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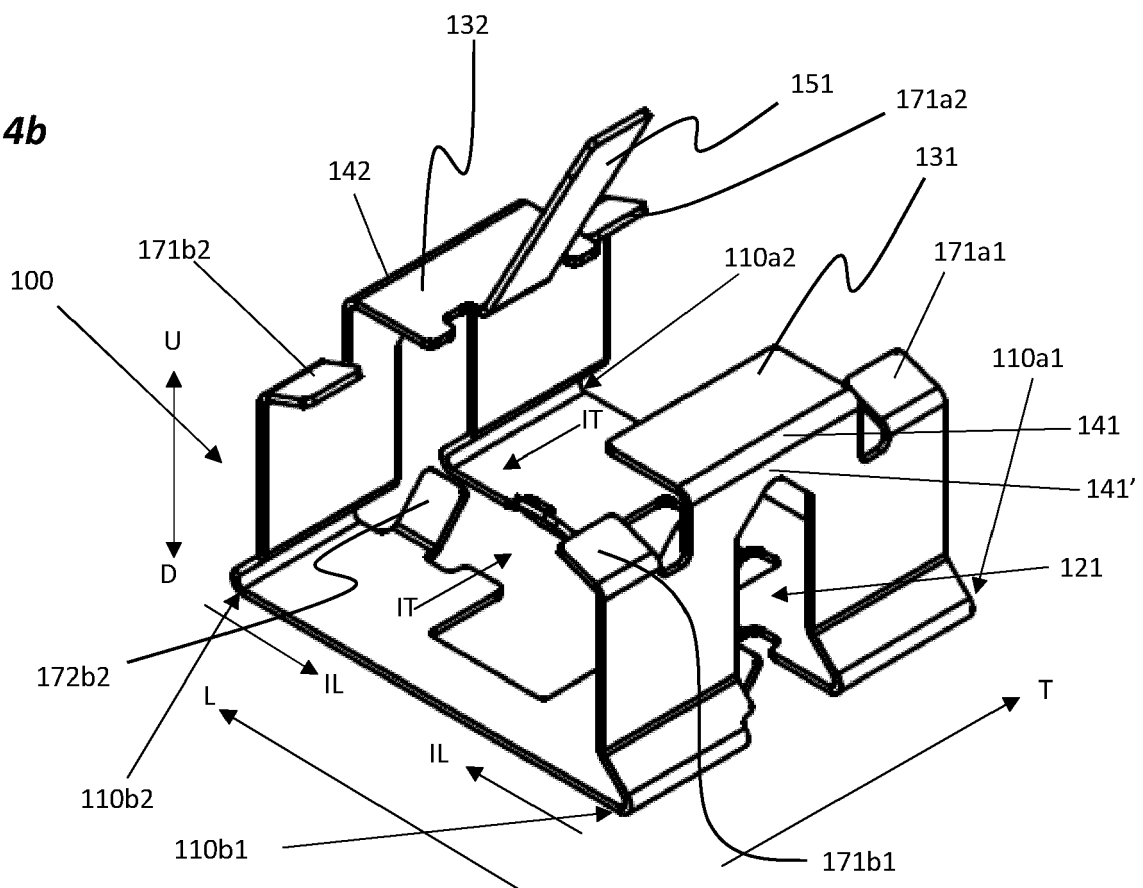
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(54) **A CONNECTION ELEMENT, A SUSPENDED CEILING SYSTEM AND A METHOD OF INSTALLING A SUSPENDED CEILING SYSTEM**

(57) A connection element (100) for interconnecting a first profile (10) having an inverted T-shaped cross-section and an extension along a longitudinal direction (L) with a second profile (20) having an inverted T-shaped

cross-section and an extension along a transversal direction (T), the second profile (20) crossing the extension (L) of the first profile (10) above the first profile (10),

Fig. 4b**EP 4 206 410 A1**

Description

Field of invention

[0001] The invention relates to a connection element for interconnecting a first profile having an inverted T-shaped cross-section and an extension along a longitudinal direction with a second profile having an inverted T-shaped cross-section and an extension along a transversal direction, the second profile crossing the extension of the first profile above the first profile.

[0002] The invention also relates to a suspended ceiling system comprising a plurality of first profiles, each having an inverted T-shaped cross-section and an extension along a longitudinal direction, the first profiles being separated from each other along a transverse direction, and a plurality of second profiles, each having an inverted T-shaped cross-section and an extension along the transversal direction, the second profiles being separated from each other along the longitudinal direction, each second profile crossing the extension of a plurality of first profiles above the first profiles.

[0003] The invention also relates to a method of installing a suspended ceiling system.

Technical Background

[0004] When installing a suspended ceiling system formed of a plurality of profiles supporting a plurality of ceiling tiles, it is typically important to secure the relative positions of the profiles such that the profiles are securely held in the intended position. This facilitates installation of the tiles and it makes it possible to provide a suspended ceiling meeting intended technical requirements, such as acoustical properties, as well as meeting aesthetical requirements by e.g., avoiding unwanted gaps between tiles and profiles.

[0005] WO2015050448A1 discloses a suspended ceiling system where a set of primary profiles are suspended from a structure, in particular a structural ceiling, using a number of suspension elements. The primary profiles are suspended parallel to each other and if necessary, partly extending in line with each other in a horizontal direction. Secondary profiles are coupled to the primary profiles using coupling brackets which are configured to allow the secondary profiles to run underneath the primary profiles. The secondary profiles are fitted extending in a second substantially horizontal direction perpendicular to the first direction. The secondary profiles are configured to support ceiling plates. The bracket has a main body which extends over an upper end of the primary profile and down along each side of the T-profile and which presents at a lower portion of each side thereof a coupling leg and a retaining tab. The coupling leg has an end configured to extend into openings in the secondary profile. The bracket is configured to be positioned on the primary profile. Thereafter, the secondary profile is configured to be positioned by a tilting motion such that

the end of the coupling leg is inserted into the opening in the secondary profile. Thereafter, the retaining tab is bent downwardly such that the secondary profile is now securely held in the intended position. However, these brackets and the resulting installation process is not convenient, and it may even result in a work hazard issue. The secondary profile may actually accidentally be dropped after it has been positioned on the coupling legs but before the retaining tabs has been bent downwardly. The installer may e.g., position the secondary profile on the coupling legs and when he/she then reaches for a pair of pliers to bend the retaining tab, the secondary profile may easily fall off of the coupling legs. It may be noted that the installation of the secondary profile to the primary profile is typically occurring well above head height of the installer, which in turn often stands on a ladder, whereby any difficulties in accomplishing the intended installation and the risk of dropping a secondary profile poses a real danger.

[0006] Thus, there is still room for improvements when it comes to providing a solution to the problem of how to secure the relative positions of the profiles such that the profiles are securely held in the intended position.

Summary of invention

[0007] It is an object of the invention to provide a solution to the problem of how to secure the relative positions of the profiles. It is especially an object of the invention to provide a solution to the problem, which solution is easy to install, and which solution entails a minimum of different kinds of components.

[0008] This object has been achieved by a connection element for interconnecting a first profile having an inverted T-shaped cross-section and an extension along a longitudinal direction with a second profile having an inverted T-shaped cross-section and an extension along a transversal direction, the second profile crossing the extension of the first profile above the first profile, the connection element comprising:

a first base portion and a second base portion configured to extend longitudinally on a respective side of the first profile,

a first pair of end portions extending upwardly from a first end portion of the first base portion and from a first end portion of the second base portion, respectively,

a second pair of end portions extending upwardly from a second end portion of the first base portion and from a second end portion of the second base portion, respectively,

wherein between the end portions of the first pair of end portions there is formed a first through-going end opening and between the end portions of the second pair of end portions there is formed a second through-going end opening, the first and second end openings being in register and being configured to

receive the first profile, and
 a first gripping flange forming part of a first bridge interconnecting the end portions of the first pair of end portions and a second gripping flange forming part of a second bridge interconnecting the end portions of the second pair of end portions, wherein the respective gripping flange is configured to extend above and engage with an upper side of a respective flange of the second profile.

[0009] With this design, there is provided a connection element which is capable of securely interconnecting the first and second profiles. The first through-going end opening formed between the end portions of the first pair of end portions and the second through-going end opening formed between the end portions of the second pair of end portions, which are in register and configured to receive the first profile in combination with the first base portion and the second base portion configured to extend longitudinally on a respective side of the first profile allows the connection element to securely receive the first profile. The distance between the of the first pair of end portions and the second pair of end portions and the connection by the first base portion and the second base portion makes it possible to provide a torsionally rigid connection element and a torsionally rigid connection to the first profile. The provision of the first gripping flange and the second gripping flange extending above and engaging with the upper side of a respective flange of the second profile makes it possible to provide a distinct gripping force in the vertical direction keeping the first and second profiles securely in position in the vertical direction. It may be noted that in the preferred embodiment, the first pair of end portions extending vertically upwardly and the second pair of end portions extends vertically upwardly is not necessary that they extend vertically. The first pair of end portions may extend inclined and/or curved upwardly and/or the second pair of end portions may extend inclined and/or curved upwardly.

[0010] The connection element may be integrally formed of a resiliently flexible material, preferably a metallic sheet material, such as a steel sheet, preferably being cut and bent to form the connection element. The connection element may e.g., be integrally formed of a resiliently flexible material, such as a metal or plastic material. A connection element of a plastic material may be moulded into the desired shape, such as being injection or compression moulded into the desired shape. A resiliently flexible material makes it possible to provide a secure interconnection between the connection element and the T-profiles. The connection element is preferably formed of a metal. The connection element is preferably formed of a sheet material being bent into the desired shape, preferably from a sheet material being cut and then bent into the desired shape. The connection element is preferably formed of a metal sheet being bent, preferably being cut and bent. Thus, in the preferred embodiment, the connection element is integrally formed of a

resiliently flexible metallic sheet material, such as a steel sheet, being cut and bent to form the connection element.

[0011] The respective gripping flange is preferably shaped as a tongue extending from the respective bridge.

[0012] The gripping flanges preferably extends inwardly, and more preferably also downwardly as seen in a non-installed state of the connection element. By the gripping flanges preferably also extending downwardly it is facilitated to provide a retaining force forcing the second profile downwardly against the first profile while still allowing a vertical play between respective the root of the respective gripping flange and respective the flange of the second profile. The presence of the vertical play facilitates installation of the connection element relative to the second profile.

[0013] The respective gripping flange is preferably flexible such that a geometrical plane defined by the respective flange may be curved and/or change its angle about a geometrical axis extending along the transverse direction and relative to the respective bridge.

[0014] Preferably, the distance between the first pair of end portions and the second pair of end portions is equal to, or slightly shorter than as seen in a non-installed state of the connection element, the maximum width of the flanges of the inverted T-shaped cross-section of the second profile as seen in a non-installed state of the connection element such that, in an installed state of the connection element, at least a portion of the first pair of end portions or the first bridge and at least a portion of the second pair of end portions or the second bridge abuts a respective edge of a respective flange of the inverted T-shaped cross-section of the second profile. Thereby, it is made possible to provide a width of this respective abutment extending along the transverse direction T, which in turn provides a distribution of the retaining forces along the transverse direction T whereby it is made possible to provide a torsionally rigid connection between the connection element and the second profile.

[0015] The connection element may further comprise a first set of abutment flanges including at least one abutment flange connected to a respective end portion of said first pair of end portions and at least one abutment flange connected to a respective end portion of said second pair of end portions,

wherein the respective abutment flange is configured to extend under and engage with an underside of respective flange of the second profile.

[0016] This provides an improved retaining effect when it comes to keeping the connection element in position relative to the second profile.

[0017] Preferably each abutment flange of the first set of abutment flanges is flexible. The respective abutment flange is preferably flexible such that a geometrical plane defined by the respective abutment flange may be curved and/or change its angle about a geometrical axis extending along the transverse direction and relative to the respective end portion.

[0018] It may be noted that it is preferred that both the gripping flanges and the abutment flanges of the first set of abutment flanges are flexible. However, it is also conceivable to have only one of the opposing flanges being flexible and the other being rigid, such as e.g., the gripping flange being flexible and the abutment flange being rigid, as long as the two opposing flanges provides a clamping force. An abutment flange being rigid may e.g., be provided by having an upper portion of the respective end portion of said first pair of end portions and an upper portion of the respective end portion of said second pair of end portions being offset inwardly such that an upper edge of the respective offset portion abuts an underside of respective flange of the second profile.

[0019] The respective abutment flange of the first set of abutment flanges preferably extends inwardly from the respective end portion as seen in a non-installed state of the connection element. The respective abutment flange of the first set of abutment flanges preferably also extends upwardly, from the respective end portion as seen in a non-installed state of the connection element. Thus, in the preferred embodiment, the respective abutment flange of the first set of abutment flanges preferably extends inclined inwardly and upwardly from the respective end portion as seen in a non-installed state of the connection element. It may be noted that whether or not the respective abutment flange of the first set of abutment flanges also extends upwardly is based on a balance between the resulting clamping forces and the forces needed to be overcome during installation of the connection element.

[0020] The first set of abutment flanges preferably includes two abutment flanges connected to a respective end portion of said first pair of end portions and two abutment flanges connected to a respective end portion of said second pair of end portions.

[0021] The abutment flanges at the first end portions, and at the second end portions, respectively, are preferably located at a distance from each other along the transversal direction.

[0022] The provision of abutment flanges at the first end portions located at a distance from each other along the transversal direction and the provision of the abutment flanges at the second end portions also located at a distance from each other along the transversal direction facilitates provision of a torsionally rigid connection between the connection element and the second profile. Preferably the abutment flanges at the first end portions, and at the second end portions, respectively, are located along the transversal direction on a respective side of the first through-going end opening and of the second through-going end opening, respectively, and/or preferably located along the transversal direction on a respective side of the first gripping flange and the second gripping flange, respectively.

[0023] The connection element preferably further comprises a second set of abutment flanges including at least one abutment flange connected to the first base portion

and at least one abutment flange connected to the second base portion, wherein the respective abutment flange is configured to extend under and engage with an underside of a bulb of the first profile.

[0024] This further facilitates provision of a strong connection between the connection element and the first profile.

[0025] Preferably each abutment flange of the second set of abutment flanges is flexible. This further facilitates the of a strong connection between the connection element and the first profile while typically still facilitating installation of the connection element.

[0026] The respective abutment flange of the second set of abutment flanges is preferably flexible such that a geometrical plane defined by the respective abutment flange may be curved and/or change its angle about a geometrical axis extending along the longitudinal direction and relative to the respective base portion.

[0027] It may be noted that it is preferred that both the gripping flanges and the abutment flanges of the second set of abutment flanges are flexible. However, it is also conceivable to have only one of the opposing flanges being flexible and the other being rigid, such as e.g., the gripping flange being flexible and the abutment flange being rigid, as long as the two opposing flanges provides a clamping force. An abutment flange being rigid may e.g., be provided by having the abutment flanges of the second set of abutment flanges extending vertically upwardly.

[0028] The respective abutment flange of the second set of abutment flanges preferably extends inwardly from the respective base portion as seen in a non-installed state of the connection element. The respective abutment flange of the second set of abutment flanges preferably also extends upwardly from the respective base portion as seen in a non-installed state of the connection element. Thus, in a preferred embodiment, the respective abutment flange of the second set of abutment flanges extends inclined inwardly and upwardly from the respective base portion as seen in a non-installed state of the connection element.

[0029] The second set of abutment flanges preferably includes two abutment flanges connected to the first base portion and two abutment flanges connected to the second base portion.

[0030] The abutment flanges connected to the first base portion and the abutment flanges connected to the second base portion, respectively, are preferably located at a distance from each other along the longitudinal direction, preferably located along the longitudinal direction on a respective side of a second register member.

[0031] The pair of abutment flanges connected to the first base portion may be positioned relative to the pair of abutment flanges connected to the second base portion in different manners.

[0032] They may e.g., be positioned in a staggered manner such that there along the longitudinal direction

will be a flange connected to the first base portion, a flange connected to the second base portion, a flange connected to the first base portion, and a flange connected to the second base portion.

[0033] Alternatively, the flanges connected to one of the base portions may be separated a greater distance compared to the flanges connected to the other one of the base portions. This difference in separation distance may, but need not, be such that there is no geometrical overlap between the flanges along the longitudinal direction.

[0034] These configurations may, but need not, be used to allow the flanges to have an overlap along the transversal direction as seen in a flat-laid state of the material from which the connection element may be formed.

[0035] Alternatively, the flanges connected to the first base portion may be directly opposing the flanges of the second base portion.

[0036] It may also be noted that the phrase "on a respective side of a second register member" may refer to being physically on a respective side or being geometrically on a respective side. The flexible flanges are in the disclosed embodiment physically connected to the same base portion and physically on a respective side of the register member. The flexible flanges are on the other hand connected to the other base portion and they are separated along their base portion a distance and located along the longitudinal direction such that geometrical projections of the flexible flanges along the transversal direction are located on a respective side of a second register member along the longitudinal direction, thus geometrically on a respective side.

[0037] The first bridge preferably further comprises a portion extending in a plane of the end portions of the first pair of end portions. This improves the stability of the connection element.

[0038] The second bridge preferably further comprises a portion extending in a plane of the portions of the second pair of end portions. This improves the stability of the connection element.

[0039] The connection element preferably further comprises a first register member connected to one of the gripping flanges, wherein the first register member is configured to extend through and engage with an opening of the second profile and thereby aid in keeping the connection element in an intended position along the extension second profile.

[0040] The connection element preferably further comprises a second register member connected to one of the base portions, wherein the second register member is configured to extend through and engage with an opening of the first profile and thereby aid in keeping the connection element in an intended position along the extension of the first profile.

[0041] The above-mentioned object has also been achieved by a suspended ceiling system comprising:

a plurality of first profiles, each having an inverted T-shaped cross-section and an extension along a longitudinal direction, the first profiles being separated from each other along a transverse direction,, a plurality of second profiles, each having an inverted T-shaped cross-section and an extension along the transversal direction, the second profiles being separated from each other along the longitudinal direction, each second profile crossing the extension of a plurality of first profiles above the first profiles, and a plurality of connection elements of the kind disclosed generally above, and disclosed in more details below, wherein respective second profile is interconnected to a first first profile by a first connection element and to a second first profile by a second connection element.

[0042] It may be noted that the suspended ceiling may comprise other profiles and that this concept is related to the interconnection of inverted T-profiles forming or forming part of the suspended ceiling. There may be e.g., be other profiles having other shapes. There may be other inverted T-profiles in the suspended ceiling system not forming part of this interconnection system. There may additional profiles shaped and/or located in the same manner as the first profiles and/or the second profiles. Thus, it may be noted that the references in the text using the terms "each" and "respective", and similar terms, refer to those profiles forming part of this interconnection system.

[0043] It may be noted that the suspended ceiling also includes a plurality of ceiling tiles. The ceiling tiles typically rests with downwardly facing surfaces on the upwardly facing surfaces of the flanges of the first T-profiles. The downwardly facing surfaces of the tiles may be their respective lower major surfaces and/or may be downwardly facing surfaces of grooves formed in the respective edge of the respective tile. The ceiling tiles may e.g., be so-called acoustic tiles. The ceiling tiles may be formed of a mineral fibre based material. One advantage with the disclosed connection element is that it does not take much space and that it therefore does not have any negative impact on the choice of tile design. Thus the skilled person is free to use conventional ceiling tiles.

[0044] The first profiles being referred to as being separated from each other along a transverse direction preferably extends in parallel with each other.

[0045] The second profiles being referred to as being separated from each other along the longitudinal direction preferably extending in parallel with each other.

[0046] In a preferred embodiment at least one second profile is interconnected to a first first profile by a first connection element, to a second first profile by a second connection element, and to a third first profile by a third connection element.

[0047] Preferably there are a plurality of second profiles separated from each other along the longitudinal

direction and each being interconnected to three or more first profiles in turn separated from each other along transverse direction, with a connection element being provided at each such interconnection.

[0048] Preferably the second profiles are suspended in a structural ceiling by suspension elements extending between the structural ceiling and the respective second profile. The first profiles are preferably in turn suspended by the connection elements to the second profiles. However, it is conceivable that the first profiles are suspended in a structural ceiling by suspension elements extending between the structural ceiling and the respective first profile, with the second profiles preferably in turn being suspended by the connection elements to the first profiles. However, it may also be noted that even though e.g., the second profiles may generally in the suspended ceiling be suspended in a structural ceiling by suspension elements extending between the structural ceiling and the respective second profile, with the first profiles generally in turn being suspended by the connection elements to the second profiles, it is conceivable that locally, both profiles may be suspended in a structural ceiling to carry higher loads or that locally the first profiles may be suspended in a structural ceiling by suspension elements extending between the structural ceiling and the respective first profile, with the second profiles locally in turn being suspended by the connection elements to the first profiles.

[0049] The above-mentioned object has also been achieved by a method of installing a suspended ceiling system, the method comprising:

suspending a plurality of second profiles in a structural ceiling by suspension elements extending between the structural ceiling and the respective second profile such that the second profiles are separated from each other along a transverse direction, wherein each second profile has an inverted T-shaped cross-section and an extension along a longitudinal direction, connecting a connection element of the kind disclosed generally above, and disclosed in more details below, to one of the second profiles by moving the connection element upwardly relative to the second profile and by flexing the gripping flanges and/or the end portions of the first and/or second pair of end portions such that the respective flange of the second profile becomes positioned underneath the respective gripping flange, positioning a first profile having an inverted T-shaped cross-section and an extension along the transversal direction below the second profiles, connecting the first profile to the second profile by moving the first profile upwardly such that the first profile becomes inserted into the through-going openings of the connection element connected to the second profile.

[0050] It may be noted that the method preferably involves connecting a plurality of such connection elements underneath a plurality of second profiles such that the connection elements are positioned along one or more geometrical transversally extending lines along which the first profiles are intended to extend. Thereby, respective first profile may be attached to several connection elements and several second profiles directly one after the other or even simultaneously.

[0051] The advantages of associated with the various features of the connection element according to the various preferred embodiments have been discussed with reference to the connection element and with reference to the suspended ceiling and those advantages and also those preferred embodiments are equally applicable to the method

[0052] It may be noted that the use of first, second, third, fourth, fifth, etc. are mainly to be seen as labels facilitating reading and that it does not necessarily mean that there need to be all the intervening numbers of present. It may e.g., be noted that it is contemplated to have a design where there is a first entity, a second entity, a third entity and a fifth entity, with the fourth entity being omitted. However, to facilitate reading, we have consistently used the same numbering first, second, third, fourth, etc., as labels of the same entity irrespective whether or not all are present, and in a sense the use of labels is based on an embodiment including all conceivable entities. In this specific case, the connection element may e.g., be provided with the register member referred to as the second register member even though it is not provided with the register member referred to as the first register member.

[0053] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

Brief description of the drawings

[0054] The invention will by way of example be described in more detail with reference to the appended schematic drawings, which shows a presently preferred embodiment of the invention.

Figure 1 discloses in a perspective view a grid for a suspended ceiling.

Figure 2 is an enlargement of a portion of the grid of figure 1 as indicated by the dashed square in figure 1 and discloses a connection element interconnecting two profiles.

Figures 3a-b are two planar views of the two profiles

and a connection element according to a first embodiment as viewed along the first profile and the second profile, respectively.

Figures 4a-d are two perspective views and two planar views of the connection element according to the first embodiment.

Figure 5 is a blank for a connection element according to the first embodiment.

Figures 6a-b are two planar views of the two profiles and a connection element according to a second embodiment as viewed along the first profile and the second profile, respectively.

Figure 7 is a planar view of the connection element according to the second embodiment.

Detailed description of preferred embodiments

[0055] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as only limited to the embodiments set forth herein; rather, these embodiments are provided for thoroughness and completeness, and allowing the skilled person to make use of the invention.

[0056] Initially a suspended ceiling system 200, including a plurality of first profiles 10, a plurality of second profiles 20 and a plurality of connection elements 100, will be described with reference to Fig. 1. Details thereof will be disclosed with reference to Figs. 2 and 3a-b. Thereafter the connection element 100 will be disclosed in more detail with reference to Figs 4a-d.

[0057] Fig. 1 is a schematic perspective view of a grid of suspended ceiling 200. The grid of the suspended ceiling 200 may also be referred to as a suspended ceiling system 200. The suspended ceiling system 200 comprises a plurality of first profiles 10, each having an inverted T-shaped cross-section and an extension along a longitudinal direction L. As is shown in figure 1, the first profiles 10 are separated from each other along a transverse direction T. The suspended ceiling system 200 also comprises a plurality of second profiles 20, each having an inverted T-shaped cross-section and an extension along the transversal direction T. The second profiles 20 are separated from each other along the longitudinal direction. Each second profile 20 crosses the extension L of a plurality of first profiles 10 above the first profiles 10. The suspended ceiling system 200 also comprises a plurality of connection elements 100 which will be disclosed in more details below. As is apparent from figure 1, respective second profile 20 is interconnected to a first first profile 10 by a first connection element 100 and to a second first profile 10 by a second connection element 100. In fact, each first profile 10 is interconnected to a plurality of second profiles 20 and each second profile is interconnected to a plurality of first profiles 10.

[0058] As shown in Fig 1. the second profiles 20 are

suspended in a structural ceiling 50 by suspension elements 30 in form of wires. Other relevant examples of suspension elements 30 are a line, a cable, a cord, a thread, a rod, a string, a chain, a rope, or a combination thereof. In the disclosed embodiment, the suspension elements 30 are connected to the bulb 23 of the second profiles 20 via clips 30a. Alternatively, the suspension elements 30 may engage with openings 25 of the second profiles 20 by having a hook at the end of respective suspension element 30.

[0059] The suspended ceiling system 200 is intended to support ceiling tiles resting on the flanges of the first profiles. There may be other inverted T-profiles in the suspended ceiling system not forming part of this interconnection system. It is e.g., common to add cross-profiles which extends between neighbouring first profiles 10. The cross-profiles are typically also inverted T-profiles and they have typically a length along the transverse direction T being equal to the distance between two neighbouring first profiles 10. With the cross-profiles installed, there is formed a grid-work of first profiles 10 and cross-profiles on the same height with their respective flanges on the same, or at least almost the same, height. The cross-profiles and the ceiling tiles form part of the suspended ceiling but they are for reason of simplicity not referred to as parts of the interconnection system.

[0060] In Fig. 2, one interconnection between a first profile 10, a second profile 20 and a connection element 100 is illustrated. The second profile 20 have flanges 21a, 21b having upper sides 21a', 21b' and lower sides 21a'', 21b''.

[0061] Figs. 4a-d illustrates a connection element 100 according to a first embodiment of the present invention. A slight variation of this embodiment is disclosed in Figs. 6a-b and 7. The connection element 100 comprises a first base portion 110a and a second base portion 110b. The first base portion 110a is configured to extend longitudinally L on a first side 10a of the first profile 10. The second base portion 110b is configured to extend longitudinally L on a second side 10b of the first profile 10.

[0062] As shown in Figs.4a-d, the connection element 100 comprises a first pair of end portions 120a1, 120b1 and a second pair of end portions 120a2, 120b2. The end portion 120a1 of the first pair of end portions 120a1, 120b1 is configured to extend upwardly U from a first end portion 110a1 of the first base portion 110a. The end portion 120b1 of the first pair of end portions 120a1, 120b1 is configured to extend upwardly U from a first end portion 110b1 of the second base portion 110b. The end portions 120a1, 120b1 of the first pair of end portions 120a1, 120b1 are located on a first side of the connection element 100 as seen along the longitudinal direction L.

[0063] Correspondingly, the end portion 120a2 of the second pair of end portions 120a2, 120b2 is configured to extend upwardly U from a second end portion 110a2 of the first base portion 110a. The end portion 120b2 of the second pair of end portions 120a2, 120b2 is configured to extend upwardly U from a second end

portion 110b2 of the second base portion 110b. The end portions 120a2, 120b2 of the second pair of end portions 120a2, 120b2 are located on a second side, opposite the first side, of the connection element 100 as seen along the longitudinal direction L.

[0064] As is shown in Figs 4a-b, and 4d, there is between the end portions 120a1, 120b1 of the first pair of end portions formed a first through-going end opening 121 and between the end portions 120a2, 120b2 of the second pair of end portions there is formed a second through-going end opening 122. The first and second end openings 121, 122 are in register and are configured to receive the first profile 10, as is e.g., shown in Fig. 3a.

[0065] The connection element 100 also comprises a first gripping flange 131. The first gripping flange 131 forms part of a first bridge 141 which interconnects the end portions 120a1, 120b1 of the first pair of end portions 120a1, 120b1. The connection element 100 comprises a second gripping flange 132. The second gripping flange 132 forms part of a second bridge 142 which interconnects the end portions 120a2, 120b2 of the second pair of end portions 120a2, 120b2. Although not necessary, the first bridge 141 may, as is the case in the preferred embodiment, further comprise a portion 141' extending in a plane of the end portions 120a1, 120b1 of the first pair of end portions 120a1, 120b1. Similarly, the second bridge 142 may also comprise a portion 142' extending in a plane of the end portions 120a2, 120b2 of the second pair of end portions 120a2, 120b2.

[0066] Each of the gripping flange 131, 132 is configured to extend above and engage with an upper side 21a', 21b' of a respective flange 21a, 21b of the second profile 20.

[0067] The connection element 100 is preferably integrally formed of a resiliently flexible metallic sheet material being cut and bent to form the connection element 100.

[0068] As is best shown in Figs. 4a-b, the respective gripping flange 131, 132 is preferably shaped as a tongue extending from the respective bridge 141, 142.

[0069] The gripping flanges 131, 132 preferably extends inwardly IL as seen in a non-installed state of the connection element 100. In the embodiment shown in Figs. 3a-b and 4a-d, the gripping flanges 131, 132 extends inwardly essentially in parallel with intended orientation along the flanges 21a, 21b of the second profile 20. Alternatively expressed, in this embodiment, the gripping flanges 131, 132 extends horizontally inwardly. The gripping flanges 131, 132 are preferably flexible.

[0070] As shown in Figs. 4a-b, the connection element 100 further comprises a first set of abutment flanges 171a1, 171b1, 171a2, 171b2. At least one abutment flange 171a1, 171b1 is connected to a respective end portion 120a1, 120b1 of said first pair of end portions 120a1, 120b1 and at least one abutment flange 171a2, 171b2 is connected to a respective end portion 120a2, 120b2 of said second pair of end portions 120a2, 120b2. There is in the preferred embodiment, two abutment

flanges 171a1, 171b1 connected to a respective end portion 120a1, 120b1 of said first pair of end portions 120a1, 120b1. There are also two abutment flanges 171a2, 171b2 connected to a respective end portion 120a2, 120b2 of said second pair of end portions 120a2, 120b2. The respective abutment flange 171a1, 171b1, 171a2, 171b2 is configured to extend under and engage with an underside 21a", 21b" of respective flange 21a, 21b of the second profile 20, as is e.g., shown in Fig. 3a. The abutment flanges 171a1, 171b1, 171a2, 171b2 of the first set of abutment flanges 171a1, 171b1, 171a2, 171b2 are preferably flexible.

[0071] As is shown in Figs. 4a-c, the respective abutment flange 171a1, 171b1, 171a2, 171b2 of the first set of abutment flanges 171a1, 171b1, 171a2, 171b2 extends inclined inwardly IL and upwardly U from the respective end portion 120a1, 120b1, 120a2, 120b2. The inclination of at least one of said abutment flanges 171a1, 171b1, 171a2, 171b2 of the first set of abutment flanges 171a1, 171b1, 171a2, 171b2 may range from 10-60 degrees, preferably 10-45 degrees, relative a horizontal plane.

[0072] The abutment flanges 171a1, 171b1 at the first end portions 120a1, 120b1 of said first pair end of portions 120a1, 120b1 are preferably located at a distance from each other along the transversal direction T. Preferably, said abutment flanges 171a1, 171b1 at the first end portions 120a1, 120b1 of said first pair end of portions 120a1, 120b1 are located along the transversal direction T on a respective side of the first through-going end opening 121, and/or located along the transversal direction T on a respective side of the first gripping flange 131. Similarly, the abutment flanges 171a2, 171b2 at the second end portions 120a2, 120b2 of said second pair end of portions 120a2, 120b2 are preferably located at a distance from each other along the transversal direction T. Preferably, said abutment flanges 171a2, 171b2 at the second end portions 120a2, 120b2 of said second pair end of portions 120a2, 120b2 are located along the transversal direction T on a respective side of the second through-going end opening 122, and/or located along the transversal direction T on a respective side of the second gripping flange 132.

[0073] The connection element 100 preferably also comprises a second set of abutment flanges 172a1, 172b1, 172a2, 172b2. At least one abutment flange 172a1, 172a2 connected to a first base portion 110a and at least one abutment flange 172b1, 172b2 connected to a second base portion 110b. In the preferred embodiment, the second set of abutment flanges 172a1, 172b1, 172a2, 172b2 includes two abutment flanges 172a1, 172a2 connected to the first base portion 110a. Similarly, in the preferred embodiment, the second set of abutment flanges 172a1, 172b1, 172a2, 172b2 includes two abutment flanges 172b1, 172b2 connected to the second base portion 110b.

[0074] The respective abutment flange 172a1, 172b1, 172a2, 172b2 of the second set of abutment flanges

172a1, 172b1, 172a2, 172b2 extends inwardly IT and preferably also upwardly U from the respective base portion 110a, 110b. The inclination of at least one of said abutment flange 172a1, 172b1, 172a2, 172b2 of the second set of abutment flanges 172a1, 172b1, 172a2, 172b2 may range from 10-60 degrees, preferably 10-45 degrees, relative to a horizontal plane. The abutment flanges 172a1, 172b1, 172a2, 172b2 are configured to extend under and engage with an underside 13 of a bulb 13 of the first profile 10. The abutment flanges 172a1, 172b1, 172a2, 172b2 are preferably flexible.

[0075] The abutment flanges 172a1, 172a2 connected to the first base portion 110a are preferably located at a distance from each other along the longitudinal direction L. Preferably, said abutment flanges 172a1, 172a2 are located along the longitudinal direction L on a respective side of the second register member 152. Similarly, the abutment flanges 172b1, 172b2 connected to the second base portion 110b are preferably located at a distance from each other along the longitudinal direction L. Preferably, said abutment flanges 172b1, 172b2 are located along the longitudinal direction L at positions geometrically being on a respective side of the second register member 152.

[0076] As is best shown in Figs. 3a-b and 4a-d, the connection element 100 may further comprise a first register member 151. In the preferred embodiment, the first register member 151 is connected to the second gripping flange 132. The first register member 151 may however alternatively be connected to the first gripping flange 131 instead. The first register member 151 extends upwardly from the gripping flange 131. The first register member 151 is in the preferred embodiment inclined upwardly and inwardly, preferably an angle of about 15-45 degrees relative to vertical. Alternatively, or as a complement, the first register member 151 may be formed of a more upright, vertical portion connected to the gripping flange 132 and ending closer to its free end in a more curved or bent portion having a more horizontal inclination. The first register member 151 is configured to extend through and engage with an opening 25 of a second profile 20. The register member 151 may thereby aid in keeping the connection element 100 in an intended position along the extension T of the second profile 20.

[0077] As is also best shown in Figs. 3a-b and 4a-d, the connection element 100 may further comprise a second register member 152. In the preferred embodiment, the second register member 152 is connected to the first base portion 110a. The second register member 152 may however alternatively be connected to the second base portion 110b instead. The second register member 152 extends downwardly from the base portion 110a. The second register member 152 is in the preferred embodiment inclined downwardly and inwardly, preferably an angle of about 15-45 degrees relative to vertical. Alternatively, or as a complement, the second register member 152 may be formed of a more upright, downwardly extending vertical portion connected to the base portion

110a and ending closer to its free end in a more curved or bent portion having a more horizontal inclination. The second register member 152 is configured to extend through and engage with an opening 15 of a first profile 10. The register member 152 may thereby aid in keeping the connection element 100 in an intended position along the extension L of the first profile 10.

[0078] In Fig. 5, there is disclosed a blank 100' cut from a resiliently flexible metallic sheet material. The blank 100' is configured to be bent along the dashed fold lines to form the connection element 100.

[0079] In Figs 6a-b and 7, there is disclosed a second embodiment of the connection element 100. The disclosure concerning the connection element 100 according to the first embodiment with reference to Figs. 3a-b, 4a-d and 5, is equally applicable to this second embodiment unless a difference is explicitly disclosed.

[0080] As is best shown in Figs. 6b and 7, the gripping flanges 131, 132 extends in this second embodiment not only inwardly IL but also downwardly D as seen in a non-installed state of the connection element 100. The inclination of the gripping flanges 131, 132 may range from 10-60 degrees, preferably 10-45 degrees, relative a horizontal plane.

[0081] As is best shown in Figs. 6b and 7, the respective abutment flange 171a1, 171b1, 171a2, 171b2 of the first set of abutment flanges 171a1, 171b1, 171a2, 171b2 extends in this second embodiment horizontally inwardly IL from the respective end portion 120a1, 120b1, 120a2, 120b2.

[0082] It will be appreciated that the present invention is not limited to the embodiments shown.

[0083] The person skilled in the art realizes that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

[0084] Additionally, variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0085] It may e.g., be noted that it is conceivable to provide a combination of the first and the second embodiment. It is e.g., conceivable to have both the respective abutment flange 171a1, 171b1, 171a2, 171b2 of the first set of abutment flanges 171a1, 171b1, 171a2, 171b2 being inclined inwardly and upwardly as shown in the first embodiment in combination with having also the gripping flanges 131, 132 being inclined inwardly and downwardly as shown in the second embodiment.

Claims

1. A connection element (100) for interconnecting a first profile (10) having an inverted T-shaped cross-section and an extension along a longitudinal direction (L) with a second profile (20) having an inverted T-shaped cross-section and an extension along a transversal direction (T), the second profile (20) crossing the extension (L) of the first profile (10) above the first profile (10), the connection element (100) comprising:
 - a first base portion (110a) and a second base portion (110b) configured to extend longitudinally (L) on a respective side (10a, 10b) of the first profile (10),
 - a first pair of end portions (120a1, 120b1) extending upwardly (U) from a first end portion (110a1) of the first base portion (110a) and from a first end portion (110b1) of the second base portion (110b), respectively
 - a second pair of end portions (120a2, 120b2) extending upwardly (U) from a second end portion (110a2) of the first base portion (110a) and from a second end portion (110b2) of the second base portion (110b), respectively,
 - wherein between the end portions (120a1, 120b1) of the first pair of end portions there is formed a first through-going end opening (121) and between the end portions (120a2, 120b2) of the second pair of end portions there is formed a second through-going end opening (122), the first and second end openings (121, 122) being in register and being configured to receive the first profile (10), and
 - a first gripping flange (131) forming part of a first bridge (141) interconnecting the end portions (120a1, 120b1) of the first pair of end portions (120a1, 120b1) and a second gripping flange (132) forming part of a second bridge (142) interconnecting the end portions (120a2, 120b2) of the second pair of end portions (120a2, 120b2), wherein the respective gripping flange (131, 132) is configured to extend above and engage with an upper side (21a', 21b') of a respective flange (21a, 21b) of the second profile (20).
2. The connection element (100) according to claim 1, wherein the connection element (100) is integrally formed of a resiliently flexible material, preferably a metallic sheet material, preferably being cut and bent to form the connection element (100).
3. The connection element according to claim 1 or 2, wherein the gripping flanges (131, 132) extends inwardly (IL), and preferably also downwardly (D) as seen in a non-installed state of the connection element (100).
4. The connection element according to any one of claims 1-3, wherein the gripping flanges (131, 132) are flexible.
5. The connection element (100) according to any one of claims 1-4, wherein the distance between the first pair of end portions (120a1, 120b1) and the second pair of end portions (120a2, 120b2) is equal to, or slightly shorter than as seen in a non-installed state of the connection element (100), the maximum width of the flanges of the inverted T-shaped cross-section of the second profile (20) as seen in a non-installed state of the connection element (100) such that, in an installed state of the connection element (100), at least a portion of the first pair of end portions (120a1, 120b1) or the first bridge (141) and at least a portion of the second pair of end portions (120a2, 120b2) or the second bridge (142) abuts a respective edge of a respective flange of the inverted T-shaped cross-section of the second profile (20).
6. The connection element (100) according to any one of claims 1-5, wherein the connection element (100) further comprises a first set of abutment flanges (171a1, 171b1, 171a2, 171b2) including at least one abutment flange (171a1, 171b1) connected to a respective end portion (120a1, 120b1) of said first pair of end portions (120a1, 120b1) and at least one abutment flange (171a2, 171b2) connected to a respective end portion (120a2, 120b2) of said second pair of end portions (120a2, 120b2), wherein the respective abutment flange (171a1, 171b1, 171a2, 171b2) is configured to extend under and engage with an underside (21a", 21b") of respective flange (21a, 21b) of the second profile (20), wherein preferably each abutment flange (171a1, 171b1, 171a2, 171b2) of the first set of abutment flanges (171a1, 171b1, 171a2, 171b2) is flexible.
7. The connection element (100) according to claim 6, wherein the respective abutment flange (171a1, 171b1, 171a2, 171b2) of the first set of abutment flanges (171a1, 171b1, 171a2, 171b2) extends inclined inwardly (IL), and preferably also upwardly (U), from the respective end portion (120a1, 120b1, 120a2, 120b2) as seen in a non-installed state of the connection element (100).
8. The connection element (100) according to claim 6 or 7, wherein the first set of abutment flanges (171a1, 171b1, 171a2, 171b2) includes two abutment flanges (171a1, 171b1) connected to a respective end portion (120a1, 120b1) of said first pair of end portions (120a1, 120b1) and two abutment flanges (171a2, 171b2) connected to a respective end portion (120a2, 120b2) of said second pair of end portions (120a2, 120b2).

- tions (120a2, 120b2),
 wherein the abutment flanges (171a1, 171b1, 171a2, 171b2) at the first end portions (120a1, 120b1), and at the second end portions (120a2, 120b2), respectively, are located at a distance from each other along the transversal direction (T), preferably located along the transversal direction (T) on a respective side of the first through-going end opening (121) and of the second through-going end opening (122), respectively, and/or preferably located along the transversal direction (T) on a respective side of the first gripping flange (131) and the second gripping flange (132), respectively.
9. The connection element (100) according to any one of claims 1-8, wherein the connection element (100) further comprises a second set of abutment flanges (172a1, 172b1, 172a2, 172b2) including at least one abutment flange (172a1, 172a2) connected to the first base portion (110a) and at least one abutment flange (172b1, 172b2) connected to the second base portion (110b),
 wherein the respective abutment flange (172a1, 172b1, 172a2, 172b2) is configured to extend under and engage with an underside (13") of a bulb (13) of the first profile (10), wherein preferably each abutment flange (172a1, 172b1, 172a2, 172b2) of the second set of abutment flanges (172a1, 172b1, 172a2, 172b2) is flexible.
10. The connection element (100) according to claim 9, wherein the respective abutment flange (172a1, 172b1, 172a2, 172b2) of the second set of abutment flanges (172a1, 172b1, 172a2, 172b2) extends inclined inwardly (IT), and preferably also upwardly (U), from the respective base portion (110a, 110b) as seen in a non-installed state of the connection element (100).
11. The connection element (100) according to claim 9 or 10, wherein the second set of abutment flanges (172a1, 172b1, 172a2, 172b2) includes two abutment flanges (172a1, 172a2) connected to the first base portion (110a) and two abutment flanges (172b1, 172b2) connected to the second base portion (110b),
 wherein the abutment flanges (172a1, 172a2) connected to the first base portion (110a) and the abutment flanges (172b1, 172b2) connected to the second base portion (110b), respectively, are located at a distance from each other along the longitudinal direction (L), preferably located along the longitudinal direction (L) on a respective side of a second register member (152).
12. The connection element according to any one of claims 1-11, wherein the first bridge (141) further comprises a portion (141') extending in a plane of the end portions (120a1, 120b1) of the first pair of end portions (120a1, 120b1), and wherein preferably also the second bridge (142) further comprises a portion (142') extending in a plane of the portions (120a2, 120b2) of the second pair of end portions (120a2, 120b2).
13. The connection element according to any one of claims 1-12, further comprising a first register member (151) connected to one of the gripping flanges (132), wherein the first register member (151) is configured to extend through and engage with an opening (25) of the second profile (20) and thereby aid in keeping the connection element (100) in an intended position along the extension (T) second profile (20).
14. The connection element according to claim 1-13, further comprising a second register member (152) connected to one of the base portions (110a), wherein the second register member (152) is configured to extend through and engage with an opening (15) of the first profile (10) and thereby aid in keeping the connection element (100) in an intended position along the extension (L) of the first profile (10).
15. A suspended ceiling system (200) comprising:
 a plurality of first profiles (10), each having an inverted T-shaped cross-section and an extension along a longitudinal direction (L), the first profiles (10) being separated from each other along a transverse direction (T),
 a plurality of second profiles (20), each having an inverted T-shaped cross-section and an extension along the transversal direction (T), the second profiles (20) being separated from each other along the longitudinal direction (L), each second profile (20) crossing the extension (L) of a plurality of first profiles (10) above the first profiles (10), and
 a plurality of connection elements (100) according to any one of claims 1-14,
 wherein respective second profile (20) is interconnected to a first first profile (10) by a first connection element (100) and to a second first profile (10) by a second connection element (100).
16. The suspended ceiling system (200) according to claim 15, wherein the second profiles (20) are suspended in a structural ceiling (50) by suspension elements (30) extending between the structural ceiling (50) and the respective second profile (20).
17. Method of installing a suspended ceiling system (200), the method comprising:
 suspending a plurality of second profiles (20) in

a structural ceiling (50) by suspension elements (30) extending between the structural ceiling (50) and the respective second profile (20) such that the second profiles (10) are separated from each other along a transverse direction (T), wherein each second profile (10) has an inverted T-shaped cross-section and an extension along a longitudinal direction (L),

connecting a connection element according to any one of claims 1-13 to one of the second profiles (20) by moving the connection element (100) upwardly (U) relative to the second profile (20) and by flexing the gripping flanges (131, 132) and/or the end portions (120a2, 120b2, 120a1, 120b1) of the first and/or second pair of end portions (120a1, 120b1, 120a1, 120b1) such that the respective flange (21a, 21b) of the second profile (20) becomes positioned underneath the respective gripping flange (131, 132),

positioning a first profile (10) having an inverted T-shaped cross-section and an extension along the transversal direction (T) below the second profiles (20),

connecting the first profile (10) to the second profile (20) by moving the first profile (10) upwardly such that the first profile (10) becomes inserted into the through-going openings (121, 122) of the connection element (100) connected to the second profile (20).

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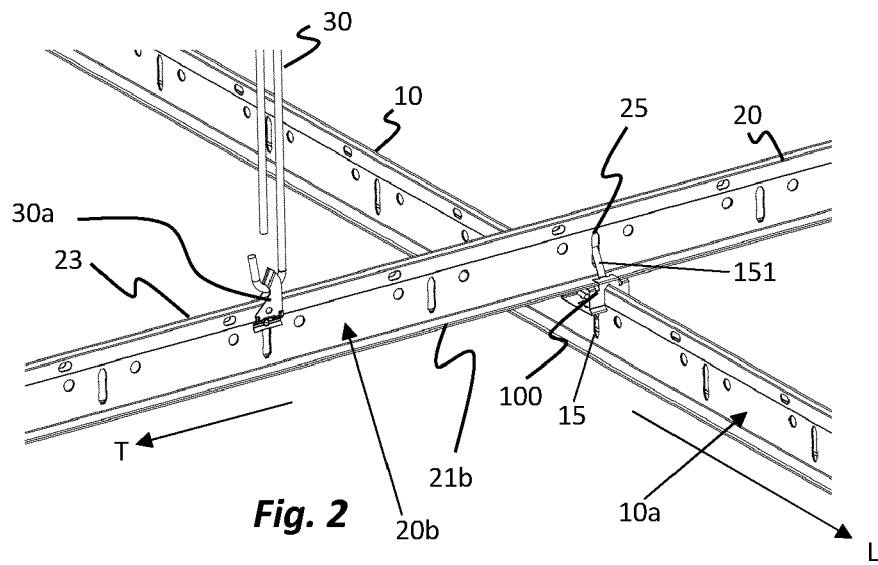
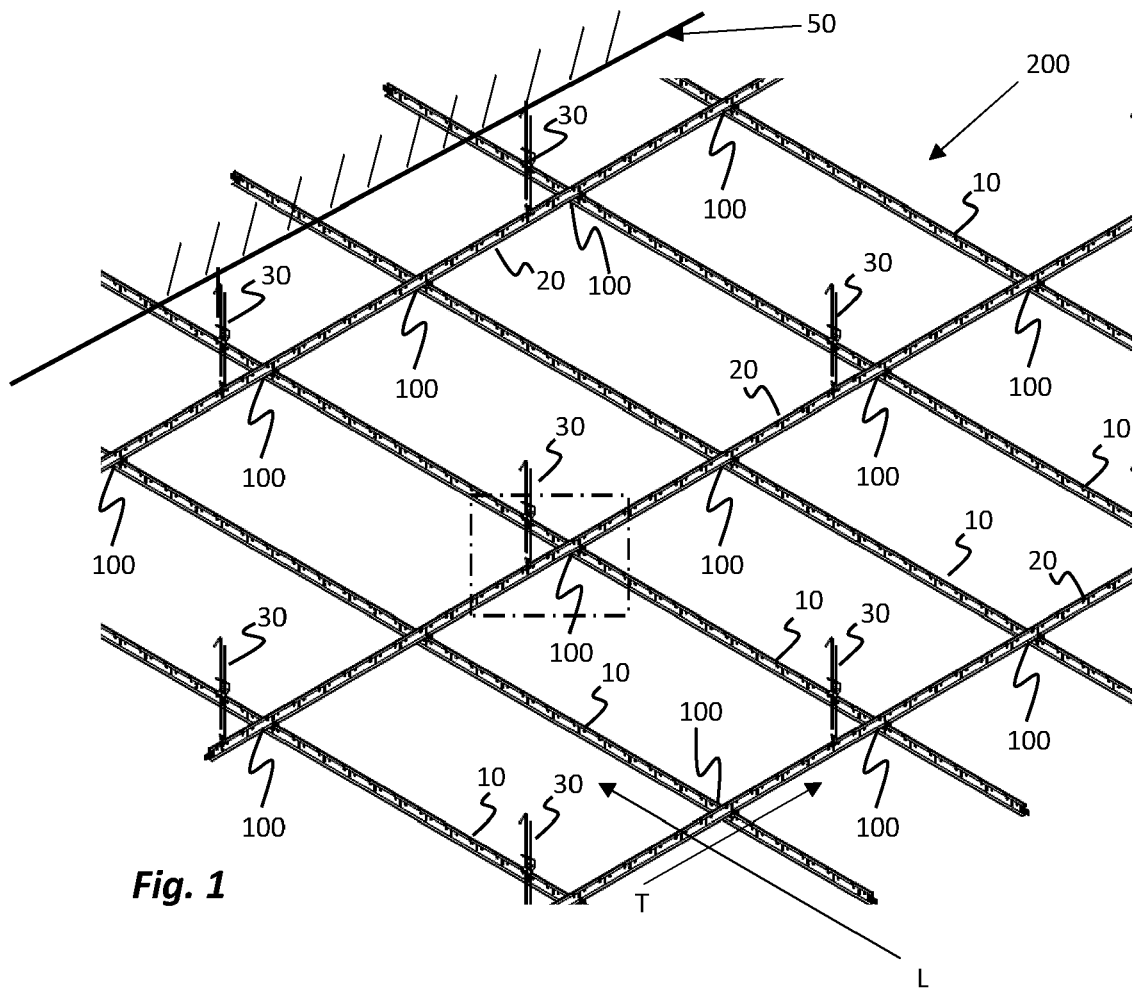
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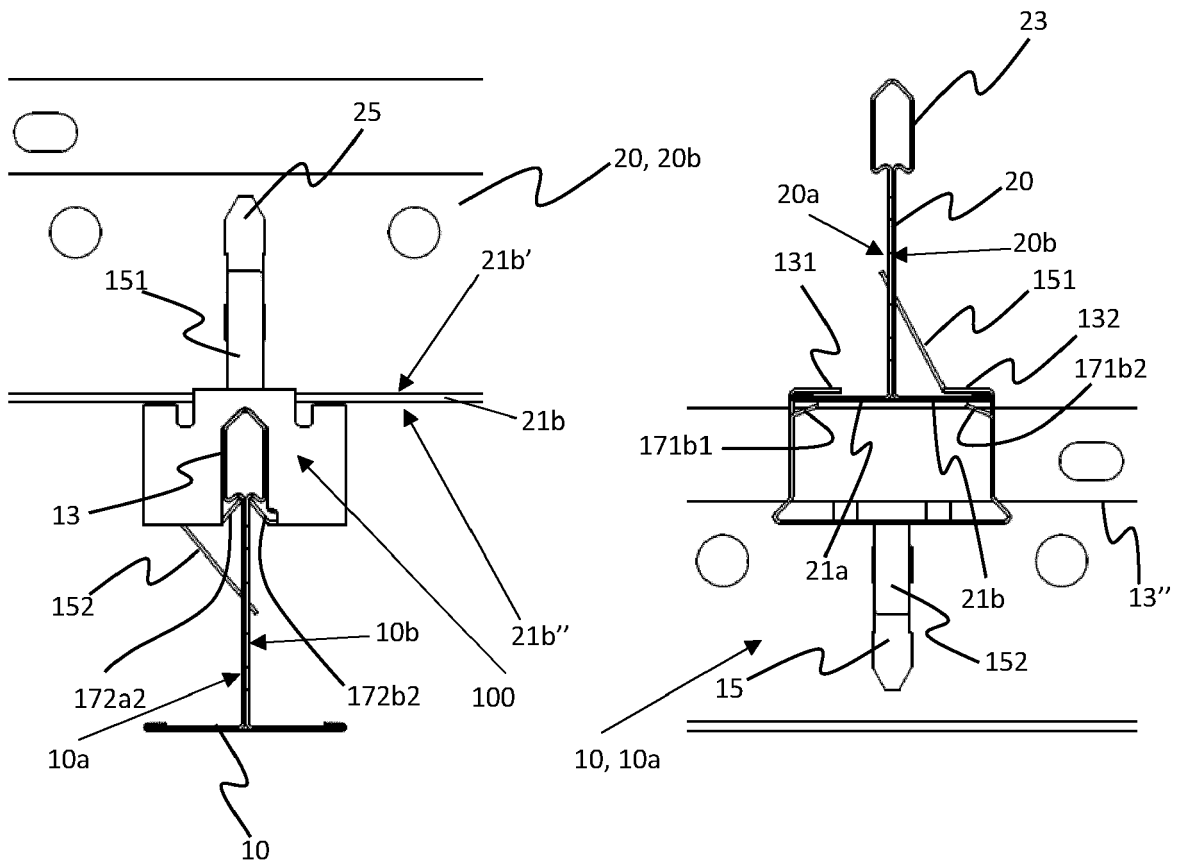


Fig. 3a

Fig. 3b

Fig. 4a

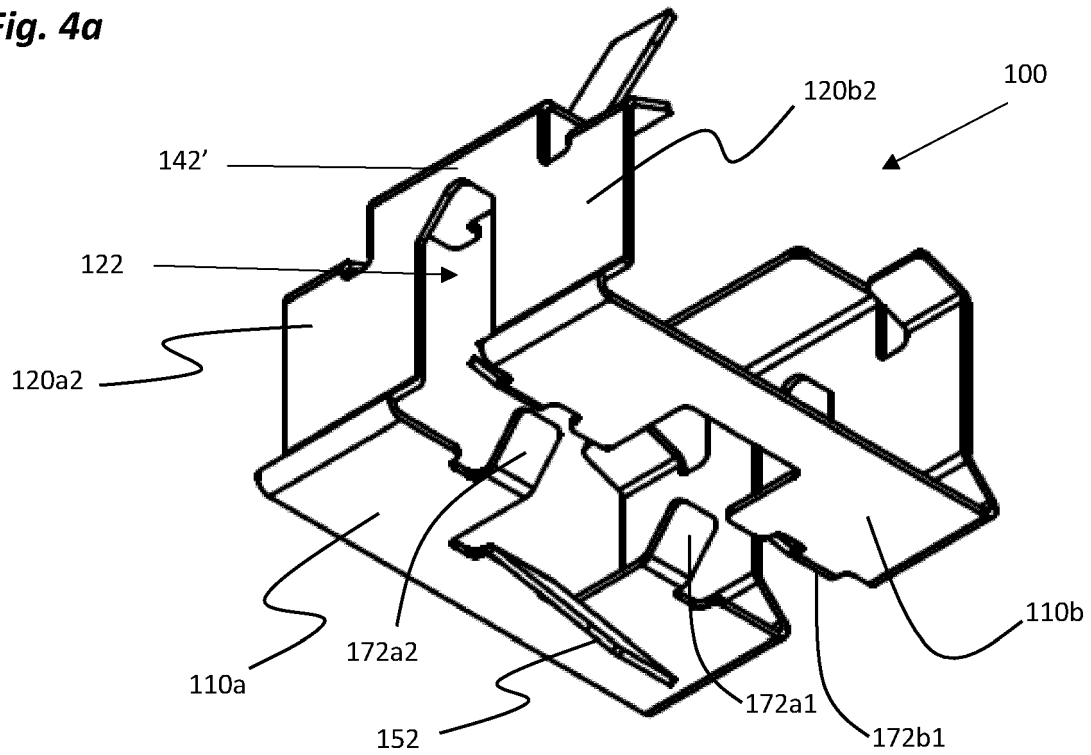


Fig. 4b

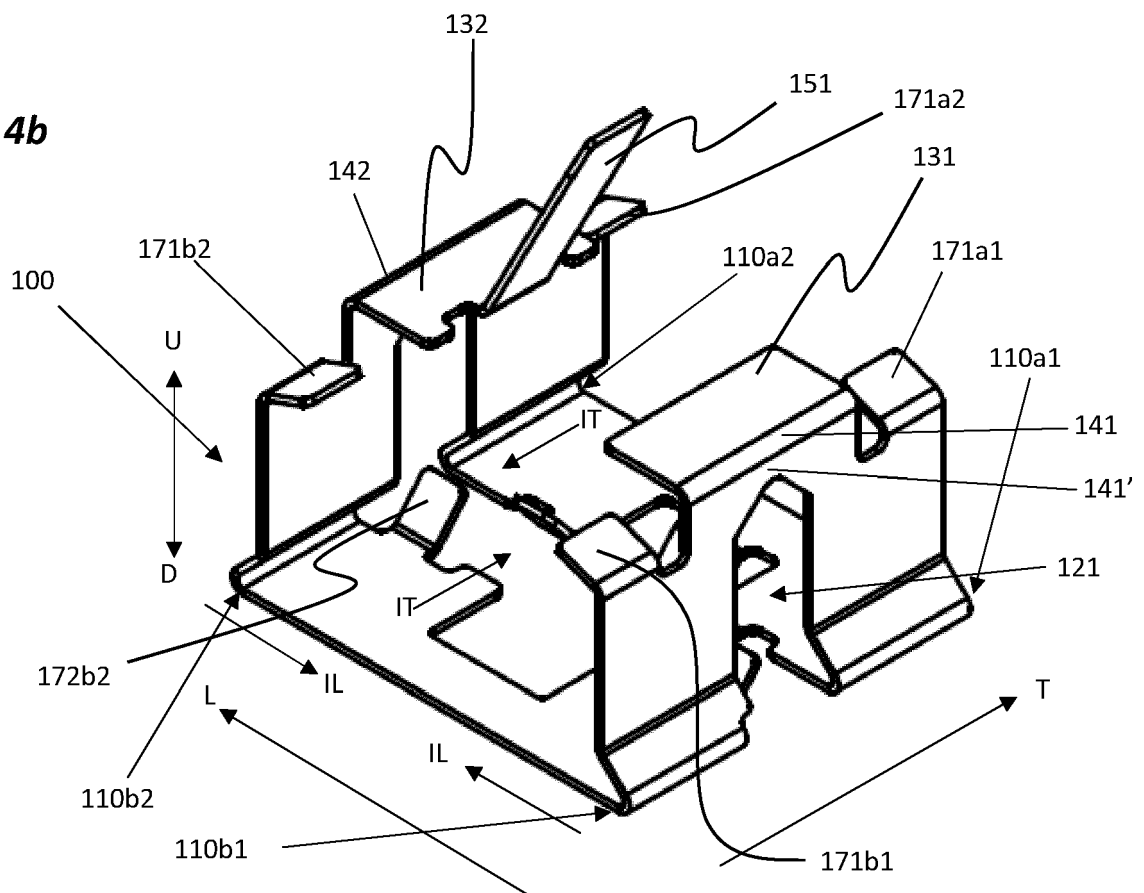


Fig. 4c

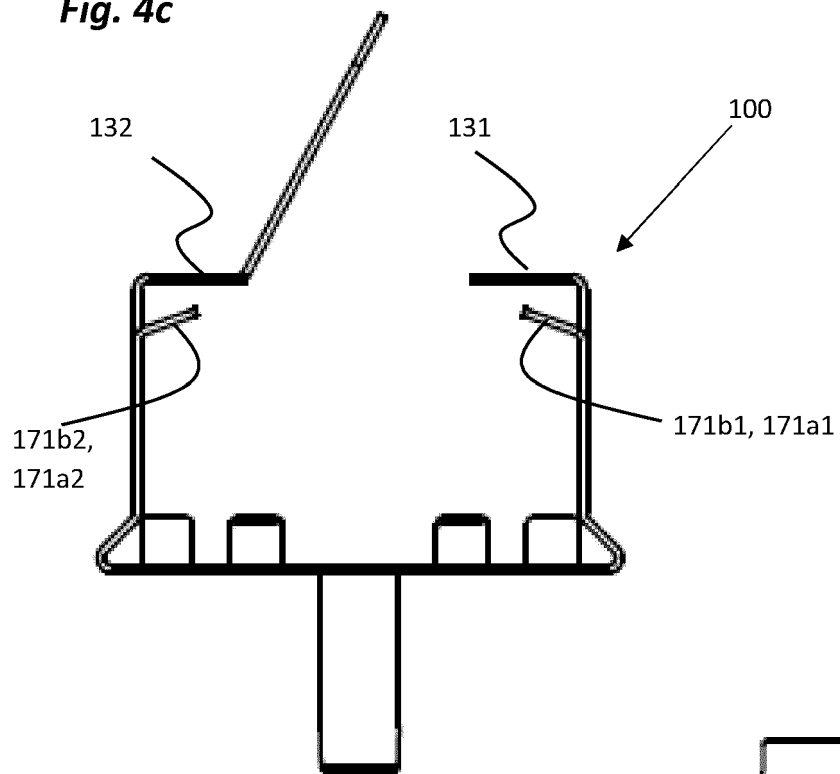


Fig. 4d

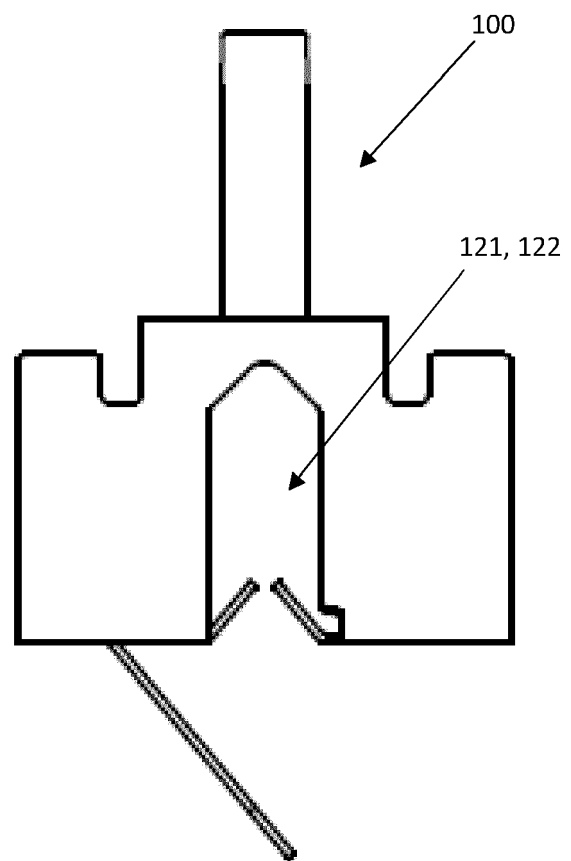
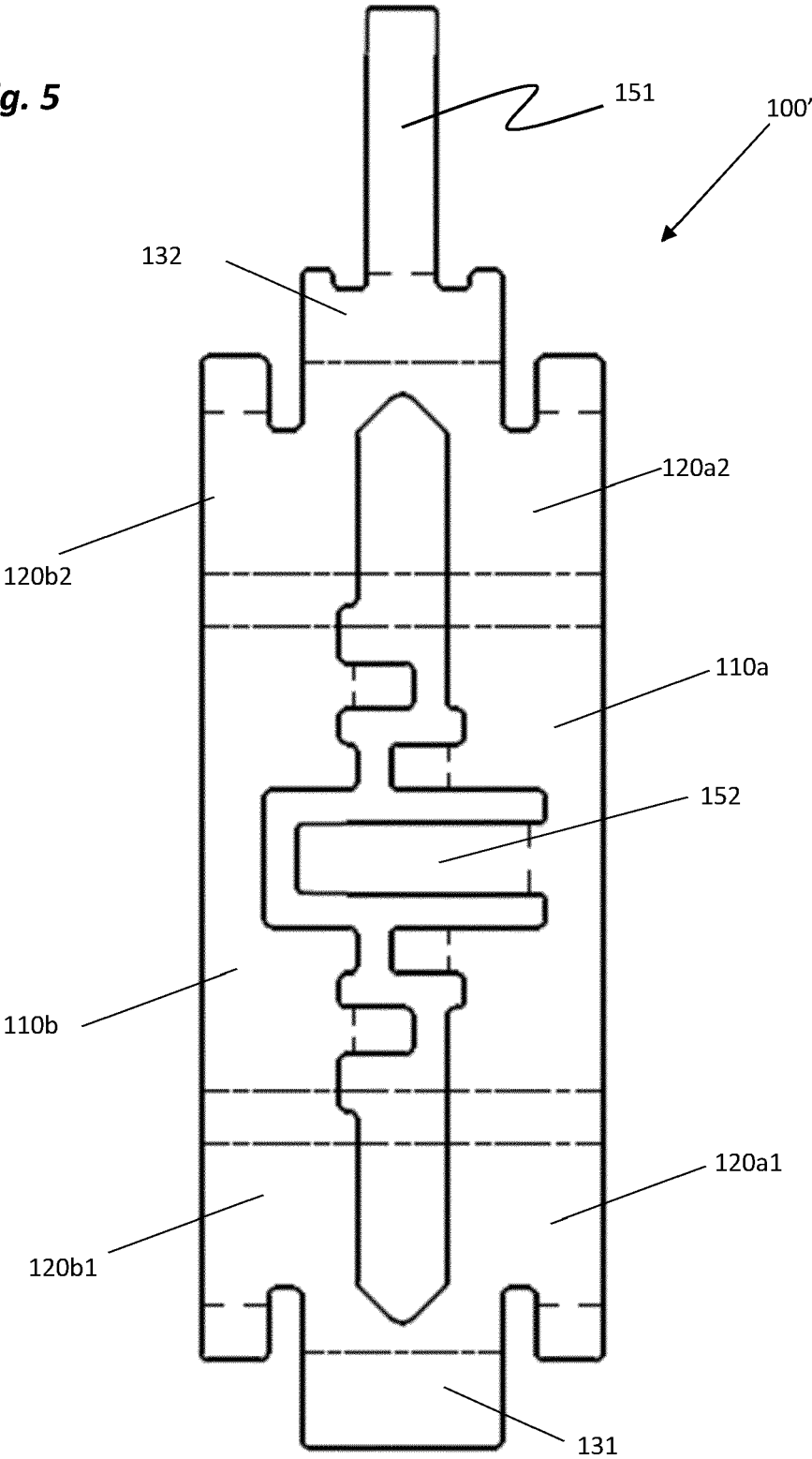


Fig. 5



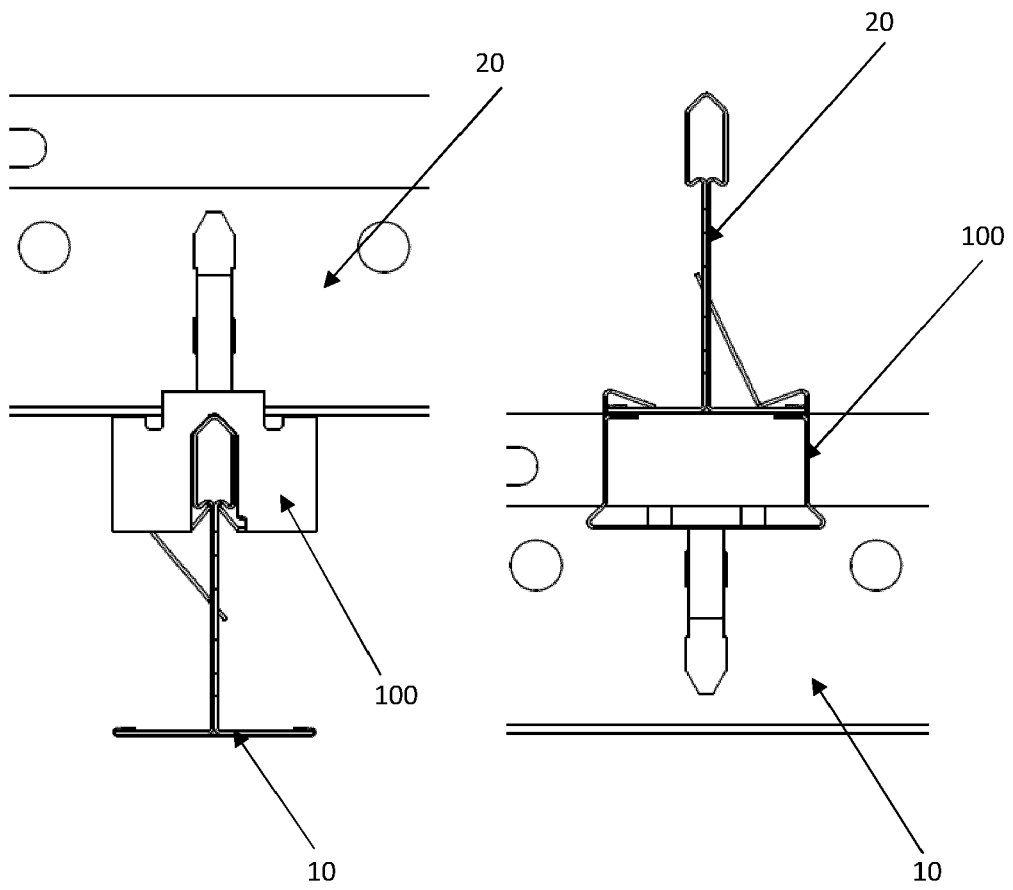
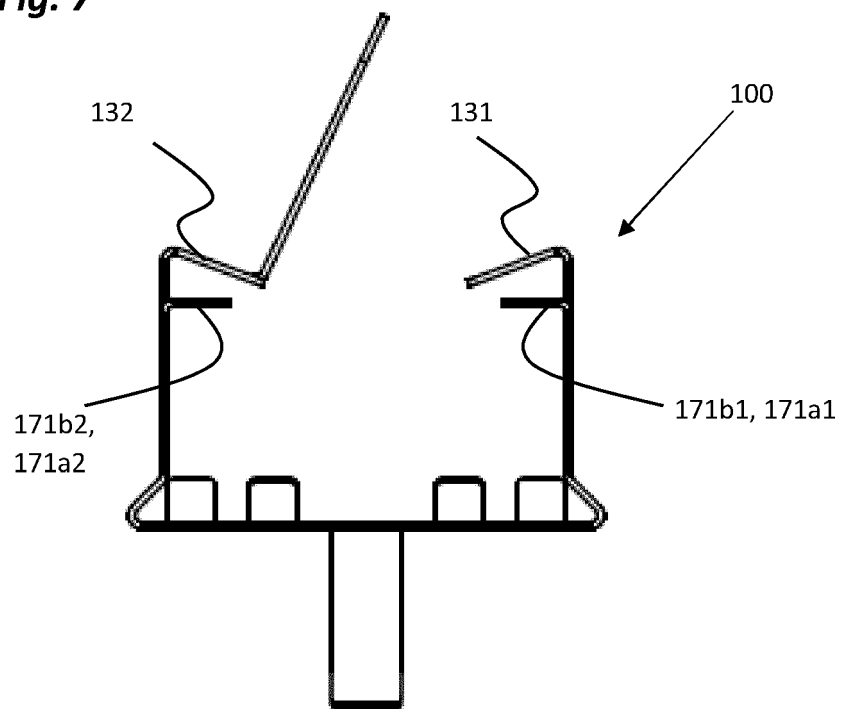


Fig. 6a

Fig. 6b

Fig. 7





EUROPEAN SEARCH REPORT

Application Number

EP 21 21 8129

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			E04B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 June 2022	Examiner Bauer, Josef
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	

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

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5 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
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02-06-2022

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