



(11)

EP 4 111 029 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
24.04.2024 Bulletin 2024/17

(51) International Patent Classification (IPC):
E21B 41/00 ^(2006.01) **E21B 33/037** ^(2006.01)
E21B 41/08 ^(2006.01) **E21B 43/017** ^(2006.01)

(21) Application number: **21711392.7**

(52) Cooperative Patent Classification (CPC):
E21B 41/0007; E21B 33/037; E21B 41/0021;
E21B 41/08; E21B 43/017

(22) Date of filing: **25.02.2021**

(86) International application number:
PCT/NO2021/050049

(87) International publication number:
WO 2021/173000 (02.09.2021 Gazette 2021/35)

(54) PROTECTIVE STRUCTURE

SCHUTZSTRUKTUR

STRUCTURE DE PROTECTION

(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

- **SPALDER, Brynjulf**
1385 ASKER (NO)
- **SCHÜLLER, Rolf Barfod**
1440 DRØBAK (NO)

(30) Priority: **28.02.2020 GB 202002848**

(74) Representative: **Zacco Norway AS**
P.O. Box 488 Skøyen
0213 Oslo (NO)

(43) Date of publication of application:
04.01.2023 Bulletin 2023/01

(73) Proprietor: **Aker Solutions AS**
1325 Lysaker (NO)

(56) References cited:
WO-A1-98/04805 WO-A2-2013/050411
GB-A- 2 355 034 GB-A- 2 426 266
GB-A- 2 514 191

(72) Inventors:
• **KNUDTZON, Christopher**
0282 OSLO (NO)

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 4 111 029 B1

Description

Technical field

[0001] The present disclosure relates to a structure for permitting overtrawling of subsea equipment and a method for installing a structure for permitting overtrawling of subsea equipment.

Background

[0002] In many industries there can be a need to perform operations at a subsea location. For example, in the offshore energy industry (e.g. including the oil and gas industry and the offshore renewables industries), the installation of power transmission equipment, power hubs, hydrocarbon wells and other equipment in a subsea location may be necessary. In particular, offshore wind and solar power generation often involves the establishment of arrays of wind turbines and/or solar panels in an offshore location. Such arrays require subsea power transmission, which often involves the installation of junction boxes, power transmission hubs and other installations subsea (e.g. on the seabed). In the oil and gas industry, hydrocarbon reserves are often located at offshore locations. In order to access these reserves, subsea operations are necessary in order to install drilling and production equipment for accessing hydrocarbon reservoirs. Again, such equipment may take the form of installations on the sea floor, which may permit access to hydrocarbon wells, for example. While subsea installations are necessary in order to access hydrocarbon reserves and/or establish offshore renewable power generation, they may also create their own problems.

[0003] The practice of trawling often involves pulling a net across the sea floor, and may be an effective means of fishing, or of marine research. This practice can, however, be damaging to subsea installations on the sea floor and, equally, subsea installations may cause damage to trawling nets and vessels where the two become entangled. In many instances, such damage can be limited by the installation of a protective structure around subsea installations that directs trawling nets away from parts of subsea installations on which they may become entangled. In many territories where both trawling and subsea installations are common, it is standard practice to provide subsea installations with protective structures to mitigate any damage that may occur.

[0004] While mitigating damage to both subsea installations, and to trawling nets and vessels, is beneficial, such protective structures can be complex, expensive and time consuming to install. There is therefore a need to provide a protective structure for subsea equipment that is simple, cheap and quick to install.

[0005] GB2514191 discloses a self-aligning subsea structure for mounting a marine riser on a hollow post of a surface casing, the structure being provided with a plurality of tubular receptacles which are secured to the riser

via lateral support arms, and which are provided with a plurality of springs. As the marine riser is mounted on the hollow post, each of the tubular receptacles is positioned on one of a plurality of guide posts, the springs acting to centre each tubular receptacle on its respective guide post, and thus to ensure correct alignment of the riser and the hollow post.

[0006] GB2355034 discloses a subsea structure which is configured to be placed on the seabed, the structure having predetermined mounting locations to receive pre-fabricated weights for holding the structure to the seabed.

[0007] WO98/04805 discloses an overtrawable protection envelope for a subsea structure which is anchored by connecting it to the subsea structure which is it to protect.

[0008] WO2013/050411 discloses a subsea well template with an underwater vehicle docking station.

[0009] GB2426266 discloses a subsea protection structure including a self-supporting shell comprising a surface made up of a plurality of angularly interconnected facets, with stiffening elements arranged where adjacent facets meet.

Summary

[0010] It is an object of the present disclosure to mitigate, alleviate or eliminate one or more of the above-identified deficiencies and disadvantages in the prior art and solve at least the above mentioned problem.

[0011] According to a first aspect there is provided a subsea system comprising a support arrangement and a structure for permitting overtrawling of subsea equipment, the structure comprising: a protective body; an engagement arrangement extending from the protective body parallel to an engagement axis; a plurality of deflection legs attached to the protective body, for deflecting trawling equipment; the engagement arrangement configured to be received by the support arrangement such that a clearance gap exists between the support arrangement and the engagement arrangement such that application of a force having a component perpendicular to the engagement axis causes relative movement and engagement between the engagement arrangement and the support arrangement so as to restrict further relative movement between the engagement arrangement and the support arrangement.

[0012] In use, the structure may come into contact with trawling equipment (and other fishing or research equipment being used on the sea floor), which may damage said fishing/research equipment, or subsea equipment positioned on the sea floor (e.g. oil and gas related equipment) if not protected. The structure acts to protect said equipment.

[0013] Upon contact with the structure, the fishing/research (e.g. trawling) equipment may exhibit a force on the structure. Said force may cause relative movement between the engagement arrangement of the structure

and a support arrangement, causing the two to come into contact. The contact between the two may result in a force as a result of friction between the engagement arrangement and the support arrangement, which may serve to limit further movement of the structure while there is contact between the structure and fishing/research equipment (e.g. trawling equipment).

[0014] The loose fit between the engagement arrangement and the support arrangement, resulting in a clearance gap therebetween, may permit a very simple installation, where the engagement arrangement is slidably engaged with the support arrangement, and is simply lowered into place without the requirement for further fastening means. Further, the weight of the structure, plus the force provided by the friction between the support arrangement and the engagement arrangement, may be sufficient to hold the structure in place to protect an item of subsea equipment without requiring the need for complex installation. Therefore, the presently described examples may provide a structure for the protection of subsea equipment that is simpler and cheaper to install than those in existence.

[0015] A second example relates the structure, wherein the protective body comprises an upper portion and a lower portion, the engagement arrangement extending from the lower portion, and the plurality of deflection legs being attached to the protective body at the upper portion.

[0016] A third example relates to the structure, wherein the engagement arrangement comprises a plurality of elongate members extending from the protective body parallel to the engagement axis.

[0017] A fourth example relates to the structure, wherein the engagement arrangement comprises four elongate members extending from the protective body parallel to the engagement axis.

[0018] A fifth example relates to the structure configured to be received by a support arrangement comprising at least one sleeve, wherein the engagement arrangement is configured to be received inside the at least one sleeve.

[0019] A sixth example relates to the structure, wherein the application of a force having a component perpendicular to the engagement axis causes relative rotational movement between the engagement arrangement and the support arrangement.

[0020] A seventh example relates to the structure, wherein the engagement between the engagement arrangement and the support arrangement results in engagement therebetween at two separate locations.

[0021] An eighth example relates to the structure, wherein the engagement between the engagement arrangement and the support arrangement provides a locking effect to prevent movement between the engagement arrangement and the support arrangement.

[0022] A ninth example relates to the structure, wherein relative rotation of the engagement arrangement relative to the support arrangement causes the engagement therebetween.

[0023] A tenth example relates to the structure, wherein the plurality of deflection legs extend obliquely relative to the engagement axis, from an attachment point on the protective body in a direction towards the engagement arrangement.

[0024] An eleventh example relates to the structure, wherein at least one of the plurality of deflection legs is configured to engage a secondary engagement arrangement, such that a clearance gap exists between the at least one deflection leg and the secondary engagement arrangement, and such that application of a force having a component perpendicular to the engagement axis causes relative movement and engagement between the secondary engagement arrangement and the at least one deflection leg so as to restrict further relative movement between the secondary engagement arrangement and the at least one deflection leg.

[0025] A twelfth example relates to the structure, wherein at least one of the engagement arrangement and the support arrangement comprises a surface feature at a point of engagement therebetween to assist to restrict movement between the engagement arrangement and the support arrangement.

[0026] A thirteenth example relates to the structure comprising a support arrangement for receiving the engagement arrangement.

[0027] A fourteenth example relates to the structure, wherein the support arrangement comprises at least two sleeve members for receiving the engagement arrangement.

[0028] According to a second aspect there is provided a method for installing a subsea system comprising a support arrangement and a structure for permitting over-trawling of subsea equipment, comprising: providing the structure comprising: a protective body; an engagement arrangement extending from the protective body parallel to an engagement axis; and a plurality of deflection legs attached to the protection body for deflecting trawling equipment; positioning the structure such that the engagement arrangement is received in the support arrangement, so as to have a clearance gap between the support arrangement and the engagement arrangement such that application of a force having a component perpendicular to the engagement axis causes relative movement and engagement between the engagement portion and the support arrangement so as to restrict further relative movement between the engagement arrangement and the support arrangement.

[0029] The present disclosure will become apparent from the detailed description given below. The detailed description and specific examples disclose preferred embodiments of the disclosure by way of illustration only. Those skilled in the art understand from guidance in the detailed description that changes and modifications may be made within the scope of the disclosure.

[0030] Hence, it is to be understood that the herein disclosed disclosure is not limited to the particular component parts of the device described or steps of the meth-

ods described since such device and method may vary. It is also to be understood that the terminology used herein is for purpose of describing particular embodiments only, and is not intended to be limiting. It should be noted that, as used in the specification and the appended claims, the articles "a", "an", "the", and "said" are intended to mean that there are one or more of the elements unless the context explicitly dictates otherwise. Thus, for example, reference to "a unit" or "the unit" may include several devices, and the like. Furthermore, the words "comprising", "including", "containing" and similar wordings does not exclude other elements or steps.

Brief descriptions of the drawings

[0031] The above objects, as well as additional objects, features and advantages of the present disclosure, will be more fully appreciated by reference to the following illustrative and non-limiting detailed description of example embodiments of the present disclosure, when taken in conjunction with the accompanying drawings.

Figure 1 is a side view of a structure for allowing overtrawling of subsea equipment.

Figures 2A and 2B illustrate detail of engagement between an engagement arrangement and a support arrangement.

Detailed description

[0032] The present description provides an improved structure for permitting overtrawling of subsea equipment and method for installing structure for permitting overtrawling of subsea equipment. According to an example embodiment there is provided a structure for permitting overtrawling of subsea equipment, comprising: a protective body; an engagement arrangement extending from the protective body parallel to an engagement axis; a plurality of deflection legs attached to the protective body, for deflecting trawling equipment; the engagement arrangement configured to be received by a support arrangement such that a clearance gap exists between the support arrangement and the engagement arrangement such that application of a force having a component perpendicular to the engagement axis causes relative movement and engagement between the engagement arrangement and the support arrangement so as to restrict further relative movement between the engagement arrangement and the support arrangement.

[0033] Figure 1 illustrates a side view of a structure 10 for allowing overtrawling of subsea equipment. The structure comprises a protective body, which in this example is shown as a frame 12. The frame 12 of Figure 1 takes the form of a rectangular prism, and in this example houses a subsea Xmas tree 14 - in this case, a vertical Xmas tree. In other examples, the structure 10 may be configured such that the frame 12 houses a junction box or

subsea power hub of an array of wind turbines or solar panels. The skilled person will appreciate that other shapes of protective body 10 are possible, depending on the dimensions of the piece of equipment to be situated therein. For example, a triangular prism shape may equally be possible, as may a pentagonal or hexagonal prism shape. For clarity of description, and to avoid unnecessary repetition, the following description will refer to the illustrated subsea equipment as a Xmas tree. However, it should be understood that, as described above, the subsea equipment could equally take other forms, such as a junction box or subsea power hub.

[0034] Extending from the frame 12 is an engagement arrangement 16. In this example, the engagement arrangement 16 extends vertically downwardly from the frame 12 in line with an engagement axis 26 which in this example is also the central axis of the structure 10, however other configurations may be possible. For example, the engagement arrangement 16 may extend at an angle from the frame 12, for example, were the frame to be placed on a non-level surface. This may be the case were the structure 10 to be placed on an uneven section of sea floor. As shown, the engagement arrangement 16 comprises at least two elongate members 18, although may comprise more that are not shown in this embodiment. The skilled reader will understand that, while two elongate members 18 are shown here, others may be present that are not visible in the view shown in Figure 1. Further, the number of elongate members 18 may depend on the shape of the protective body 12. For example, the protective body 12 may comprise an elongate member 18 located at each corner thereof. As such, where the protective body 12 has a rectangular prism shape, then the protective body 12 may comprise four elongate members 18, where the protective body 12 has a triangular prism shape, the protective body 12 may comprise three elongate members 18, where the protective body 12 comprises a pentagonal prism shape, the protective body 12 may comprise five elongate members 18, etc..

[0035] The simple extension of the engagement arrangement 16 from the protective body (e.g. the frame 12) may facilitate simple engagement of the protective body with a support arrangement, for example by simply lowering the protective body onto the support arrangement, and without any need for reconfiguration of a part or parts of the protective body. Further, having a plurality of elongate members may assist to prevent rotation of the protective body relative to the support structure, and may facilitate a more precise alignment of the protective body with the engagement arrangement.

[0036] As shown, the engagement arrangement 16 is received in a support arrangement 20. The support arrangement 20 of Figure 1 is coupled to the Xmas tree 14 via tree structure 22, although it may be possible to couple the support arrangement 20 to an alternative structure. The support arrangement 20 may be permanently coupled to the Xmas tree 14 (or other piece of subsea

equipment). For example, the support arrangement 20 may form part of a guide base on the Xmas tree 14, or other piece of subsea equipment. In some examples, the support arrangement 20 may comprise further uses, other than as a support arrangement for the structure 10. For example, where the support arrangement 20 is, or comprises, a guide base, then the support arrangement may also be used for other purposes, such as for guiding tooling/equipment into the Xmas tree 14, or for the attachment of conduits to the Xmas tree 14.

[0037] In other examples, the support arrangement 20 may be coupled to an anchor point on the seabed, and it is possible that the support arrangement 20 is separate from the Xmas tree 14. The support arrangement 20 comprises two support sleeves in this example, each of which correspond to an elongate member 18. As previously described in relation to the elongate members 18 of the protective body 12, the support arrangement 20 may comprise more or fewer than two sleeves, as shown. Additionally, the number of sleeves may correspond to the shape of the frame of the protective body. The sleeves shown have a hollow cylindrical shape, and are open at each end to permit an elongate member 18 to pass through. However, the skilled reader will appreciate that other shapes may be possible. For example, an elongate member 18 and/or a sleeve of the support arrangement 20 may have a square cross-section. Having a sleeve in the support arrangement 20 may facilitate a simple engagement with the engagement arrangement 16, by permitting the engagement arrangement 16 to be slidably received in the support arrangement 20 without the need for reconfiguration of the support arrangement, while also providing secure engagement.

[0038] Although not shown in Figure 1, the engagement arrangement 16 may comprise a surface feature to assist in restricting movement when engaged with the support arrangement 20. For example, the elongate member 18 may comprise a roughened outer surface, or a roughened portion of outer surface. The roughened portion may provide increased friction upon engagement with the support arrangement 20 so as to assist to prevent relative movement, while relative movement therebetween would be permitted in where the engagement arrangement 16 and the support arrangement 20 are not engaged. Additionally or alternatively, the support arrangement 20 may comprise a roughened surface. For example, the inner surface (or a portion of the inner surface) of a sleeve may be roughened. Where the engagement arrangement 16 and/or the support arrangement 20 comprises a roughened portion, then positioning of the roughened portion may be at a location likely to experience engagement between the engagement arrangement 16 and the support arrangement 20.

[0039] Additionally or alternatively, the engagement arrangement 16 and the support arrangement 20 may each comprise corresponding profiles that may engage to assist to prevent relative movement therebetween. For example the engagement arrangement 16 and the sup-

port arrangement 20 may each comprise a toothed profile that are configurable to engage. A toothed profile may be located on an outer surface of an elongate member 18 or the engagement arrangement 16, while a toothed profile may be located on an inner surface of a cylinder of the support arrangement 20.

[0040] When the engagement arrangement 16 is received by the support arrangement 20, the elongate member 18 may come to rest on the sea floor, or may come to rest as a result of an abutment between the support arrangement 20 and the frame 12.

[0041] The structure 10 additionally comprises a plurality of deflection legs 24 attached thereto. In this example, the deflection legs 24 are attached to the frame 12. As can be seen the deflection legs 24 extend obliquely relative to the engagement axis 26, and in this example the deflection legs 24 extend away from the engagement axis 26. The structure 10 (here, the frame 12 of the structure 10) comprises an upper portion 28 to which the legs 24 are attached, and a lower portion 30 from which the engagement arrangement 16 extends. The upper portion 28 may refer to the upper half of the structure 10 (e.g. the frame 12), while the lower portion 30 may refer to the lower half. Alternatively, the upper portion may refer to any portion located upwardly (with the structure 10 in the installation position as shown in Figure 1) of the lower portion 30 from which the engagement arrangement 16 extends. In some examples, the lower portion 30 may be defined by the location of the engagement arrangement 16, while the upper portion 28 may be any location on the structure 10 located upwardly thereof (when in the installation position).

[0042] The oblique extension of the deflection legs 24 relative to the engagement axis 26 may assist to guide an object away from the illustrated subsea Xmas tree 14. Further, the deflection legs 24 being attached to an upper portion of the structure 10 (in this case, the frame 12) may permit an object to be guided away from the subsea Xmas tree 14 and over the top of the structure, before allowing it to pass down the other side of the structure. Such guidance may therefore eliminate or reduce damage to both the subsea Xmas tree 14 and an object passing over the structure 10.

[0043] The deflection legs 24 may additionally engage a secondary engagement arrangement 32. The secondary engagement arrangement 32 may be installed on the sea floor, and may be independent of the subsea Xmas tree 14. Alternatively, the engagement arrangement 32 may comprise a connection to the subsea Xmas tree 14, or the support arrangement 20. The secondary engagement arrangement 32 may comprise a recess or groove into which a portion of a deflection leg 24 may be positioned. Additionally or alternatively, the secondary engagement arrangement 32 may comprise a protruding member against which, or into which, a deflection leg 24 may be placed. The deflection legs 24 may be placed relative to the secondary engagement arrangement 32 such that a clearance gap exists between the secondary

engagement arrangement 32 and the deflection legs 24, in a similar way to there being a clearance gap between the engagement arrangement 16 and the support arrangement 20.

[0044] Matter may be removed from the solid structure of the deflection legs 24. The deflection legs 24 may be hollow, and/or may comprise a void 34 or a plurality of voids 34 therein. Removal of such matter may permit the structure 10 to be more lightweight than otherwise. Additionally, it may also assist to minimise the effect of sub-sea currents on the structure 10, by permitting fluid to flow through the structure, rather than impinge upon its surface.

[0045] As described, in instances where an object comes into contact with the structure 10, the deflection legs 24 assist to guide said object away from the subsea Xmas tree 14. During contact between the structure 10 and the object, a force acts on the structure 10. An example of such a force is illustrated by arrow 40. In this case, the force acts at an angle of 20 degrees to the horizontal, and therefore comprises a horizontal component (e.g. the component is horizontal in the configuration shown in Figure 1, although this component of the force may also be considered to be acting perpendicular to the engagement axis 26). The force acting on the structure 10 may cause movement of the structure 10 (e.g. rotational movement), as well as the engagement arrangement 16 that extends therefrom. As the support arrangement 20 is not directly connected to the structure 10 (or to the engagement arrangement 16), then a force 40 acting on the structure 10 may not result in movement of the support arrangement 20. As such, the force 40 may cause relative movement between the structure 10 and the support arrangement 20. Due to the clearance gap between the support arrangement 20 and the engagement arrangement, there may be either, or both of, translational or rotational movement of the structure 10 relative to the support arrangement 20.

[0046] In the illustrated example of Figure 1, there is rotational movement between the structure 10 and the support arrangement 20, caused by the force 40 impacting on the structure 10. As illustrated, the engagement arrangement 16 is in contact with the support arrangement 20 at two points at an at least one of the engagement arrangement 16 and support arrangement 20 pairings, which is illustrated by arrows 42, 44. This contact between the engagement arrangement 16 and the support arrangement 20 may provide a locking effect to prevent, or at least restrict, movement of the support arrangement (and therefore the structure 10) relative to the engagement arrangement 20. In addition, similar locking may occur between the deflection legs 24 of the structure and the secondary support structure 32, which may further assist to provide a locking effect of the structure. The locking effect may prevent upward movement of the structure 10 as a result of any upward component of force that may act upon the structure, for example as a result of an object (such as a trawler net) passing thereover.

As such, the structure may simply be held in place by virtue of the weight of the structure, plus the counteracting force provided by friction between the support arrangement 20 and the engagement arrangement 16.

[0047] A further locking effect may be achieved as a result of the engagement between the deflection legs 24 and the secondary engagement arrangement 32, which may also comprise a clearance gap therebetween.

[0048] Illustrated in Figure 2A and 2B are examples of engagement between a support arrangement 20 and an engagement arrangement 16. As can be seen in Figure 2A, the engagement arrangement 16 contacts the support arrangement at two contact locations, 16a, 16b, owing to the support arrangement 20 being in the form of a cylindrical sleeve, and the engagement arrangement 16 being in the form of a cylinder, rotated relative to the support arrangement 20. Each of the contact locations 16a, 16b, are separate and distinct from one another. Having two contact locations 16a, 16b, may increase the area of contact between the engagement arrangement 16 and the support arrangement 20, which may assist to lock the engagement arrangement 16 in the support arrangement 20 as a result of friction therebetween.

[0049] Figure 2b illustrates an example of a surface feature 50 that may be included at a known contact location 16a between the engagement arrangement 16 and the support arrangement 20. In this case, the engagement arrangement 16 is shown just prior to engagement with the support arrangement 20, and the surface feature comprises a toothed profile. In this example, a surface feature 50 is located on both the outer surface of the engagement arrangement 16 and the inner surface of the support arrangement 20. Although both surfaces are shown as having surface features 50, another possibility may be that only one surface comprises a surface feature. The surface feature may equally be a roughened surface, rather than a toothed surface, or indeed any other surface feature that may increase the friction force between the engagement arrangement 16 and the support arrangement 20.

[0050] The second aspect of this disclosure is of a method for installing a structure for permitting overtrawling of subsea equipment, comprising: providing a structure comprising: a protective body; an engagement arrangement extending from the protective body parallel to an engagement axis; and a plurality of deflection legs for deflecting trawling equipment; positioning the structure such that the engagement arrangement is received in a support arrangement, so as to have a clearance gap between the support arrangement and the engagement arrangement such that application of a force having a component perpendicular to the engagement axis causes relative movement and engagement between the engagement portion and the support arrangement so as to restrict further relative movement between the engagement arrangement and the support arrangement.

[0051] The positioning of the structure may comprise the lowering of the protective body and engagement ar-

rangement onto a support arrangement. Where the engagement arrangement comprises a plurality of elongate members extending parallel to the engagement axis, and the support arrangement comprises a plurality of sleeves then the number of elongate members may correspond to the number of sleeves. A central axis of one, some or each of the elongate members may be aligned with a central axis of one, some or each of the sleeves, and the protective body may then be lowered onto the support arrangement, such that the engagement arrangement is received in the support arrangement.

[0052] Where, for example, operations are required to be performed on the subsea equipment, the structure may be able to be lifted from the subsea equipment. Due to the nature of the slidable engagement between the engagement arrangement and the support arrangement, such lifting may take place without requiring reconfiguration of the structure.

[0053] The person skilled in the art realises that the present disclosure is not limited to the preferred embodiments described above. The person skilled in the art further realises that modifications and variations are possible within the scope of the appended claims. For example, the described structure may be simply be used to permit protection of subsea equipment. While a subsea Xmas tree is used in the described examples, any subsea equipment may be protected, such as a subsea power hub or junction box. Additionally, variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the disclosure, from a study of the drawings, the disclosure, and the appended claims.

Claims

1. A subsea system comprising a support arrangement (20) and a structure (10) for permitting overtrawling of subsea equipment, the structure (10) comprising:

a protective body (12);
 an engagement arrangement (16) extending from the protective body (12) parallel to an engagement axis (26);
 a plurality of deflection legs (24) attached to the protective body (12) for deflecting trawling equipment;
 wherein that the engagement arrangement (16) is configured to be received by the support arrangement (20) such that a clearance gap exists between the support arrangement (20) and the engagement arrangement (16) such that application of a force having a component perpendicular to the engagement axis (26) causes relative movement and engagement between the engagement arrangement (16) and the support arrangement (20) so as to restrict further relative movement between the engagement arrange-

ment (16) and the support arrangement (20).

2. The structure (10) according to claim 1, wherein the protective body (12) comprises an upper portion and a lower portion, the engagement arrangement (16) extending from the lower portion, and the plurality of deflection legs (24) being attached to the protective body (12) at the upper portion.
3. The structure (10) according to claim 1 or 2, wherein the engagement arrangement (16) comprises a plurality of elongate members (18) extending from the protective body (12) parallel to the engagement axis (26).
4. The structure (10) according to claim 3, wherein the engagement arrangement (16) comprises four elongate members (18) extending from the protective body (12) parallel to the engagement axis (26).
5. The structure (10) according to any preceding claim wherein the support arrangement (20) comprises at least one sleeve, wherein the engagement arrangement (16) is configured to be received inside the at least one sleeve.
6. The structure (10) according to any preceding claim, wherein the application of a force having a component perpendicular to the engagement axis (26) causes relative rotational movement between the engagement arrangement (16) and the support arrangement (20).
7. The structure (10) according to any preceding claim, wherein the engagement between the engagement arrangement (16) and the support arrangement (20) results in engagement therebetween at two separate locations.
8. The structure (10) according to any preceding claim, wherein the engagement between the engagement arrangement (16) and the support arrangement (20) provides a locking effect to prevent movement between the engagement arrangement (16) and the support arrangement (20).
9. The structure (10) according to any preceding claim, wherein relative rotation of the engagement arrangement (16) relative to the support arrangement (20) causes the engagement therebetween.
10. The structure (10) according to any preceding claim, wherein the plurality of deflection legs (24) extend obliquely relative to the engagement axis (26), from an attachment point on the protective body (12) in a direction towards the engagement arrangement (16).

11. The structure (10) according to any preceding claim, wherein at least one of the plurality of deflection legs (24) is configured to engage a secondary engagement arrangement (32), such that a clearance gap exists between the at least one deflection leg (24) and the secondary engagement arrangement (32), and such that application of a force having a component perpendicular to the engagement axis (26) causes relative movement and engagement between the secondary engagement arrangement (32) and the at least one deflection leg (24) so as to restrict further relative movement between the secondary engagement arrangement (32) and the at least one deflection leg (24).
12. The structure (10) according to any preceding claim, wherein at least one of the engagement arrangement (16) and the support arrangement (20) comprises a surface feature at a point of engagement therebetween to assist to restrict movement between the engagement arrangement (16) and the support arrangement (20).
13. The structure (10) according to any preceding claim, comprising a support arrangement (20) for receiving the engagement arrangement (16).
14. The structure (10) according to claim 13, wherein the support arrangement (20) comprises at least two sleeve members for receiving the engagement arrangement (16).
15. A method for installing a subsea system comprising a support arrangement (20) and a structure (10) for permitting overtrawling of subsea equipment, comprising:
providing the structure (10) comprising:
- a protective body (12);
 - an engagement arrangement (16) extending from the protective body (12) parallel to an engagement axis (26); and
 - a plurality of deflection legs (24) attached to the protective body (12) for deflecting trawling equipment;
- wherein the method further comprises positioning the structure (10) such that the engagement arrangement (16) is received in the support arrangement (20), so as to have a clearance gap between the support arrangement (20) and the engagement arrangement (16) such that application of a force having a component perpendicular to the engagement axis (26) causes relative movement and engagement between the engagement arrangement (16) and the support arrangement (20) so as to restrict further relative movement between the engagement arrangement (16) and the support arrangement (20).

Patentansprüche

1. Unterwassersystem, das eine Stützenordnung (20) und eine Struktur (10) umfasst, die Schleppnetzfishen über Unterwasserausrüstung ermöglicht, wobei die Struktur (10) Folgendes umfasst:

einen Schutzkörper (12);
eine Eingriffsanordnung (16), die sich von dem Schutzkörper (12) parallel zu einer Eingriffsachse (26) erstreckt;
eine Vielzahl von Ablenkungsschenkeln (24), die an dem Schutzkörper (12) zum Ablenken von Schleppnetzfishereiausrüstung befestigt ist;
wobei die Eingriffsanordnung (16) dazu konfiguriert ist, von der Stützenordnung (20) aufgenommen zu werden, so dass ein Zwischenraum zwischen der Stützenordnung (20) und der Eingriffsanordnung (16) besteht, so dass ein Ausüben einer Kraft, die eine Komponente aufweist, die senkrecht zu der Eingriffsachse (26) ist, eine relative Bewegung und einen Eingriff zwischen der Eingriffsanordnung (16) und der Stützenordnung (20) verursacht, um eine weitere relative Bewegung zwischen der Eingriffsanordnung (16) und der Stützenordnung (20) einzuschränken.
2. Struktur (10) nach Anspruch 1, wobei der Schutzkörper (12) einen oberen Teil und einen unteren Teil umfasst, die Eingriffsanordnung (16) sich von dem unteren Teil erstreckt und die Vielzahl von Ablenkungsschenkeln (24) an dem oberen Teil an dem Schutzkörper (12) befestigt ist.
3. Struktur (10) nach Anspruch 1 oder 2, wobei die Eingriffsanordnung (16) eine Vielzahl von länglichen Elementen (18), die sich von dem Schutzkörper (12) parallel zu der Eingriffsachse (26) erstreckt, umfasst.
4. Struktur (10) nach Anspruch 3, wobei die Eingriffsanordnung (16) vier längliche Elemente (18), die sich von dem Schutzkörper (12) parallel zu der Eingriffsachse (26) erstrecken, umfasst.
5. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei die Stützenordnung (20) mindestens eine Hülse umfasst, wobei die Eingriffsanordnung (16) dazu konfiguriert ist, innen in der mindestens einen Hülse aufgenommen zu werden.
6. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei das Ausüben einer Kraft, die eine Komponente aufweist, die senkrecht zu der Eingriffsachse (26) ist, eine relative Drehbewegung zwischen der Eingriffsanordnung (16) und der Stützenordnung (20) verursacht.

7. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei der Eingriff zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) einen Eingriff dazwischen an zwei verschiedenen Stellen verursacht. 5
8. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei der Eingriff zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) einen Verriegelungseffekt bereitstellt, um eine Bewegung zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) zu verhindern. 10
9. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei die relative Drehbewegung der Eingriffsanordnung (16) relativ zu der Stützenanordnung (20) den Eingriff dazwischen verursacht. 15
10. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei die Vielzahl von Ablenkungsschenkeln (24) sich schräg relativ zu der Eingriffsachse (26) erstreckt, von einem Befestigungspunkt auf dem Schutzkörper (12) in einer Richtung zu der Eingriffsanordnung (16). 20
11. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei mindestens einer der Vielzahl von Ablenkungsschenkeln (24) dazu konfiguriert ist, in Eingriff mit einer sekundären Eingriffsanordnung (32) zu stehen, so dass ein Zwischenraum zwischen dem mindestens einen Ablenkungsschenkel (24) und der sekundären Eingriffsanordnung (32) besteht und so dass das Anwenden einer Kraft, die eine Komponente aufweist, die senkrecht zu der Eingriffsachse (26) ist, eine relative Bewegung und einen Eingriff zwischen der sekundären Eingriffsanordnung (32) und dem mindestens einen Ablenkungsschenkel (24) verursacht, um eine weitere relative Bewegung zwischen der sekundären Eingriffsanordnung (32) und dem mindestens einen Ablenkungsschenkel (24) zu einschränken. 25
30
12. Struktur (10) nach einem der vorhergehenden Ansprüche, wobei mindestens eine der Eingriffsanordnung (16) und der Stützenanordnung (20) ein Oberflächenmerkmal an einem Eingriffspunkt dazwischen umfasst, um ein Einschränken von Bewegung zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) zu unterstützen. 35
40
13. Struktur (10) nach einem der vorhergehenden Ansprüche, die eine Stützenanordnung (20) zum Aufnehmen der Eingriffsanordnung (16) umfasst. 45
50
14. Struktur (10) nach Anspruch 13, wobei die Stützenanordnung (20) mindestens zwei Hülselemente zum Aufnehmen der Eingriffsanordnung (16) umfasst. 55

15. Verfahren zum Installieren eines Unterwassersystems, das eine Stützenanordnung (20) und eine Struktur (10) umfasst, die Schleppnetzfischen über Unterwasserausrüstung ermöglicht, umfassend: Bereitstellen der Struktur (10), die Folgendes umfasst: 5

einen Schutzkörper (12);
eine Eingriffsanordnung (16), die sich von dem Schutzkörper (12) parallel zu einer Eingriffsachse (26) erstreckt; und
eine Vielzahl von Ablenkungsschenkeln (24), die an dem Schutzkörper (12) zum Ablenken von Schleppnetzfischereiausrüstung befestigt ist;
wobei das Verfahren ferner Positionieren der Struktur (10) umfasst, so dass die Eingriffsanordnung (16) in der Stützenanordnung (20) aufgenommen ist, um einen Zwischenraum zwischen der Stützenanordnung (20) und der Eingriffsanordnung (16) aufzuweisen, so dass ein Ausüben einer Kraft, die eine Komponente aufweist, die senkrecht zu der Eingriffsachse (26) ist, eine relative Bewegung und einen Eingriff zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) verursacht, um eine weitere relative Bewegung zwischen der Eingriffsanordnung (16) und der Stützenanordnung (20) einzuschränken.

Revendications

1. Système sous-marin comprenant un agencement de support (20) et une structure (10) pour permettre la surpêche au chalut d'un équipement sous-marin, la structure (10) comprenant : 35
 un corps protecteur (12) ;
 un agencement de mise en prise (16) s'étendant depuis le corps protecteur (12) de manière parallèle à un axe de mise en prise (26) ;
 une pluralité de pattes de déviation (24) fixées au corps protecteur (12) pour dévier l'équipement de pêche au chalut ;
 dans lequel l'agencement de mise en prise (16) est conçu pour être reçu par l'agencement de support (20) de telle sorte qu'un espace libre existe entre l'agencement de support (20) et l'agencement de mise en prise (16) de telle sorte que l'application d'une force présentant une composante perpendiculaire à l'axe de mise en prise (26) provoque un mouvement relatif et une mise en prise entre l'agencement de mise en prise (16) et l'agencement de support (20) de manière à restreindre davantage un mouvement relatif entre l'agencement de mise en prise (16) et l'agencement de support (20). 40
45
50
55

2. Structure (10) selon la revendication 1, dans laquelle le corps protecteur (12) comprend une partie supérieure et une partie inférieure, l'agencement de prise (16) s'étendant depuis la partie inférieure, et la pluralité de pattes de déviation (24) étant fixées au corps protecteur (12) au niveau de la partie supérieure. 5
3. Structure (10) selon la revendication 1 ou 2, dans laquelle l'agencement de mise en prise (16) comprend une pluralité d'éléments allongés (18) s'étendant depuis le corps protecteur (12) de manière parallèle à l'axe de mise en prise (26). 10
4. Structure (10) selon la revendication 3, dans laquelle l'agencement de mise en prise (16) comprend quatre éléments allongés (18) s'étendant depuis le corps protecteur (12) de manière parallèle à l'axe de mise en prise (26). 15
5. Structure (10) selon une quelconque revendication précédente, dans laquelle l'agencement de support (20) comprend au moins un manchon, dans laquelle l'agencement de mise en prise (16) est conçu pour être reçu à l'intérieur de l'au moins un manchon. 20
6. Structure (10) selon une quelconque revendication précédente, dans laquelle l'application d'une force présentant une composante perpendiculaire à l'axe de mise en prise (26) provoque un mouvement de rotation relatif entre l'agencement de mise en prise (16) et l'agencement de support (20). 25
7. Structure (10) selon une quelconque revendication précédente, dans laquelle la mise en prise entre l'agencement de mise en prise (16) et l'agencement de support (20) aboutit à une mise en prise entre eux au niveau de deux emplacements distincts. 30
8. Structure (10) selon une quelconque revendication précédente, dans laquelle la mise en prise entre l'agencement de mise en prise (16) et l'agencement de support (20) fournit un effet de verrouillage pour empêcher tout mouvement entre l'agencement de mise en prise (16) et l'agencement de support (20). 35
9. Structure (10) selon une quelconque revendication précédente, dans laquelle la rotation relative de l'agencement de mise en prise (16) par rapport à l'agencement de support (20) provoque la mise en prise entre eux. 40
10. Structure (10) selon une quelconque revendication précédente, dans laquelle la pluralité de pattes de déviation (24) s'étendent de manière oblique par rapport à l'axe de mise en prise (26), depuis un point de fixation sur le corps protecteur (12) dans une direction vers l'agencement de mise en prise (16). 45
11. Structure (10) selon une quelconque revendication précédente, dans laquelle au moins l'une de la pluralité de pattes de déviation (24) est conçue pour venir en prise dans un agencement de mise en prise secondaire (32), de telle sorte qu'un espace libre existe entre l'au moins une patte de déviation (24) et l'agencement de mise en prise secondaire (32), et de telle sorte que l'application d'une force présentant une composante perpendiculaire à l'axe de mise en prise (26) provoque un mouvement relatif et une mise en prise entre l'agencement de mise en prise secondaire (32) et l'au moins une patte de déviation (24) de manière à restreindre davantage un mouvement relatif entre l'agencement de mise en prise secondaire (32) et l'au moins une patte de déviation (24). 50
12. Structure (10) selon une quelconque revendication précédente, dans laquelle au moins l'un de l'agencement de mise en prise (16) et de l'agencement de support (20) comprend une caractéristique de surface au niveau d'un point de mise en prise entre eux pour aider à restreindre le mouvement entre l'agencement de mise en prise (16) et l'agencement de support (20). 55
13. Structure (10) selon une quelconque revendication précédente, comprenant un agencement de support (20) pour recevoir l'agencement de mise en prise (16).
14. Structure (10) selon la revendication 13, dans laquelle l'agencement de support (20) comprend au moins deux éléments de manchon pour recevoir l'agencement de mise en prise (16).
15. Procédé d'installation d'un système sous-marin comprenant un agencement de support (20) et une structure (10) pour permettre la surpêche au chalut d'un équipement sous-marin, comprenant : la fourniture de la structure (10) comprenant :
 - un corps protecteur (12) ;
 - un agencement de mise en prise (16) s'étendant depuis le corps protecteur (12) de manière parallèle à un axe de mise en prise (26) ; et
 - une pluralité de pattes de déviation (24) fixées au corps protecteur (12) pour dévier l'équipement de pêche au chalut ;
 dans lequel le procédé comprend en outre le positionnement de la structure (10) de telle sorte que l'agencement de mise en prise (16) est reçu dans l'agencement de support (20), de manière à avoir un espace libre entre l'agencement de support (20) et l'agencement de mise en prise (16) de telle sorte que l'application d'une force présentant une composante perpendiculaire à l'axe de mise en prise (26) provoque un mouve-

ment relatif et une mise en prise entre l'agencement de mise en prise (16) et l'agencement de support (20) de manière à restreindre davantage un mouvement relatif entre l'agencement de mise en prise (16) et l'agencement de support (20). 5

10

15

20

25

30

35

40

45

50

55

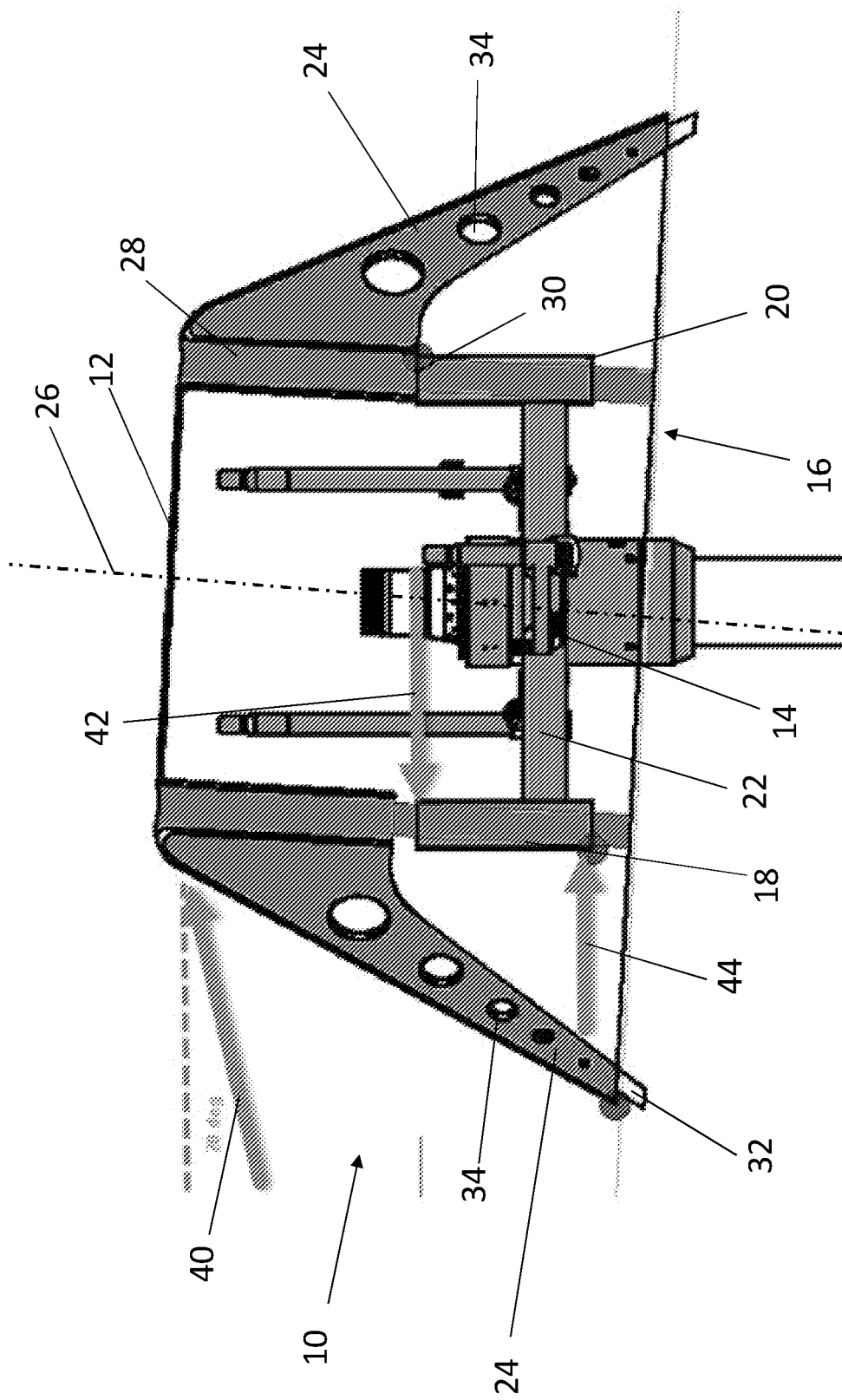


Figure 1

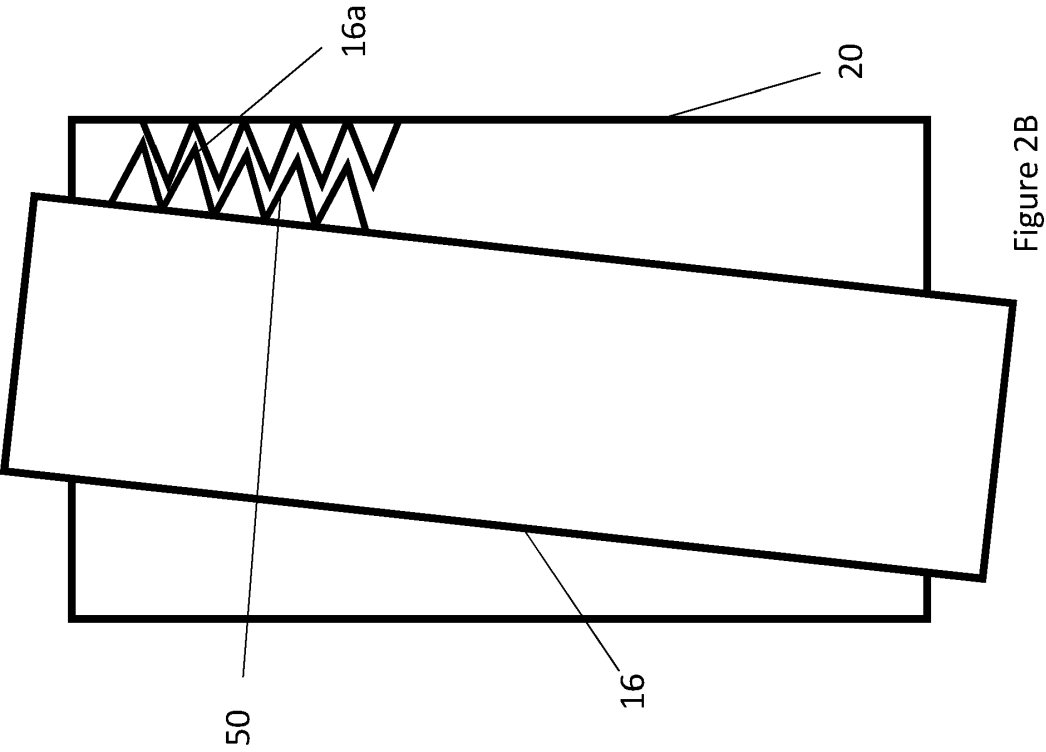


Figure 2B

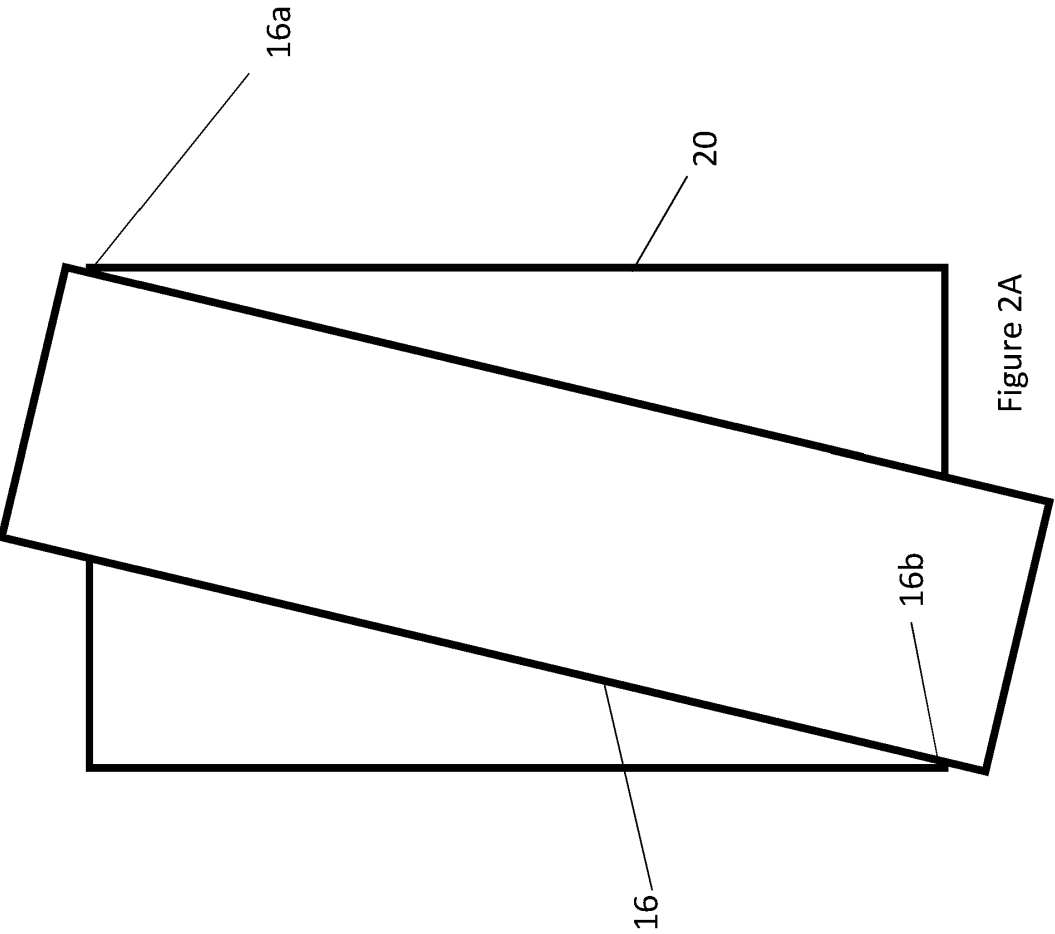


Figure 2A

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2514191 A [0005]
- GB 2355034 A [0006]
- WO 9804805 A [0007]
- WO 2013050411 A [0008]
- GB 2426266 A [0009]