



Apparatus for the stationary arrangement of floating
bodies

Description

The present invention relates to an apparatus for the stationary arrangement of floating bodies. The invention is described in this case with reference to so-called "offshore units", such as for example oil-drilling and production units, such as semi-submersibles or FPSOs (floating production storage and offloading - oil production and storage vessels) as well as offshore barges. It should be noted that the invention can optionally also be applied to ships.

Plants of this type must usually be installed in a fixed manner on the sea in order for example to carry out oil drilling. For this purpose it is known from the prior art that plants of this type are fastened to the sea bed by traction means such as cables or chains. In this case use is made of chain traction devices of this type which are described here. The traction means can be tightened in the fastening procedure, wherein the lashing procedure of a chain or a traction means can be carried out by means of reciprocating cylinders by way of stop bars or pawls.

Under specified circumstances it may be possible for the release of the traction means to become necessary, for example if the position of the offshore unit has to be changed in the event of an emergency. This may be the case for example with an undesired escape of gas. In this case there must be a provision for the traction means to be capable of being released as quickly as



possible. When loaded, the chain traction devices known in the prior art either cannot be released at all or can be released only with damage to the device.

A so-called quick release or emergency release is not possible or is uncontrolled in practice and is subject to considerable safety risks. In addition, in the case of release designs known from the prior art it is not possible to form an engagement again once a release has taken place. In this way, it is possible for example - if chains are provided as the traction means - that stop bars, which are generally used for locking the chain, will be released and can no longer be inserted into the chain after the release procedure.

The object of the present invention is therefore to provide apparatus for the stationary arrangement of floating bodies in bodies of water, which also permit a release of the traction means under specified conditions.

These objects are attained according to the invention by the subject matter of the independent claim. Advantageous embodiments and further developments form the subject matter of the sub-claims.

An apparatus according to the invention for the stationary arrangement of floating bodies in bodies of water has a traction means which connects the floating body to a bottom of the body of water in order to fasten the floating body with respect to the bottom. In addition, the apparatus has a rotatable holding device around which a portion of the traction means is guided or deflected, the traction means being arranged on the rotatable holding device in a fixed manner in terms of

traction in such a way that a movement of the traction means is caused by a rotation of the holding device.

In addition, a first drive member is provided which is coupled to the holding device in such a way that a rotation of the first drive member in at least one direction of rotation causes a rotation of the rotatable holding device. In addition, a locking device is provided in order to prevent a rotation of the first drive member at least for a time, wherein a locking element of the locking device is capable of being coupled to an area of the drive member. According to the invention the locking element is used at least for a time for driving the holding device in a rotary manner.

An arrangement of the traction means on the holding device in a fixed manner in terms of traction may be an arrangement in which the traction means is laid at least locally around the holding device and engages with a portion of the holding device in such a way that the traction means is moved by a rotation of the holding device and in this way for example a tightening or a loosening of the traction means with respect to the bottom of the body of water is possible.

It is therefore proposed according to the invention that not only is the locking element used as a brake in order to lock the holding device or the drive member respectively and, in this way, to fix the position of the floating body in the normal state, but in addition the same locking element is also used for moving and for driving the drive member and thus also the holding device.

The holding device can be for example a toothed wheel or

a sprocket wheel which is mounted so as to be rotatable with respect to a stationary axle. It would also be possible, however, for a shaft to be provided which is mounted so as to be rotatable (with respect to a stand) and on which in turn the holding device in the form of a toothed wheel or a sprocket wheel is arranged preferably in a rotationally fixed manner.

In the case of an advantageous embodiment the drive member is a drive wheel. This drive wheel can be arranged in this case on the holding device, so that a rotation of the drive wheel directly causes a rotation of the holding device. It would also be possible, however, for the drive member to be a drive wheel which engages in the manner of a gear mechanism with the holding device for example by way of a set of teeth.

It is preferable, however, for the drive wheel to be a drive wheel with an external periphery without teeth. It would also be possible, however, for the drive shaft itself to act as the drive member and for example to engage the locking element directly in an area of the shaft. It is preferable, however, on grounds of the transmission of forces for the drive wheel to have a larger diameter than the aforesaid shaft.

It is preferable for the locking element to be capable of being laid on an external periphery of the drive wheel and thus to produce a braking or locking of the drive wheel by forces in the radial direction of the latter.

In the case of a further advantageous embodiment the locking element is movable in a direction of rotation of the holding device.

In other words the locking element is movable about the drive wheel in a peripheral direction of the latter even in the peripheral direction thereof and is thus to be driven in the direction of rotation of the holding device. It is preferable for the locking element to be movable at a peripheral angle which amounts to at least 2° , preferably at least 5° and in a particularly preferred manner at least 7° . In this way, speeds of the traction means in the range of 2 m per minute can be achieved as a whole.

In the case of a further advantageous embodiment the locking element extends around the holding device by a pre-set peripheral angle, this peripheral angle amounting to at least 90° , preferably at least 180° , preferably at least 270° and in a particularly preferred manner at least 340° . In this way, a release or a braking of the drive wheel can also be achieved by a contraction of the locking element.

It is advantageous for a starting portion of the locking element and an end portion of the locking element to be connected by way of a connecting element. A distance between the starting portion of the locking element and the end portion of the locking element can be reduced by means of a suitable actuation, this preferably being a brake band, in order to alter (or increase) the friction contact between the locking element and the drive wheel in this way.

In the case of a further advantageous embodiment the locking device has a drive device for moving the locking element. In this case - as mentioned above - this drive device moves the aforesaid locking element in a peri-

pheral direction of the holding device. In an advantageous embodiment the drive device is selected from a group of drive devices which includes hydraulic drives, pneumatic drives, electric motors and the like. It is particularly preferred for an hydraulic piston drive to be provided as the drive, since it is possible for very high forces to be transmitted by this.

In the case of a further advantageous embodiment the drive device is a drive device moving in a linear manner.

It is advantageous for the rotatable holding device, as mentioned above, to be arranged so as to be rotatable by means of bearing devices on an axle arranged in a rotationally fixed manner with respect to a stand. In this case this stand can in turn be arranged in a fixed manner or in a releasable manner on the floating body or on the deck of this body. Sliding bearings can be used for example as the bearings. It is also advantageous for the first drive device to be articulated and/or linked to the stand. In this case it is also advantageous for the first drive device to absorb the forces which are exerted by the traction means.

In the case of a further advantageous embodiment the apparatus has a second drive device in order to apply the locking element to the first drive member. This can again advantageously be an hydraulic element or an hydraulic piston element.

It is advantageous in this case for the two ends of the second drive device to be arranged on the locking element. It is advantageous for this second drive apparatus to have a pre-tensioning device in order to be - in a state

without current for example - in a specific end position. It is advantageous for this to be a setting in which an engagement between the locking element and the drive wheel is present, so that in the event of a failure of the current or energy sources a locked state of the holding device is always achieved and thus also a fastened state of the floating body.

In addition, the apparatus advantageously has a second drive member which is coupled or capable of being coupled to the holding device in such a way that a rotation of the second drive member in at least one direction of rotation causes a rotational movement of the rotatable holding device. In this case the second drive member can be designed in the same way as the first drive member and can likewise be equipped with driving and locking elements in the same way.

It would also be possible, however, for only the first drive member to be equipped with a movable locking element, so that a rotation can be carried out and the second drive member has only one fixed locking element which acts in the manner of a fixing brake. It would also be possible for only one drive member to be provided, but in this case additional fixing means will be provided which permit a rotation of this drive member with the holding device only under specific conditions. This could be carried out for example in the manner of a freewheel mechanism.

In the case of a further advantageous embodiment the traction means is a chain. It would also be possible, however, for a cable which for example is wound a multiplicity of times around the holding device to be used as

the traction means. The chain, however, is preferred. It is advantageous for this chain to be deflected around the holding device only by a specific angle, for example an angle of 180°.

In the case of a further advantageous embodiment the apparatus has an engagement member for engaging in the links of the chain. In this way, for example, the holding device could be a sprocket wheel which engages in each case in the links of the chain and thus - as mentioned above - makes possible the connection between the chain and the holding device in a fixed manner in terms of traction.

Further advantageous embodiments are evident from the accompanying drawings. In the drawings

Figure 1 is a perspective view of an apparatus according to the invention;

Figure 2 is a front view of the apparatus as shown in figure 1;

Figure 3 is a plan view of the apparatus as shown in figure 1;

Figure 4 is a rear view of the apparatus as shown in figure 1, and

Figure 5 is a side view of the illustration of the individual elements of the apparatus as shown in figure 1.

Figure 1 is a perspective view of an apparatus 1 according to the invention for the stationary arrangement of floating bodies in bodies of water. In this case - as mentioned above - this apparatus can be connected on deck

or in a fixed manner to the floating body. The reference number 2 designates a chain (shown only in part) which in this case is guided around a holding device 4 shown only in part. This holding device 4 is in this case arranged so as to be rotatable with respect to a stand 20 with the aid of bearing devices 18. In this case the chain is connected to the holding device in a fixed manner in terms of traction, so that as the holding device rotates the chain can also be moved, for example clamped or loosened. The reference number 8 designates a first drive member which in this case is designed in the form of a driving pulley which is arranged in a rotationally fixed manner on the holding device 4. A second drive pulley 28 is connected to the holding device likewise in a rotationally fixed manner here.

The reference number 10 designates in its entirety a locking device, which can prevent a rotation of the drive member 8 or the drive member 28 and thus also a rotation of the holding device 4 and thus a movement of the traction means 2. This locking device 10 has in this case a locking element 12 which extends around the external periphery of the drive member 8. This external periphery of the drive member 8 is provided in this case with a substantially smooth, i.e. in particular not serrated, surface. The references 12a and 12b relate to two end portions of the locking element which can be moved towards each other in order to brake or lock the drive member 8, so that the (internal) periphery which is formed by this locking element can be reduced.

In this way, a contact with the drive member 8 with friction locking can be produced and so a locking or braking thereof can be achieved. It would also be

possible, however, for a locking element to be provided which engages on an internal periphery of the first drive wheel 8. For this purpose the driving wheel could have an edge which projects along its axis of rotation and on the inner face of which the locking element can engage which can then be designed in the manner of a brake shoe for example.

The reference number 24 designates in each case hydraulic pistons which are used for braking or for applying the locking element 12 to the drive member 8 or 28 respectively. For this purpose, the pistons 24 in each case actuate a lever 44 which is likewise linked to the locking element 12 by way of a joint 34. During this movement a distance between the first link element 34 and a second link element 35, which is arranged in turn in a fixed manner on the second end portion 12b of the locking element, can be increased or reduced. The reference number 32 relates to a connecting element such as a connecting rod which connects these two link areas 34 and 35 to each other. In addition, the hydraulic element 24 is arranged in the second end area in a manner linked to a further articulation point 37. In this case this articulation and/or link point 37 too is fastened to the locking element 12. This connecting element can be rigidly connected in this case to the articulation areas 34 and 35 in an articulated manner.

A rotation of the drive member 8 or 28 respectively can be carried out with the aid of a drive device 14. For this purpose, for example, the locking element 12 is applied to the drive member 8 and then, as a result of the piston element 14 being moved out in the articulation area 35 which is situated on the locking element 12, is

moved along its circular shape. The driving device 14 is also articulated accordingly in a manner articulated to a bearing 36 - which in turn is arranged on the stand in a fixed manner - and is also articulated at the other end in a manner articulated to the articulation area 35.

In order to carry out the clamping of the chain in a practical manner, the locking element 12 can rest for example against the first drive member 8 in this case and a rotation can be carried out at the same time by an extension movement of the drive element 14. At the same time the second driving device 14, which is applied to the drive member 28, is loosened, so that a rotation is made possible in this case. As soon as this drive element 14, which is used for driving the drive member 8, has been extended completely, the locking element 12 can be applied to the second drive member 28 by way of the second drive device 24 and after that the first drive element 14 which is applied to the drive member 8 can be loosened. After that, the left-hand drive element 14 shown in figure 1 can drive the second drive member 28.

The reference number 42 relates to a load measurement device which determines the load pressing as a whole upon the drive devices 14. The reference number 46 designates a length measurement device by way of which it is possible to determine how far the traction means has been moved out or in.

Figure 2 is a side view of the apparatus as shown in figure 1. It is evident that the traction means 2 is guided in this case between the two drive members 8 and 28. In this case too, the holding device 4 which is arranged on the stand 20 is again shown.

Figure 3 is a plan view of the apparatus as shown in figure 1. In particular, the respective drive devices 14 and 24, which are used in each case for moving the drive members on the one hand and for producing and releasing the locking, are again evident here. In addition, the holding device 4, which is used for engaging in the traction means 2, i.e. the individual chain links, is shown here.

Figure 4 is a detailed illustration of the apparatus as shown in figure 1. The respective drive devices 14 and 24 are again evident in a manner similar to figure 3.

Finally, figure 5 is an illustration of the apparatus in which elements arranged one behind the other in each case are also illustrated. It is evident that the holding device 4 is designed in the form of a sprocket wheel, the individual teeth (or nests or pockets) 4a engaging in each case in the openings of the respective chain links. In addition, it is evident that in this case the chain is guided around this holding device 4 by an angle of approximately 180°. In addition, it is evident that in their interior the two drive devices 24 have in each case spring elements 52 which move the individual pistons of these second drive devices back. In this way it is made possible for both the two second drive devices 24 to be completely tightened in each case in a state without current or in an error state, and this leads to both the first drive member 8 and the second drive member 28 (cf. figure 1) being blocked. In this way, the drive members 28 act as "fail-safe devices".

All the features disclosed in the application documents

are claimed as being essential to the invention, insofar as they are novel either individually or in combination as compared with the prior art.

List of References

1	apparatus
2	chain
4	holding device
4a	teeth (or nests or pockets)
8	drive member
10	locking device
12	locking element
12a, 12b	end portions of the locking element
14	drive device
18	bearing device
20	stand
24	hydraulic pistons
28	drive pulley
32	connecting element
34, 35	articulation elements
36	bearing
27	articulation point and/or link point
42	load measurement device
44	lever
46	length measurement device
52	spring element

Apparatus for the stationary arrangement of floating
bodies

Claims

1. An apparatus (1) for the stationary arrangement of floating bodies in bodies of water with a traction means (2) which connects a floating body to the bottom of the body of water in order to fasten the floating body with respect to the bottom, with a holding device (4) around which a portion of the traction means (2) is guided, wherein the traction means (2) is arranged on the rotatable holding device (4) in a fixed manner in terms of traction in such a way that a movement of the traction means is caused by a rotation of the holding device, with a first drive member (8) which is coupled to the holding device (4) in such a way that a rotation of the first drive member (8) in at least one direction of rotation causes a rotation of the rotatable holding device (4) and with a locking device (10) in order to prevent a rotation of the first drive member (8) at least for a time, wherein a locking element (12) of the locking device (10) is capable of being coupled to an area of the drive member (8), characterized in that the locking element (12) is used at least for a time for driving the holding device (4) in a rotary manner.
2. An apparatus (1) according to claim 1, characterized in that the drive member (8) is a drive wheel (8).
3. An apparatus (1) according to claim 2, characterized in that the locking element (12) is capable of being

laid on an external periphery of the drive wheel (8).

4. An apparatus (1) according to at least one of the preceding claims, characterized in that the locking element (12) is movable in a direction of rotation of the holding device (4).
5. An apparatus (1) according to claim 1, characterized in that a starting portion (12a) of the locking element (12) and an end portion (12b) of the locking element are connected to each other by way of a connecting element (16).
6. An apparatus (1) according to at least one of the preceding claims, characterized in that the locking device has a drive device (14) for moving the locking element (12).
7. An apparatus (1) according to claim 6, characterized in that the drive device (14) is linked to a stand (20).
8. An apparatus (1) according to at least one of the preceding claims, characterized in that the apparatus has a second drive device (24) in order to apply the locking element (12) to the first drive member (8).
9. An apparatus (1) according to at least one of the preceding claims, characterized in that it has a second drive member (28) which is coupled to the holding device (4) in such a way that a rotation of the drive member (8) in at least one direction of rotation causes a rotation of the rotatable holding device (4).

10. An apparatus (1) according to at least one of the preceding claims, characterized in that the traction means (2) is a chain (2).