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(71) Applicant: **SI.AL. S.R.L.**
25030 Brandico (BS) (IT)

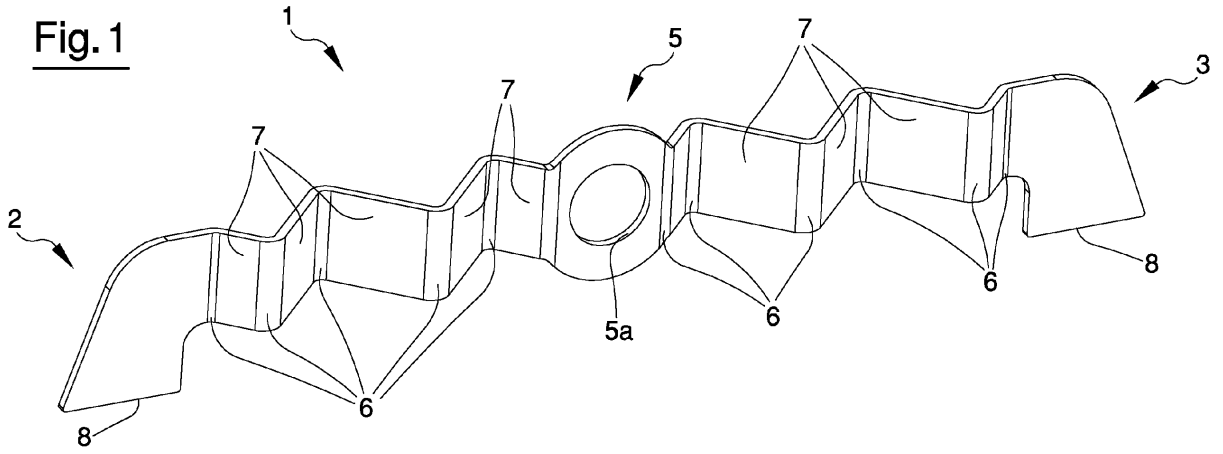
(72) Inventor: **Gandellini, Alberto**
25030 BRANDICO (BRESCIA) (IT)

(74) Representative: **Tirloni, Bartolomeo**
Bugnion S.p.A.
Viale Lancetti, 17
20158 Milano (IT)

(54) A fall protection hooking device and related fall protection system

(57) A fall protection hooking device (1) having a substantially plate-like conformation and provided with a first end (2) and a second end (3), structurally opposite to said first end, which are intended to be stiffly fixed to an anchoring element (31) so as to be made mutually integral, and provided with a hooking portion (5) structurally interposed between the ends and structured for the hooking of a fall protection cable (15), the hooking device comprising a first series of folding lines (6), interposed between the first end and the hooking portion, and a second series of folding lines, interposed between the second end and the hooking portion, where each pair of adjacent folding lines in each series delimits a respective sub-portion (7) of the hooking device (1) so as to define a series of sub-portions each lying in a plane which is oblique with respect to the lying plane of the adjacent sub-portions, where the hooking device is structured for deforming, in use, at least at the folding lines (6) due to a tensile force applied to the hooking portion, so that the hooking portion changes its position with respect to the first end and the second end.

Fig. 1



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Description

[0001] This invention is in the sector of fall protection safety systems intended for buildings. In particular this invention relates to a fall protection hooking device, as a support for safety lines or a fall protection hooking element, the fall protection system comprising said device and a fall protection safety method.

[0002] There are prior art fall protection hooking devices, and related fall protection systems, intended to be permanently mounted on building structures which are typically located a predetermined height above the ground, such as building roofs, walls or beams/girders, as a safety system for operators who work at that height. The operator anchors to such systems the personal safety cable (usually equipped with a winder), or other suitable device, which is connected to his harness, so that he can work in complete safety. Should the operator lose his balance and slip downwards, such fall protection systems prevent the operator from hitting the structures below or the ground, or they at least limit the violence of the contact. In that way, the operator can safely proceed on the building structure, for example while putting on the roof or cover, as well as building technical plants, gutters, chimneys or skylights, and for the related repair and maintenance of them.

[0003] There are prior art individual fall protection hooking elements, for example of the type shown in document EP2292874, which have a main body, to which the personal safety cable is fixed, and two fastening portions located on opposite sides of the main body and intended to be fastened to a fixed structure of the building. Such hooking elements allow absorption of the sudden stress deriving from a fall by an operator connected to them, by deformation of their own structure, in such a way as to lessen the wrenching action applied to the operator.

[0004] There are also prior art plate-shaped supports for safety lines intended to be fastened on a building and comprising a metal plate stably connected to the roof and equipped with a portion for hooking the connecting cable of a safety line and structured in such a way that they deform and absorb the wrenching action deriving from the operator fall.

[0005] The Applicant has found that the currently available fall protection hooking devices and related fall protection systems are not without disadvantages and can be improved from various points of view.

[0006] In particular, the Applicant has found that prior art fall protection hooking devices cannot effectively absorb the stresses coming from every axis, since they are structured to deform mainly along one or few preferred tensile axes.

[0007] The Applicant has also found that prior art deformable hooking devices may not be able to efficiently lessen the high intensity sudden stresses deriving from an operator fall.

[0008] In general, the Applicant has found that prior art fall protection systems have a complex structure and/or significant dimensions and/or weight and/or complex production and/or installation and/or high production cost.

[0009] In this situation, the basic aim of this invention, according to its various aspects and/or embodiments, is to provide a fall protection hooking device, a fall protection system comprising said device and a fall protection safety method that can overcome one or more of the above-mentioned disadvantages.

[0010] In particular, one of the aims of this invention is to provide a fall protection hooking device and a related fall protection system which can withstand the sudden stress caused by a fall by an operator connected to them, without said fall causing abrupt breaks in the structure of the device and/or partial or total detachment of the device from the fixed structure of the building to which it is fastened, and at the same time characterised by a high level of effectiveness in the action of absorbing the sudden stress deriving from the operator fall.

[0011] A further possible aim of this invention is to provide a fall protection system which is strong enough for working in any operating conditions, that is to say, which can remain fastened to the building structure following a sudden stress deriving from a fall by an operator hooked to it, can withstand the fatigue cycles caused by its own thermal expansion and that of the building structure and can preserve its mechanical features unchanged as time passes.

[0012] A further possible aim of this invention according to one or more of its various aspects is to provide a fall protection hooking device, system and safety method which are more reliable and/or guarantee an operator anchored to the device, working on the roof of a building, greater safety.

[0013] One of the possible aims of this invention according to one or more of its various aspects is to provide a fall protection hooking device and system which are characterised by reduced thickness and/or dimensions and/or reduced use of material for their production.

[0014] One or more of these aims, in addition to other possible aims, which will become clearer from the description given below, are substantially achieved by a fall protection hooking device, as a fall protection hooking element or safety line support, a fall protection system and a fall protection safety method, with the technical features described in one or more of the appended claims, each of which taken alone (without the relative dependent claims) or in any combination with the other claims, as well as according to the following aspects and/or example embodiments, variously combined, also with the aforesaid claims.

[0015] According to one aspect the invention relates to a fall protection hooking device having a substantially plate-like conformation and provided with a first end and a second end, structurally opposite to said first end, intended to be stiffly fixed to an anchoring element so as to be made mutually integral, and provided with a hooking

portion structurally interposed between said first and second end and structured for the hooking of a fall protection cable, the hooking device developing with structural continuity from the first to the second end passing through the hooking portion, the hooking device presenting a first series of folding lines, interposed between said first end and said hooking portion, and a second series of folding lines, interposed between the second end and said hooking portion, each pair of adjacent folding lines in each series delimiting a respective sub-portion of the hooking device so as to define a series of sub-portions each lying in a plane which is oblique with respect to the lying plane of the adjacent sub-portions, the hooking device being structured for deforming, in use, at least at said folding lines due to a tensile force applied to said hooking portion, so that the hooking portion changes its position with respect to the first end and the second end.

[0016] The Applicant believes that the combination of the above-mentioned technical features, in particular the presence of the first and second series of folding lines at which, in use, the device deforms due to a tensile force applied to the hooking portion structurally interposed between the two ends intended to be stiffly fixed to an anchoring element so as to be made mutually integral, so that the hooking portion changes its position with respect to the ends, allows a hooking device to be obtained which is able to effectively dampen the wrenching action in the event of an operator fall and can absorb the stress deriving from said fall (preventing said stresses from discharging on the fasteners attached to the building structure or to the roof) and at the same time characterised by a simple, rational structure which is easy and inexpensive to produce, for example by means of suitable cuts and bends of a single part having a plate-like conformation (for example a portion of sheet metal).

[0017] The Applicant also believes that the above-mentioned technical features advantageously allow stable and balanced fixing to a building structure, by means of the anchoring element, which is strong enough to withstand typical strains for the fall protection device, and at the same time can absorb in an original way the stress produced by a fall. In fact, said absorption occurs through deformation of the structure of the device, said deformation typically comprising (at least partial) compression (of the folding lines) of the portion of the device located between the hooking portion and the end (first or second) on the side of the tensile force (or at least one component of it) and stretching (of the folding lines) of the portion of the device between the hooking portion and the end (second or first) on the side opposite to the above-mentioned tensile force.

[0018] That method of deformation of the structure may allow the device to effectively absorb stresses which are ideally directed along any axis and in any direction, combining in any condition the compression of some folding lines and stretching of others.

[0019] According to one aspect the anchoring element is intended to be stiffly fixed to a building structure and, in use, is interposed between the device and the building structure. Equivalently, the first and second ends can be fixed directly to the building structure. According to one aspect, the deformation of the device remains elastic at least up to a value of said tensile force less than or equal to 2 kN, preferably less than or equal to 2.5 kN. In that way the device effectively absorbs the small stresses deriving from normal use by an operator (and/or from thermal cycles), without compromising the potential for absorbing the stresses in the event of a fall.

[0020] According to one aspect, said deformation becomes plastic (permanent) at a value of said tensile force greater than 2 kN, preferably greater than 3 kN, and even more preferably greater than 4 kN. In that way, the device effectively absorbs the sudden stresses caused by an operator fall. The expression plastic (permanent) deformation refers to inelastic deformation.

[0021] According to the Applicant the device, folded along the above-mentioned folding lines into a series of sub-portions, forms an element with a predetermined level of plastic yielding and able to limit or cancel out the sudden nature of a fall stress. The Applicant has found, through testing, that the energy developed in the fall is used to plastically deform the anchoring body, at the same time reducing the wrenching action applied to the operator and the maximum load that the device must support, thus allowing the device to be made smaller than prior art devices, as well as making smaller parts for fixing the device to the building structure. According to one aspect, the hooking device comprises a first portion of the device interposed between said first end and said hooking portion and a second portion of the device interposed between said second end and said hooking portion.

[0022] According to one aspect, the first and second portions are identical to each other and symmetrical with respect to a middle plane of symmetry passing through the hooking portion.

[0023] According to one aspect, the first portion of the device and the second portion of the device extend parallel and adjacent to each other. According to one aspect, the first and second portions lie geometrically on the same side of the hooking portion.

[0024] According to one aspect, the first portion of the device and the second portion of the device extend on the same line. According to one aspect, the first and second portions lie geometrically on opposite sides of the hooking portion.

[0025] According to one aspect, the first and second ends are provided with a respective end face, preferably flat, which in use is intended to be fixed directly to the building structure or, in a preferred alternative, to the anchoring element. According to one aspect, the end faces of the first and second ends, which are preferably identical, lie in the same lying plane.

[0026] According to one aspect, the folding lines of the first and/or second series of folding lines lie in respective planes which are transversal (preferably at a right angle) to said lying plane. In that way, the device is structured

in such a way that, in use, it responds with a greater deformation, and so with greater energy absorption, in particular for a tensile force which has a main component parallel with the lying plane. According to an alternative aspect, the folding lines of the first and/or second series of folding lines lie in respective planes which are substantially parallel with said lying plane. In that way, the device is structured in such a way that, in use, it responds with a greater deformation, and so with greater energy absorption, in particular for a tensile force which has a main component that is transversal (preferably at a right angle) to the lying plane.

[0027] According to one aspect, the first and second series of folding lines each comprise at least three folding lines, preferably at least five, by way of example at least six.

[0028] According to one aspect, the first and second series of sub-portions define a respective series of smallest angles between each pair of respective adjacent sub-portions. Preferably each of the smallest angles is on a face of the respective first or second portion of the device opposite to the face on which the adjacent smallest angles are.

[0029] According to one aspect, the smallest angle defined between two adjacent sub-portions is constant.

[0030] According to one aspect, the smallest angle defined between at least two adjacent sub-portions (preferably between all of the adjacent sub-portions) is less than or equal to 135°, preferably less than or equal to 110°, even more preferably equal to 90°. The Applicant has found that the above-mentioned choice of the smallest angle gives the device the desired capacity to absorb the force developed by the tensile force, before arriving at complete plastic stretching of the sub-portions which corresponds to a practically flat configuration.

[0031] According to one aspect, the device has a constant thickness, preferably between 1 mm and 10 mm.

[0032] According to one aspect, the fall protection hooking device has an overall dimension, along an axis at a right angle to the lying plane, less than, preferably less than half of, even more preferably less than one quarter of, the overall dimension of the fall protection device along an axis passing through the two end faces. That limits the height extension of the fall protection device from the fixed structure to which it will be fixed. That is advantageous because it allows a reduction in the overall dimensions of the device and limits, depending on the application, the vertical distance between the hooking portion and the first and second ends, that is to say, the lever arm of the tensile force applied to the hooking portion.

[0033] According to one aspect, the invention relates to a fall protection system comprising:

- a fall protection hooking device according to one or more of the aspects of this invention and/or the claims,
- an anchoring element, having a substantially plate-like conformation and intended to be stiffly fixed to a portion of a building structure, and provided with a lower face and an upper face, opposite to said lower face,

where the first end and the second end are stiffly fixed to said upper face of the anchoring element so as to be made mutually integral.

[0034] The Applicant believes that the plate-like conformation of the anchoring element guarantees stable, secure and easy fixing on building structures (for example a roof) already provided with a cover, and can be obtained in an easy, inexpensive way.

[0035] According to one aspect, the anchoring element is shaped to match a portion of the building structure, the lower face being intended to correspond with a respective portion of surface of the building structure and the upper face comprising at least a flat portion. In that way, it is possible to achieve easy, stable mounting of the hooking device on the flat portion of the anchoring element and of the entire fall protection system on the building structure, in particular a building structure having a surface that is not flat. Moreover, by modifying the anchoring element it is possible to mount the fall protection system on building structures which have different surfaces. According to one aspect, the anchoring element extends mainly longitudinally and has a constant cross-section. According to one aspect, the anchoring element is a plate with a rectangular plan and is provided with at least one folding line parallel with the longitudinal extension and defining two walls. According to a further aspect, the anchoring element is provided with two folding lines which are parallel with the longitudinal extension and define a central wall and a pair of lateral walls at the sides of the central wall.

[0036] According to one aspect, the anchoring element has a thickness of between 1 mm and 10 mm, preferably constant.

[0037] According to another aspect, the anchoring element is a substantially flat plate.

[0038] According to one aspect, the building structure is a roof or a roof covering, for example a flat, corrugated, trapezoidal (box) profile or standing seam profile covering, for example made of sheet metal, concrete, wood, plastic or insulating material. Preferably the building structure is a sheet metal covering for a building (warehouse or other) having a plurality of raised ribs which are parallel with each other (known as "trapezoidal profile sheets"), the anchoring element being shaped to match one of the ribs. Alternatively, the building structure is a standing seam profile sheet metal covering.

[0039] According to one aspect, the anchoring element is shaped to match a rib of a trapezoidal profile sheet.

[0040] According to one aspect, the fall protection system comprises mounting members for stiffly fixing the system to the building structure. Preferably, said mounting members are structured for fixing the anchoring element to the building structure in such a way as to render

the anchoring device, the anchoring element and the building structure integral with each other.

[0041] According to one aspect, the mounting members comprise a plurality of bolts or self-drilling (and/or self-tapping) screws structured for inserting each in a respective hole of the anchoring element and for drilling a respective hole in said building structure (for example in the sheet metal covering of the building structure) and stiffly fixing the position of the anchoring element in contact with the building structure. According to one aspect, the anchoring element is structured for fixing to a rib of a standing seam profile sheet.

[0042] According to one aspect, the invention relates to a safety line comprising two fall protection systems according to this invention, (which are intended to be) fixed in mutually distanced positions of a fixed building structure, and a connecting cable which is hooked between the two hooking devices.

[0043] According to one aspect, the invention relates to the above-mentioned building structure provided with one or more of the above-mentioned fall protection systems or the above-mentioned safety line.

[0044] According to a further aspect, the invention relates to a fall protection safety method comprising the steps of:

- providing the fall protection system according to this invention,
- installing said system on a building structure, so that said anchoring element is fastened to said building structure and said hooking portion protrudes from the building structure and is accessible for the hooking of a fall protection cable.

[0045] According to a further aspect, the invention relates to a use of the hooking device according to this invention as a fall protection hooking element or as a support for safety lines, in which the hooking portion hooks, respectively, an operator safety cable or a safety line connecting cable.

[0046] Other features and advantages will become more apparent from the detailed description below of some embodiments, also including a preferred non-limiting embodiment of a fall protection hooking device and system according to this invention. The description is set out below with reference to the accompanying drawings which are provided solely for purposes of illustration without limiting the scope of the invention and in which:

- Figure 1 is a perspective view of a possible embodiment of a hooking device in accordance with this invention;
- Figure 2 is a plan view of the device of Figure 1;
- Figure 3 is a perspective view of a possible embodiment of a fall protection system in accordance with this invention, comprising the device of Figure 1;
- Figure 4 is a perspective view of a further possible embodiment of a fall protection system in accordance with this invention, comprising the device of Figure 1;
- Figure 5 is a perspective view of a further possible embodiment of a hooking device in accordance with this invention;
- Figure 6 is a perspective view of a further possible embodiment of a fall protection system in accordance with this invention and comprising the device of Figure 5, said device being in a non-deformed configuration;
- Figure 7 is a perspective view of the fall protection system of Figure 6 with the hooking device in a deformed configuration.

[0047] With reference to the accompanying drawings, the reference number 1 denotes in its entirety a fall protection hooking device according to this invention and the reference number 50 denotes in its entirety a fall protection system according to this invention. In general, the same reference number is used for the same elements in their alternative embodiments.

[0048] The fall protection hooking device 1 has a substantially plate-like shape and is provided with a first end 2 and a second end 3, structurally opposite to said first end, which are intended to be stiffly fixed to an anchoring element 31 so as to be made mutually integral. The hooking device 1 is also provided with a hooking portion 5, structurally interposed between the first end and the second end and structured for the hooking of a fall protection cable 15, the hooking device extending with structural continuity from the first end to the second end, passing through the hooking portion. The hooking device 1 comprises a first series of folding lines 6, interposed between the first end and the hooking portion, and a second series of folding lines 6, interposed between the second end and said hooking portion, each pair of adjacent folding lines in each series delimiting a respective sub-portion 7 of the hooking device so as to define a series of sub-portions each lying in a plane which is oblique with respect to the lying plane of the adjacent sub-portions. The hooking device 1 is structured for deforming, in use, at least at the folding lines 6 due to a tensile force applied to the hooking portion 5, so that the hooking portion changes its position with respect to the first end and the second ends.

[0049] Preferably, (as shown for example in Figures 3, 4, 6 and 7) the anchoring element 31 is intended to be stiffly fixed to a building structure 60 and, in use, is interposed between the device and the building structure. Equivalently (in an embodiment not illustrated) the first end 2 and the second end 3 can be fixed directly to the building structure.

[0050] Preferably, the deformation of the device remains elastic at least up to a value of said tensile force less than or equal to 2 kN, preferably less than or equal to 2.5 kN.

[0051] Preferably, the deformation becomes plastic (permanent) at a value of said tensile force greater than

2 kN, preferably greater than 3 kN, and even more preferably greater than 4 kN.

[0052] The Applicant has observed that the value of the tensile force beyond which the deformation is no longer elastic also depends on the axis of the tensile force. For example, in the example embodiment illustrated in Figures 1 to 4, for a tensile force oriented at a right angle to the folding lines, said value is around 4 kN, while for a tensile force oriented parallel with the folding lines, said value is around 2 kN.

[0053] Preferably the device 1 is structured so that it deforms, due to a tensile force greater than 2 kN, by means of plastic compression of the sub-portions defined by the first series or second series of folding lines which tends to move the folding lines towards each other and by means of a plastic stretching of the sub-portions defined by the second, or respectively first, series of folding lines which tends to move the folding lines away from each other, said stretching causing the hooking portion to move away from the first end or the second end along the axis of application of the tensile force. According to one aspect of this invention, the first and second series of folding lines can equivalently be substituted with respective yielding elements structured for deforming, in use, due to a tensile force applied to the hooking portion, so that the hooking portion changes its position with respect to the first end and the second end.

[0054] Preferably, the device 1 comprises a first portion of the device interposed between the first end 2 and the hooking portion 5 and a second portion of the device interposed between the second end 3 and the hooking portion 5. Preferably, as in the example embodiments illustrated in the accompanying drawings, the first and second portions are identical to each other and symmetrical with respect to a middle plane of symmetry passing through the hooking portion 5.

[0055] Preferably, as shown for example in Figures 5, 6 and 7, the first portion of the device and the second portion of the device extend parallel and adjacent to each other. Preferably, the first and second portions lie geometrically on the same side of the hooking portion. Preferably, the first and second portions are separated by a slit with width less than or equal to 20 mm, preferably 10 mm, by way of example equal to around 5 mm.

[0056] Preferably, as shown for example in Figures 1, 2, 3 and 4, the first portion of the device and the second portion of the device extend on the same line (schematically indicated in Figure 2 and labelled 9). Preferably, the first and second portions lie geometrically on opposite sides of the hooking portion. Preferably, the first and second ends are separated by a distance greater than or equal to 50 mm, preferably 100 mm, by way of example around 300 mm. By way of example, the width of each of the end faces 8 is around 40 mm. Preferably, the first end 2 and the second end 3 are provided with a respective end face 8, preferably flat, which in use is intended to be fixed directly to the building structure 60 or, in a preferred alternative, to the anchoring element 31. Preferably, the end faces 8 of the first and second ends, which are preferably identical, lie in the same lying plane.

[0057] Preferably, as shown for example in Figures 1 to 4, the folding lines 6 of the first and/or second series of folding lines lie in respective planes which are transversal (preferably at right angles) to said lying plane.

[0058] Alternatively, as shown for example in Figures 5 to 7, the folding lines 6 of the first and/or second series of folding lines lie in respective planes which are substantially parallel with the lying plane. Preferably, the first and second series of folding lines each comprise at least three folding lines, preferably at least five, by way of example six.

[0059] Preferably, the first and second series of sub-portions define a respective series of smallest angles between each pair of respective adjacent sub-portions. Preferably each of the smallest angles is on a face of the respective first or second portion of the device opposite to the face on which the adjacent smallest angles are.

[0060] Preferably, the first and/or the second portion of the device are bent in such a way that the respective series of sub-portions has a "saw-toothed" shape, for example the even sub-portions lie in respective planes which are parallel with each other and the odd sub-portions lie in respective planes which are parallel with each other. Alternatively, the first and/or the second portion of the device are bent in such a way that the series of sub-portions has a square wave or practically sinusoidal shape (in that case a continuum of folding lines can be considered). However, this invention covers all embodiments of the device in which each sub-portion is oriented according to any angle relative to the previous and/or next sub-portion.

[0061] Preferably, the smallest angle defined between two adjacent sub-portions is constant.

[0062] Preferably, the smallest angle defined between at least two adjacent sub-portions (preferably between all of the adjacent sub-portions) is less than or equal to 135°, preferably less than or equal to 110°, even more preferably equal to 90°.

[0063] Preferably, the device has a constant thickness, preferably of between 1 mm and 10 mm. By way of example, the thickness of the device is equal to around 3 mm (for example, in the embodiment illustrated in Figures 1 to 4) or 4 mm (for example, in the embodiment shown in Figures 5 to 7).

[0064] Preferably, the hooking portion 5 is structured with a ring shape, from which the first portion and the second portion branch off, and the ring comprises a hooking hole 5a for the hooking of the above-mentioned safety cable 15, for example for the insertion of a safety carabiner or other coupling members 20. In that way, it is possible to prevent the unhooking, for example accidental, of the safety cable from the hooking portion.

[0065] The hooking portion 5 may be integral with the remaining portions of the device (as shown by way of example in the accompanying drawings), or equivalently it may be a separate body which is stiffly fixed to them,

as for example in the case of an eyebolt provided with a bolt which is inserted in a hole through an intermediate portion between the first series and second series of folding lines and fixed with a locknut.

[0066] Preferably, the fall protection hooking device has an overall dimension, along an axis at a right angle to the lying plane, less than, preferably less than half of, even more preferably less than one quarter of, the overall dimension of the fall protection hooking device along an axis passing through the two end faces.

[0067] Figures 3, 4 and 6, 7 show two example embodiments of a fall protection system 50 in accordance with this invention.

[0068] The fall protection system 50 comprises an anchoring element 31, having a substantially plate-like conformation and intended to be stiffly fixed to a portion of a building structure 60, and provided with a lower face 31a and an upper face 31b, opposite to said lower face. The system also comprises an above-mentioned hooking device 1, having the first end 2 and the second end 3 stiffly fixed to the upper face 31b of the anchoring element 31.

[0069] Preferably, the anchoring element 31 is shaped to match a portion of the building structure, the lower face 31a being designed to correspond with a respective portion of surface of the building structure and the upper face 31b comprising at least a flat portion. Preferably, the anchoring element 31 extends mainly longitudinally and has a constant cross-section.

[0070] Preferably, the anchoring element is a plate with a rectangular plan and, as shown by way of example in Figures 3, 4, 6 and 7, is provided with two folding lines which are parallel with the longitudinal extension and define a central wall 32 and a pair of lateral walls 33 at the sides of the central wall.

[0071] Preferably, the anchoring element has a thickness of between 1 mm and 10 mm, preferably constant.

[0072] Preferably, as shown by way of example in Figures 6 and 7, the building structure 60 is a building covering made of sheet metal, having a plurality of raised ribs which are parallel with each other (known as "trapezoidal profile sheets"), the anchoring element 31 being shaped to match one of the ribs. Alternatively, the building structure may be a standing seam profile sheet metal covering.

[0073] Preferably, as shown in the example embodiment in Figures 3, 6 and 7, the anchoring element 31 is shaped to match a rib of a trapezoidal profile sheet (said trapezoidal profile sheet is not illustrated in Figure 3 and may for example be of the type shown in Figures 6 and 7).

[0074] Preferably, the respective end faces 8 of the first end and second ends of the hooking device occupy a limited portion of the upper face of the anchoring element. Preferably, the sum of the areas of the upper face of the anchoring element occupied by the end faces of the first and second ends is less than half, preferably than one third, preferably than one fifth, of the overall area of the upper surface, preferably of the central wall, of the anchoring element.

[0075] Preferably, the end faces of the first and second ends are located in a substantially middle position of the longitudinal dimension of the anchoring element, so as to avoid or reduce, in practice, twisting moments on the main body.

[0076] Preferably, the end faces of the first and second ends are fixed to the upper face of the anchoring element in line with said longitudinal extension (as shown in the accompanying drawing) or alternatively are rotated, preferably through the same angle, relative to the longitudinal extension.

[0077] Preferably, the first end and the second end of the hooking device are fixed to the upper face of the anchoring element by means of respective welded joints 41.

[0078] Preferably, the fall protection system comprises mounting members 30 for stiffly fixing the system to the building structure. Preferably, the mounting members are structured for fixing the anchoring element 31 to the building structure in such a way as to render the anchoring device 1, the anchoring element 31 and the building structure 60 integral with each other. Preferably, the anchoring element comprises a plurality of through holes, preferably arranged in a plurality of parallel rows, preferably located on the above-mentioned pair of lateral walls 33.

[0079] Preferably, the mounting members comprise a plurality of bolts or self-drilling (and/or self-tapping) screws 34 structured for inserting each in a respective hole of the anchoring element and for drilling a respective hole in said building structure (for example in the sheet metal covering of the building structure) and stiffly fixing the position of the anchoring element in contact with the building structure.

[0080] Preferably, the hooking device 1 and/or the hooking element 31 and/or the mounting members 30 (or example the screws 34) are made of metal material, for example steel, preferably stainless or galvanised.

[0081] Preferably, as shown in the example embodiment in Figure 4, the anchoring element 31 is structured for fixing to a rib of a standing seam profile sheet and comprises two folding lines which are parallel with the longitudinal extension and define a central wall 32 and a pair of lateral walls 33 at the sides of the central wall, said walls creating a groove 35 on the lower face. Preferably, the anchoring element 31 comprises a pair of mounting blocks 37 each having a respective upper surface, lower surface and lateral surface. The blocks being inserted in the above-mentioned groove 35 and fixed with the respective upper face towards the anchoring element 31, preferably by means of one or more respective screws 36 (by way of example two) passing through the upper face 31b and the lower face 31a of the anchoring element.

[0082] Preferably, each block 37 comprises a respective recess 38 which is open on the lower surface and shaped to match a rib of a standing seam profile sheet, and one or more fixing members 39 (for example bolts, screws or threaded grub screws) inserted in respective

holes passing through the lateral surface and the recess and structured so as to render the respective block integral with the rib of the standing seam profile sheet.

[0083] In that way, it is easy to stably mount the fall protection system to a standing seam profile sheet, typically having ribs which are very thin transversally (that is to say, with main longitudinal extension and reduced transversal thickness, for example just a few millimetres), for which it is difficult to use mounting members for example of the type described for trapezoidal profile sheets, that is to say, which require the use of screws acting directly on the anchoring element and on the fixed structure. Preferably, the blocks 37 of said pair of blocks are positioned in the groove 35 in longitudinally spaced positions, preferably being positioned at the longitudinal ends of the anchoring element. That makes it possible to increase the overall stability of the mounting and balancing of the fall protection system. Figure 6 shows by way of example a fall protection system 50 fitted on a covering 60 and subjected to a tensile force, applied by the cable 15, having a value such that it produces an elastic deformation in the device 1. Figure 7 shows by way of example a possible configuration adopted by the system of Figure 5 following the application of a tensile force having a value such that it produces a permanent plastic deformation of the device 1, for example following a fall by the operator hooked to the safety cable. According to one aspect, the invention relates to a method for producing a hooking device according to this invention. The method preferably comprises the steps of preparing a flat plate (preferably rectangular or square); cutting, for example laser cutting, the flat plate along at least one cutting line so as to shape the above-mentioned first end 2 and second end 3 and the above-mentioned hooking potion 5; bending the device along the above-mentioned first series and second series of folding lines 6. In that way it is possible to obtain the device according to this invention in a simple and economical way. Moreover, the method is highly repeatable and advantageously may be automated.

Claims

1. A fall protection hooking device (1) having a substantially plate-like conformation and provided with a first end (2) and a second end (3), structurally opposite to said first end, intended to be stiffly fixed to an anchoring element (31) so as to be made mutually integral, and provided with an hooking portion (5) structurally interposed between said first and second end and structured for the hooking of a fall protection cable (15),
the hooking device developing with structural continuity from the first to the second end passing through the hooking portion,
the hooking device presenting a first series of folding lines (6), interposed between said first end (2) and said hooking portion (5), and a second series of folding lines (6), interposed between said second end (3) and said hooking portion (5), each pair of adjacent folding lines in each series delimiting a respective sub-portion (7) of the hooking device so as to define a series of sub-portions each lying on a plane oblique with respect to the lying plane of the adjacent sub-portions,
the hooking device being structured for deforming, in use, at least at said folding lines (6) due to a tensile force applied to said hooking portion (5), so that the hooking portion changes its position with respect to the first and the second end.

2. The device (1) according to claim 1 where said deformation of the device remains elastic at least up to a value of said tensile force less than or equal to 2 kN, preferably less than or equal to 2.5 kN, and where said deformation becomes plastic at a value of said tensile force greater than 2 kN, preferably greater than 2.5 kN.

3. The device (1) according to claim 1 or 2 comprising a first portion of the device interposed between said first end and said hooking portion and a second portion of the device interposed between said second end and said hooking portion, said first and second portion being identical one to the other and symmetrical with respect to the hooking portion.

4. The device (1) according to any one of the preceding claims where the first portion of the device and the second portion of the device develop along the same line and geometrically lie on opposite sides of the hooking portion.

5. The device (1) according to any one of the preceding claims where said first and second series of folding lines each comprise at least three folding lines, preferably at least five, and where the first and the second series of sub-portions define a respective series of smallest angles between each pair of respective adjacent sub-portions, each of said smallest angles being on a face of the respective first or second portion of the device opposite to the face on which the adjacent smallest angles are.

6. A fall protection system (50) comprising:

- a fall protection hooking device (1) according to any one of claims 1 to 5, and
- the anchoring element (31), having a substantially plate-like conformation and intended to be stiffly fixed to a portion of a building structure (60), and provided with a lower face (31a) and an upper face (31b), opposite to said lower face, where the first (2) and the second end (3) are stiffly fixed to said upper face of the anchoring

element so as to be made mutually integral.

7. The system (50) according to claim 6 where the anchoring element (31) is countershaped to a portion of the building structure, said lower face (31a) being intended to correspond with a respective portion of surface of the building structure and said upper surface (31b) comprising at least a flat portion, the anchoring element having preferably a prevalent longitudinal development and a constant cross-section, where the anchoring element (31) is a plate with rectangular plan and is provided with two folding lines parallel to the longitudinal development and defining a central wall (32) and a couple of side walls (33) on the sides of the central wall.

8. The system (50) according to claim 6 or 7 comprising mounting members (30) structured to stiffly fix the system to the building structure, said mounting members comprising a plurality of bolts or self-drilling and/or self-tapping screws (34) structured for inserting each in a respective hole of the anchoring element and for drilling a respective hole in said building structure and stiffly fixing the position of the anchoring element in contact with the building structure.

9. A fall protection safety method comprising the steps of:

- providing the fall protection system (50) according to any one of the claims 6 to 8;
- installing said system on a building structure (60), so that said anchoring element (31) is fastened to said building structure and said hooking portion (5) of the fall protection hooking device protrudes from the building structure and is accessible for the hooking of a fall protection cable (15).

10. The method according to claim 9 wherein said fall protection hooking device is used as a fall protection hooking element or as a support for safety lines, said hooking portion hooking, respectively, a security cable of an operator or a connection cable of a safety line.

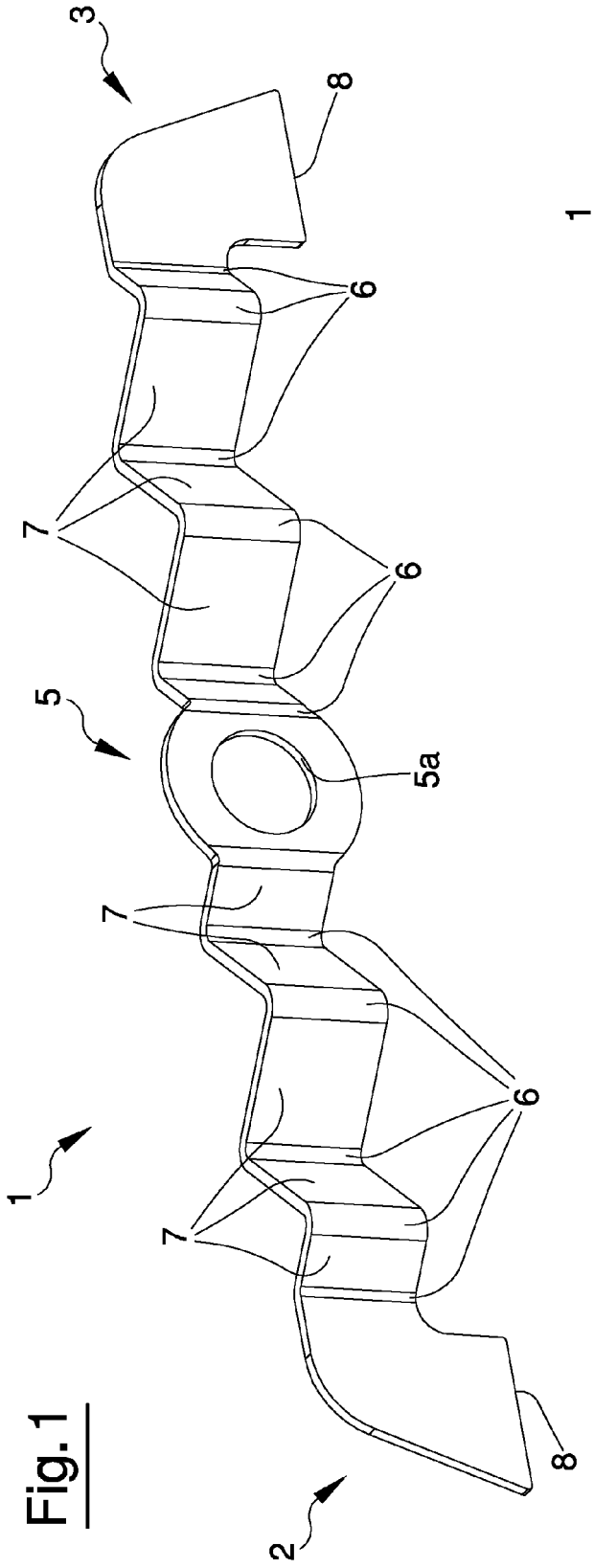

Fig. 1

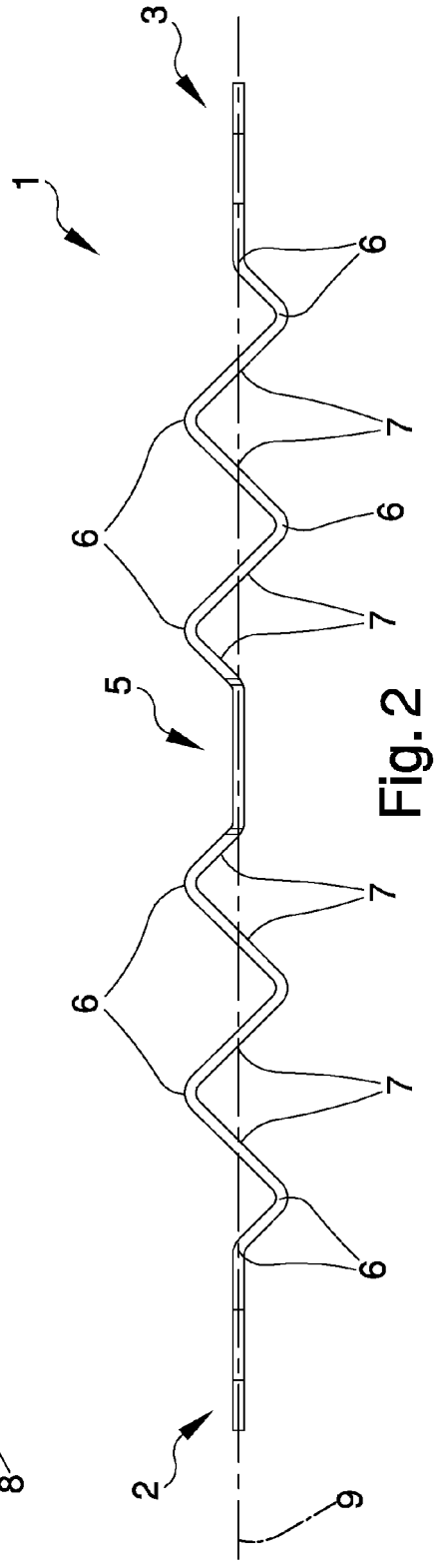

Fig. 2

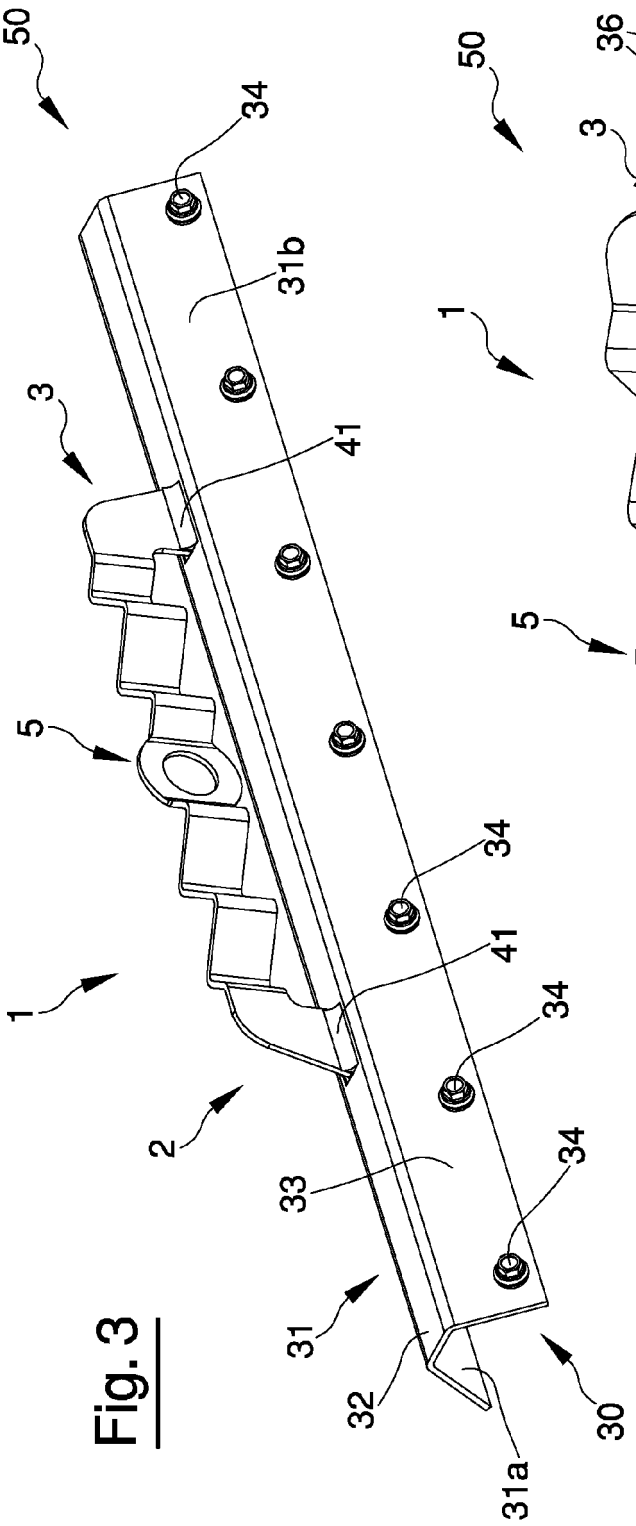
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Fig. 3

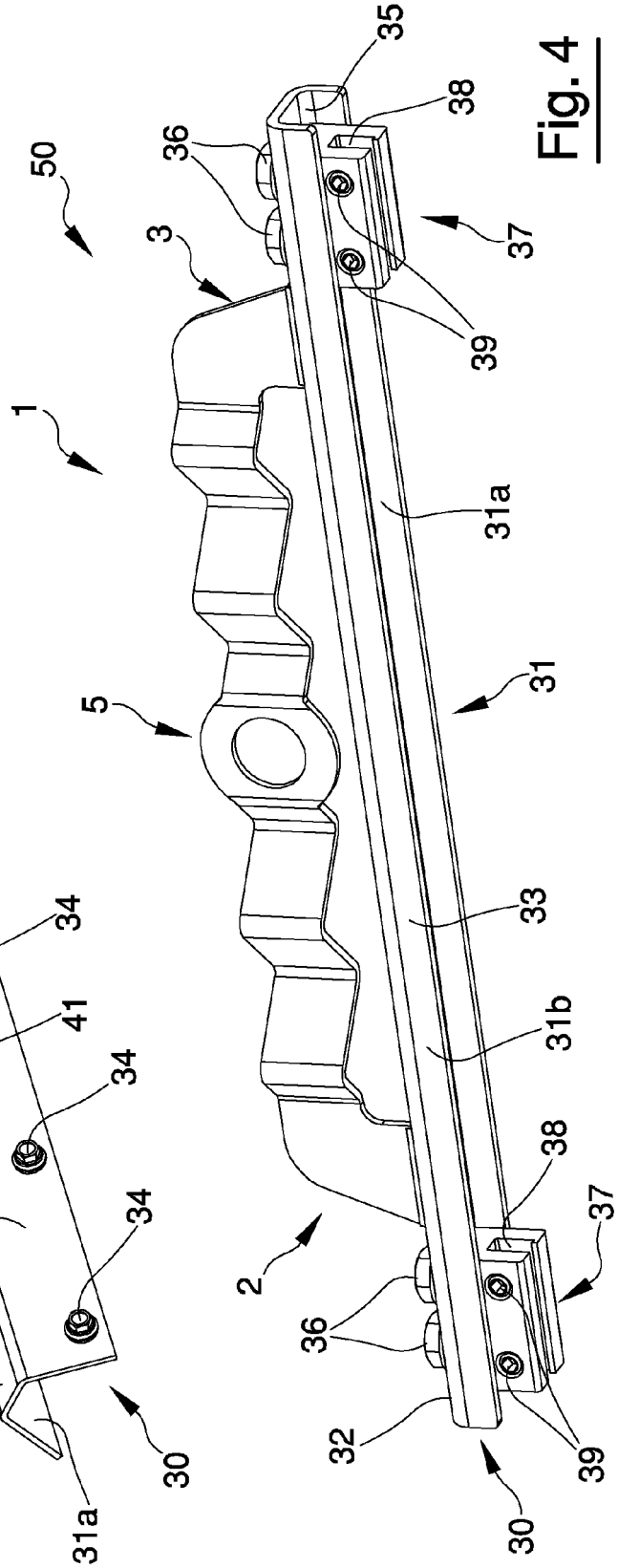
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Fig. 4

Fig. 5

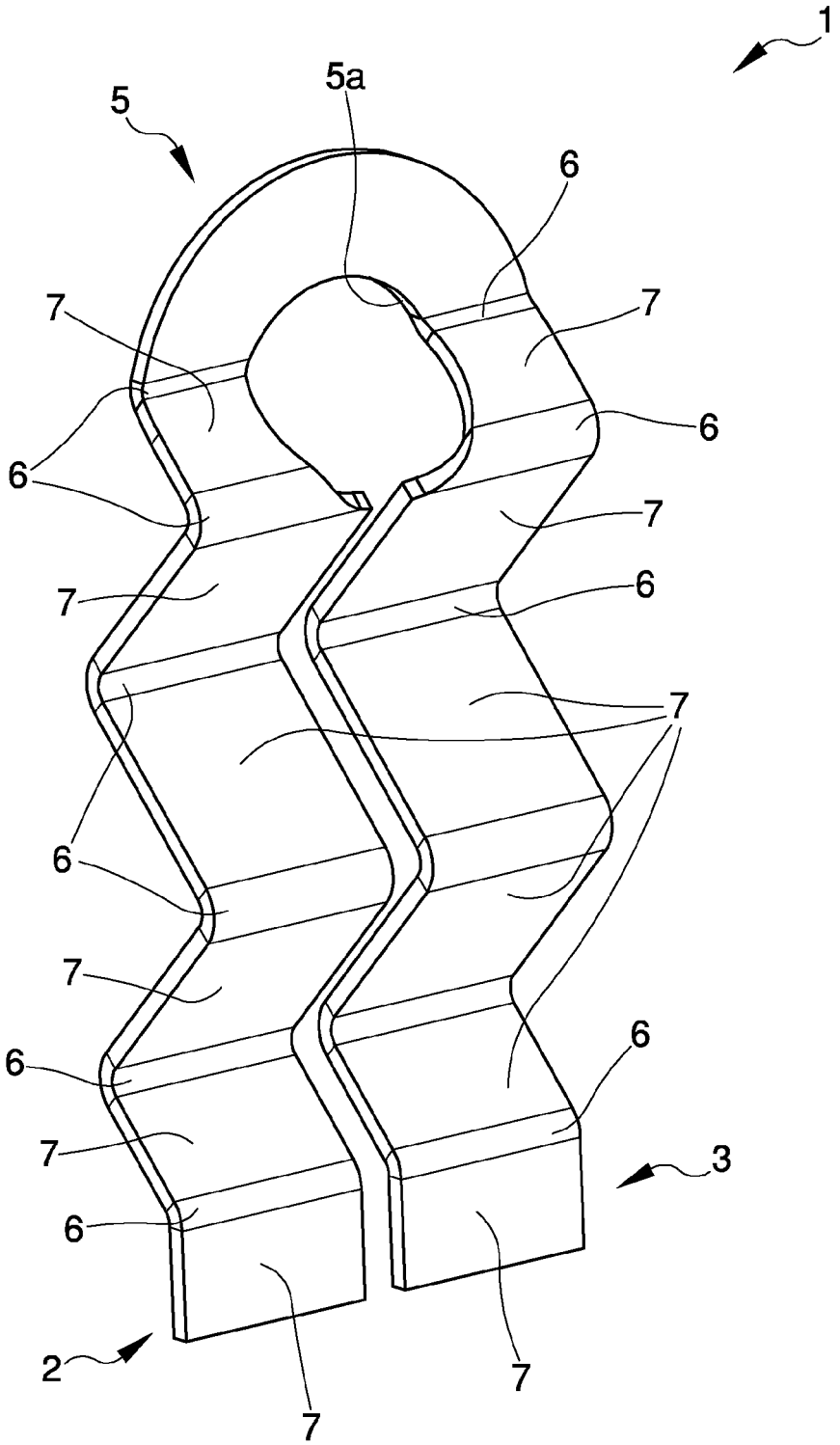


Fig. 6

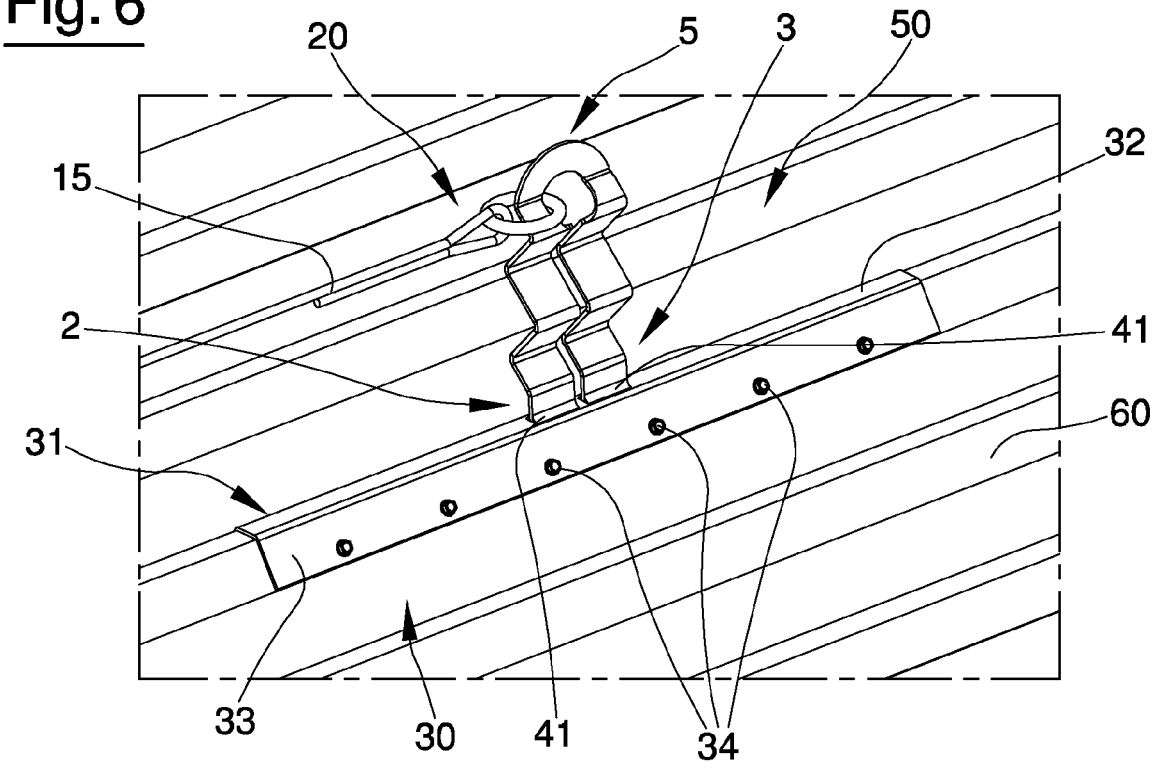
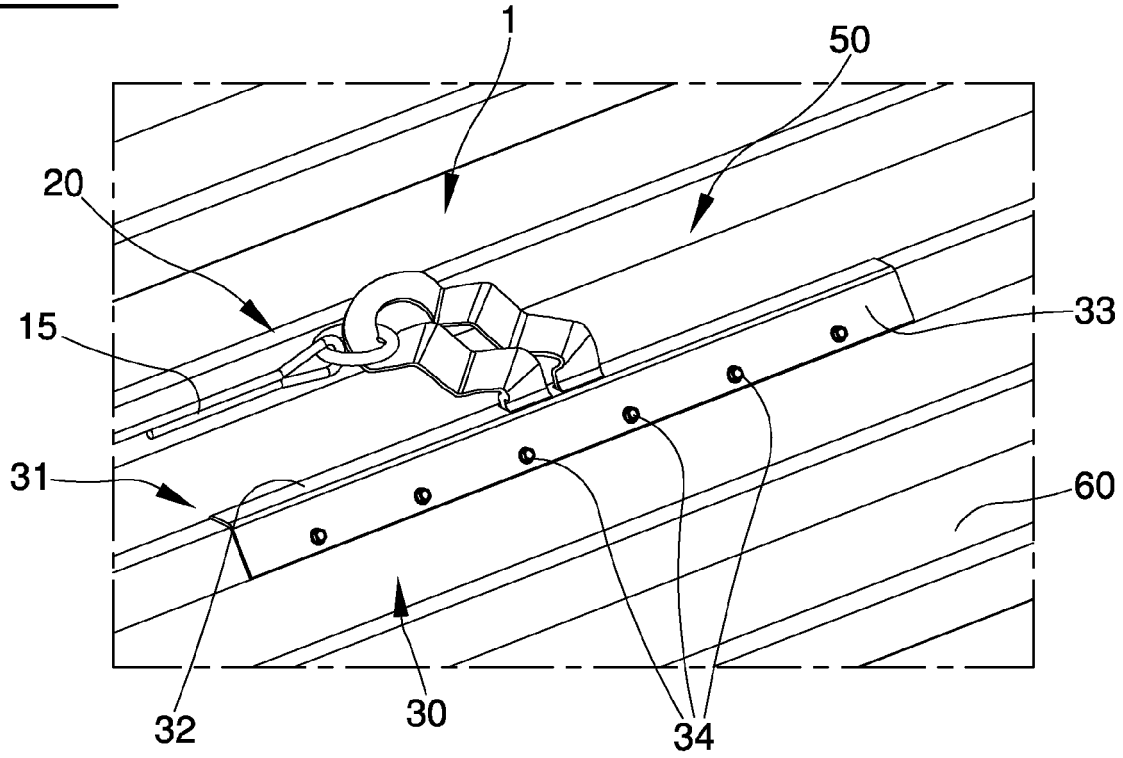


Fig. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 4960

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ES 1 072 008 U (PLAZA VILAR JESUS [ES]) 5 May 2010 (2010-05-05) * figures * -----	1-10	INV. E04G21/32 A62B35/04
			TECHNICAL FIELDS SEARCHED (IPC) E04G A62B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 July 2012	Andlauer, Dominique

CATEGORY OF CITED DOCUMENTS

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25-07-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
ES 1072008 U	05-05-2010	ES 1072008 U	05-05-2010
		FR 2956586 A3	26-08-2011

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