(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 079 988 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.10.2022 Bulletin 2022/43

(21) Application number: **22167267.8**

(22) Date of filing: **08.04.2022**

(51) International Patent Classification (IPC):
E04D 13/12 *(2006.01)* ***E06C 1/34*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E04D 13/12; E06C 1/345

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **19.04.2021 SE 2150481**

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(54) WALKWAY ARRANGEMENT FOR A ROOF

(57) The disclosure relates to a walkway arrangement, the walkway arrangement (100) comprising: a walkway (200), a walkway console (300) and a roof console (400); wherein the walkway console (300) comprises a first attachment means (302, 304) for attaching the walkway console (300) to the walkway (200) and a second attachment means (312, 314) for attaching the walkway console (300) to the roof console (400); the roof console (400) comprises a third attachment means (402, 404) for attaching the roof console (400) to a roof (500) and a fourth attachment means (412, 414) configured to cooperate with the second attachment means (312, 314) for attachment of the walkway console (300) to the roof console (400); and wherein the second attachment means (312, 314) and the fourth attachment means (412, 414), in operation, together form: a first overlapping area (A1) comprising a rotation axis around which the walkway console (300) can be rotated in relation to the roof console (400) for adjusting a first angle (α) between a walking plane (WP) of the walkway (200) and a first plane (P1) parallel with an inclination (I) of the roof (500), and a second overlapping area (A2) comprising a locking mechanism for locking the walking plane (WP) of the walkway (200) in relation to the first plane (P1) in the first angle (α), wherein the second overlapping area (A2) extends in the roof console (400) along and around a second plane (P2) extending outwards from the first plane (P1) in a second angle (β) in relation to the first plane (P1).

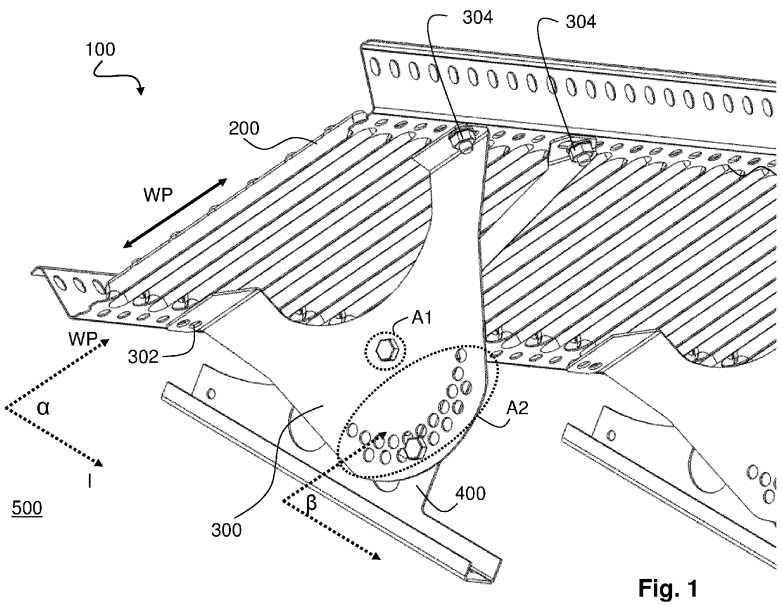

Fig. 1

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Description

TECHNICAL AREA

[0001] The present disclosure relates to a walkway arrangement for a roof.

BACKGROUND OF THE INVENTION

[0002] Roof equipment such as snow fences, railings, ladders, walkways and safety wires with anchoring points have been a requirement for some years. Most of these are attached to the roof with roof consoles. Recently the requirements on the loads that the roof equipment can handle have been increased quite drastically. One of these requirements is that for instance an arrangement with a walkway should be able to handle static weights up to 260 kg placed on the walkway without the arrangement collapsing and in particular the consoles.

[0003] In order to handle these requirements, the walkway arrangement needs to be reinforced and one of the areas where such reinforcements may be placed is on the consoles. This may be done by choosing thicker steel plates from which the consoles are made or to introduce folded edges or ribs.

SUMMARY

[0004] An objective of the present invention is to provide an improved walkway arrangement compared to prior art.

[0005] Another objective of the present invention is to provide a walkway arrangement being robust and having good energy absorbing properties.

[0006] The above and further objectives are solved by the subject matter of the independent claims. Further advantageous embodiments of the invention can be found in the dependent claims.

[0007] According to an aspect of the invention a walkway arrangement for a roof is provided, the walkway arrangement comprises: a walkway, a walkway console and a roof console; wherein

the walkway console comprises a first attachment means for attaching the walkway console to the walkway and a second attachment means for attaching the walkway console to the roof console;
the roof console comprises a third attachment means for attaching the roof console to a roof and a fourth attachment means configured to cooperate with the second attachment means for attachment of the walkway console to the roof console, or vice versa; and wherein
the second attachment means and the fourth attachment means, in operation, together form:

a first overlapping area comprising a rotation axis around which the walkway console can be rotated in relation to the roof console for adjusting a first angle between a walking plane of the walkway and a first plane parallel with an inclination of the roof, and
a second overlapping area comprising a locking mechanism for locking the walking plane of the walkway in relation to the first plane in the first angle, wherein the second overlapping area extends in the roof console along and around a second plane extending outwards from the first plane in a second angle in relation to the first plane.

[0008] The expression "in operation" herein may be understood as how different parts of the walkway arrangement are arranged and/or located in relation to each other and/or to different parts of a roof, a roof structure, or a roof surface when mounted and in use.

[0009] The first plane may in embodiments coincide with the inclination of the roof. This may be understood such that a vector representing the inclination of the roof is parallel to and located in the first plane. An inclined roof is a roof that is not horizontal but have an inclination or a slope with an angle larger than zero degrees in relation to a horizontal plane. Mentioned first plane may in examples be denoted a roof surface. The second angle, due to the herein defined geometry, extends outwards from the first plane.

[0010] Further, an overlapping area may be considered as an area in which the walkway console and the roof console overlap with each other when attached to each other in operation. This also implies that the second attachment means and the fourth attachment means overlap with each other in the overlapping areas.

[0011] With the present walkway arrangement, a robust design is provided that can withstand high static loads on the walkway and at the same time provide desired energy absorbing properties. Hence, the present walkway arrangement may be a suitable part of a general fall protection system.

[0012] In an embodiment of the walkway arrangement according to the above aspect, the second angle is any angle in a group comprising: larger than 45 degrees and smaller than or equal to 90 degrees: larger than 75 degrees and smaller than or equal to 90 degrees, larger than 85 degrees and smaller than or equal to 90 degrees, and substantially 90 degrees.

[0013] This may also be understood such that the second plane is angled to the first plane in any of the above-mentioned angle intervals. That the second plane extends outwards from the first plane implies that the second angle is larger than 0 degrees and smaller than 180 degrees. Hence, the second plane would be parallel to the first plane if the second angle would be 0 or 180 degrees. The second angle may be defined as an angle between a first vector representing the inclination of the roof in the slope direction and a second vector located in the second plane and extending outwards from the

first plane.

[0014] The different angle intervals result in different energy absorbing properties of the walkway arrangement.

[0015] In an embodiment of the walkway arrangement according to the above aspect, the first angle and the second angle have substantially the same value.

[0016] In an embodiment of the walkway arrangement according to the above aspect, the roof console comprises an outward extending part in relation to the first plane, and wherein the second overlapping area is located in a distal part of the outward extending part in relation to the walkway in operation.

[0017] In embodiments, the outward extending part extends perpendicular to the first plane.

[0018] This location of the second overlapping area provides desired deformation/collapsing properties of the walkway arrangement.

[0019] In an embodiment of the walkway arrangement according to the above aspect, the roof console comprises an elongated part extending along the first plane, in operation, and comprising the third attachment means.

[0020] In an embodiment of the walkway arrangement according to the above aspect, the elongated part is attached to one side of the outward extending part.

[0021] In an embodiment of the walkway arrangement according to the above aspect, an extension of the outward extending part along the first plane is larger than 50% of an extension of the elongated part along the first plane.

[0022] The above ratio results in robust fasting to the roof and at the same robust support of the walkway.

[0023] In an embodiment of the walkway arrangement according to the above aspect, the roof console comprises at least one first deformation initiator.

[0024] An advantage with this embodiment is that the energy properties of the walkway arrangement can be configured for different applications.

[0025] In an embodiment of the walkway arrangement according to the above aspect, the first deformation initiator is located in a proximal part of the outward extending part in relation to the walkway in operation.

[0026] This location of the second overlapping area provides desired deformation/collapsing properties of the walkway arrangement.

[0027] In an embodiment of the walkway arrangement according to the above aspect, the roof console comprises an engagement means configured to engage with roof equipment for holding the roof equipment.

[0028] In an embodiment of the walkway arrangement according to the above aspect, the second overlapping area is located in a distal part of the walkway console in relation to the walkway in operation.

[0029] This location of the second overlapping area provides desired collapsing properties of the walkway arrangement.

[0030] In an embodiment of the walkway arrangement according to the above aspect, the walkway console is U-shaped, and wherein the first attachment means are located at the supporting legs of the U-shaped walkway console in a proximal part of the walkway console in relation to the walkway for supporting the walkway in operation.

[0031] An advantage with this embodiment is that a robust design with reduced amount of sheet metal for manufacturing the walkway console can be provided.

[0032] In an embodiment of the walkway arrangement according to the above aspect, the walkway console comprises at least one second deformation initiator.

[0033] An advantage with this embodiment is that the energy absorbing properties of the walkway arrangement can be configured for different applications.

[0034] In an embodiment of the walkway arrangement according to the above aspect, the second deformation initiator is located between the first overlapping area and the second overlapping area in the walkway console.

[0035] This location of the second overlapping area provides desired deformation/collapsing properties of the walkway arrangement.

[0036] In an embodiment of the walkway arrangement according to the above aspect, the first deformation initiators and/or the second deformation initiators comprises an area with a weakening.

[0037] In an embodiment of the walkway arrangement according to the above aspect, the walkway arrangement comprises a supporting beam extending in an angle from the first overlapping area to the walkway to support the walkway in operation.

[0038] An advantage with this embodiment is that a more robust support for the walkway is provided.

[0039] In an embodiment of the walkway arrangement according to the above aspect, the second attachment means and the fourth attachment means comprise cut-outs or through holes in sheet metal.

[0040] The cut-outs or through holes may be combined with bolts, screws or any other suitable means for attachment of the roof console to the walkway console so as to form the first and second overlapping areas.

[0041] In an embodiment of the walkway arrangement according to the above aspect, the second attachment means and the fourth attachment means at least partially overlap in the first overlapping area and in the second overlapping area.

[0042] Further applications and advantages of the embodiments of the invention will be apparent from the following detailed description.

BRIEF DESCRIPTION OF DRAWINGS

[0043] In the following detailed description of the invention, reference will be made to the accompanying drawings, of which

Fig. 1 shows a walkway arrangement in a perspective view from below according to embodiments of the invention;

Fig. 2 and 3 respectively shows the walkway console and the roof console in Fig. 1 as separate parts in perspective view;

Fig. 4 and 5 show a walkway in two different perspective views according to embodiments of the invention;

Fig. 6 and 7 respectively shows a walkway console and a roof console as separate parts according to embodiments of the invention in perspective view;

Fig. 8 to 10 show a walkway console according to different embodiments of the invention; and

Fig. 11 and 12 illustrate a walkway arrangement after a fall test.

DETAILED DESCRIPTION OF THE INVENTION

[0044] Measures of reinforcing a walkway arrangement may conflict with other requirements for walkway arrangements. Apart from being arranged to walk on, they may also function as anchoring points for personal fall protection systems. The anchoring points used with walkways are often designed as safety wires running along the walkway, usually on an outer side of the walkway facing the eaves. In this regard, one requirement is that the roof equipment should be able to handle fall weights, such as a person falling off the walkway, wherein the arrangement should deform or collapse in a controlled manner, providing energy absorbing properties such that the fall is dampened or arrested. If the walkway arrangement is too rigid, the stop of the fall will be very sudden, and the falling person may be adversely affected by such a sudden stop resulting in severe injury.

[0045] Hence, a walkway arrangement should fulfil a number of different requirements. For example, a deformed walkway arrangement should be capable of holding a fall weight that according to current standards amounts to thousand kilos. Further, the roof should not be damaged by such a fall, which means that the walkway arrangement has to deform or collapse in a controlled manner and such that an attachment point of the personal fall protection holding the weight is moved as close as possible to the roof surface in order to reduce the leverage of the pulling forces from the weight. Otherwise, the leverage may cause the walkway arrangement to be removed from the roof or at least damage the roof seriously. Thus, it has been identified a need for a solution that can handle increased loads with improved energy absorbing properties and suitable deformation properties. Therefore, it is herein disclosed a walkway arrangement mitigating or fully solving the drawbacks of conventional walkway arrangements.

[0046] Fig. 1 shows a walkway arrangement 100 in a perspective view from below according to embodiments of the invention. Fig. 2 and 3 show the walkway console 300 and the roof console 400 in Fig. 1 as separate parts when not being attached to each other, i.e., not mounted together in operation.

[0047] With reference to Figs. 1 to 3, the walkway arrangement 100 comprises: a walkway 200, a walkway console 300 and a roof console 400. The walkway console 300 comprises a first attachment means 302, 304 for attaching the walkway console 300 to the walkway 200 and a second attachment means 312, 314 for attaching the walkway console 300 to the roof console 400. The roof console 400 further comprises a third attachment means 402, 404 for attaching the roof console 400 to a roof 500 and a fourth attachment means 412, 414 configured to cooperate with the second attachment means 312, 314 for attachment of the walkway console 300 to the roof console 400, or vice versa.

[0048] Further, the second attachment means 312, 314 and the fourth attachment means 412, 414, in operation, together form a first overlapping area A1 comprising a rotation axis around which the walkway console 300 can be rotated in relation to the roof console 400 for adjusting a first angle α between a walking plane WP of the walkway 200 and a first plane P1 parallel with an inclination I of a roof 500. The second attachment means 312, 314 and the fourth attachment means 412, 414, in operation, further together form a second overlapping area A2 comprising a locking mechanism for locking the walking plane WP of the walkway 200 in relation to the first plane P1 in the first angle α, wherein the second overlapping area A2 extends in the roof console 400 along and around a second plane P2 extending outwards from the first plane P1 in a second angle β in relation to the first plane P1. Hence, the walkway console 300 act as an intermediate part arranged between the walkway 200 and the roof console 400 for supporting the walkway 200.

[0049] The relation between the first plane P1 and the second plane P2 is illustrated in Fig. 3 where two different second angles $\beta 1$ and $\beta 2$ are shown. In a first example $\beta 1$ (P2 = P2') is close to 45 degrees while a second example $\beta 2$ (P2 = P2") is substantially 90 degrees. The latter case is the actual configuration shown in Fig. 3. Theoretically, the second angle β may have a value within a very wide range. However, it has been realised for practical implementations that the second angle β may be any angle in a group comprising: larger than 45 degrees and smaller than or equal to 90 degrees: larger than 75 degrees and smaller than or equal to 90 degrees, larger than 85 degrees and smaller than or equal to 90 degrees, and substantially 90 degrees. With the present walkway arrangement 100, some of the fourth attachment means of the roof console 400 will be placed in an area close to the roof and close to an end area of the roof console facing an eaves of the roof and cooperates with some of the second attachment means of the walkway console 300.

[0050] As also disclosed in Fig. 1 and 3, the roof console 400 comprises an outward extending part 424 in relation to the first plane P1 and the second overlapping area A2 is located in a distal part 452 of the outward extending part 424 in relation to the walkway 200, in operation, according to embodiments of the invention. The

first overlapping area A1 is located in the proximal part 454 of the outward extending part 424 in relation to the walkway 200.

[0051] From Fig. 2 it is also noted that the walkway console 300 may have a flat shape and when mounted in operation extend in parallel with the outward extending part 424 of the roof console 400. The first overlapping area A1 may be located at the centre section of the walkway console 300 while the second overlapping area A2 is located in a distal part 352 of the walkway console 300 in relation to the walkway 200.

[0052] The roof console 400 may further comprise an elongated part 422 extending along the first plane P1, in operation, as shown in the Figs. The elongated part 422 comprises the third attachment means 402, 404 for fastening the roof console 400 to the roof 500. In relation to the outward extending part 424, the elongated part 422 may be attached to one side of the outward extending part 424 in embodiments of the invention. Thereby, simplified installation of the walkway arrangement 100 with some types of roof tiles available on the market. For more robust fastening of the walkway arrangement 100 to the roof 500 and at the same time providing robust support for the walkway 200, an extension of the outward extending part 424 along the first plane P1 may be larger than 50% of an extension of the elongated part 422 along the first plane P1.

[0053] Fig. 4 shows a walkway arrangement 100 in a first perspective view from below and Fig. 5 shows the walkway arrangement 100 of Fig. 4 in a second perspective view from below according to further embodiments of the invention. As shown in Fig. 4 and 5, and also shown in the previous Figs., the second attachment means 312, 314 and the fourth attachment means 412, 414 may comprise cut-outs or through holes in sheet metal. Mentioned cut-outs and through holes may be combined with any other suitable attachment means for attaching the different parts of the present walkway arrangement. In the shown example, such attachment means are bolts 412', 414', 312', 314' but are not limited thereto. It may be noted that the rotational axis of the first overlapping area A1 may be defined by such a bolt in combination with cut-outs.

[0054] What further may be noted from Fig. 4 is the shape of the walkway console 300. In the disclosed example, the walkway console 300 has a U-shape that is arranged with its legs being attached to the walkway 200 for supporting the latter. Hence, the first attachment means 302, 304 are located at the supporting legs 326, 328 of the U-shaped walkway console 300 in a proximal part 352 of the walkway console 300 in relation to the walkway 200 for supporting the walkway 200 in operation. The proximal part 352 comprises the supporting legs 326, 328.

[0055] In embodiments of the invention, the walkway 200 may rest in an unfixed manner on the supporting leg closest to the roof in operation as shown in Fig. 1. Hence, no bolt or screw is arranged in the through hole 302 of the supporting leg closest to the roof. Thereby, the deformation of the walkway arrangement 100 will be different compared to when the walkway 200 is resting in a fixed manner on the supporting leg being closest to the roof.

[0056] To further support the walkway 200 a supporting beam or strut 212 may be arranged to extend in an angle from the first overlapping are A1 to the walkway 200 to support the walkway 200 in operation. The supporting beam 212 is hence angled in relation to a supporting leg. Thereby, three supporting points for the walkway 200 is provided in this embodiment thereby increasing the robustness of the walkway arrangement 100 even further.

[0057] Fig. 6 and 7, respectively, shows a walkway console 300 and a roof console 400 as separate parts when not being attached to each other according to yet further embodiments of the invention. As noted, the roof console 400 may comprises at least one first deformation initiator 442 located at suitable regions of the roof console 400. A configuration having good deformation properties is the case when the first deformation initiator 442 is located in a proximal part 454 of the outward extending part 424 in relation to the walkway 200 in operation. The first deformation initiator 442 may in further embodiments be directed towards the walkway 200. Thereby, the first deformation initiator will guide the deformation when a load exceeding a threshold load is applied at the walkway arrangement 100.

[0058] The roof console 400 may also comprise an engagement means 432 configured to engage with roof equipment for holding the roof equipment, not shown in the Figs. The engagement means may be elongated and/or circular through holes for engagement with corresponding engagement means of roof equipment but are not limited thereto. Non-limiting examples of engagement means are circular through holes in different sizes, elongated slots and slits that may or may not be combined with circular holes. Other non-limiting examples of engagement means may be different types of couplings and connections such as screw connections and bolt connections. Further non-limiting examples are protrusions or other protruding portions for engagement with a roof equipment. Examples of roof equipment are snow fences and ridge rails.

[0059] Regarding the deformation properties of the walkway console 300, the second overlapping area A2 may be located in a distal part 352 of the walkway console 300 in relation to the walkway 200 in operation. In this respect, the walkway console 300 may also comprise at least one second deformation initiator 342. Fig. 8 to 10 show different walkway consoles 300 having different configurations of the second deformation initiator 342 and where the second overlapping area A2 is located in the distal part 352 of the walkway console 300. Different configurations will provide different deformation properties. A configuration with good deformation property is the case when the second deformation initiator 342 is located between the first overlapping area A1 and the

second overlapping area A2 in the walkway console 300 as illustrated in the Figs.

[0060] What may also be noted is that the third attachment means of the walkway console 300 may be arranged generally along a circle sector with a radius in relation to the rotational axis comprised in the first overlapping area A1.

[0061] Generally, the deformation initiators will provide controlled bending or collapsing of the walkway arrangement 100. With these designs, the first deformation initiator 442 will cause the walkway arrangement 100 to bend and collapse when exposed to forces from a person, secured to the walkway arrangement 100 with personal fall protection equipment, falling off the walkway. The walkway arrangement 100 will then act as an energy absorbing unit. Further, the controlled collapsing will move the force point towards and close to the roof such that the leverage of the force point is reduced, thereby minimizing the risk that the roof console 400 is torn off the roof.

[0062] The second deformation initiator 342 will also ascertain that attachment points on the walkway 200 will move towards the roof surface due to the collapsing, minimizing the leverage. This is illustrated in Figs. 11 and 12 where a walkway arrangement 100 is exposed to a test with a falling weight. Fig. 11 shows how the walkway arrangement 100 is collapsing during the fall. Due to the force/load on the roof console 400, the first deformation initiator 442 causes a break of the roof console 400 so that the upper section 424 of the roof console 400, the walkway console 300 and the walkway 200 are moved in the force direction FD. As seen in deformation area DA the second deformation initiator 342 due to its location on the walkway console 300 will causes the walkway console 300 with the upper section 424 of the roof console 400 to bend and move the walkway 200, and thus the force point FP closer towards the roof surface. The bending will continue when the fall is stopped, moving the walkway 200 and the force point FP even closer to the roof surface, as seen in Fig. 12. This controlled bending and collapsing reduces the leverage for the force and will thus reduce the risk that the upper part of the roof console 400 attached to the roof is exposed to high lifting forces, which otherwise could lead to that the roof console 400 is torn off from the roof.

[0063] The present walkway arrangement 100 may be produced from sheet metal parts bent in suitable shapes. Hence, sheet metal may be punched in different shapes and thereafter bent or folded for producing different parts of the walkway arrangement 100 according to embodiments of the invention. The different parts of the walkway arrangement 100 may thereafter be attached to each other by means of any suitable attachment means known in the art, such as using through holes with bolts, adhesives, and welding.

[0064] Finally, it should be understood that the invention is not limited to the embodiments described above, but also relates to and incorporates all embodiments within the scope of the appended independent claims.

Claims

1. A walkway arrangement (100) for a roof (500), the walkway arrangement (100) comprising: a walkway (200), a walkway console (300) and a roof console (400); wherein

   the walkway console (300) comprises a first attachment means (302, 304) for attaching the walkway console (300) to the walkway (200) and a second attachment means (312, 314) for attaching the walkway console (300) to the roof console (400);
   the roof console (400) comprises a third attachment means (402, 404) for attaching the roof console (400) to a roof (500) and a fourth attachment means (412, 414) configured to cooperate with the second attachment means (312, 314) for attachment of the walkway console (300) to the roof console (400), or vice versa; and wherein
   the second attachment means (312, 314) and the fourth attachment means (412, 414), in operation, together form:

      a first overlapping area (A1) comprising a rotation axis around which the walkway console (300) can be rotated in relation to the roof console (400) for adjusting a first angle (α) between a walking plane (WP) of the walkway (200) and a first plane (P1) parallel with an inclination (I) of the roof (500), and a second overlapping area (A2) comprising a locking mechanism for locking the walking plane (WP) of the walkway (200) in relation to the first plane (P1) in the first angle (α), wherein the second overlapping area (A2) extends in the roof console (400) along and around a second plane (P2) extending outwards from the first plane (P1) in a second angle (β) in relation to the first plane (P1).

2. The walkway arrangement (100) according to claim 1, wherein the second angle (β) is any angle in a group comprising: larger than 45 degrees and smaller than or equal to 90 degrees: larger than 75 degrees and smaller than or equal to 90 degrees, larger than 85 degrees and smaller than or equal to 90 degrees, and substantially 90 degrees.

3. The walkway arrangement (100) according to claim 1 or 2, wherein the roof console (400) comprises an outward extending part (424) in relation to the first plane (P1), and wherein the second overlapping area (A2) is located in a distal part (452) of the outward extending part (424) in relation to the walkway (200) in operation.

4. The walkway arrangement (100) according to claim 3, wherein the roof console (400) comprises an elongated part (422) extending along the first plane (P1), in operation, and comprising the third attachment means (402, 404).

5. The walkway arrangement (100) according to claim 4, wherein the elongated part (422) is attached to one side of the outward extending part (424).

6. The walkway arrangement (100) according to any one of claims 3 to 5, wherein an extension of the outward extending part (424) along the first plane (P1) is larger than 50% of an extension of the elongated part (422) along the first plane (P1).

7. The walkway arrangement (100) according to any one of claims 3 to 6, wherein the roof console (400) comprises at least one first deformation initiator (442).

8. The walkway arrangement (100) according to claim 7, wherein the first deformation initiator (442) is located in a proximal part (454) of the outward extending part (424) in relation to the walkway (200) in operation.

9. The walkway arrangement (100) according to any one of the preceding claims, wherein the roof console (400) comprises an engagement means (432) configured to engage with roof equipment (600) for holding the roof equipment (600).

10. The walkway arrangement (100) according to any one of the preceding claims, wherein the second overlapping area (A2) is located in a distal part (352) of the walkway console (300) in relation to the walkway (200) in operation.

11. The walkway arrangement (100) according to any one of the preceding claims, wherein the walkway console (300) is U-shaped, and wherein the first attachment means (302, 304) are located at the supporting legs (326, 328) of the U-shaped walkway console in a proximal part (352) of the walkway console (300) in relation to the walkway (200) for supporting the walkway (200) in operation.

12. The walkway arrangement (100) according to any one of the preceding claims, wherein the walkway console (300) comprises at least one second deformation initiator (342).

13. The walkway arrangement (100) according to claim 12, wherein the second deformation initiator (342) is located between the first overlapping area (A1) and the second overlapping area (A2) in the walkway console (300).

14. The walkway arrangement (100) according to any one of the preceding claims, comprising a supporting beam (212) extending in an angle from the first overlapping area (A1) to the walkway (200) to support the walkway (200) in operation.

15. The walkway arrangement (100) according to any one of the preceding claims, wherein the second attachment means (312, 314) and the fourth attachment means (412, 414) comprise cut-outs or through holes in sheet metal.

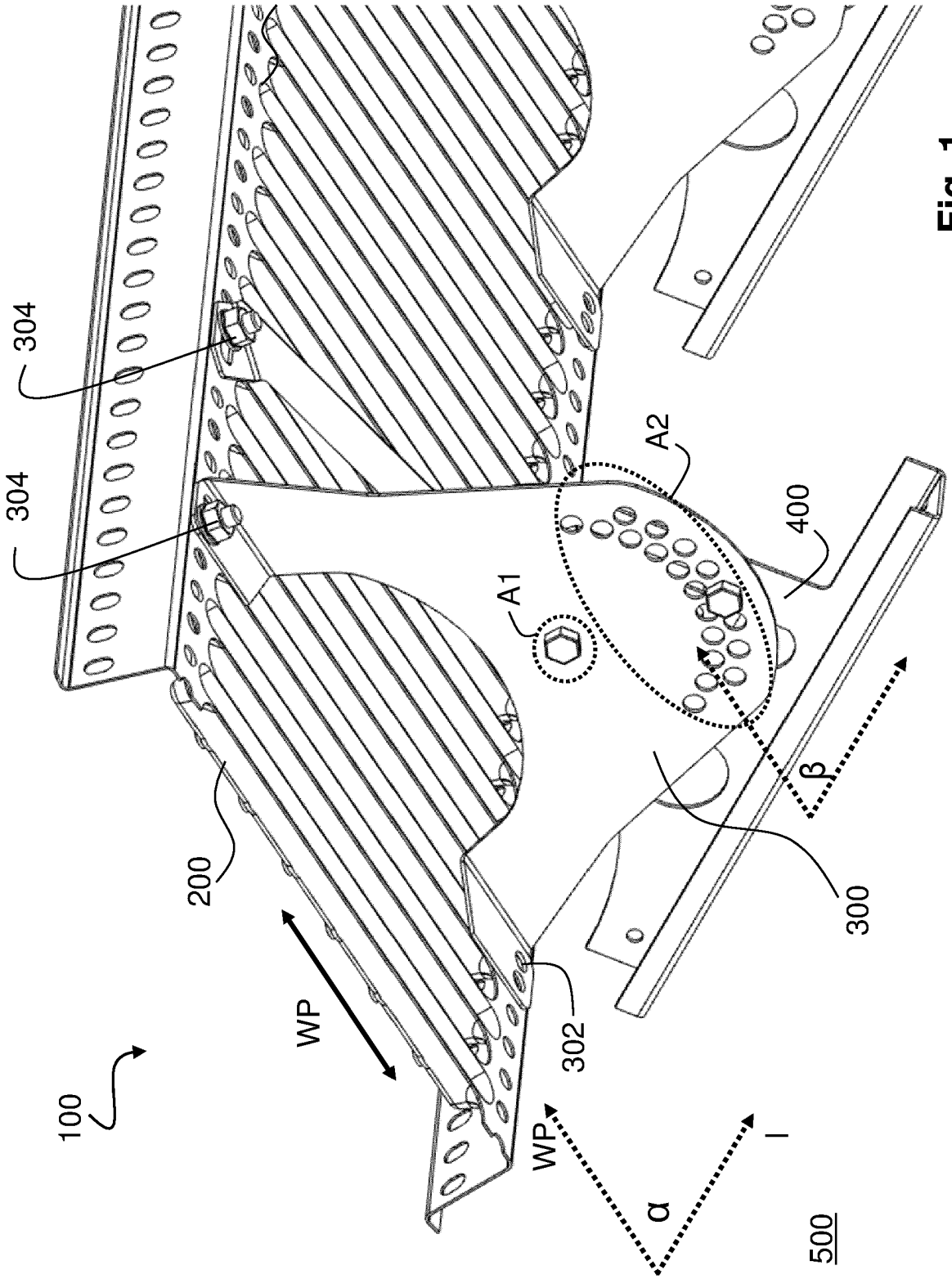


Fig. 1

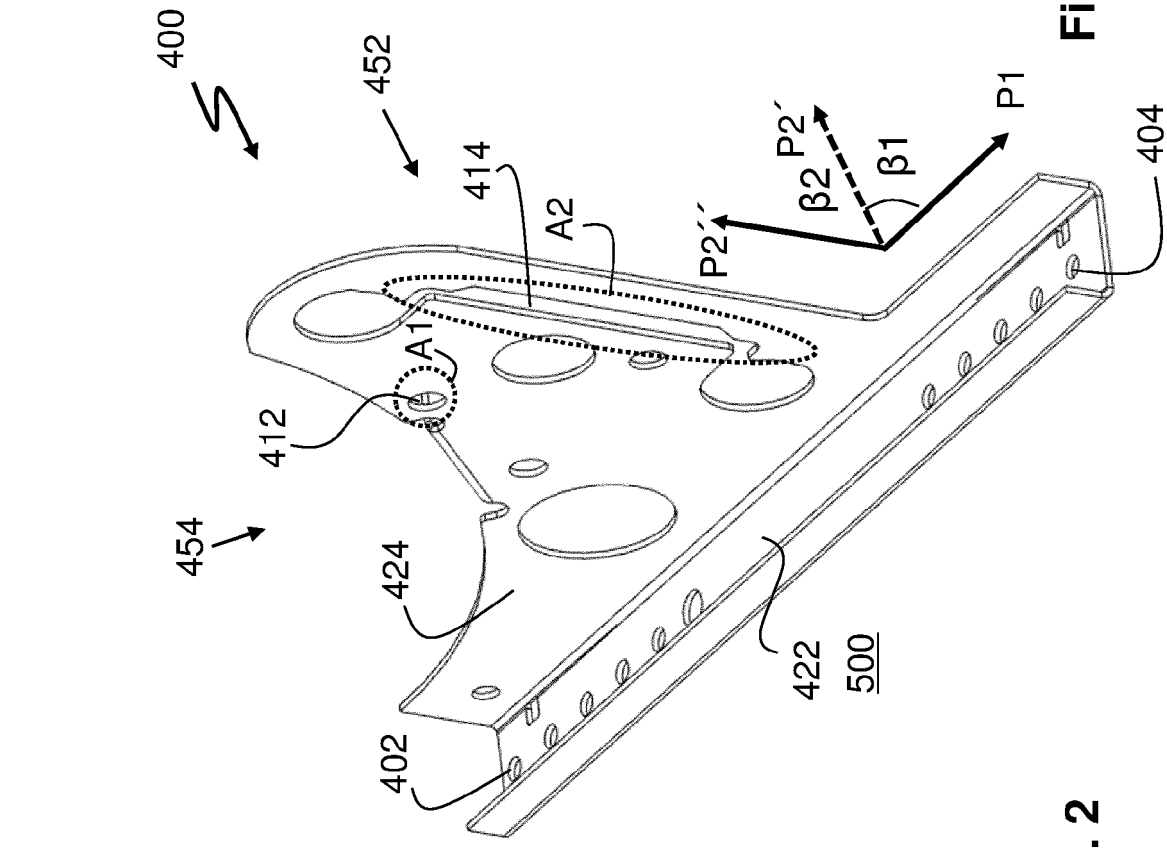

400
452
414
A2
A1
412
454
424
402
422
500
404
P1
P2´
β2
β1
P2´´

Fig. 3

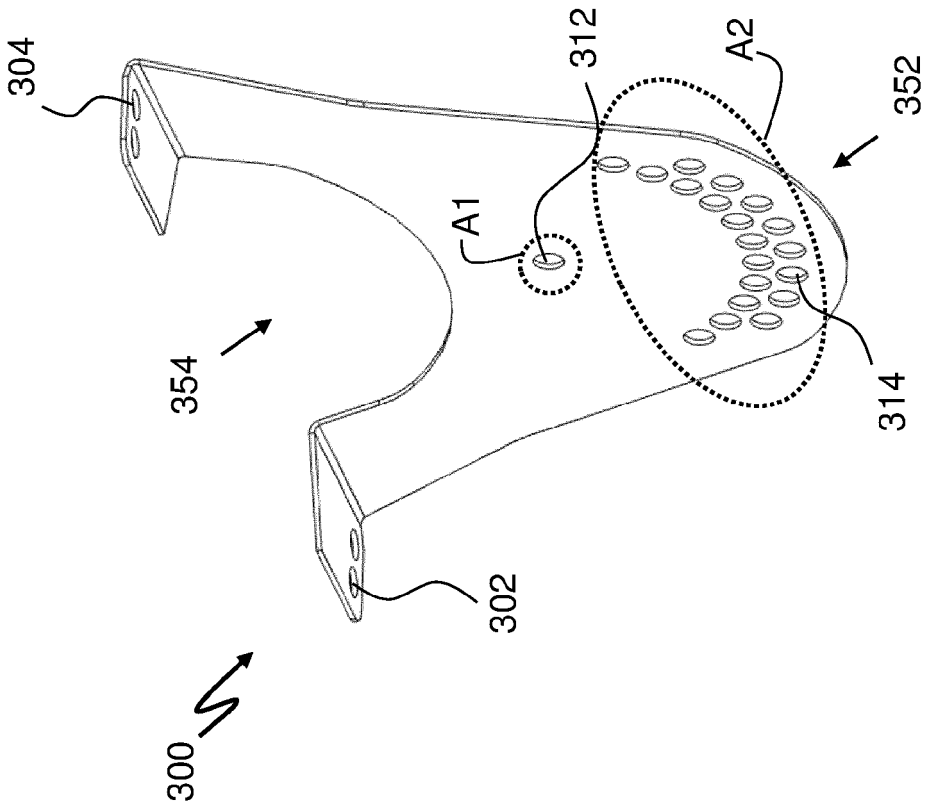

304
312
A2
352
A1
354
314
302
300

Fig. 2

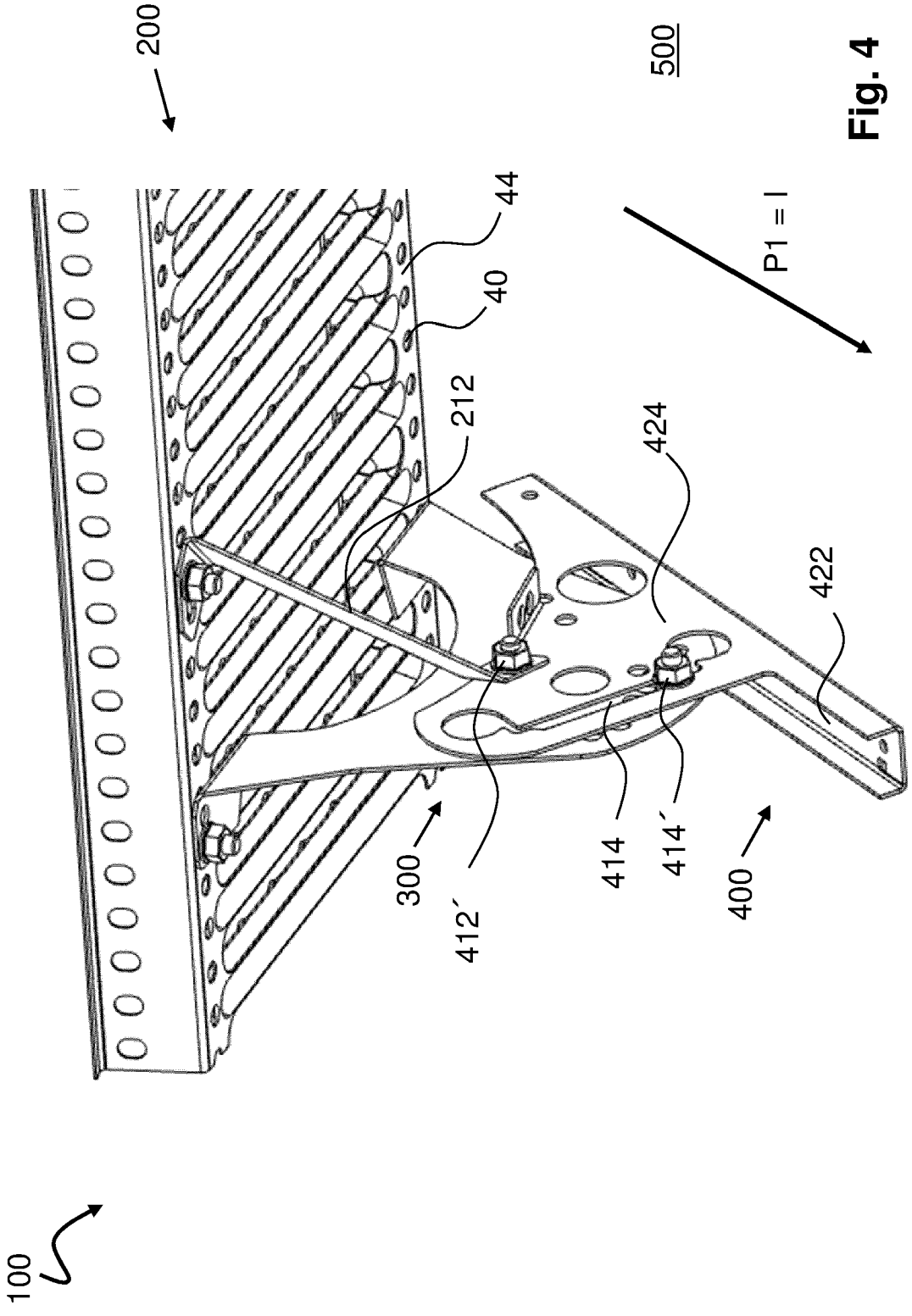


Fig. 4

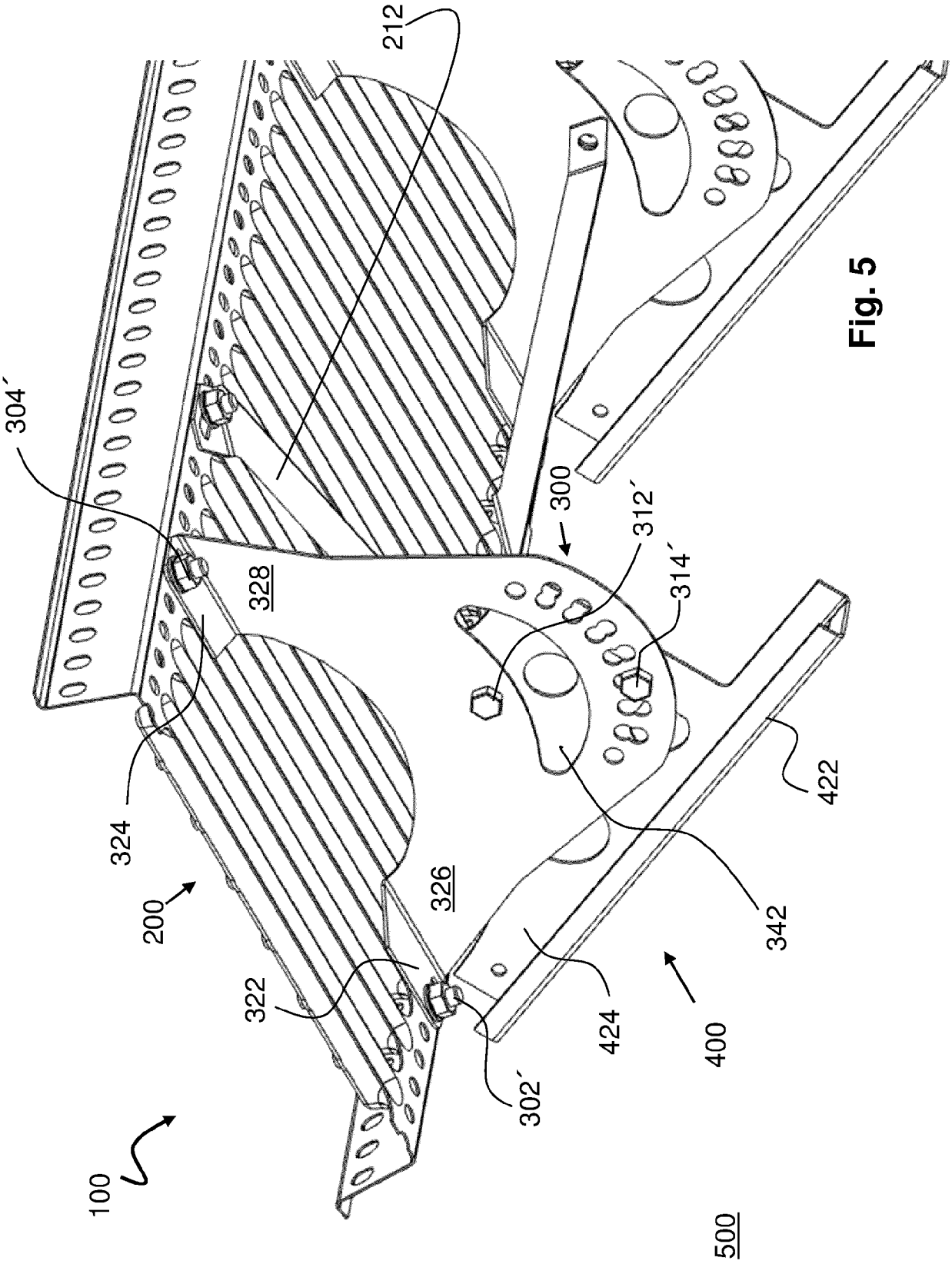
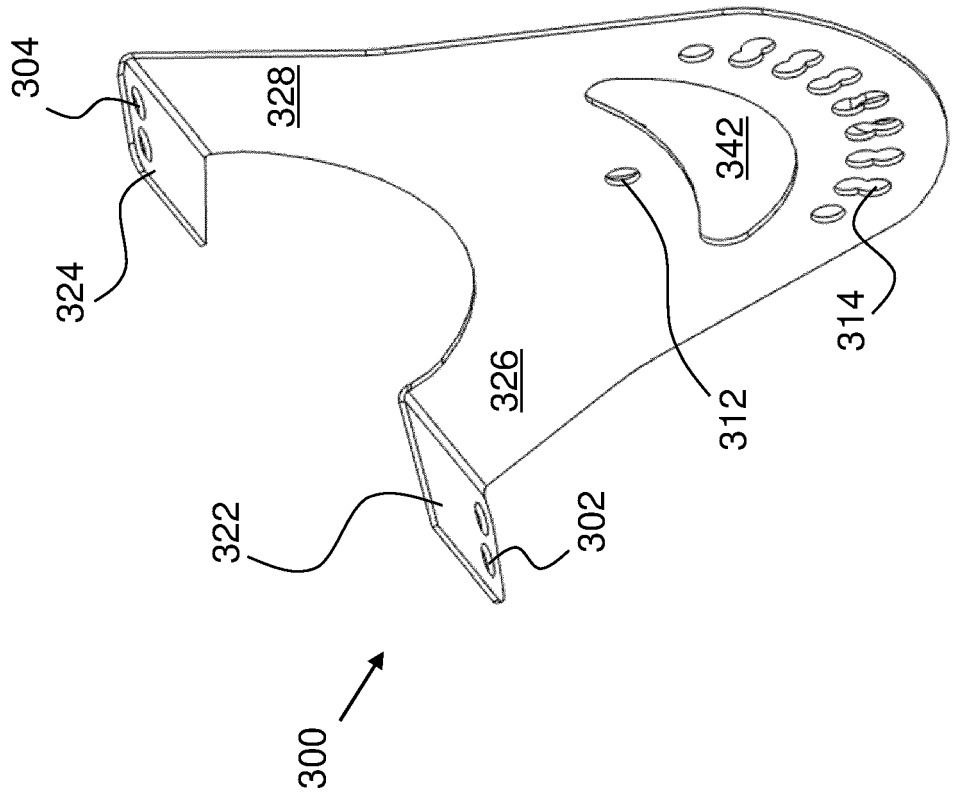

212
304´
300
312´
314´
328
324
326
322
200
342
422
424
400
302´
100
500

Fig. 5


304
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324
342
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326
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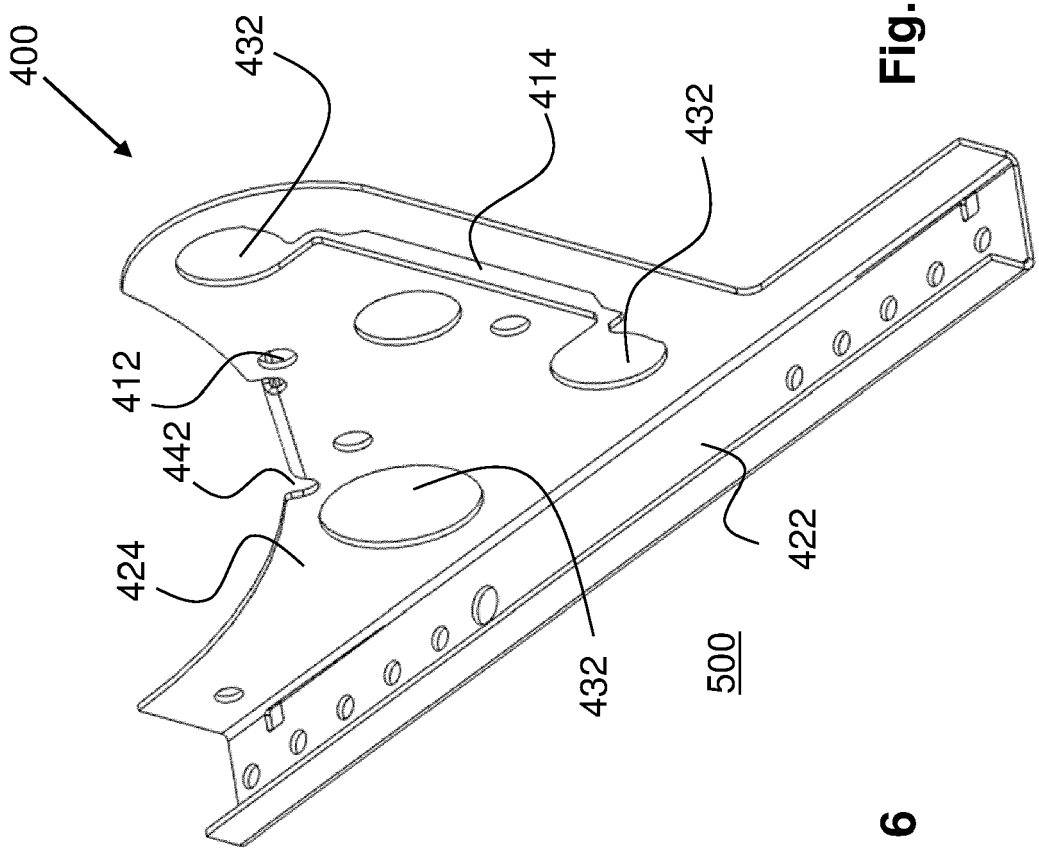
322
302
300

Fig. 6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432
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442
424
422
432
500

Fig. 7

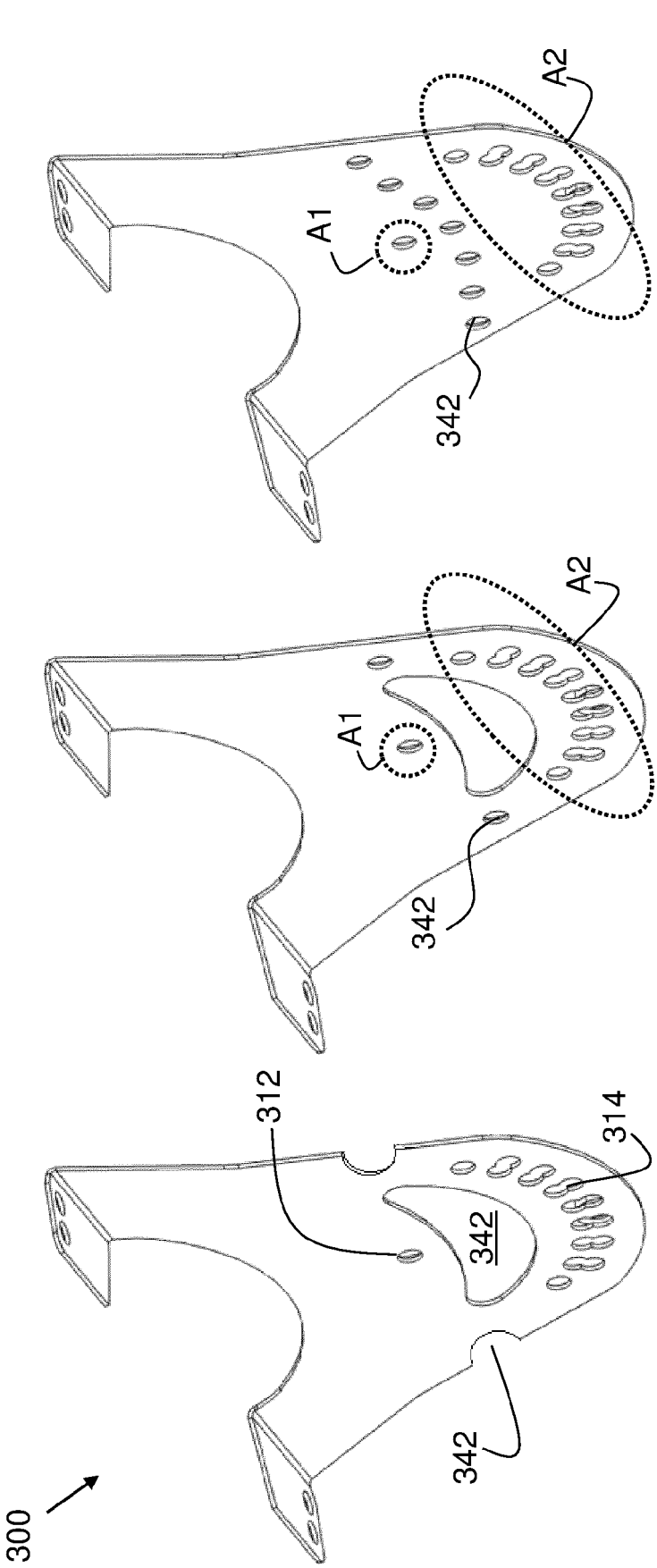

Fig. 8

Fig. 9

Fig. 10

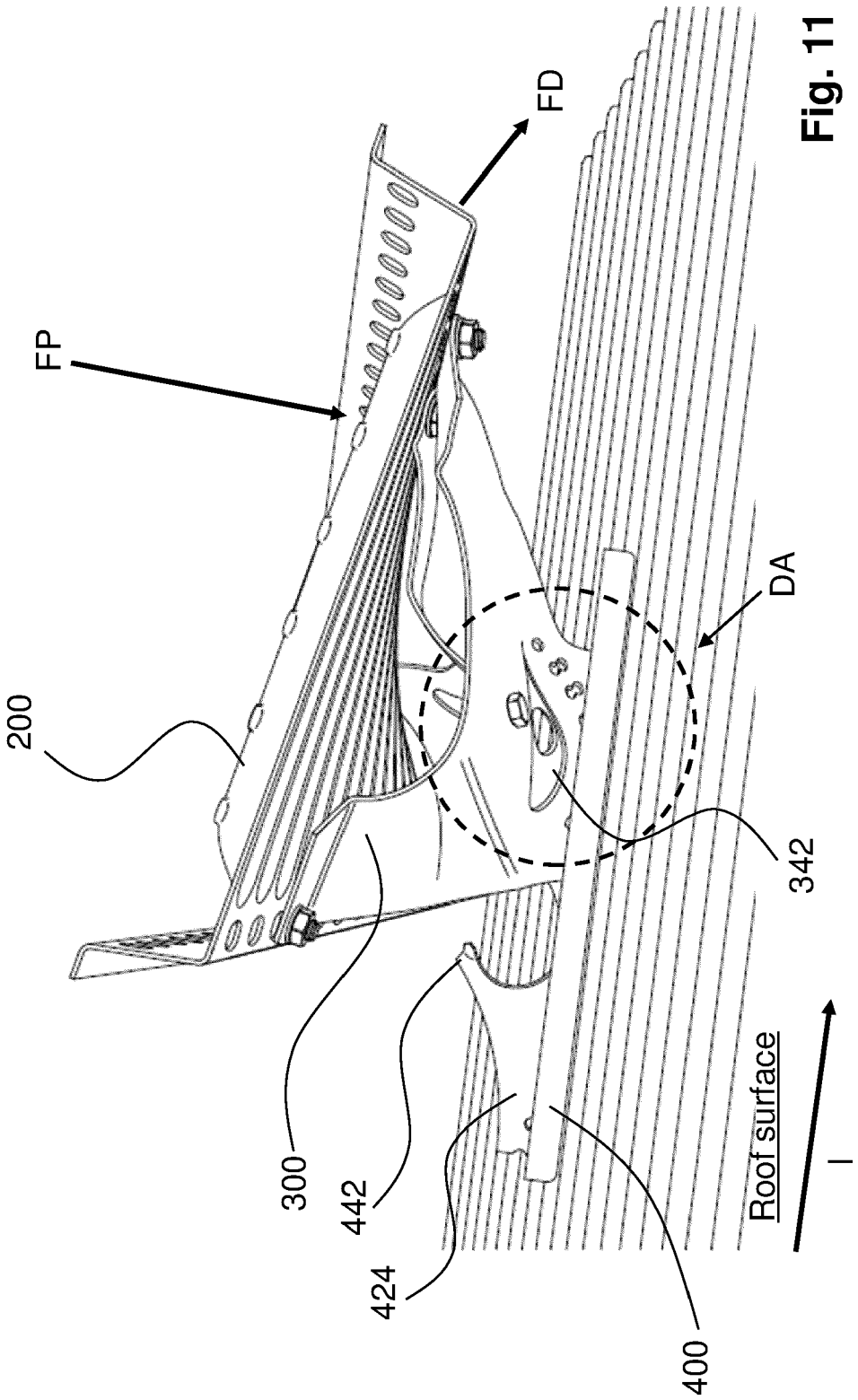

Fig. 11

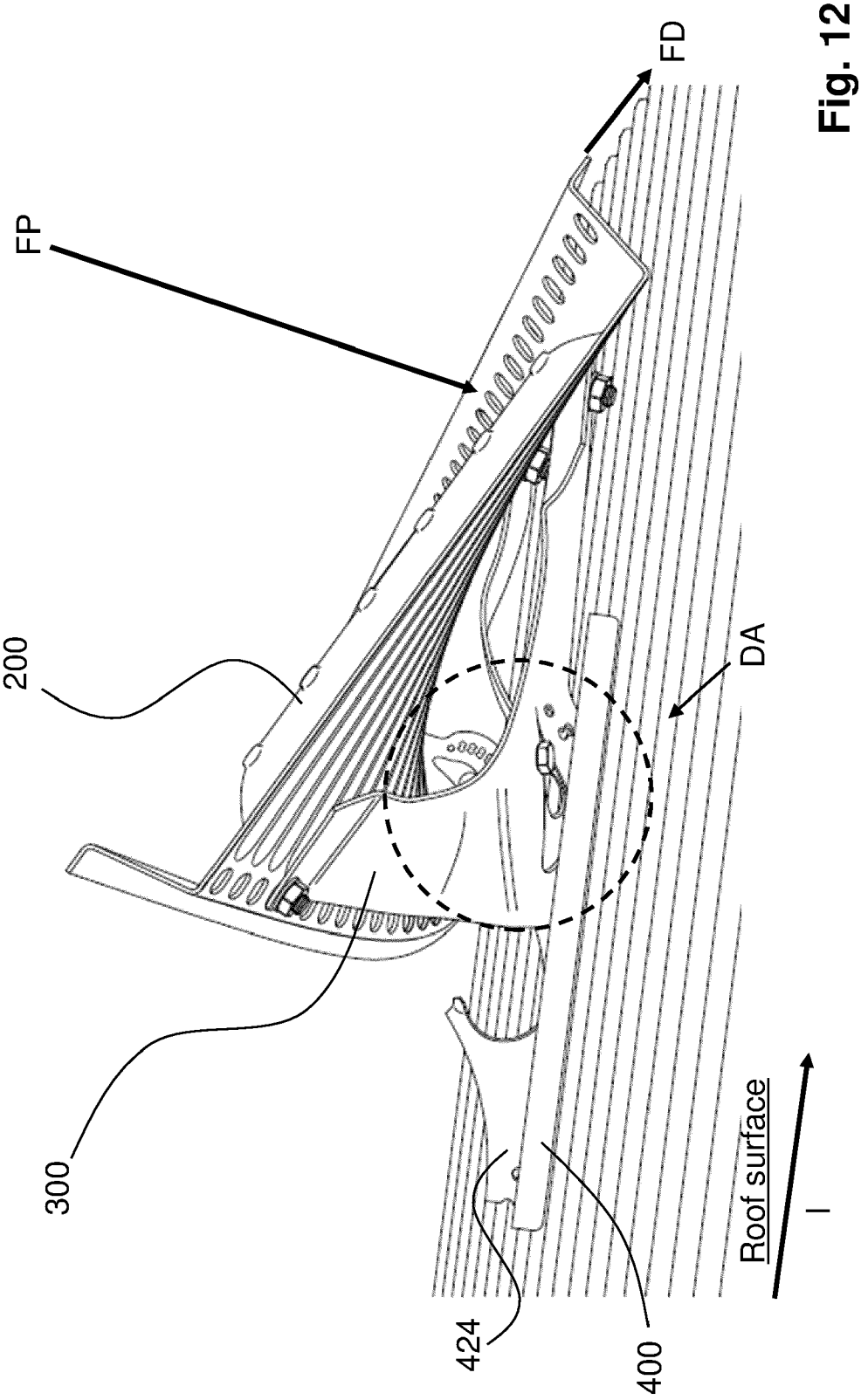

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 7267

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

E04D
E06C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 July 2022	Tran, Kim Lien

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