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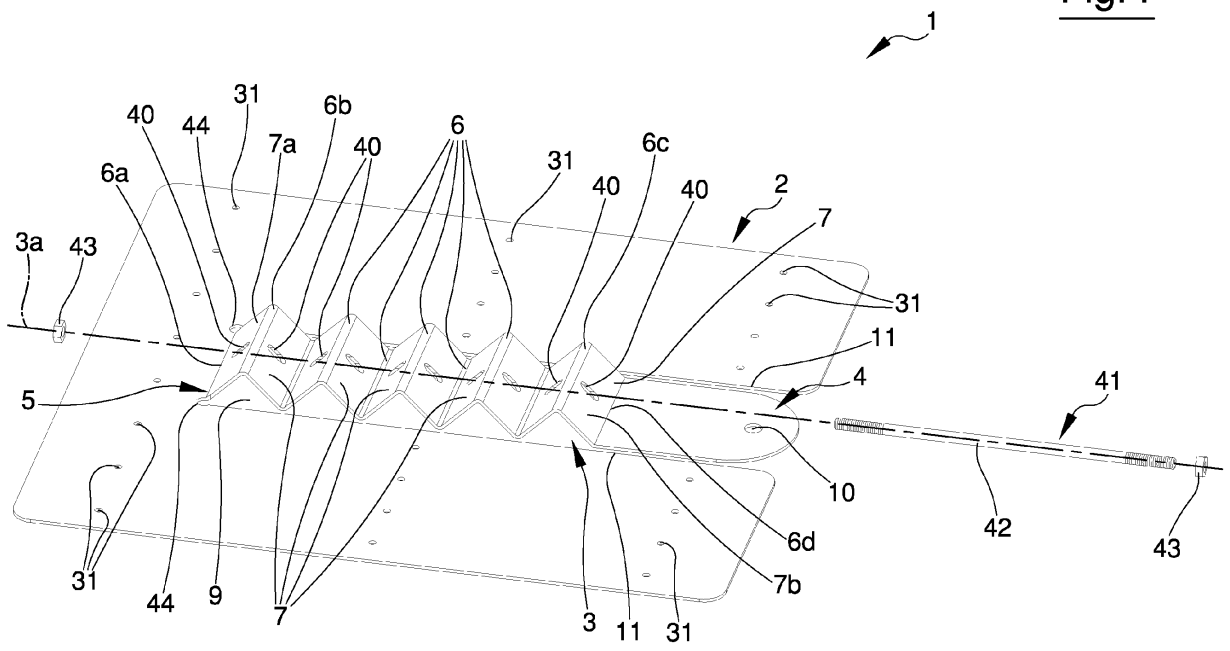
(54) A supporting device for safety lines

(57) A supporting device (1) for safety lines comprising a main body having a substantially plate-like conformation and rigidly fixed to a building structure (60) and an anchoring body having a substantially plate-like conformation and provided with a constrained end integrally fixed to the main body and a free end, wherein the plan area of the main body is greater than the plan area of the anchoring body, wherein the anchoring body has a series of folding lines interposed between the free end and constrained end, each pair of adjacent folding lines delimiting a respective sub-portion of the anchoring body so as to define a series of sub-portions each lying in a plane oblique to the lying plane of the adjacent sub-portions; wherein the anchoring body is structured for deforming at least at said folding lines due to a tensile force applied to said free end so that the free end changes its position relative to the constrained end.

Fig. 1



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Description

[0001] The present invention relates to a supporting device for safety lines, the safety line comprising such a device, a method of manufacturing such a device and a method for carrying out a static test on a safety line.

[0002] Safety lines are known, of the type shown in document W02008/081375 for example, that are designed to be mounted on fixed structures typically placed to some height from the ground, such as building roofs, walls or beams, and act as the safety system for operators working to such heights from the ground. These safety lines, in case of loss of balance by the operator and downwards slip, prevent the operator's impact against underlying structures or the ground, or at all events reduce the impact's violence.

[0003] Safety lines are known which comprise stiff supporting devices or stakes fastened at mutually spaced positions, typically to a roof of a building structure, such as a house, a cottage, a shed or the like. A connecting cable, preferably of steel, is fastened between the supporting devices to which cable the operator can be hooked devices for protection against falls from a higher place (such as slings, safety cables, hooking ropes, retaining ropes, winding elements, snap-hooks or similar safety equipment), so that the operator can move along the cable between the supporting stakes. In this manner the operator can move safely on the building structure, during manufacture or covering of the roof, for example, as well as for accomplishment of technical plants, gutters, flues or skylights, and for the related repair and maintenance operations.

[0004] Also known are supporting devices for safety lines fastened to building covering elements and consisting of a metal plate steadily secured to the covering element and provided with a portion (a ring, for example) typically welded to the plate, projecting from the plate itself for fastening of the connection cable to the safety line.

[0005] However, since these devices are substantially stiff, they have a drawback. Actually, when the operator constrained to the safety line accidentally loses his/her balance and falls from a higher place, the fall is stopped by the safety cable in a substantially instantaneous manner. However the kinetic energy stored during the fall is discharged onto the supporting device in an impulsive manner, typically in the form of a tensile stress. This stress can involve breaking of the device or separation of same from the bearing structure to which it is fastened (as a consequence of the mechanical anchoring system carrying out fixing). In addition, this stress can be discharged in an impulsive manner on the operator, thus bringing about possible consequences on his/her physical integrity.

[0006] To obviate this drawback, in known safety lines a shock-absorbing member is interposed in series between the connection cable and at least one supporting device, which member is designed to absorb the aforesaid stress by means of an element submitted to elastic or inelastic deformation.

[0007] Also known are supporting devices for safety lines capable of being deformed in case of fall of the operator, to mitigate the jerks he/she receives. These devices consist for example of a stake that is such positioned that its longitudinal extension is orthogonal to the building structure and is able to deform when submitted to the force resulting from the operator's fall, typically by bending towards the pulling direction of the connection cable.

[0008] The Applicant has found that present supporting devices for safety lines have drawbacks and are susceptible of improvements under different points of view.

[0009] In particular, the Applicant has found that known deformable supports for safety lines are characterised by a complicated structure and/or high bulkiness and/or weight, and/or by complexity in manufacture and/or installation, and by high manufacturing costs.

[0010] The Applicant has also found that known deformable devices are not able to effectively mitigate the impulsive stresses in case of fall.

[0011] The Applicant has further found that known methods for carrying out acceptance tests during installation have drawbacks too. As known, the safety lines once installed on a building structure have to be submitted to acceptance tests (for example, a static test consisting in applying, over a period of time, a constant force greater than 2 kN, typically of 5 kN) in order to be sure that the safety line is sufficiently strong and the installation has been carried out correctly. However, the acceptance tests cannot be carried out on known deformable devices because they can determine a permanent deformation of the devices that would impair the mechanical behaviour in case of stresses.

[0012] In addition it is the Applicant's opinion that known permanently deformable devices are not able to be submitted to acceptance tests in an easy manner during installation.

[0013] Under this situation, the aim underlying the present invention, in its different aspects and/or embodiments, is to make available a supporting device for safety lines, a safety line comprising such a device and a method of carrying out a static test, which are capable of obviating one or more of the aforesaid drawbacks.

[0014] Another aim of the present invention is to make available a support for safety lines that is sufficiently strong for supporting a safety line under any operating condition, i.e. that is able to remain fastened to the building structure following an impulsive stress resulting from the fall of an operator hooked to the safety line, bear the stretch typical of the connection cable, resist the fatigue cycles due to thermal expansion of the safety line and keep the mechanical features unchanged over time.

[0015] It is a further aim of the present invention to provide a supporting device adapted to be easily submitted to a static test.

[0016] A further aim of the invention is to provide a

method for carrying out a static test on a safety line that does not give rise to permanent deformation in the supporting devices and is of simple and easy accomplishment.

[0017] One or more of the above aims, and other possible aims that will become more apparent in the course of the following description are substantially achieved by a supporting device for safety lines, a safety line comprising such a device, a method of manufacturing such a device and a method of carrying out a static test on a safety line, having the technical features contained in one or more of the accompanying claims, each of which is taken alone (without the relevant depending parts) or in any combination with the other claims, as well as according to the following aspects and/or embodiments, differently combined, also with the aforesaid claims.

[0018] In an aspect, the invention relates to a supporting device for safety lines, comprising:

- a main body having a substantially plate-like conformation and intended to be stiffly fixed to a building structure, and
- an anchoring body having a substantially plate-like conformation and provided with a constrained end integrally fixed to the main body and a free end opposite to said constrained end, wherein the plan area of the main body is greater than the plan area of the anchoring body, wherein the anchoring body has a series of folding lines interposed between said free end and constrained end, each pair of adjacent folding lines delimiting a respective sub-portion of the anchoring body 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;

wherein said anchoring body is structured for deforming at least in correspondence with said folding lines, due to a tensile force applied to said free end so that the free end changes its position with respect to the constrained end.

[0019] The Applicant thinks that the combination of the above technical features, in particular the presence of the series of folding lines at which the anchoring body deforms due to a tensile force applied to the free end, to such an extent that the free end modifies its position relative to the constrained end, this allows a supporting device for safety lines to be obtained that is able to effectively dampen the jerk in case of fall of an operator and absorb the stress resulting from such a fall (preventing this stress from being discharged on the elements for fastening to the building structure or the covering element); said device being at the same time characterised by a simple and functional structure of easy and cheap manufacture.

[0020] The Applicant also thinks that the technical feature according to which the plan area of the main body is greater than the plan area of the anchoring body advantageously allows a supporting device to be obtained that is capable of ensuring wide and distributed fastening to the building structure, strong enough to withstand the stresses typical of a safety line.

[0021] In addition, since the device is made up of a plate-like main body and a plate-like anchoring body, the height of same can be limited relative to the building structure to which it is fixed, by limiting the lever arm of the tensile force on the device. The plate-like conformation of the main body ensures steady, safe and easy fastening onto building structures already provided with a covering element (a roof, for example). Moreover, the device made up of plate-like bodies can be obtained in a simple and cheap manner, by carrying out cuts in a plate-like piece for example, for shaping the main body and anchoring body obtained from such a piece.

[0022] The Applicant thinks that the presence of folding lines in the anchoring body (as far as the Applicant knows, this expedient has never been used), which lines are of simple structure and can be easily integrated into a plate-like structure (for example, they can be obtained by simple folding of a sheet metal portion), makes it possible to obtain a plate-like device having the desired mechanical behaviour, coming to this result in an inexpensive manner.

[0023] In an aspect, said deformation of the anchoring body 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 this manner, the device effectively absorbs the small stresses resulting from normal use of the safety line (and/or from thermal cycles) without impairing the potential capacities of stress absorption in case of fall.

[0024] In an aspect said deformation becomes plastic at a value of said tensile force greater than 2 kN, preferably greater than 3 kN, more preferably greater than 4 kN. In this manner, the device effectively absorbs the impulsive stresses due to the operator's fall. By plastic deformation it is intended an inelastic deformation.

[0025] According to the Applicant, the anchoring body, folded down along the folding lines in a series of sub-portions constitutes an element having a predetermined plastic compliance and capable of limiting or eliminating the impulsive character of a stress from a fall. The Applicant has ascertained, through a functional test, that the energy generated in the fall is used for plastically deforming the anchoring body, reducing the maximum load that the device has to bear and therefore enabling said device to be under-sized relative to known devices and the material used to be reduced, typically limiting the thickness of the main and anchoring bodies, the members for fastening the main body to the building structure being under-sized too.

[0026] In an aspect said anchoring body is structured for deforming, by effect of said tensile force greater than 2 kN, by stress relieving or plastic extension of the sub-portions that will tend to bring the anchoring body to a flat configuration, such plastic extension producing elongation of the anchoring body and causing the free end

to move apart from the constrained end in the direction of application of the tensile stress.

[0027] In an aspect, said free end is designed to be constrained to a connection cable of a safety line.

[0028] In an aspect, said series of folding lines comprises an odd number of folding lines, preferably at least 5, more preferably at least 7, most preferably at least 9.

[0029] In an aspect, the series of sub-portions defines a series of smallest angles between each pair of adjacent sub-portions. Preferably, each of said smallest angles is on a face of the anchoring body opposite to the face on which the adjacent smallest angles are.

[0030] In an aspect, the anchoring body is folded in such a manner that the series of sub-portions has a "saw-tooth" conformation, for instance the even sub-portions lie in mutually-parallel respective planes and the odd sub-portions lie in mutually parallel respective planes. In an alternative aspect, the anchoring body is folded in such a manner that the series of sub-portions has a square or almost sinusoidal wave conformation. However, the present invention includes every embodiment of the anchoring body in which each sub-portion is oriented according to any angle with respect to the preceding sub-portion.

[0031] In an aspect, the smallest angle formed between two adjacent sub-portions is constant.

[0032] In an aspect, the smallest angle formed between at least two adjacent sub-portions (preferably between all adjacent sub-portions) is less than or equal to 135°, preferably less than or equal to 110°, most preferably of 90°. The Applicant has ascertained that said selection of the smallest angle gives the anchoring body the desired capacity of absorbing the force generated by the tensile force before coming to a full plastic extension of the sub-portions corresponding to a flat configuration.

[0033] In an aspect, said series of sub-portions comprises a first sub-portion, comprised between the first and the second folding lines, and a last sub-portion, comprised between the penultimate and the last folding line. In an aspect, the first folding line is coincident with said constrained end.

[0034] In an aspect, the free end of the anchoring body has an end edge. In an aspect, the end edge is substantially flush with the main body, in particular coplanar with the first folding line.

[0035] In an aspect, the main body identifies two half-spaces that are opposite thereto and both comprising the main body itself, and the anchoring body extends in one alone of said half-spaces.

[0036] In an aspect, the main body has a planar conformation.

[0037] In an aspect, the plan area of the main body is greater than twice, preferably three times, the plan area of the anchoring body. In an aspect, the main body and/or anchoring body have constant respective thickness, preferably the same thickness, preferably included between 1 mm and 10 mm.

[0038] In an aspect, the anchoring body has a longitudinal extension direction extending from said constrained end to said free end and orthogonally intersecting the series of folding lines.

[0039] In an aspect, the anchoring body and main body have a respective longitudinal size, parallel to said longitudinal extension direction, and a respective transverse size, orthogonal to said longitudinal extension direction.

[0040] In an aspect, the longitudinal size and/or lateral size of the main body is at least twice, preferably three times, the transverse size of the anchoring body.

[0041] In an aspect, the main body surrounds the anchoring body at least on two sides, preferably at least on three sides. In this manner, in case of fall, the stress received by the second portion of the main body is evenly transmitted to the main body itself preventing the fastening members from being damaged.

[0042] In an aspect, the anchoring body is disposed in the middle position of the transverse dimension of the main body, so as to avoid twisting moments on the main body or reduce them.

[0043] In an aspect, the main body is of concave polygonal shape with hollow concavity, and said constrained end of the anchoring body is contained in said concavity. In an aspect the main body forms a substantially plate-like unique body with the anchoring body. In an aspect, said anchoring body is of convex polygonal shape (of rectangular shape, for example).

[0044] In an aspect, the supporting device comprises coupling members structured for allowing anchoring of a connection cable of a safety line to the device itself.

[0045] In an aspect, the free end of the anchoring body comprises a through hole.

[0046] In an aspect, said coupling members comprise a pin inserted in said through hole and a ball joint (a ball bearing for example or a ball-and-socket joint, of known type for example) associated with said pin and intended to be fixed to an end of a connection cable. In this way, since the end of the connection cable can rotate inside the ball joint, the connection cable, due to side and vertical displacements, is able to move and adjust its position relative to the device, under any operating condition of the safety line and in particular in case of fall of an operator. In this manner, misalignments between the connection cable and anchoring body, said longitudinal extension direction for example, are prevented from creating too many stresses inside the device, in particular the anchoring body, which can cause the undesirable deformation of the device itself.

[0047] In an aspect, the supporting device comprises fastening members for rigidly fixing the device to the building structure. In an aspect, the main body has a plurality of through holes, preferably disposed along a plurality of parallel rows.

[0048] In an aspect, said locking members comprise a plurality of self-tapping (or thread-forming) screws structured in such a manner that each of them enters a respective hole of said main body and forms a respective hole in said building structure (for instance, in the cover-

ing element of sheet metal of said building structure) and rigidly fixes the position of the main body in contact with the building structure.

[0049] In an aspect, the fastening members comprise at least one assembling bar the shape of which matches that of a surface portion of the building structure and is interposed between the supporting device and the building structure itself, in such a manner that the self-tapping screws pass therethrough, and make the main body integral with the assembling bar and the surface portion of the building structure.

[0050] Preferably, said main body and/or anchoring body and/or assembling bar are made of metal material, steel for example, and preferably zinc-plated steel.

[0051] In an aspect, at least said first and last sub-portions of the anchoring body comprise a respective through slot. Preferably, all sub-portions of the anchoring body comprise a respective through slot, preferably all slots being aligned.

[0052] In an aspect, the invention relates to an assembly comprising a supporting device according to the present invention, and a locking device configured for mechanically constraining the first and last sub-portions so as to resist said tensile force at least up to a value greater than or equal to 3 kN and to prevent the plastic deformation of the anchoring body.

[0053] In an aspect, the locking device comprises a locking pin, a bolt or threaded post for example, such structured that it can enter the through slots of the first and last sub-portion (preferably all sub-portions), and one or more nuts to be screwed down on the bolt or post, respectively.

[0054] In an aspect, the invention relates to a safety line comprising at least one supporting device in accordance with the present invention. In an aspect, the safety line comprises two supporting devices in accordance with the present invention, fastened at mutually spaced positions to a fixed building structure, and a connection cable suitably fastened for connecting said two supporting devices.

[0055] In an aspect, the invention relates to a building structure provided with said safety line, the building structure typically being a roof, a roof covering element, a flat, undulated, fretted or crimped covering element, made of sheet metal, cement, wood, plastic or insulating material, for example.

[0056] In an aspect, the invention relates to a method of manufacturing a supporting device according to the present invention, the method comprising the steps of:

- providing a flat plate;
- cutting, for example by laser cutting, said flat plate at least along a cutting line so as to separate said anchoring body from said main body, along said cutting line;
- bending said anchoring body along said folding lines.

[0057] In this manner, the device being the object of the present invention can be obtained in a simple and cheap manner. In addition, this method is highly repeatable and advantageously can be automated.

[0058] In an aspect, the cutting step comprises the step of carrying out cuts along two cutting lines, preferably parallel to each other, and extending from a perimetral edge of the flat plate preferably until beyond half the longitudinal length of the plate.

[0059] In an aspect, in said cutting step, said cutting line is a path fully inside the flat plate (i.e. it does not intersect the plate perimeter), so as to obtain an anchoring body internal to the main body and surrounded by it preferably on four sides.

[0060] In an aspect, said flat plate is of rectangular shape.

[0061] In an aspect, said manufacturing method of a supporting device comprises, preferably in the step of cutting said flat plate, the step of making one or more relief openings at the ends of said cutting line, by means of notches or by punching, for example. In this way, it is possible to distribute the tensile force transmitted from the anchoring body to the main body, in particular in case of fall, at the constrained end and prevent this tensile force from being discharged on a single point at the end of the cutting line. This advantageously avoids formation of cracks between the main body and the anchoring body, which cracks are potentially dangerous for the integrity of the supporting device.

[0062] In a further aspect, the invention relates to a method of carrying out a static test on a safety line, the method comprising the steps of:

a) installing on a building structure, a safety line comprising a first and a second supporting device spaced apart from each other and a connection cable connecting said two devices, at least the first one of said supporting devices having a main body designed to be stiffly fixed to a building structure, and an anchoring body provided with a constrained end integrally fixed to the main body and a free end opposite to said constrained end, the free end being fastened to said connection cable, wherein the anchoring body has at least one first and one last sub-portions, wherein said anchoring body is structured for being plastically deformed due to a tensile force or stretch applied to said free end greater than 2 kN in such a manner that the last sub-portion plastically modifies its position relative to the first one;

b) mechanically constraining the first and last sub-portions of said first supporting device in such a manner as to prevent the last sub-portion from plastically modifying its position relative to the first one when a tensile force greater than or as high as 3 kN, preferably greater than or as high as 4 kN is applied to said free end;

c) after step b), applying a tensile force greater than or as high as 3 kN to the connection cable over a predetermined period of time;

d) after step c), reducing said tensile force to a smaller value or, preferably to a 2 kN value;

e) releasing said first and last sub-portions of said anchoring body of the first supporting device so as to allow said plastic deformation.

[0063] The method described in the last-mentioned aspect advantageously enables static tests to be carried out on safety lines in an easy, quick and cheap manner. In addition, this method does not damage the components of the safety line.

[0064] In an aspect in step c), said determined tensile force is greater than or as high as 4 kN, preferably greater than or as high as 5 kN (in some cases it can reach 10 kN) and said determined period of time is longer than 1 minute, preferably longer than or as long as 2 minutes, preferably longer than or as long as 3 minutes.

[0065] In an aspect in step a), the first or both of the supporting devices are according to the supporting device as disclosed in the present invention in its various aspects.

[0066] Further features and advantages will become more apparent from the detailed description of some embodiments, one of which is the preferred one, given by way of non-limiting example, of a supporting device for safety lines in accordance with the present invention. This description will be set out hereinafter with reference to the accompanying drawings, given by way of non-limiting example, in which:

- Fig. 1 is a perspective and partly exploded view of a supporting device for safety lines in accordance with the present invention;
- Fig. 2 is a diagrammatic perspective view of a safety line in accordance with the present invention, installed on a covering element of a building structure and comprising two devices seen in Fig. 1;
- Fig. 2A shows a detail of Fig. 2, with some parts in split.

[0067] With reference to the drawings, a supporting device for safety lines according to the present invention is generally identified with reference numeral 1 and a safety line according to the present invention is generally denoted at 50. In general, the same reference numerals are used for the same elements, possibly in their variants.

[0068] The safety line comprises two supporting devices 1, fastened at mutually spaced apart positions to a fixed building structure 60, and a connection cable 15 fastened to said two supporting devices. By way of example, the building structure is a covering element of a shed's roof, a fretted covering element for example, made of sheet metal.

[0069] Optionally, in order to improve the absorption capacity, the safety line may further comprise at least one damping device (not shown), comprising a spring for example, interposed in series between the connection cable and a supporting device.

[0070] Device 1 comprises a main body 2 having a plate-like (preferably flat) conformation, and an anchoring body 3 having a plate-like conformation and provided with a free end 4 and a constrained end 5 opposite to the free end and integrally fixed to the main body. Preferably, the size of the plan area of the main body 2 is four times the plan area of the anchoring body 3. The anchoring body has a series of folding lines 6 interposed between the free and constrained ends, and each pair of adjacent folding lines delimits a respective sub-portion 7 of the anchoring body, so as to define a series of sub-portions each of them lying in an oblique plane relative to the lying plane of the adjacent sub-portions. The anchoring body is such structured that it becomes deformed at least at the folding lines 6, due to a tensile force applied to the free end 4 in such a manner that the free end modifies its position relative to the constrained end 5.

[0071] By way of example, the deformation remains elastic at least up to a value of the tensile stress included between about 2.5 kN and 4 kN, above which the deformation becomes plastic (or inelastic).

[0072] Preferably, as shown by way of example in the figures, the anchoring body is folded down in such a manner that the series of sub-portions has a "sawtooth" conformation, for example the even sub-portions lying in respective planes parallel to each other and the odd sub-portions lying in respective planes parallel to each other. For instance, the series of folding lines comprises eleven folding lines.

[0073] In an alternative aspect, not shown, the anchoring body is such folded down that the series of sub-portions takes a substantially sinusoidal wave conformation, i.e. the anchoring body is folded without interruption. In this case the folding lines constitute a continuous long anchoring body.

[0074] Preferably the smallest angle formed between two adjacent sub-portions is constant and equal to about 90°.

[0075] Preferably, the series of sub-portions comprises a first sub-portion 7a, included between the first 6a and second 6b folding lines, and a last sub-portion 7b included between the penultimate 6c and last 6d folding lines. Preferably the first folding line is coincident with said constrained end 5. Preferably, the constrained end comprises two relief openings 44 (for example of circular shape) on opposite sides.

[0076] Preferably, the main body identifies two opposite half-spaces relative thereto and both comprising the main body itself, and the anchoring body extends in one alone of said half-spaces. Preferably, the anchoring body extends in height, between 0 mm and 100 mm, preferably 80 mm, more preferably 60 mm, from the main body. By way of example, the anchoring body extends from the level of the main body about 50 cm in height from the main body.

[0077] Preferably, all sub-portions, except for the first sub-portion, extend starting a minimum height of 10 mm, preferably 20 mm, from the main body. In this way the

anchoring body is raised relative to the main body and does not interfere with the covering element of the building structure and/or the assembling bars and/or the fastening members during every operating condition of the safety line. Preferably, the free end 4 of the anchoring body has an end edge 4a. Preferably, the end edge 4a is substantially flush with the main body, in particular it is coplanar with the first folding line. In an alternative aspect, not shown, the end edge is to a different level from the level of the main body, in particular to a different level from the first folding line, and is coincident with said last folding line. For instance, the end edge can be to a level of about 20 mm from the level of the main body, so as to avoid interferences between the free end or the connection cable or the anchoring means and the covering element of the building structure.

[0078] The main body can have conformation different from the flat one, so that it may conform to the shape of the building structure.

[0079] The main body and anchoring body have a constant thickness, for instance of about 3 mm. Typically, the anchoring body has a longitudinal extension direction 3a oriented from said constrained end to said free end and orthogonally intersecting the series of folding lines. Preferably, the folding lines are straight, preferably of same length.

[0080] Preferably, the main body surrounds the anchoring body on three sides, said anchoring body being disposed in the middle position of the transverse dimension of the main body.

[0081] Alternatively (not shown), the main body surrounds the anchoring body on four sides, said anchoring body being disposed in the middle position of the main body.

[0082] Preferably, the main body is of concave polygonal shape and has a hollow concavity 9, said constrained end of the anchoring body being contained in said concavity. The free end of the anchoring body preferably comprises a through hole 10. The supporting device preferably comprises coupling members 20 such structured as to enable anchoring of a connection cable of a safety line to the device itself.

[0083] The coupling members comprise a pin 21 fitted in the through hole and a ball joint 22 (a ball bearing or a ball-and-socket joint of known type, for example) associated with said pin and secured to an end of the connection cable.

[0084] Typically, the supporting device, in use, comprises fastening members 30 for rigidly fastening the device to the building structure. The main body has a plurality of through holes 31, preferably disposed along a plurality of parallel rows.

[0085] Preferably the fastening members comprise a plurality of self-tapping screws (not shown) structured in such a manner that each of them is fitted in a respective hole of said main body and makes a respective hole in said building structure (in the covering element of sheet metal of said building structure, for example), rigidly fastening the position of the main body in contact with the building structure.

[0086] In an aspect, the fastening members comprise at least one assembling bar 32 conforming in shape to a surface portion of the building structure and interposed between the supporting device and the building structure itself, in such a manner that said self-tapping screws pass therethrough and make the main body, assembling bar and surface portion of the building structure integral with each other. Preferably, the assembling bars are fastened to the surface portion of the building structure by means of (thread-forming) screws passing through a side surface of the bar itself.

[0087] Preferably, the assembling bar has an inner surface designed to correspond to a respective surface portion of the building structure and the preferably flat upper surface designed to contact said main body. In this way it is possible to obtain a steady and easy assembling of the device on building structures having an unflat surface. In addition, by modifying the assembling bar, the device can be installed on building structures having different surfaces.

[0088] When the building structure is a fretted sheet metal comprising a plurality of surface portions that are raised relative to a bottom surface, the assembling members can comprise several assembling bars (three, for example), each of them conforming in shape to a respective surface portion, and the plurality of self-tapping screws is disposed in several rows (three, by way of example), each row being in register with a respective assembling bar.

[0089] Preferably, the supporting device is mounted on the building structure in such a manner that the longitudinal extension direction of the anchoring body is orthogonal to said assembling bars.

[0090] Preferably, at least said first and last sub-portions of the anchoring body comprise a respective through slot 40. Preferably, all sub-portions of the anchoring body comprise a respective through slot 40, preferably all slots being aligned.

[0091] Preferably, a locking device 41 is configured for mechanically constraining the first and last sub-portions so that they resist the tensile force up to at least one value equal to 5 kN and prevent plastic deformation of the anchoring body.

[0092] Preferably, the locking device comprises a locking pin 42, a threaded post for example, such structured that it enters the through slots of all sub-portions, ad two nuts 43 to screw down the post.

[0093] Alternatively, the locking device comprises a stiff rod (not shown) having two clamps at the ends thereof, which clamps are designed to be removably hooked to the first and last sub-portions, respectively.

[0094] Preferably, the main body forms a substantially plate-like unique body with the anchoring body. In this case the manufacturing method of the supporting device can advantageously comprise the steps of providing a rectangular (or square) flat plate; cutting by laser cutting

for example, the flat plate along a pair of parallel cutting lines 11 that are long about three-quarters the longitudinal length of the plate, so as to separate the anchoring body from the main body along said cutting lines; folding the anchoring body along the folding lines.

Claims

1. A supporting device (1) for safety lines comprising:

- a main body (2) having a substantially plate-like conformation and intended to be stiffly fixed to a building structure (60) and
- an anchoring body (3) having a substantially plate-like conformation and provided with a constrained end (5) integrally fixed to the main body and a free end (4) opposite to said constrained end, wherein the plan area of the main body is greater than the plan area of the anchoring body, wherein the anchoring body has a series of folding lines (6) interposed between said free end and constrained end, each pair of adjacent folding lines delimiting a respective sub-portion (7) of the anchoring body so as to define a series of sub-portions each lying in a plane oblique with respect to the lying plane of the adjacent sub-portions;

wherein said anchoring body is structured for deforming at least in correspondence of said folding lines due to a tensile force applied to said free end so that the free end changes its position with respect to the constrained end.

2. The device (1) according to claim 1, wherein said deformation of the anchoring body 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 wherein said deformation becomes plastic at a value of said tensile force greater than 2 kN, preferably greater than 3 kN.

3. The device (1) according to anyone of the preceding claims, wherein said series of folding lines comprises a number of folding lines greater than or equal to five and wherein the series of sub-portions defines a series of smallest angles between each pair of adjacent sub-portions, each of said smallest angles being on a face of the anchoring body opposite to the face on which the adjacent smallest angles are.

4. The device (1) according to anyone of the preceding claims, wherein the smallest angle formed between at least two adjacent sub-portions, preferably at least five pairs of adjacent sub-portions, is less than or equal to 135°, preferably less than or equal to 110°.

5. The device (1) according to anyone of the preceding claims, wherein the main body forms with the anchoring body a single body substantially plate-like.

6. The device (1) according to anyone of the preceding claims, wherein the anchoring body and the main body have a respective longitudinal dimension and a respective transversal dimension, orthogonal to said direction of longitudinal development, wherein the main body surrounds on three sides the anchoring body and wherein the anchoring body is placed in middle position of the transversal dimension of the main body.

7. The device (1) according to anyone of the preceding claims, wherein the supporting device comprises coupling members (20) structured for allowing the anchor of a connection cable of a safety line to the device itself, the free end of the anchoring body comprising a through hole, wherein said coupling members comprise a pin inserted in said through hole and a ball joint associated with said pin and intended to be fixed to an end of a connection cable.

8. The device (1) according to anyone of the preceding claims, wherein said series of sub-portions comprises a first sub-portion (7a), comprised between the first (6a) and the second folding line (6b), and a last sub-portion (7b), comprised between the penultimate (6c) and the last folding line (6d), said first and last sub-portions of the anchoring body comprising a respective through slot (40).

9. An assembly comprising a supporting device according to anyone of the preceding claims, and a locking device (41) configured for mechanically constraining the first and last sub-portions so as to oppose itself to said tensile force at least up to a value greater than or equal to 3 kN and to prevent the plastic deformation of the anchoring body.

10. A method of manufacturing a supporting device according to anyone of the preceding claims, the method comprising the steps of:

- providing a flat plate, preferably rectangular;
- cutting, for example by laser cutting, said flat plate at least along a cutting line so as to separate said anchoring body from said main body, along said cutting line;
- bending said anchoring body along said folding lines.

Fig. 1

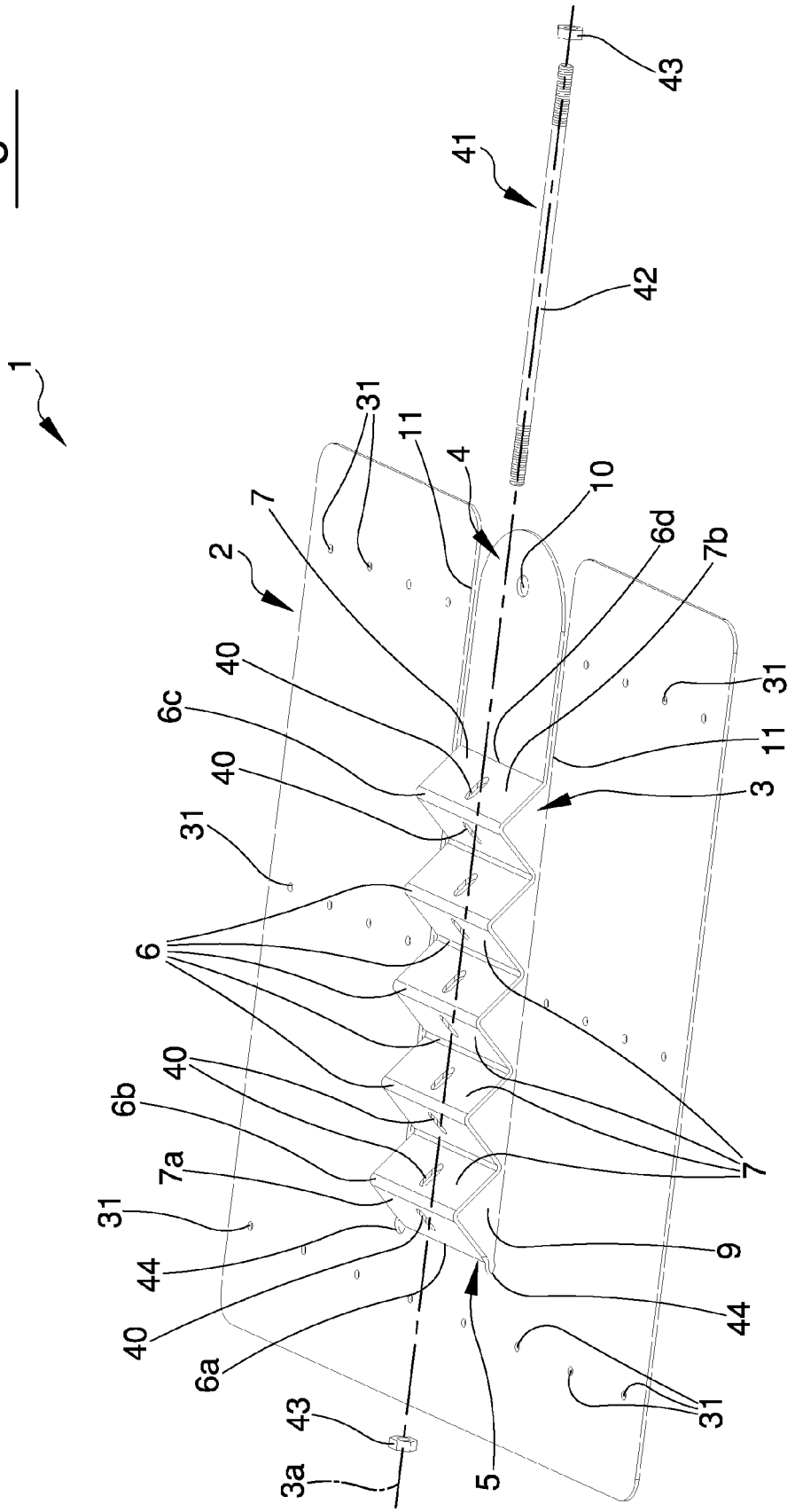
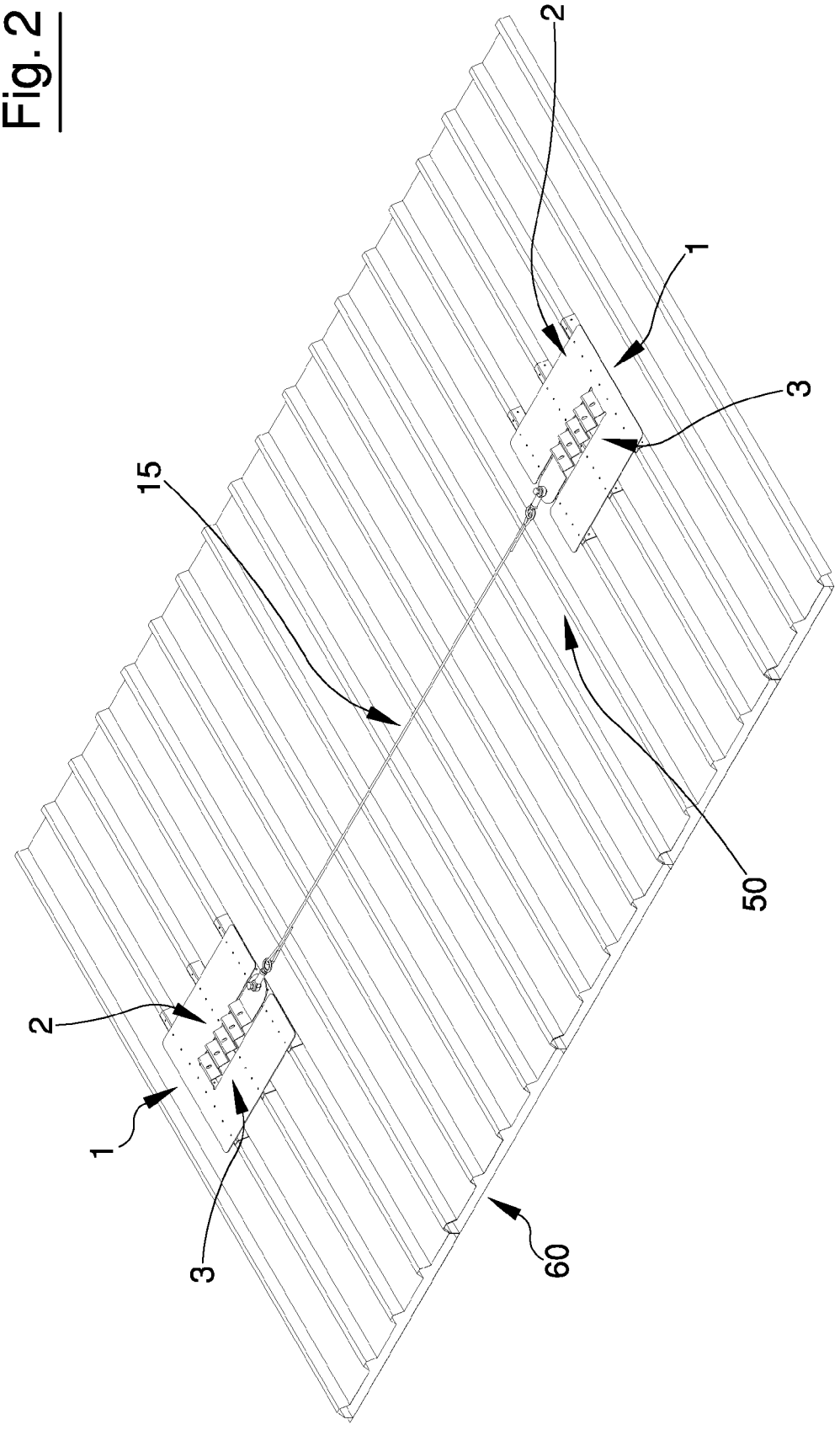


Fig. 2



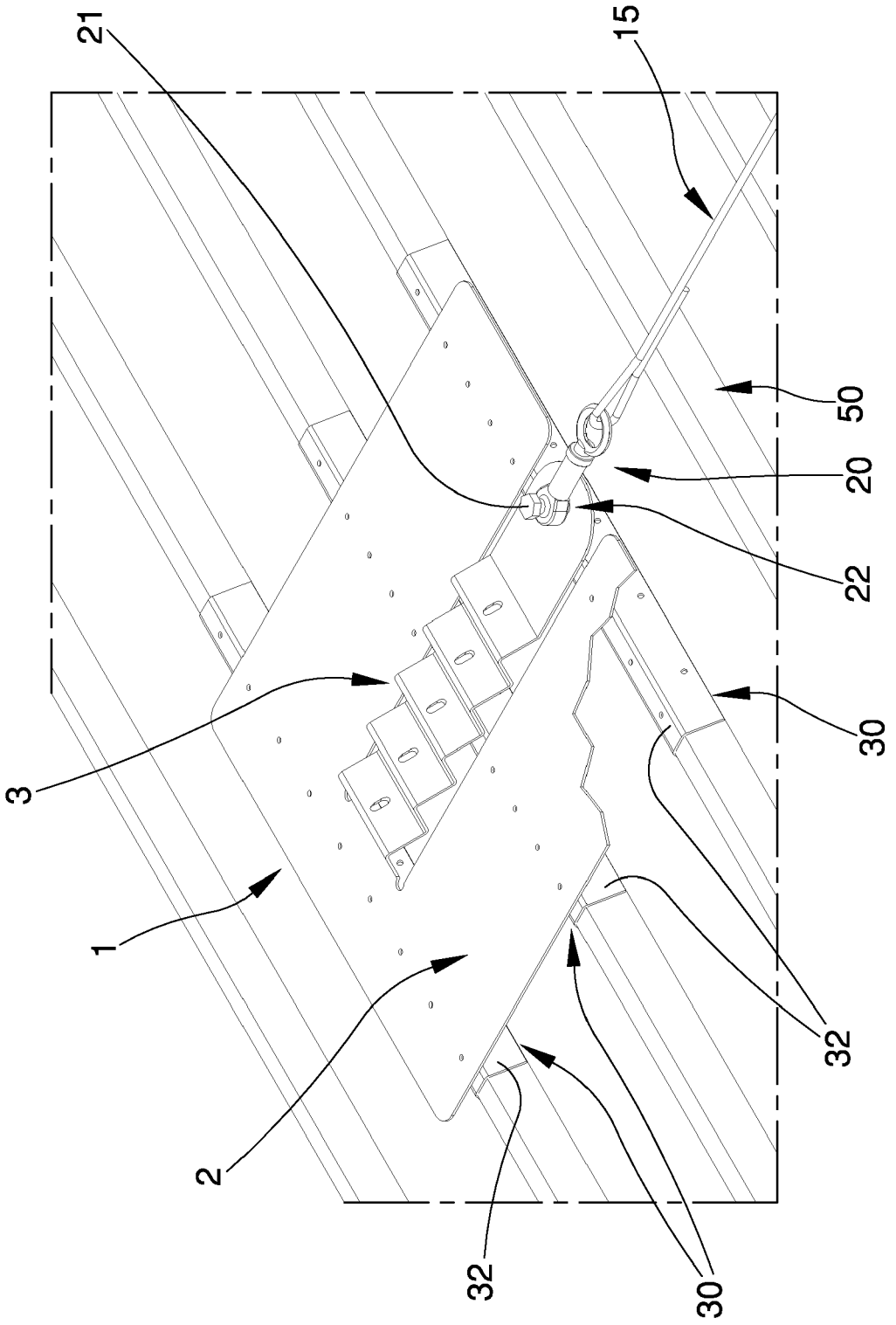


Fig. 2A

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 4099

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 February 2012	Andlauer, Dominique

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