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(54) **SECURING ARRANGEMENT**

(57) The present invention relates to a securing arrangement (10) for a building roof, comprising at least two anchoring structures (12, 18) to be attached to rigid elements of the building roof, at least two attachment structures (16, 20) arranged to said at least two anchoring structures, at least one connecting element (22) arranged

between said at least two attachment structures (16, 20), which at least one connecting element (22) is arranged for securing personnel on said building roof, wherein said at least two attachment structures (16, 20) are designed to withstand different force levels.

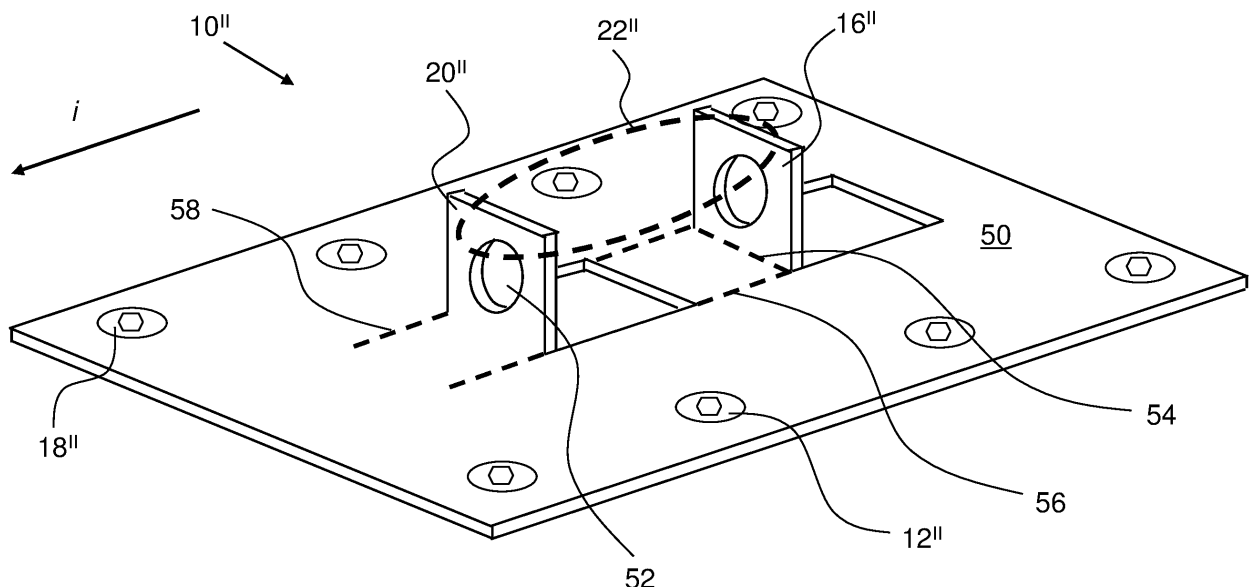


Fig. 5

Description

TECHNICAL AREA

[0001] The present application relates to an arrangement for securing persons working on elevated structures such as roofs.

BACKGROUND OF INVENTION

[0002] On elevated structures such as roofs, there is a requirement that approved fall protection systems must be present if the vertical drop is more than 2 meters. The requirement further states that on roofs with low roof pitches, the roof must have arrangements that offer anchoring of persons if they are closer than 2 meters from the edge of the roof. For roofs with higher roof pitches, there is a requirement that persons on the roof be anchored at all times.

[0003] Some solutions for securing persons on roofs include walkways, roof ladders, snow fences and the like on condition that they are installed in accordance with approved installation instructions. Other solutions include specific anchoring systems such as posts that are anchored to the roof and steel wires running between the posts. A person with personal safety equipment can hook onto the wires and can thereby move around on the roof. In any of these solutions, an approved system shall be able to handle dynamic tests with a weight of 100 kg falling freely from 2.5 meters and static tests with a weight of 1000 kg hanging freely for 3 minutes.

[0004] In order to reduce the effects of impact forces on a person falling off a roof and is caught by the personal safety equipment and the securing systems, some systems have been developed that absorb the load generated by the fall. Some systems comprise for instance coils attached to the fixed structure at one end and with an attachment point at the other end. The attachment point may be a wire connector on to which a person may attach a personal safety equipment such as a harness. The coils are often protected and placed inside housings. If the coils are exposed to forces at the attachment points, for instance if a person secured to the attachment points falls off a roof, the coils will act as shock absorbers when expanded due to the force. The solution is also intended to minimize the damage of the roof during such situations.

[0005] The drawback with these types of solutions is that the coils are rather bulky and visible because they are positioned with a central axis generally perpendicular to the roof surface. Further, the coils are protected with covers that make them even bulkier.

[0006] Wo 2006123979 discloses another solution for providing energy damping action. Here plate-shaped brackets are fixedly attached to a roof. The brackets are arranged with apertures for attaching roof equipment such as snow fences, walkways and the like. Personal safety equipment is intended to be attached to the roof equipment and not to the bracket itself. Each bracket is

arranged with two yielding zones designed to yield at different load levels. Thus, if a person connected to the roof equipment falls off the roof the yielding zones will provide an energy damping function. This solution requires both brackets and roof equipment for providing the desired function.

[0007] There is thus a demand for fall arrest and shock absorbers that are fully compliant and safe for users and at the same time are not too bulky and visible.

BRIEF DESCRIPTION OF INVENTION

[0008] The present invention intends to solve the drawbacks of the state of the art solutions with a securing arrangement comprising the features of the independent patent claims. Preferable embodiments of the invention form the subject of the dependent patent claims.

[0009] According to a main aspect of the invention, it comprises a securing arrangement for a building roof, that may comprise at least two anchoring structures to be attached to rigid elements of the building roof, thereby providing fixed and sturdy anchoring structures for the securing arrangement.

[0010] Further, at least two attachment structures may be arranged to the at least two anchoring structures and at least one connecting element may be arranged between the at least two attachment structures. The at least one connecting element may be arranged for securing personnel provided with personal fall arrest equipment on said building roof.

[0011] Preferably, the at least two attachment structures may be designed to withstand different force levels. With this solution, a dampening effect is obtained of the forces acting on a person falling off the building roof in that the at least two attachment structures will act so to say in series with one attachment structure withstanding a lower force level that will deform and break first while the at least second attachment structure is capable of withstanding a higher force level that will stop the fall.

[0012] In order to obtain a good performance of the securing arrangement, the at least two attachment structures, when the securing arrangement is mounted on a building roof, may be positioned generally in line with the inclination of the roof and wherein the attachment structure with higher force resistance is positioned closer to the eaves of the roof. Thus, the force from a person falling off the roof acting on the securing arrangement is generally in line with the positions of the attachment structures and may firstly affect the attachment structure with the lower force resistance, providing the dampening effect while the attachment structure with the higher force resistance will then stop the fall.

[0013] In order to provide a good dampening effect, the attachment structure with lower force resistance may be designed to break at a certain force level and in that regard, the attachment structure with the lower force resistance may be provided with break initiators. With such a solution, a controlled and predetermined action of the

dampening effect may be obtained.

[0014] According to a further aspect, the attachment structures may comprise any of steel rings, steel wires, steel chains or steel plates. The design of the attachment structures may thus be realised by many different elements that can provide the desired functionality. Further, the connecting element may comprise any of steel rings, steel wires or steel chains. An important aspect in this regard is that the design of the connecting element ensures a secure and non-breakable connection for personal safety equipment.

[0015] According to further aspects, the at least two anchoring structures may comprise bolts or screws. This provides a fast, simple and yet sturdy and secure attachment of the securing arrangement to the roof, without having to manipulate and/or modify the roof in order to obtain a fixed attachment, which is often the case with state of the art solutions where parts of the roof is removed in order to provide anchoring in structures under the roof covering.

[0016] In addition, the securing arrangement may further comprise elements for providing attachment of walkways, ridge and roof rails or snow fences. The securing arrangement will then perform more functions than just for personal securing. In that regard, the securing arrangement may comprise a steel plate console. In order to further obtain a dampening effect, the steel plate console may comprise break initiators designed to break at a certain force applied on said securing arrangement.

[0017] These and other aspect of and advantages with the present invention will become apparent from the following detailed description and from the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0018] In the following detailed description of the invention, reference will be made to the accompanying drawings, of which

Fig. 1 shows a first embodiment of a securing arrangement attached to a fixed structure such as a roof of a building,

Fig. 2 shows a detailed view of a first attachment structure of the securing arrangement of Fig. 1,

Fig. 3 shows a variant of the embodiment of Fig. 1,

Fig. 4 shows a second embodiment of a securing arrangement,

Fig. 5 shows a third embodiment of a securing arrangement,

Fig. 6 shows a fourth embodiment of a securing arrangement,

Fig. 7 shows a fifth embodiment of a securing arrangement.

DETAILED DESCRIPTION OF THE INVENTION

[0019] A first embodiment of the invention is shown in

Fig. 1. The securing arrangement 10 comprises a first anchoring structure 12 to be secured to a fixed structure 14 of a building, for example a roof truss. The first anchoring structure 12 may be a bolt or screw or other suitable fastening element adapted to the material of the fixed structure. The first anchoring structure 12 is provided with a first attachment structure 16. In the embodiment of Fig. 1, the first attachment structure 16 may be a ring attached to, or being integral with, the anchoring structure 12. Further, the securing arrangement comprises a second anchoring structure 18 to be secured to the fixed structure of the building, that may have the same design as the first anchoring structure 12. The second anchoring structure 18 may further be arranged with a second attachment structure 20 that may be of the same type as the first attachment structure 16. However, it is of course possible that the attachment structures are of different design as will be described. The arrangement of the anchoring structures with the attachment structures is preferably oriented such that they are generally aligned with the direction of inclination i of the roof towards the eaves of the roof, which will generally correspond to the direction of force on the securing arrangement as will be described below.

[0020] A connecting element 22 is further arranged between the attachment structures 16, 20 arranged to couple the attachment structures to each other. The connecting element 22 may be a wire, chain, steel ring or the like sturdy and strong element. The important thing is that the attachment structures 16, 20 act together as will be described. In this regard, the attachment structures 16, 20 are designed to withstand different forces applied. For instance if a person has connected to the securing arrangement, and in particular to the connecting element 22, and the person falls off the building, the first attachment structure 16 will break when a certain force is obtained, which force the second attachment structure 20 is designed to withstand and wherein the second attachment structure 20 then will stop the fall via the connecting element 22.

[0021] The attachment structures 16, 20 are generally aligned with the inclination of the roof as described, wherein preferably the first attachment structure 16 is placed higher up than the second attachment structure 20 as seen in the direction of inclination i , so that the force created by the falling person will act mainly first on the first attachment structure 16 and subsequently on the second attachment structure 20. This will provide a dampening action on the falling person so that an abrupt impact is avoided, which would be the case with a single very strong attachment point.

[0022] Designing the first attachment structure 16 to break at a certain force may for example include a weakening point or break initiator 24 on for example the ring such as removed material on one point as seen in Fig. 2. As an alternative, the attachment of the first attachment structure 16 to the anchoring structure 12 may be provided with break initiators 26. It is to be understood that

other measures may be used, for instance that the first attachment structure is made of a material with weaker properties, causing breaking of the first attachment structure 16 at a certain force that the second attachment structure 20 can withstand.

[0023] Figure 3 shows a variant of the securing arrangement 10 of Fig. 1. Here the attachment structures 16, 20 are attached to a plate 26 or the like structure that in turn is secured to the fixed structure of the building by at least two anchoring structures 12, 18 such as bolts. For the rest, the variant of Fig. 3 has the same features as the securing arrangement of Fig. 1.

[0024] Further, Fig. 4 shows another embodiment of a securing arrangement 10^I. In this embodiment, at least four anchoring structures 12^I, 18^I are attached to the rigid structure of the building roof. The anchoring structures 12^I, 18^I may be bolts screwed into the rigid structure of the building and work in pairs. Between two first anchoring structures 12^I, a first attachment structure 16^I is arranged and between two second anchoring structures 18^I, a second attachment structure 20^I is arranged, where the attachment structures 16^I, 20^I are attached to the anchoring structures 12^I and 18^I respectively. The attachment structures 16^I, 20^I may be for example steel wires provided with loops at each end, through which loops the anchoring structures 12^I run. With four anchoring structures 12^I and 18^I and thus two attachment structures 16^I, 20^I a two-step function may be obtained. In this regard, the attachment structures 16^I, 20^I are designed with different strength. Between the two attachment structures a connecting element 22^I is arranged. The connecting element 22^I may be a wire, a chain, a steel ring or the like.

[0025] With this embodiment, a securing of personal safety equipment is done by attaching to the connecting element 22^I. Also here, the securing arrangement is such that should a connected person then fall off the roof, the first attachment structure 16^I will break when a certain force is reached while the second attachment structure 20^I can withstand this force. As with the previous embodiment, a dampening action is obtained by this solution. As seen in the figure, the anchoring structures to the right may be arranged with a load distributing plate 26^I. As with the previous embodiment, the first attachment structure 16^I may be provided with break initiators such as weakened sections, other types of material, and the like.

[0026] For all the embodiments shown above, more than two attachment structures may be used for added security and also for added dampening functionality wherein successive attachment structures as seen in the direction of inclination *i* towards the eaves have increasing strength.

[0027] Figure 5 shows a further embodiment of a securing arrangement 10^{II}. Here a plate, for example a steel plate 50, is bolted to a fixed structure of the building with a number of anchoring structures 12^{II}, 18^{II} securing the plate 50. At least a first and a second attachment structure 16^{II}, 20^{II} are arranged in the plate 50 in the form of first and second tongues 16^{II}, 20^{II} cut out in the plate 50

and bent in relation to the plane of the plate 50. The tongues 16^{II}, 20^{II} are provided with passages 52 through which a connecting element 22^{II} runs. As with the previous embodiments, the connecting element 22^{II} may be a wire, a chain or a steel ring. In order to obtain the desired functionality, the first tongue 16^{II} may be arranged with a breaking initiator 54 such as a groove at the base of one of the tongues, providing a lesser force resistance. Thus, when a person connected to the connecting element 22^{II} falls off a roof, the first tongue 16^{II} with the lesser strength will bend and eventually break, providing a dampening effect on the fall. The second tongue 20^{II} may also provide a dampening effect in that it may bend, but is designed not to break.

[0028] In order to provide even further dampening effect, the first tongue 16^{II} with the lesser force resistance may be provided with breaking initiators 56 that run towards the cut-out for the second tongue 20^{II}. During a force applied, the breaking initiators 56 of the first tongue will successively break, causing a dampening effect, until eventually the breaking of the initiators 56 reach the cut-out of the second tongue 20^{II}. It is also possible to add further dampening functionality by arranging breaking initiators 58 also for the second tongue 20^{II} such that force applied on also the second tongue 20^{II} will cause the initiators 58 to successively break along the initiators, but only to the point where they end. As with the previous embodiments, the plate 50 may be provided with more than two attachment structures, where successive attachment structures are designed with added strength.

[0029] The embodiment shown in Fig. 6 has a somewhat different design than the previous embodiments. The securing arrangement 10^{III} comprises a console 60 to be attached to a roof. The console 60 comprises a base plate 62 with at least two holes 64 or passages through which anchoring structures 12^{III}, 18^{III} may be inserted and bolted to the rigid structure of the building. First and second attachment structures 16^{III}, 20^{III} in the form of cut-outs are arranged surrounding parts of the holes 64, in the embodiment shown rectangles with three sides. With this embodiment, the console 60 will function as connecting element between the attachment structures 16^{III}, 20^{III}. As with the previous embodiments, the first attachment structure 16^{III} is designed with lesser strength than the second attachment structure 20^{III}. This may for example be obtained by a breaking initiator 68 that will cause the area surrounding the first attachment structure to bend and deform and eventually break.

[0030] Personal safety equipment may be attached directly to the console 60 or to further roof elements such as snow fences, ridge and roof rails, walkways and the like that are attached to the console 60. The console 60 may in line with the present invention be provided with further means for dampening a fall. As seen in Fig. 6, a breaking initiator 70 in the form of a cut-out in the vicinity of a hole 72 in the console 60 is provided. A force on the console will cause a breakage of the material between the cut-out 70 and the hole 72, causing a deformation of

the console 60 that will function as a dampening action.

[0031] Figure 7 shows another embodiment of a securing arrangement 10^{IV}. It comprises first and second anchoring structures 12^{IV}, 18^{IV} such as bolts or screws anchored to a rigid structure of a building roof. First and second attachment structures 16^{IV}, 20^{IV} are attached to the anchoring structures 12^{IV}, 18^{IV} comprising first and second holes arranged in a plate 80, for example a steel plate, through which the anchoring structures 12^{IV}, 18^{IV} pass. In this embodiment the plate 80 is designed and functions as a connecting element 22^{IV}. In order to provide an attachment point 82 for personal safety equipment, the plate 80 may comprise a steel ring or the like firmly attached to the plate 80.

[0032] The attachment structure 16^{IV} is further arranged with break initiators 84 such as grooves surrounding the first hole of the first attachment structure. If a certain load is applied on the connecting element 22^{IV} by for example a person falling off the roof, the break initiators of the first attachment structure will break causing a deformation of the plate, and thereby a force dampening effect. The second attachment structure 20^{IV} is however designed so strong that it will arrest the fall. As an alternative to break initiators surrounding the first anchoring structure, a break initiator 86 may be placed between the first anchoring structure 12^{IV} and the attachment structure 82, such as a groove running generally transversal to the longitudinal direction of the plate 80.

[0033] It is to be understood that the embodiment described above and shown in the drawings is to be regarded only as a non-limiting example of the invention and that it may be modified in many ways within the scope of the patent claims.

Claims

1. Securing arrangement (10) for a building roof, comprising:

- at least two anchoring structures (12, 18) to be attached to rigid elements of the building roof with a distance between them;
- each of said at least two anchoring structures arranged with an attachment structure (16, 20);
- at least one connecting element (22) arranged between said attachment structures (16, 20), which at least one connecting element (22) is arranged for attachment of personal safety equipment for securing personnel on said building roof, wherein

said attachment structures (16, 20) of the at least two anchoring structures (12, 18) are designed to withstand different force levels.

2. Securing arrangement according to claim 1, wherein said at least two attachment structures (16, 20),

when the securing arrangement (10) is mounted on a building roof, are positioned generally in line with the inclination (*i*) of the roof and wherein the attachment structure (20) with higher force resistance is positioned closer to the eaves of the roof.

3. Securing arrangement according to claim 1 or 2, wherein the attachment structure (16) with lower force resistance is designed to break at a certain force level.
4. Securing arrangement according to claim 3, wherein the attachment structure with the lower force resistance (16) is provided with break initiators (24, 26, 54, 56, 68, 84).
5. Securing arrangement according to any of the claims 1 to 4, wherein said attachment structures (16, 20) comprise any of steel rings, steel wires, steel chains or steel plates.
6. Securing arrangement according to any of the preceding claims, wherein said connecting element (22) comprises any of steel rings, steel wires or steel chains.
7. Securing arrangement according to claim 1 or 2, wherein said at least two anchoring structures (12, 18) comprise bolts or screws.

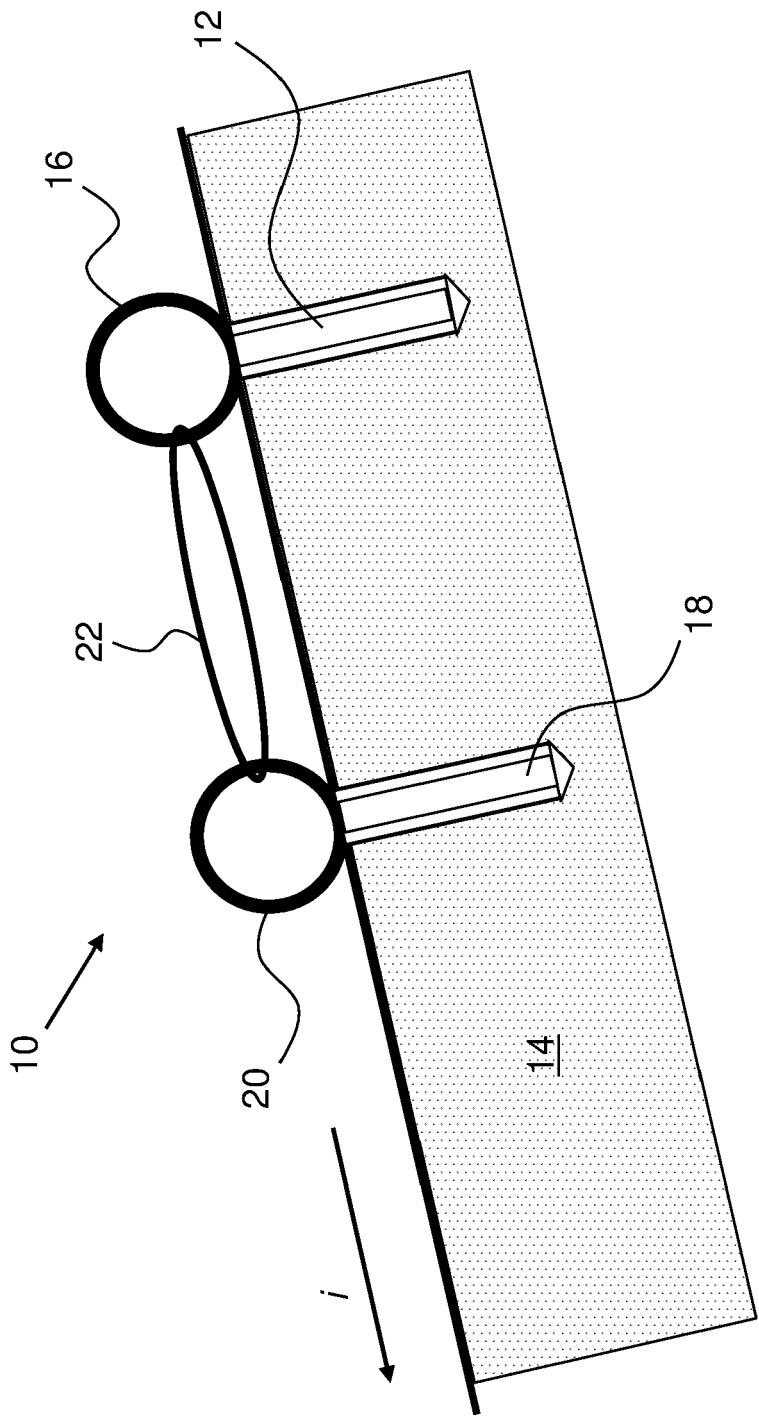
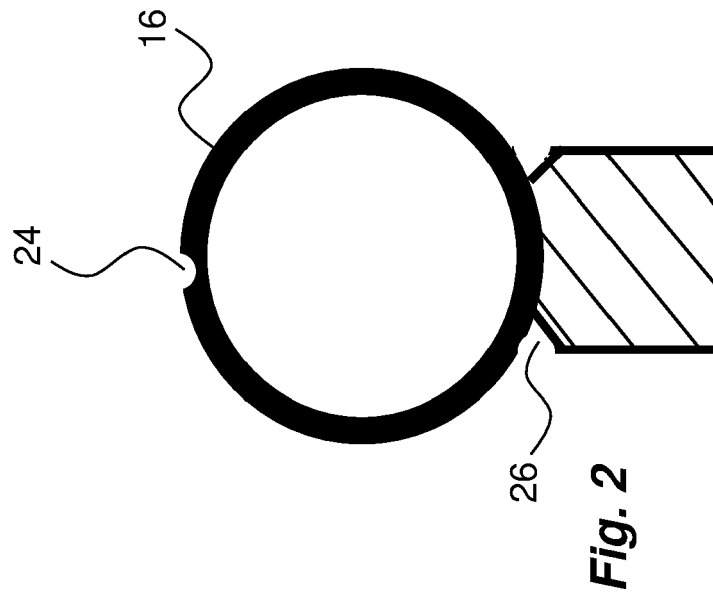


Fig. 1



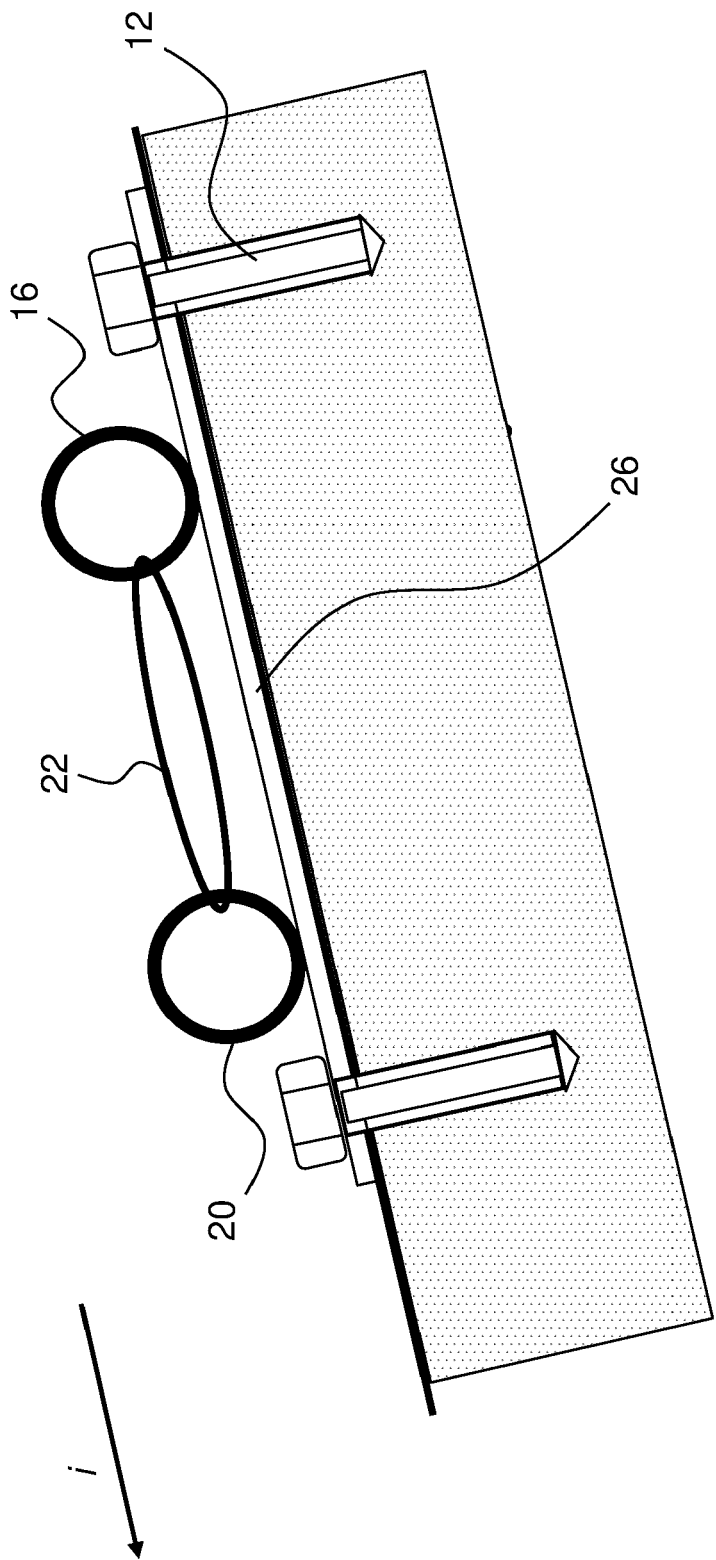


Fig. 3

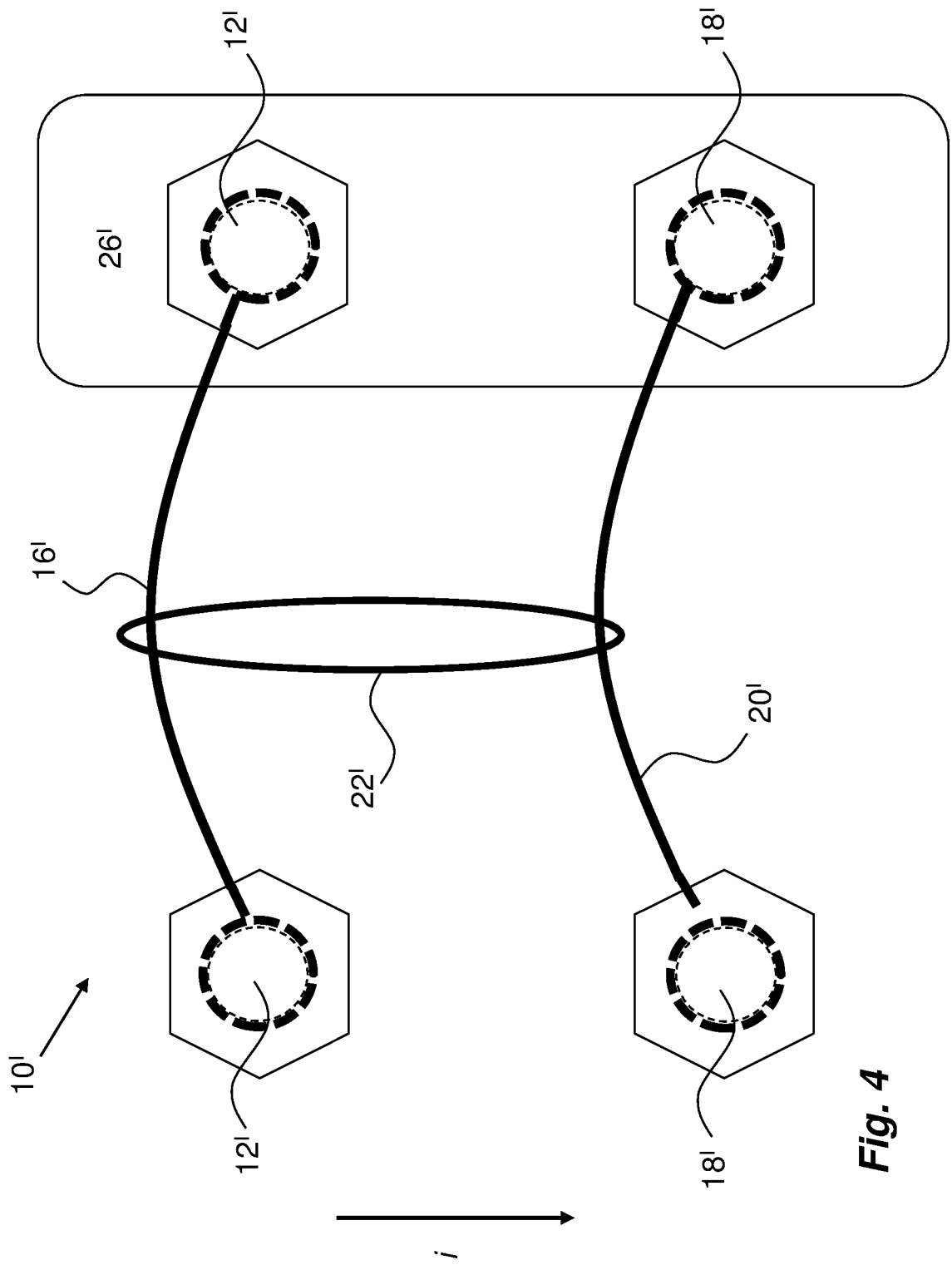


Fig. 4

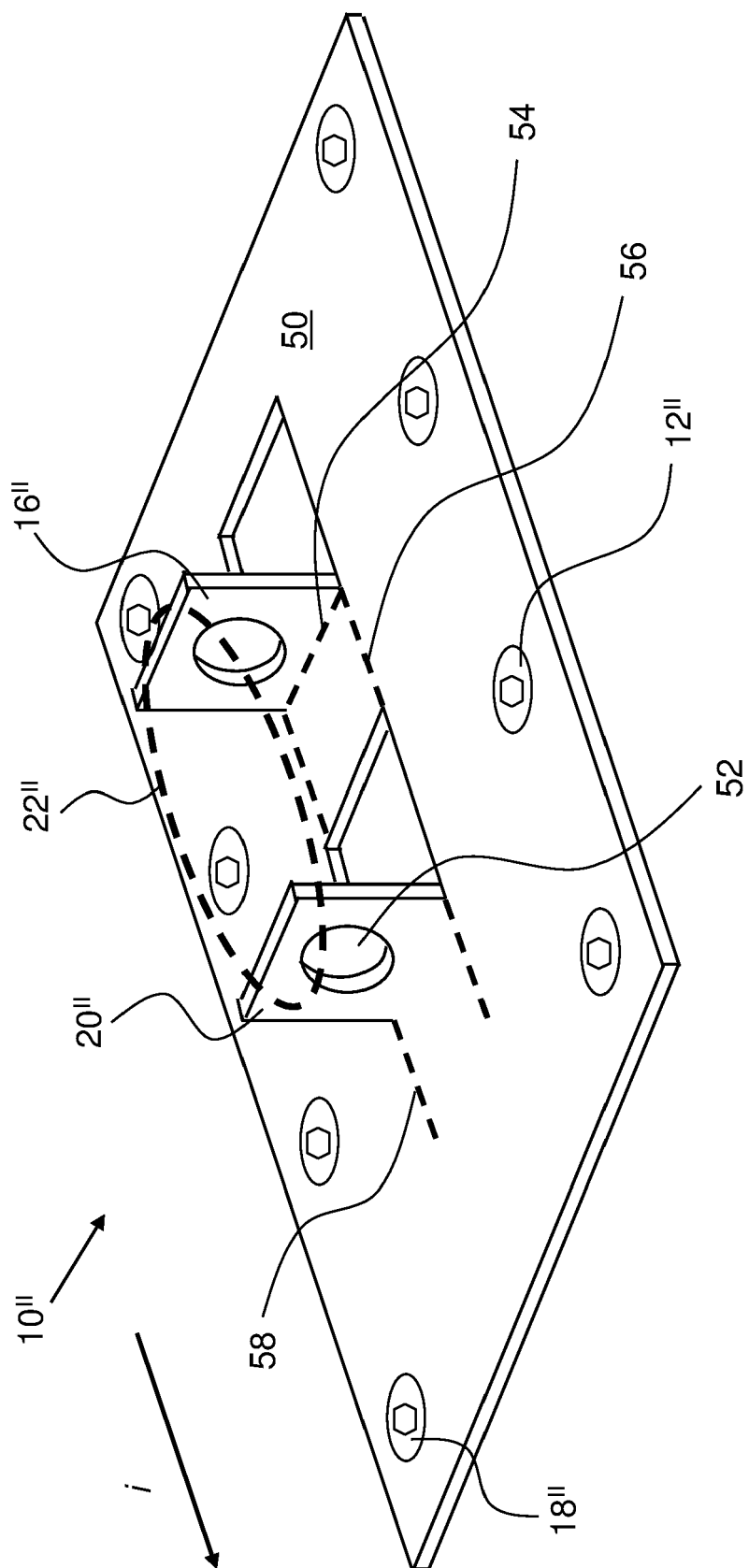


Fig. 5

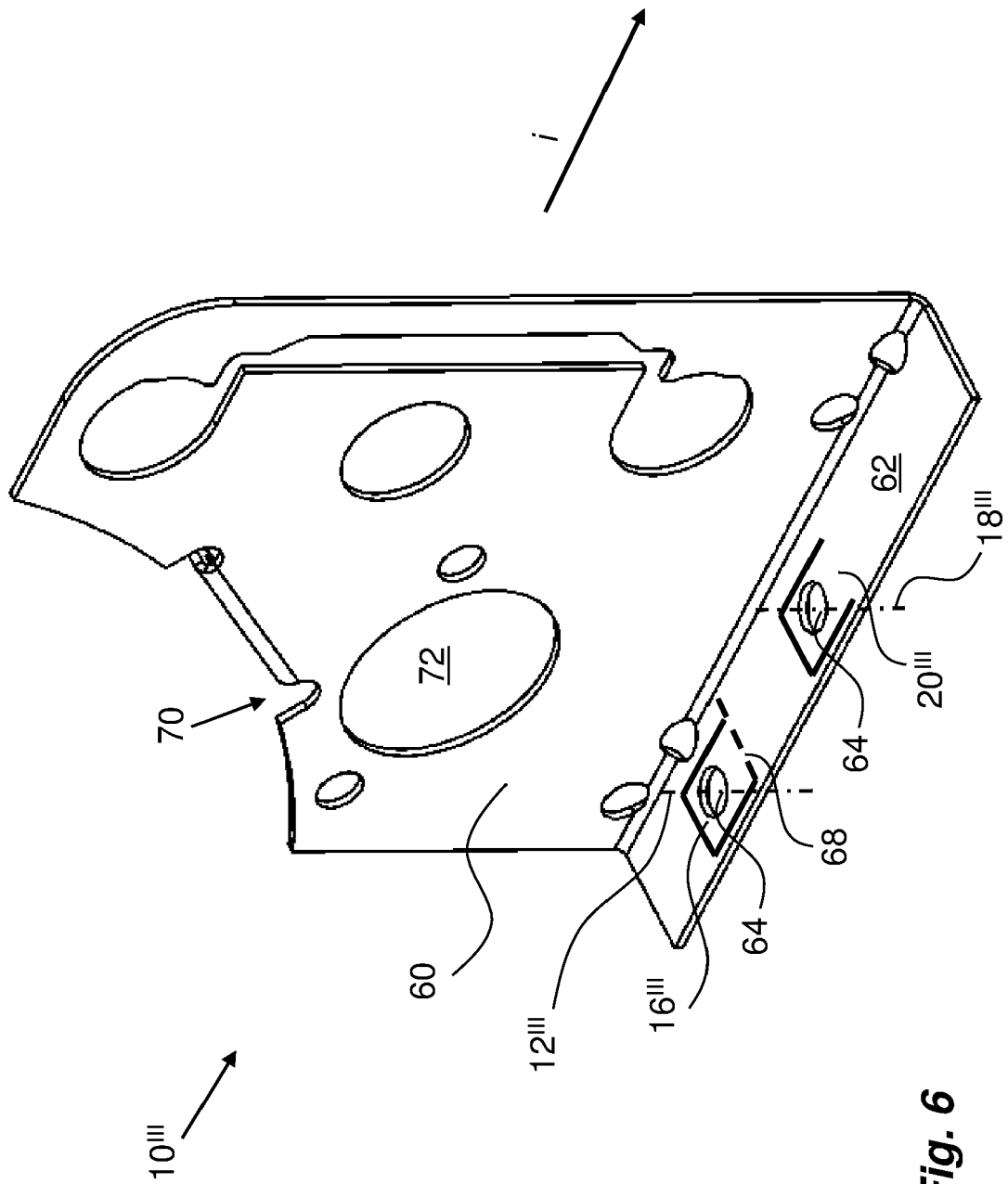


Fig. 6

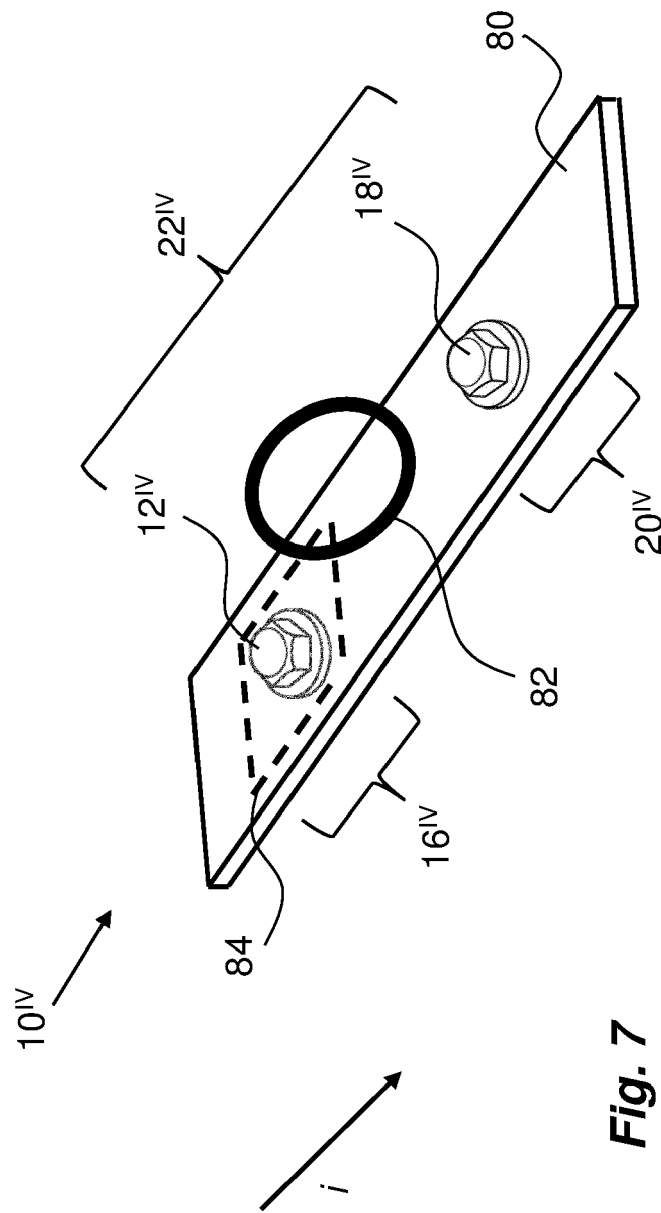


Fig. 7



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Application Number

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 31 January 2022	Examiner Garmendia Irizar, A
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
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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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