such that the ceiling tile 2 can pass between the profiles 10, 11 and lifted above the profiles 10, 11. The ceiling tile 2 is then released such that the ceiling tile 2 falls down and in position. The retaining portion 24 of the fixing member 20 passes the bulb 14 of the profile 10 and snaps into engagement with the surface 15 of the lower portion of the bulb 14. Since friction between the fixing member 20 and the profile 10 is low, the retaining portion 24 easily can pass the bulb 14. The ceiling tile 2 reaches its final position wherein an edge portion of the ceiling tile 2 rests on the flange 12 of the profile 10, and wherein the retaining portion 24 of the fixing member 20 engages the surface 15 of the bulb 14.

[0068] With reference to figs. 4 and 5, a method for dismounting the suspended ceiling 1 will be described. Figs. 4 and 5 show a suspended ceiling 1 of the type described above including the fixing member 20 as described above. In order to dismount a ceiling tile 2 from the suspended ceiling 1, the profile 10 is twisted or torsioned about a longitudinal direction of the profile 10 such that at least a portion of the profile 10 is angled about the longitudinal axis of the profile 10. Preferably, a portion of

the profile 10 is angled at a position located at the centre of the ceiling tile along the profile 10. Preferably, the profile 10 is angled at a position near the fixing member 20. The profile 10 is twisted in a direction such that the bulb 14 moves away from the fixing member 20 and the ceiling tile 2. By twisting the profile 10 about the longitudinal direction, the engagement between the retaining portion 24 of the fixing member and the bulb 14 of the profile 10 is released. More specifically, the engagement between the retaining portion 24 and the inclined surface 15 of the lower portion of the bulb 14 is released. When the profile 10 is twisted in a direction away from the fixing member 20, the bulb 14 is moved in relation to the fixing member 20 and the ceiling tile 2. Thereby, the bulb 14 moves away from the retaining portion 24 and the engagement between the retaining portion 24 and the bulb 14 is released. The retaining portion 24 can pass beside the bulb 14.

[0069] Since the compressed fibre material of the ceiling tile, for example glass wool, is non-rigid and flexible, the ceiling tile arranged on the opposite side of the profile 10 allows the profile 10 to be twisted and does not hinder the displacement of the profile 10.

[0070] Preferably, for a profile having a height of 32 mm, the profile 10 is angled 5-7°. Thereby, the bulb 14 is moved 2-3 mm, which is enough to release the engagement between the retaining portion 24 and the bulb 14, and let the retaining portion 24 pass beside the bulb 14. Required torque moment is about 0,2 Nm.

[0071] The profile 10 may be twisted by applying a force or torque to the profile 10. Preferably, the force or torque may be applied to the flange 12 of the profile 10. Preferably, the force or torque is applied to an end portion of the flange 12. In the longitudinal direction of the profile 10, the torque or force is preferably applied to the profile 10 at a position located at the centre of the ceiling tile along the profile 10. The force may be applied by pushing or gripping the flange 12 by hand. A person may grip the profile 10 an end portion of the flange 12 opposite the side of the profile 10 where the fixing member 20 is located, and rotate that side of the profile 10 downwardly. As an alternative or in addition, the person may push the flange 12 at the same side of the profile 10 as the side where the fixing member 20 is located, and rotate the side upwardly.

[0072] Alternatively, a tool may be used in order to grip an end portion of the flange 12 opposite the side of the profile 10 where the fixing member 20 is located. The tool is then used to rotate the profile 10 about the longitudinal direction of the profile 10.

[0073] While twisting the profile 10 such that the engagement between the retaining portion 24 and the bulb 14 is released, the edge of the ceiling tile 2 can be lifted upwardly. When the ceiling tile 2 is lifted, the fixing member 20 arranged on the opposite side edge of the ceiling tile 2 will release its engagement with bulb 14 of the other profile 10. Thereby, the ceiling tile 2 can be dismounted from the grid formed by the profiles 10.

[0074] If desired, the ceiling tile 2 can be remounted to the profile 10 again.

[0075] The profile 10 is elastically deformed when being twisted or torsioned. The material of the profile 10 is chosen such that the profile 10 allows twisting by being elastically deformed. Even if the profile 10 is produced of a material having a low yield point, twisting of the profile 10 within its elastic region is possible since the profile 10 is suspended at suspension points arranged at a large distance from each other, for instance at least 600 mm, and since the torque is applied to the profile 10 at a position located at the centre of the ceiling tile along the profile 10.

[0076] The properties of the profile 10 in relation to the properties of the fixing member 20 are chosen such that the profile 10 elastically deforms when a torque or force is applied to the profile 10 and the fixing member 20 does not deform. The modulus of elasticity of the fixing member 20 may be exceeding the modulus of elasticity of the profile 10. Consequently, the profile 10 will deform and the fixing member 20 will withstand the stress without deforming. Further, the yield point of the fixing member 20 may be exceeding the yield point of the profile 10. The profile 10 may be produced from a material having a yield point $R_{p0,2}$ of 200-400 N/mm^2, preferably 300 N/mm^2. The fixing member 20 may be produced from a material having a yield point $R_{p0,2}$ of more than 400 N/mm^2, preferably more than 500 N/mm^2. The yield point $R_{p0,2}$ an offset yield point, wherein value is set at 0,2 % of the strain

[0077] It is contemplated that there are numerous modifications of the embodiments described herein, which are still within the scope of the invention as defined by the appended claims.

[0078] It is for example contemplated that the grid supporting said at least one ceiling tile comprise at least one profile having a bulb as described above and one or more conventional profiles. It is also contemplated that the fixing member may be attached to both main runners and/or cross runners. In the shown embodiment, fixing members are arranged at two opposite sides of the ceiling tile. Fixing member may also be arranged at opposite sides the profile, as seen in fig. 1. However, it is also contemplated that the fixing members are arranged at more than two sides, for example at four sides of the ceiling tile, or at only one side. Preferably, the fixing members are arranged opposite each other. More than one fixing member may also be arranged at the same side of the ceiling tile.

Claims

1. A suspended ceiling (1) comprising
at least one demountable ceiling tile (2) made of a compressed fibre material, which is non-rigid and flexible, having a front surface (2a), a rear surface (2b) opposite the front surface (2a) and one or more edge surfaces (2c) extending between the front and

rear surfaces (2a, 2b), and
at least two profiles (10, 11) adapted to support said at least one ceiling tile (2),
wherein at least one of said profiles (10) comprises a flange (12) and a web (13) having a bulb (14), and a fixing member (20) adapted to fixedly engage with said at least one ceiling tile (2), wherein at least a fixing portion (21) of the fixing member (20) is adapted to be inserted into said at least one ceiling tile (2) via an edge surface (2c) of the said at least one ceiling tile (2),
the fixing member (20) having a retaining portion (24) adapted for engagement with the bulb (14), **characterized in that**
the retaining portion (24) is adapted for engagement with the bulb (14) from beneath relative to the bulb (14) and only on a side of the profile (10) facing said at least one ceiling tile (2) into which the fixing portion (21) is adapted to be inserted, wherein the retaining portion (24) of the fixing member (20) is adapted to release the engagement with the bulb (14) when said at least one profile (10) is twisted such that at least a portion of the profile (10) is angled about a longitudinal axis of said at least one profile (10).

2. A suspended ceiling (1) according to claim 1, wherein the engagement of the retaining portion (24) with the bulb (14) prevents displacement of the fixing member (20) in a horizontal direction.

3. A suspended ceiling (1) according to any one of claims 1-2, wherein the retaining portion (24) is adapted to engage with a surface (15) of the bulb (14) facing the flange (12).

4. A suspended ceiling (1) according to claim 3, wherein said surface (15) of the bulb (14) forms a transition between the bulb (14) and the web (13).

5. A suspended ceiling (1) according to claim 3 or 4, wherein said surface (15) of the bulb (14) is inclined towards the web (13) in a direction away from the flange (12).

6. A suspended ceiling (1) according to any one of claims 1-5, wherein the bulb (14) is integrally formed with the web (13).

7. A suspended ceiling (1) according to any one of claim 1-6, wherein said at least one profile (10) is twistable by elastic deformation of said at least one profile (10).

8. A suspended ceiling (1) according to any one of claims 1-7, wherein said at least one profile (10) is adapted to be elastically deformed when a force or torque to said at least one profile (10) while the fixing member (20) is adapted to remain in its original shape and position.

9. A suspended ceiling (1) according to any one of claims 1-8, wherein the yield point $R_{p0,2}$ of the fixing member (20) is more than 400 N/mm^2, preferably more than 500 N/mm^2.

10. A suspended ceiling (1) according to any one of claims 1-9, wherein the yield point $R_{p0,2}$ of said at least one profile (10) is 200-400 N/mm^2, preferably 300 N/mm^2.

11. A suspended ceiling (1) according to any one of claims 1-10,
wherein at least a portion of said at least one profile (10) is twistable 3-10°, preferably 5-7°, about a longitudinal axis of said at least one profile (10).

12. A suspended ceiling (1) according to any one of claims 1-11,
wherein an edge portion of the front surface (2a) of said at least one ceiling tile (2) is adapted to rest on the flange (12).

13. Method for dismounting a suspended ceiling (1), comprising

- providing a suspended ceiling (1) comprising at least one demountable ceiling tile (2) made of a compressed fibre material, which is non-rigid and flexible, having a front surface (2a), a rear surface (2b) opposite the front surface (2a) and one or more edge surfaces (2c) extending between the front and rear surfaces (2a, 2b),
at least two profiles (10 ,11) adapted to support said at least one ceiling tile (2), wherein at least one of said profiles (10) comprises a flange (12) and a web (13) having a bulb (14), and
a fixing member (20) adapted to fixedly engage with said at least one ceiling tile (2), wherein at least a fixing portion (21) of the fixing member (20) is adapted to be inserted into said at least one ceiling tile (2) via an edge surface (2c) of said at least one ceiling tile (2),
the fixing member (20) having a retaining portion (24) adapted for engagement with the bulb (14) from beneath relative the bulb (14) and only on a side of the profile (10) facing said at least one ceiling tile (2) into which the fixing portion (21) is adapted to be inserted,
- releasing the engagement between the retaining portion (24) of the fixing member (20) and the bulb (14) by applying a force or torque to said at least one profile (10) such that said at least one profile (10) is twisted such that at least a portion of said at least one profile (10) is angled about a longitudinal axis of said at least one profile (10) thereby moving the bulb (14) away from the retaining portion (24) of the fixing member (20).

14. Method according to claim 13, further comprising lifting said at least one ceiling tile (2) upwards at least at the fixing member side while applying said force or torque to said at least one profile (10).

15. Method according to claim 13 or 14, wherein the step of applying a force or torque to said at least one profile (10) comprises applying a force or torque to the flange (12) of said at least one profile (10).

Patentansprüche

1. Hängedecke (1), umfassend:

- mindestens eine demontierbare Deckenplatte (2) aus einem komprimierten Fasermaterial, das nachgiebig und biegsam ist, mit einer Vorderfläche (2a), einer Rückfläche (2b) gegenüber der Vorderfläche (2a) und einer oder mehreren Randflächen (2c) aufweist, die sich zwischen den Vorder- und Rückflächen (2a, 2b) erstrecken, und

mindestens zwei Profile (10, 11), die geeignet sind, um die mindestens eine Deckenplatte (2) zu tragen;

wobei mindestens eines der Profile (10) einen Flansch (12) und einen Steg (13) mit einem Kolben (14) umfasst, und

ein Befestigungselement (20), das geeignet ist, um fest mit der mindestens einen Deckenplatte (2) in Eingriff zu kommen, wobei mindestens ein Befestigungsabschnitt (21) des Befestigungselements (20) geeignet ist, um in die mindestens eine Deckenplatte (2) über eine Randfläche (2c) der mindestens einen Deckenplatte (2) eingefügt zu werden,

wobei das Befestigungselement (20) einen Halteabschnitt (24) aufweist, der zum Eingriff mit dem Kolben (14) geeignet ist,

dadurch gekennzeichnet, dass der Halteabschnitt (24) geeignet ist zum Eingriff mit dem Kolben (14) von unten mit Bezug auf den Kolben (14) und nur auf einer Seite des Profils (10), die der mindestens einen Deckenplatte (2) gegenüberliegt, zur Einfügung in die der Befestigungsabschnitt (21) geeignet ist, wobei der Halteabschnitt (24) des Befestigungselements (20) geeignet ist, um den Eingriff mit dem Kolben (14) zu lösen, wenn das mindestens eine Profil (10) derart verdreht wird, dass mindestens ein Abschnitt des Profils (10) um eine Längsachse des mindestens einen Profils (10) abgewinkelt ist.

2. Hängedecke (1) nach Anspruch 1, wobei der Eingriff des Halteabschnitts (24) mit dem Kolben (14) eine Verlagerung des Befestigungselements (20) in einer waagerechten Richtung verhindert.

3. Hängedecke (1) nach einem der Ansprüche 1 bis 2, wobei der Halteabschnitt (24) geeignet ist, um mit einer Oberfläche (15) des Kolbens (14) gegenüber dem Flansch (12) in Eingriff zu kommen.

4. Hängedecke (1) nach Anspruch 3, wobei die Oberfläche (15) des Kolbens (14) einen Übergang zwischen dem Kolben (14) und dem Steg (13) bildet.

5. Hängedecke (1) nach Anspruch 3 oder 4, wobei die Oberfläche (15) des Kolbens (14) in Richtung auf den Steg (13) in einer sich von dem Flansch (12) entfernenden Richtung geneigt ist.

6. Hängedecke (1) nach einem der Ansprüche 1 bis 5, wobei der Kolben (14) mit dem Steg (13) einstückig gebildet ist.

7. Hängedecke (1) nach einem der Ansprüche 1 bis 6, wobei das mindestens eine Profil (10) durch elastische Verformung des mindestens einen Profils (10) verdrehbar ist.

8. Hängedecke (1) nach einem der Ansprüche 1 bis 7, wobei das mindestens eine Profil (10) geeignet ist, um elastisch verformt zu werden, wenn eine Kraft oder ein Drehmoment auf das mindestens eine Profil (10) ausgeübt wird, während das Befestigungselement (20) geeignet ist, um in seiner ursprünglichen Form und Position zu bleiben.

9. Hängedecke (1) nach einem der Ansprüche 1 bis 8, wobei die Streckgrenze $R_{p0,2}$ des Befestigungselements (20) mehr als 400 N/mm^2, bevorzugt mehr als 500 N/mm^2 beträgt.

10. Hängedecke (1) nach einem der Ansprüche 1 bis 9, wobei die Streckgrenze $R_{p0,2}$ des mindestens einen Profils (10) 200 bis 400 N/mm^2, bevorzugt 300 N/mm^2 beträgt.

11. Hängedecke (1) nach einem der Ansprüche 1 bis 10, wobei mindestens ein Abschnitt des mindestens einen Profils (10) um 3 bis 10°, bevorzugt um 5 bis 7°, um eine Längsachse des mindestens einen Profils (10) verdrehbar ist.

12. Hängedecke (1) nach einem der Ansprüche 1 bis 11, wobei ein Randabschnitt der Vorderfläche (2a) der mindestens einen Deckenplatte (2) geeignet ist, um auf dem Flansch (12) zu liegen.

13. Verfahren zum Demontieren einer Hängedecke (1), umfassend folgende Schritte:

- Bereitstellen einer Hängedecke (1), umfassend:

mindestens eine demontierbare Deckenplatte (2) aus einem komprimierten Fasermaterial, das nachgiebig und biegsam ist, mit einer Vorderfläche (2a), einer Rückfläche (2b) gegenüber der Vorderfläche (2a) und einer oder mehreren Randflächen (2c), die sich zwischen den Vorder- und Rückflächen (2a, 2b) erstrecken,
mindestens zwei Profile (10, 11), die geeignet sind, um die mindestens eine Deckenplatte (2) zu tragen; wobei mindestens eines der Profile (10) einen Flansch (12) und einen Steg (13) mit einem Kolben (14) umfasst, und
ein Befestigungselement (20), das geeignet ist, um fest mit der mindestens einen Deckenplatte (2) in Eingriff zu kommen, wobei mindestens ein Befestigungsabschnitt (21) des Befestigungselements (20) geeignet ist, um in die mindestens eine Deckenplatte (2) über eine Randfläche (2c) der mindestens einen Deckenplatte (2) eingefügt zu werden,
wobei das Befestigungselement (20) einen Halteabschnitt (24) aufweist, der geeignet ist zum Eingriff mit dem Kolben (14) von unten mit Bezug auf den Kolben (14) und nur auf einer Seite des Profils (10), die der mindestens einen Deckenplatte (2) gegenüberliegt, zur Einfügung in die der Befestigungsabschnitt (21) geeignet ist,

- Lösen des Eingriffs zwischen dem Halteabschnitt (24) des Befestigungselements (20) und des Kolbens (14) durch Ausüben einer Kraft oder eines Drehmoments auf das mindestens eine Profil (10), so dass das mindestens eine Profil (10) derart verdreht wird, dass mindestens ein Abschnitt des mindestens einen Profils (10) um eine Längsachse des mindestens einen Profils (10) abgewinkelt ist, wodurch der Kolben (14) von dem Halteabschnitt (24) des Befestigungselements (20) entfernt wird.

14. Verfahren nach Anspruch 13, ferner umfassend das Anheben der mindestens einen Deckenplatte (2) nach oben, mindestens auf der Seite des Befestigungselements, wobei die Kraft oder das Drehmoment auf das mindestens eine Profil (10) ausgeübt wird.

15. Verfahren nach Anspruch 13 oder 14, wobei der Schritt des Ausübens einer Kraft oder eines Drehmoments auf das mindestens eine Profil (10) das Ausüben einer Kraft oder eines Drehmoments auf den Flansch (12) des mindestens einen Profils (10) umfasst.

Revendications

1. Plafond suspendu (1) comprenant
au moins une dalle de plafond démontable (2) faite de matériau fibreux compressé qui est non-rigide et souple, dotée d'une surface frontale (2a), d'une surface arrière (2b) opposée à la surface frontale (2a) et d'une ou plusieurs surfaces périphériques (2c) s'étendant entre la surface frontale et les surfaces arrière (2a, 2b) et
au moins deux profilés (10, 11) aptes à supporter ladite au moins une dalle de plafond (2),
au moins un desdits profilés (10) comprenant une bride (12) et un voile (13) comportant un boudin (14) et
un élément de fixation (20) apte à s'engager fixement dans ladite au moins une dalle de plafond (2), au moins une section de fixation (21) de l'élément de fixation (20) étant apte à être insérée dans ladite au moins une dalle de plafond (2) via une surface périphérique (2c) de ladite au moins une dalle de plafond (2),
l'élément de fixation (20) comportant une section de retenue (24) apte à s'engager dans le boudin (14), **caractérisé en ce que**
la section de retenue (24) est apte à s'engager dans le boudin (14) par-dessous relativement au boudin (14) et seulement sur une face du profilé (10) faisant face à ladite au moins une dalle de plafond (2) dans laquelle la section de fixation (21) est apte à être insérée, la section de retenue (24) de l'élément de fixation (20) étant apte à défaire l'engagement dans le boudin (14) lorsque ledit au moins un profilé (10) est tordu de manière à ce qu'au moins une partie du profilé (10) soit coudée autour d'un axe longitudinal du dit au moins un profilé (10).

2. Plafond suspendu (1) selon la revendication 1, dans lequel l'engagement de la section de retenue (24) dans le boudin (14) empêche le déplacement de l'élément de fixation (20) dans un sens horizontal.

3. Plafond suspendu (1) selon l'une quelconque des revendications 1 et 2, dans lequel la section de retenue (24) est apte à s'engager dans une surface (15) du boudin (14) faisant face à la bride (12).

4. Plafond suspendu (1) selon la revendication 3, dans lequel ladite surface (15) du boudin (14) créée une transition entre le boudin (14) et le voile (13).

5. Plafond suspendu (1) selon la revendication 3 ou 4, dans lequel ladite surface (15) du boudin (14) est inclinée vers le voile (13) dans un sens s'éloignant de la bride (12).

6. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 5, dans lequel le boudin (14) for-

me partie intégrante avec le voile (13).

7. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 6, dans lequel ledit au moins un profilé (10) peut être tordu par déformation élastique dudit au moins un profilé (10).

8. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 7, dans lequel ledit au moins un profilé (10) est apte à être déformé élastiquement lorsqu'une force ou un couple est appliqué à l'au moins un profilé (10) pendant que l'élément de fixation (20) est apte à rester dans sa position et sa forme d'origine.

9. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 8, dans lequel la limite d'élasticité $R_{p0,2}$ de l'élément de fixation (20) est supérieure à 400 N/mm^2, de préférence supérieure à 500 N/mm^2.

10. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 9, dans lequel la limite d'élasticité $R_{p0,2}$ dudit au moins un profilé (10) est de 200 à 400 N/mm^2, de préférence 300 N/mm^2.

11. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 10, dans lequel au moins une partie dudit au moins un profilé (10) peut être tordue de 3 à 10°, de préférence 5 à 7°, autour d'un axe longitudinal dudit au moins un profilé (10).

12. Plafond suspendu (1) selon l'une quelconque des revendications 1 à 11, dans lequel une section périphérique de la surface frontale (2a) de ladite au moins une dalle de plafond (2) est apte à reposer sur la bride (12).

13. Procédé de démontage d'un plafond suspendu (1), comprenant :

- la mise en place d'un plafond suspendu (1) comprenant
au moins une dalle de plafond démontable (2) faite de matériau fibreux compressé qui est non-rigide et souple, dotée d'une surface frontale (2a), d'une surface arrière (2b) opposée à la surface frontale (2a) et d'une ou plusieurs surfaces périphériques (2c) s'étendant entre la surface frontale et les surfaces arrière (2a, 2b),
au moins deux profilés (10, 11) aptes à supporter ladite au moins une dalle de plafond (2), au moins un desdits profilés (10) comprenant une bride (12) et un voile (13) comportant un boudin (14) et
un élément de fixation (20) apte à s'engager fixement dans ladite au moins une dalle de plafond (2), au moins une section de fixation (21) de l'élément de fixation (20) étant apte à être insérée dans ladite au moins une dalle de plafond (2) via une surface périphérique (2c) de ladite au moins une dalle de plafond (2),
l'élément de fixation (20) comportant une section de retenue (24) apte à s'engager dans le boudin (14) par-dessous relativement au boudin (14) et seulement sur une face du profilé (10) faisant face à ladite au moins une dalle de plafond (2) dans laquelle la section de fixation (21) est apte à être insérée,
- la dissociation de l'engagement entre la section de retenue (24) de l'élément de fixation (20) et le boudin (14) en appliquant une force ou un couple audit au moins un profilé (10) de manière à ce que ledit au moins un profilé (10) soit tordu de sorte qu'au moins une partie du dit au moins un profilé (10) décrive un angle autour d'un axe longitudinal du dit au moins un profilé (10), ce qui éloigne le boudin (14) de la section de retenue (24) de l'élément de fixation (20).

14. Procédé selon la revendication 13, comprenant en outre l'élévation de ladite au moins une dalle de plafond (2) vers le haut au moins sur la face de l'élément de fixation tout en appliquant ladite force ou ledit couple audit au moins un profilé (10).

15. Procédé selon la revendication 13 ou 14, dans lequel l'étape d'application d'une force ou d'un couple audit au moins un profilé (10) comprend l'application d'une force ou d'un couple à la bride (12) dudit au moins un profilé (10).

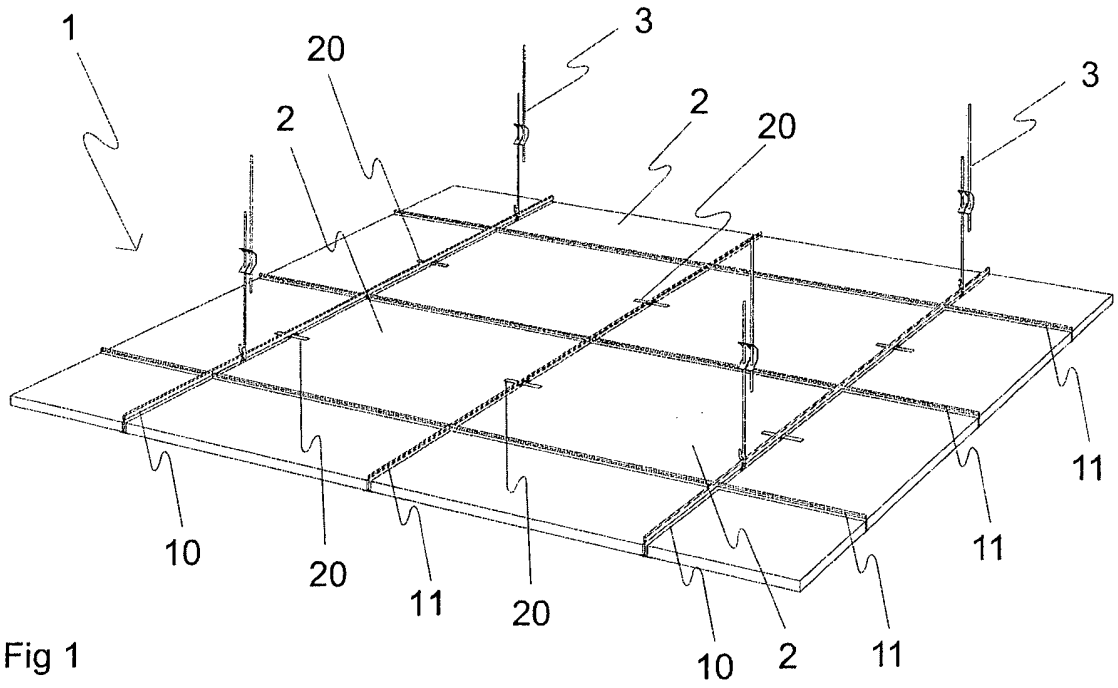

Fig 1

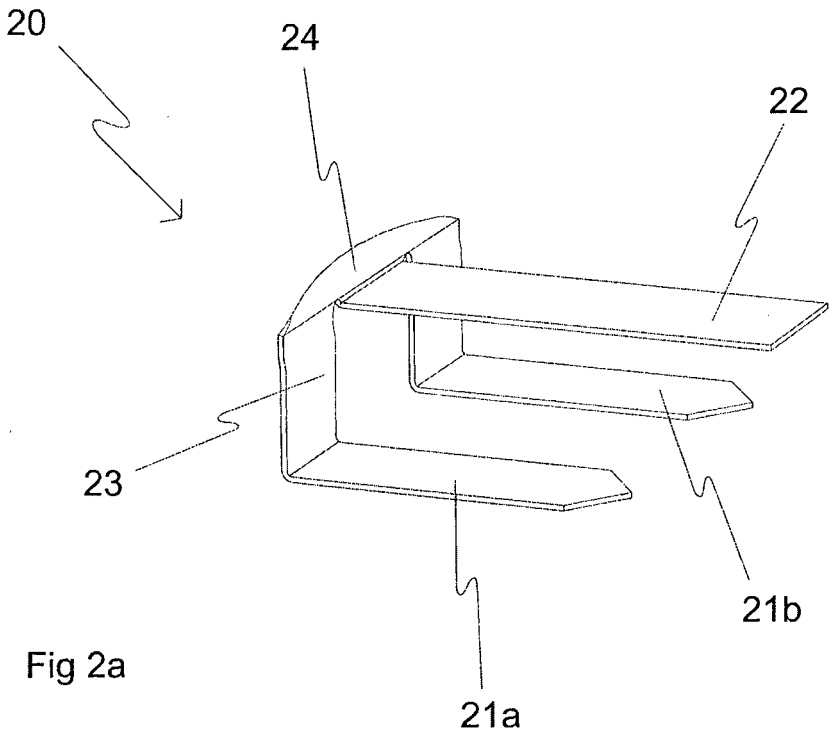

Fig 2a

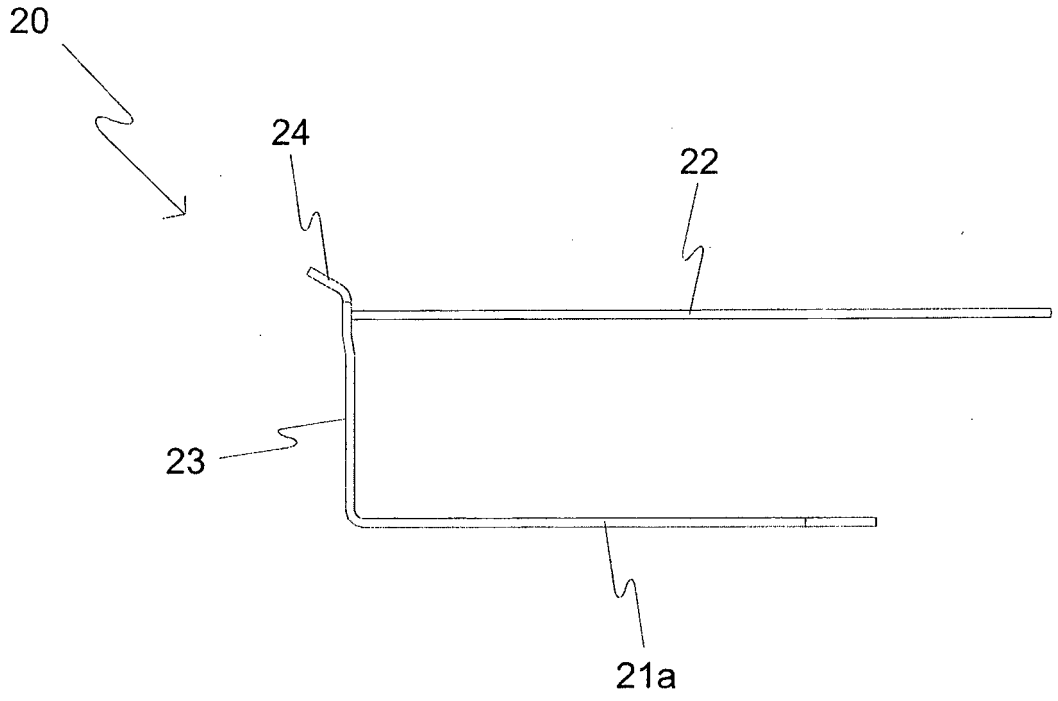

Fig 2b

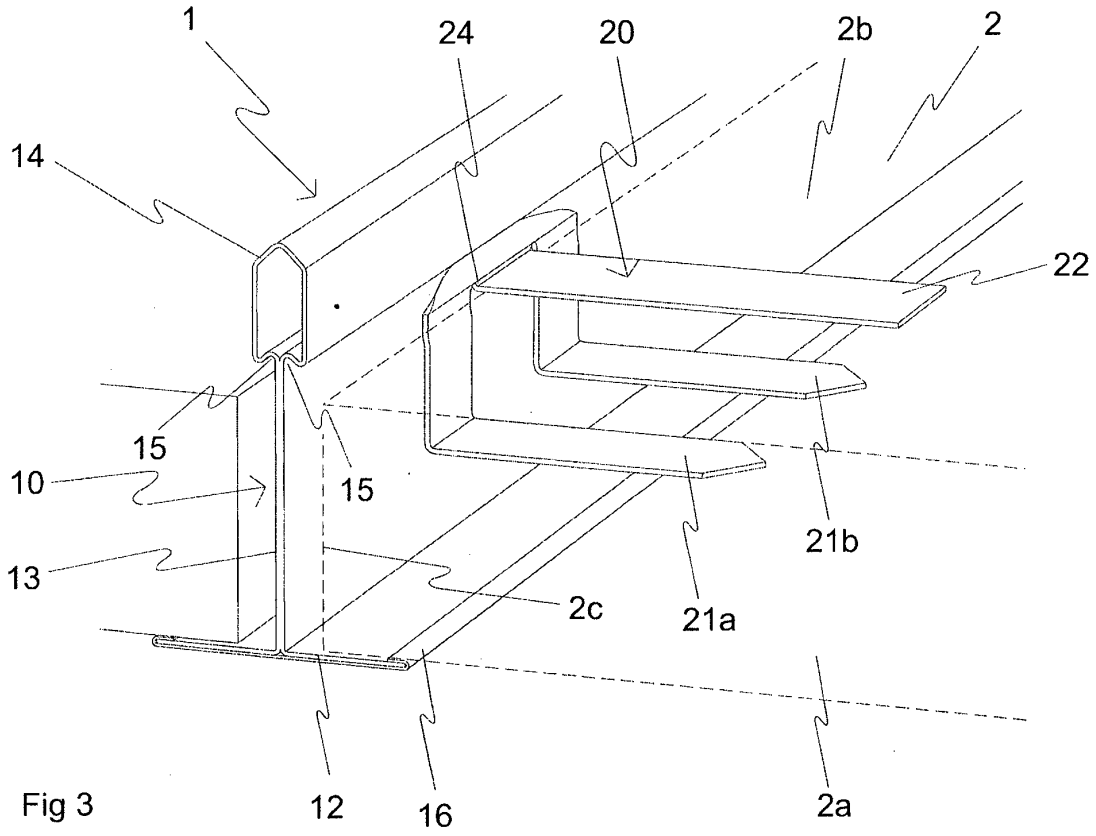
1
24
20
2b
2
14
22
15
15
10
13
21b
2c
21a
12
16
2a

Fig 3

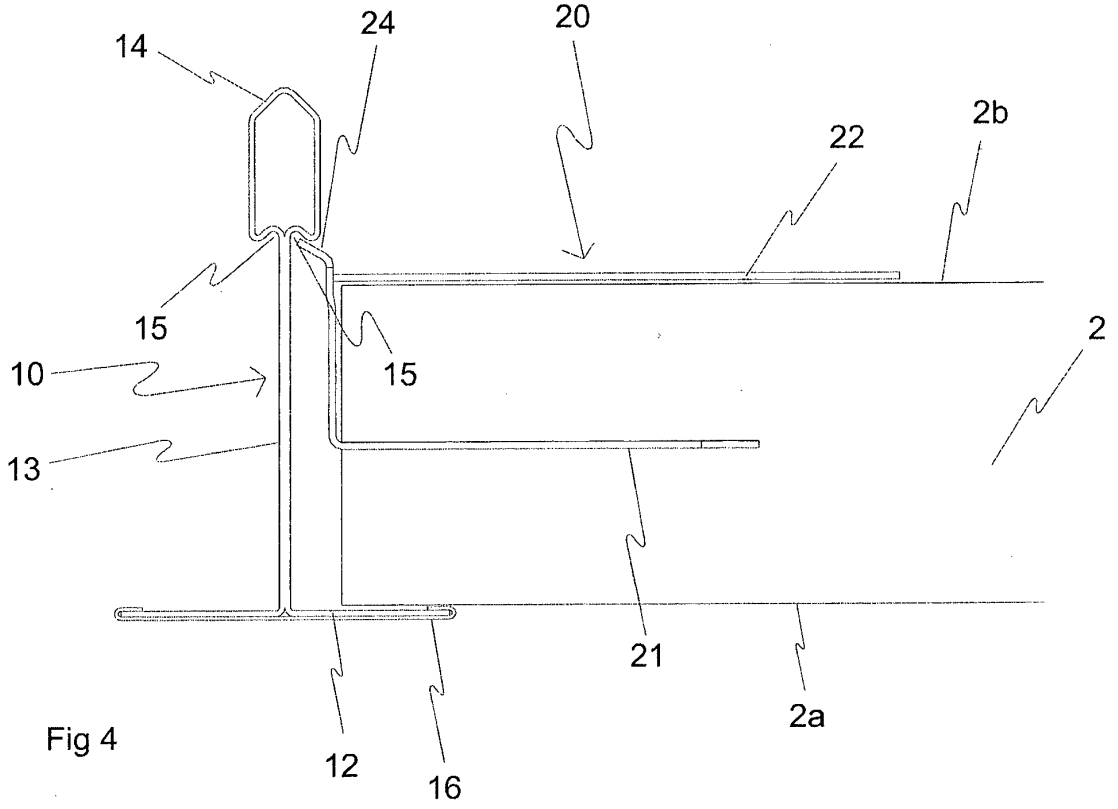
14
24
20
22
2b
15
15
10
2
13
21
2a
12
16

Fig 4

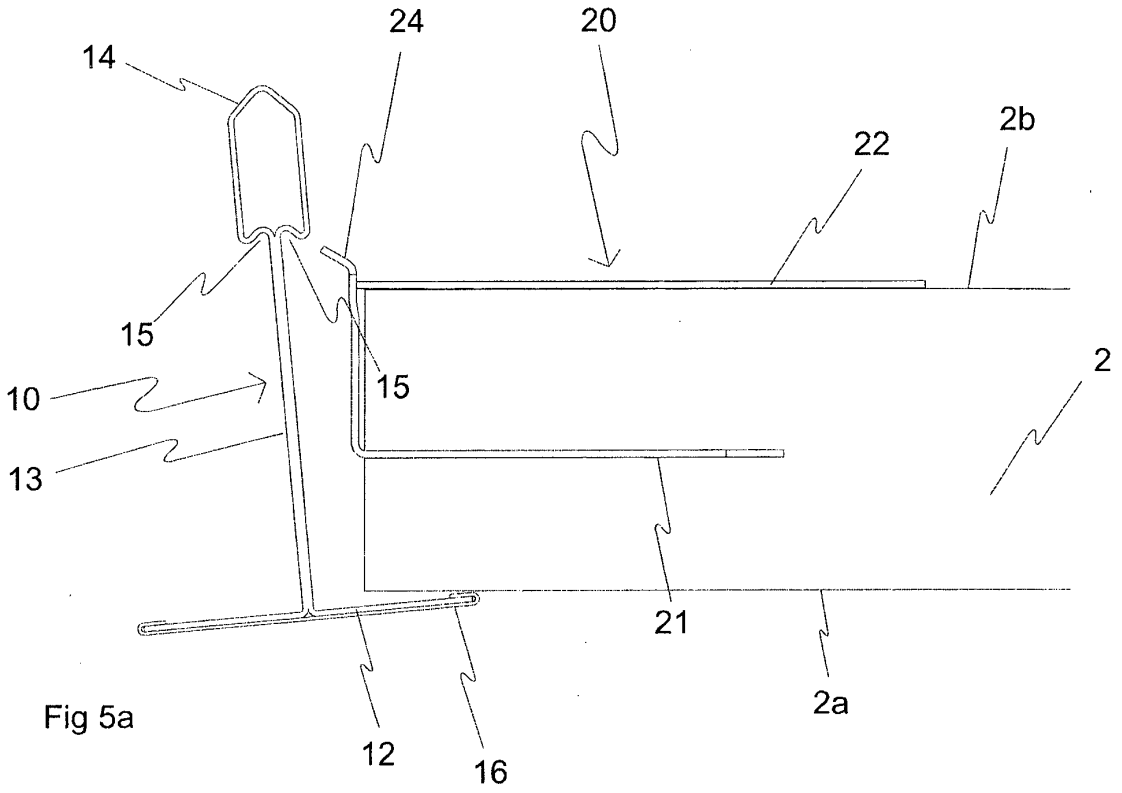
14
24
20
22
2b
15
15
10
13
2
21
2a
12
16

Fig 5a

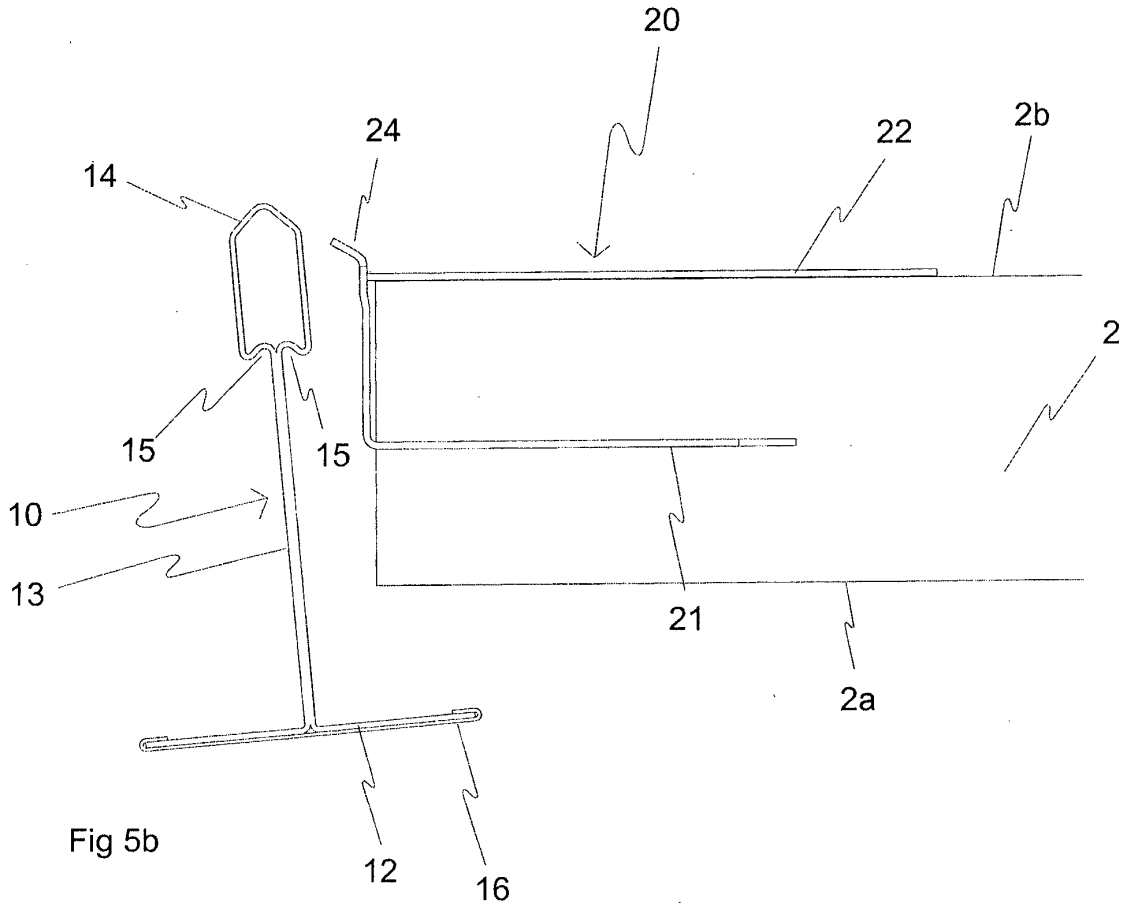
20
24
22
2b
14
2
15
15
10
13
21
2a
12
16

Fig 5b

REFERENCES CITED IN THE DESCRIPTION

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