

FAIRLEAD LOCKING SYSTEM AND METHOD OF OPERATION

FIELD

- The present invention relates to fairleads on vessels such as ships and oil rigs.
- 5 More specifically, the invention relates to securely locking the fairleads when not in use.

BACKGROUND

- In offshore mooring systems, mooring chains are used to temporarily secure the offshore structure, such as a floating oil rig, to the seabed to ensure the structure does
- 10 not drift from the desired location. The mooring chains often reach from an anchor on the seabed to a point on the oil rig. To allow the mooring chains to be reeled in and out and to hold the chains close to the rig, the chains are usually received in a fairlead secured to a lower end of the rig.

- A fairlead is a device used to guide a line, rope, chain or cable. Typically a
- 15 fairlead comprises a rotatable guide wheel comprising a track for reeling the line, rope, chain or cable therethrough. The rotatable guide wheel is mounted on a support structure which is pivotably mounted to a rig by welding the support structure to the hull or another major structural component of the rig. The support structure is pivotably mounted to allow the fairlead to pivot in use, thereby allowing the fairlead to point in a
- 20 plurality of directions to receive and guide a chain from any of the plurality of directions.

- The chain passing through the fairlead is typically taught or in tension in use. In such condition, the fairlead is held firmly in a particular orientation. However, when the chain is slackened or removed from the fairlead, for example when the mooring of the rig is no longer required, the fairlead is free to pivot relative to the hull. The fairlead can hit
- 25 the hull violently and repeatedly in severe weather or during moving of the rig. This can cause damage to the fairlead and/or the hull. In this connection, it is essential that the fairlead is secured from pivoting after the chain has been slackened or removed from the fairlead.

- The long-standing method of securing a fairlead when not in use is to use a
- 30 bolster hook on a chain. The bolster hook is attached to the end of the chain and the chain is reeled through the fairlead until the bolster hook engages a fixture, referred to as a bolster, located elsewhere on the hull. This allows the chain to be pulled tight again and therefore secures the fairlead at a particular orientation. The bolster hooks are large, extremely heavy, and are often not kept on board the rig. Therefore, when the

bolster hooks are to be attached (one for each fairlead around the rig) they have to be sailed out to the rig by boat. It may typically take around eight to ten hours to attach all of the bolster hooks if just one boat is used, or around four hours if two boats are used. With every hour of offshore operations costing considerable sums of money, it is time consuming and expensive to attach the bolster hooks in this manner.

In use, extreme loads are transferred to the fairlead, therefore it is essential that the fairlead is strong and that there is a secure connection to the hull. Attempts have been made to lock the fairleads when not in use without requiring bolster hooks and the associated installation time. For example, in one such prior art method, the fairlead is provided with a semi-circular locking ring comprising a plurality of apertures. During installation of the fairlead on the hull of the rig, an aperture must be cut in the hull to receive the semi-circular locking ring therethrough. Internally on the hull structure there is provided a locking pin for engaging the semi-circular locking ring when it protrudes through the aperture in the hull. In this manner, the fairlead can be locked at a particular orientation. However, there are several drawbacks of this arrangement.

The described arrangement requires forming an aperture in the hull of the rig. Fairleads are typically located nearer to the bottom of the hull, where it is of critical importance that the strength and integrity of the hull is maintained. Therefore, making an aperture in the hull to receive the locking ring weakens this critical structure. Furthermore, it is required that the hull be certified for use. Post-certification cutting of an aperture in the hull would result in recertification being required, which is time consuming and expensive. Additionally, the hull structure may not pass the certification process if the strength and integrity of the hull has been affected by the forming of the aperture. Furthermore, internal access to the hull is required to mount a locking mechanism to the hull in this manner. It can be time consuming and difficult to gain internal access to the hull.

The invention has for its object to remedy or to reduce at least one of the drawbacks of the prior art, or at least provide a useful alternative to prior art.

The object is achieved through features, which are specified in the description below and in the claims that follow.

SUMMARY

The invention is defined by the independent patent claims. The dependent claims define advantageous embodiments of the invention.

According to a first aspect of the invention, there is provided a fairlead locking system for providing pivotal locking and unlocking of a fairlead mounted on an external face of a vessel, comprising: an attachment means for providing attachment of the locking system to the external face of the vessel in use; a locking plate for locating
5 wholly externally of the vessel in use and for providing attachment of the locking system to the fairlead in use; and a locking mechanism configured to lock and unlock the fairlead in use; wherein the locking plate comprises a locking device receiving means and the locking mechanism comprises a locking device configured to engage the receiving means to lock the fairlead to arrest pivotal motion of the fairlead, and
10 disengage the receiving means to unlock the fairlead to allow pivotal motion of the fairlead.

Advantageously, this arrangement does not require the forming of an aperture in the external face of the vessel, therefore the strength and integrity of the vessel is maintained. Typically, fairleads are located near the bottom portion of hulls in semi-
15 submersible oil rigs, where the hull must be strong and the integrity of the hull is of critical importance. Furthermore, the cost of installation is greatly reduced, as is the time required for installation and maintenance. Still further, the arrangement may not require re-certification of the vessel, as an aperture through the vessel is not required to be formed. The fairlead locking system may be treated as a part of the fairlead for
20 certification purposes, which may make the installation of the fairlead locking system much easier and faster than prior art methods. Activation of the fairlead locking system to pivotally lock a fairlead may be considerably faster than prior art methods. Additionally, support vessels are not required to lock a fairlead using the fairlead locking system, thus reducing the cost of locking the fairlead.

25 The external face of the vessel may be a hull of a ship or oil rig such as, but not limited to, a semi-submersible oil rig.

The locking plate may be a locking ring of semi-circular or arcuate shape. Alternatively, the locking plate may be a hexagonal ring, heptagonal ring, octagonal ring, nonagonal ring or decagonal ring.

30 The attachment plate may be configured to be welded to the external surface of the vessel. The attachment plate may be configured to be bolted to the external surface of the vessel.

The locking plate may be configured to be welded to the fairlead. The locking plate may be configured to be bolted to the fairlead.

The locking mechanism may form a gap within which the locking plate can be received and freely rotate within in use. The gap ensures that there is little or no friction between the locking plate and components of the locking mechanism, therefore heat and wear may be reduced or eliminated.

5 The locking device receiving means may comprise at least one aperture or at least one detent or at least one tooth. Apertures, detents and teeth are shapes which can be easily formed in materials. Furthermore, apertures, detents and teeth may be easily and securely engaged by a locking device.

10 The locking device receiving means may comprise a plurality of apertures or a plurality of detents or a plurality of teeth. Providing a plurality of apertures or a plurality of detents or a plurality of teeth allows a plurality of possible locking positions to be provided. This is advantageous as it may be desired to lock the fairlead in different positions, during servicing or maintenance activities for example.

15 The plurality of apertures or detents or teeth may be arranged in the locking plate such that as the fairlead pivots the apertures or detents or teeth successively align with the locking device. This may provide a plurality of potential locking positions.

The locking device may comprise at least one locking pin or at least one locking clamp.

20 The locking device may be controlled by one or more of: manual actuation; hydraulic actuation; mechanical actuation; electrical actuation; remote actuation.

The locking mechanism may further comprise an activation member for activating the locking mechanism to engage the locking device with the locking device receiving means.

25 The activation member may comprise a handle for operation by a human, a robot or a remotely operated vehicle.

The activation member may be configured to extend to an operation deck on the vessel, such that in use the activation member can be operated directly from the operation deck. This may remove the need to provide a remotely operated vehicle or a human operator to operate the locking mechanism.

30 The locking plate may comprise at least one stopper configured to abut the attachment means to arrest the pivoting of the locking plate in use.

The attachment means may comprise at least one recess configured to receive the at least one stopper.

According to a second aspect of the invention, there is provided a fairlead system comprising: a fairlead comprising a guide device and at least one fixation for pivotally mounting the fairlead on the external face of the vessel; and a fairlead locking system according to the first aspect of the invention.

5 The fairlead may comprise a body, wherein the guide device is pivotally mounted in the body.

 The at least one fixation may be at least one bracket configured to be welded to the external face of the vessel.

 A plurality of fixations may be provided.

10 The locking ring may be integrally formed with the fairlead.

 According to a third aspect of the invention, there is provided an offshore vessel comprising: an external face; the fairlead system of the second aspect of the invention; wherein the fairlead is mounted on the external face of the vessel; the locking system is attached to the external face of the vessel by the attachment means; the locking plate is
15 located wholly externally of the vessel; and the locking device receiving means is aligned with the locking device such that in use the locking device can engage the receiving means to lock the fairlead to arrest pivotal motion of the fairlead, and disengage the receiving means to unlock the fairlead to allow pivotal motion of the fairlead.

20 According to a fourth aspect of the invention, there is provided a method of assembling a fairlead system for providing pivotally locking and unlocking of a fairlead mounted on an external face of a vessel, comprising the steps of: providing a fairlead system according to the second aspect of the invention; attaching the at least one fixation of the fairlead to the external face of the vessel such that the fairlead is pivotally
25 mounted to the external face; attaching the attachment means of the locking system to the external face of the vessel; attaching the locking plate to the fairlead; and locating the locking plate in the locking mechanism such that the locking plate can freely rotate within the locking mechanism and such that the locking device can be aligned with the locking device receiving means in the locking plate in use.

30 According to a fifth aspect of the invention, there is provided a method of pivotally locking a fairlead, comprising the steps of: providing a fairlead system according to the second aspect of the invention; and moving the locking device into engagement in the locking device receiving means, thereby stopping the pivotal movement of the fairlead.

According to a sixth aspect of the invention, there is provided a method of pivotally unlocking a fairlead, comprising the steps of: providing a fairlead system according to the second aspect of the invention; and moving the locking device out of engagement with the locking device receiving means, thereby allowing pivotal
5 movement of the fairlead.

According to a seventh aspect of the invention, there is provided use of a fairlead system according to the second aspect of the invention on an offshore vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Embodiments of the invention will now be described with reference to the following drawings, in which:

Figure 1a shows a first example of a fairlead locking system;

Figure 1b shows a detailed view of the locking mechanism of the fairlead locking system shown in Figure 1a;

15 Figures 1c and 1d show the fairlead of Figure 1a in first and second positions respectively;

Figures 1e shows the fairlead of Figure 1a in a third position at its farthest point of pivotal travel in a first direction;

Figure 1f shows the fairlead of Figure 1a in a fourth position at its farthest point of
20 pivotal travel in a second direction;

Figures 1g, 1h and 1i show details of components of the fairlead locking system shown in Figure 1a;

Figure 1j shows an alternative view of the fairlead with a component of the fairlead locking system shown in Figure 1a attached thereto;

25 Figure 2a shows a second example of a fairlead locking system;

Figure 2b shows a detailed view of the locking mechanism of the fairlead locking system shown in Figure 2a;

Figures 2c and 2d show the fairlead of Figure 2a in first and second positions respectively;

Figures 2e shows the fairlead of Figure 2a in a third position at its farthest point of pivotal travel in a first direction;

Figure 2f shows the fairlead of Figure 2a in a fourth position at its farthest point of pivotal travel in a second direction;

5 Figures 2g and 2h show details of components of the fairlead locking system shown in Figure 2a;

Figures 3a and 3b show an alternative fairlead locking system; and

Figures 4a and 4b show another alternative example of a fairlead locking system.

10 For clarity reasons, some elements may in some of the figures be without reference numerals. A person skilled in the art will understand that the figures are just principal drawings. The relative proportions of individual elements may also be distorted.

DETAILED DESCRIPTION OF THE DRAWINGS

A fairlead locking system is the main subject of the following description.

15 Therefore, for clarity reasons, other components such as a hull and a fairlead are shown in dotted lines, with the fairlead locking system shown in solid lines.

Figure 1a shows a first example of a fairlead locking system 100 comprising major components of an attachment means in the form of an attachment plate 110, a locking mechanism 120 and a locking plate in the form of a locking ring 130. The fairlead
20 locking system 100 is for locking a fairlead 200 to a hull 300 of a vessel, ship, rig or other offshore structure.

The terms lock/locked and unlock/unlocked are used throughout the present description and are intended herein to mean the following. Lock/locked is intended to mean that the fairlead is temporarily arrested in its free horizontal movement.

25 Unlock/unlocked is intended to mean that the fairlead is not arrested in its free horizontal movement by the locking mechanism, but the fairlead may of course be restricted or arrested in its free horizontal movement by means of a taught chain passing through the fairlead in use.

30 The term locking ring is used throughout the present description and is intended to mean any full ring, semi-circular ring, or arc section configured as described herein. It will also be understood that locking ring may cover other shapes not strictly circular, but

providing substantially the same effect of moving the apertures therein into a position to be engaged for locking. As non-limiting examples only, the locking rings described herein may be replaced by hexagonal rings, heptagonal rings, octagonal rings, nonagonal rings or decagonal rings.

5 Still referring to Figure 1a further details of the fairlead 200 are now provided. The fairlead 200 comprises a body 210 and a guide wheel 220 rotatably mounted in the body 210 and configured to receive a chain, cable or the like, as is well known in the art. The fairlead 200 is secured to the hull 300 by means of an upper fixation 230a and a lower fixation 230b which are typically welded to the hull 300. The upper and lower
10 fixations 230a, 230b are configured to allow pivoting of the body 210 and guide wheel 220 around an axis Y, thereby allowing the fairlead 200 to pivot to secure mooring chains from a plurality of angles, as previously described. The exact configuration of the body 210, guide wheel 220, and fixations 230a, 230b is not important, and may be provided in a plurality of different ways.

15 Referring now to Figure 1b, further details of the fairlead locking system 100 can be seen in larger scale. The attachment plate 110 is configured to be attached to an external surface of the hull 300 (see Figure 1a) by any suitable securing means, preferably by welding. By welding the attachment plate 110 to an external surface of the hull 300 on the same face of the hull 300 as the fairlead 200, an aperture in the hull 300
20 need not be formed, thereby protecting the integrity of the hull 300 and making installation faster and easier.

 The locking ring 130 is configured to be attached to the body 210 of the fairlead 200 by any suitable securing means, preferably by welding. In other examples, the locking ring 130 may be releasably attached to the body 210 such that the locking ring
25 130 can be easily removed for replacement or maintenance. In other examples, the locking ring 130 may be integrally formed with the body 210. The locking ring 130 is preferably arranged to be located in a gap 121 in the locking mechanism 120, thereby avoiding rubbing or frictional forces between the locking ring 130 and the locking mechanism 120 when the locking ring 130 rotates when the locking mechanism 120 is in
30 the unlocked configuration shown in Figure 1b.

 Figures 1c and 1d show the locking mechanism 120 in a locked configuration. The fairlead 200 is not free to move horizontally in a pivotal fashion around the Y-axis as previously explained. It can be seen most clearly in these figures that the locking ring 130 comprises a plurality of apertures 131, and that as the fairlead 200 pivots, the

plurality of apertures 131 successively align with the locking mechanism 120 thereby allowing the locking mechanism 120 to arrest the movement of the locking ring 130 and therefore the fairlead 200 by means of a locking pin 122. Although apertures 131 are used in the presently described example, detents or recesses may be provided in other
5 examples. The purpose of the apertures 131 is to receive a locking device to arrest the pivotal movement of the fairlead 200. Therefore, it will be apparent to a person skilled in the art that any known locking device receiving means may be provided instead of the apertures 131 shown in the presently described example.

Similarly, although the locking device is a locking pin 122 in the presently
10 described example, it will be understood that there are a myriad of solutions to provide mechanical locking of an aperture 131 (or recess, detent etc.) of the locking ring 130. For example, the locking mechanism 120 may displace the locking pin 122 by means of hydraulic actuation into an aperture 131, as will be easily understood by a person skilled in the art. As another non-limiting example, the locking mechanism 120 may be provided
15 with a small motor to mechanically drive the pin 122 into an aperture 130 when required. In some examples there may be an electrical and/or hydraulic connection to the operations deck on the rig or vessel. In some other non-limiting examples not shown, there may be a wireless connection to the locking mechanism 120 through any known wireless communications protocol, thereby allowing the locking mechanism 120 to be
20 remotely controlled.

Figures 1e shows the fairlead 200 in a position at its farthest point of pivotal travel in a first direction, and Figure 1f shows it in its farthest point of pivotal travel in a second direction. It can be seen in these figures that using the locking mechanism 120, the fairlead 200 can be locked in either of these positions, or in any position between
25 these two positions. In this regard, the fairlead 200 can be neatly secured substantially in line with the hull 300 and in a locked configuration such that the fairlead 200 will not become damaged or damage the hull 300 or any other equipment by moving violently during moving of the rig or in severe weather.

For completeness, an individual detail view of the locking ring 130 is provided in
30 Figure 1g, the locking ring 130 assembled together with the locking mechanism 120 in Figure 1h and an individual detail view of the locking mechanism 120 in Figure 1i. Additionally, an alternative view of the locking ring 130 mounted on the fairlead 200 is shown in Figure 1j.

Referring now to Figures 2a to 2h, an alternative example of a fairlead locking system 100' is provided. Similar components to the fairlead locking system 100 shown previously are given the same reference numeral with prime (') added.

Figures 2a and 2b shows that in this example, the locking mechanism 120' comprises an activation member 123' for activating the locking mechanism 120' to locate a locking pin 122' into or through an aperture 131' in the locking ring 130'. In the presently described example, the activation member 123' comprises a linkage arrangement 124' to translate a motion of the activation member 123' to a motion of the pin 122' into the aperture 131'. It will be understood that a myriad of available linkage arrangements 124' would be suitable and may be used to transfer the motion of the activation member 123' to a locking of the locking mechanism 120'. Still referring to Figures 2a and 2b, it can be seen that the activation member 123' provides a short handle which can be manually activated to lock the locking mechanism 120'. It will be easily understood that the handle may be operated by a human, a robot or a remotely operated vehicle or the like.

In an alternative example not shown, the activation member 123' extends to an operation deck on the vessel or rig. In this arrangement, the activation member 123' may be operated directly from an operation deck, rather than requiring lowering of personnel or remotely operated vehicles or the like. The described activation member 123' reaching to the operation deck may provide a more reliable means of activation over wireless control previously discussed.

Figures 2c and 2d show the locking mechanism 120' in a locked configuration. The fairlead 200' is not free to move horizontally in a pivotal fashion as previously explained. Figures 2e shows the fairlead 200' in a position at its farthest point of pivotal travel in a first direction, and Figure 2f shows it in its farthest point of pivotal travel in a second direction. It can be seen in these figures that using the locking mechanism 120', the fairlead 200' can be locked in either of these positions, or in any position between these two positions. For completeness, the locking ring 130', locking mechanism 120' and activation member 123' are shown assembled in Figure 2g, and the activation member 123' and locking mechanism 120' are shown in Figure 2h.

Although in the presently described examples, the locking rings 130, 130' and attachment plates 120, 120' are attached to the body 210, 210' of the fairlead 200, 200' and hull 300, 300' respectively, it will be understood that in some examples the locking ring 130, 130' may be integrally formed with the body 210, 210' of the fairlead 200, 200'

and the attachment plate 110, 110' may be integrally formed with the hull 300, 300'. Additionally, it will be understood that there may be intermediate components between the attachment plate 110, 110' and the hull 300, 300', for example an intermediate bracket or receiving fixture. Similarly, there may be intermediate components between
5 the locking ring 130, 130' and the body 210, 210', for example an intermediate bracket or receiving fixture.

It will be appreciated that in Figures 1a, 1c, 1d, 1e and 1f, the body 210 of the fairlead 200 is shown detached from the lower fixation 230b, purely to illustrate how the body 210 may be pivotably mounted using a lower fixation 230b. Likewise, in Figures 2a,
10 2c, 2d, 2e and 2f, the body 210' of the fairlead 200' is shown detached from the lower fixation 230b', purely to illustrate how the body 210' may be pivotably mounted using a lower fixation 230b'.

Referring now to Figures 3a and 3b, an alternative example of a fairlead locking system 100'' is provided. Similar components to the fairlead locking system 100, 100' shown in Figures 1a to 2h are given similar reference numerals with addition of double prime (''). In this connection, the fairlead locking system 100'' comprises major
15 components of an attachment means in the form of an attachment plate 110'', a locking mechanism 120'' and a locking plate in the form of a locking ring 130''. The fairlead locking system 100'' is similarly for locking a fairlead (not shown) to a hull (not shown) of
20 a vessel, ship, rig or other offshore structure. The fairlead and hull are not shown in the interest of brevity, but are substantially the same as the previously described fairlead and hull.

Still referring to Figures 3a and 3b, further details of the fairlead locking system 100'' are now provided. The locking ring 130'' is preferably arranged to be located in a
25 gap 121'' in the locking mechanism 120'', thereby avoiding rubbing or frictional forces between the locking ring 130'' and the locking mechanism 120'' when the locking ring 130'' rotates when the locking mechanism 120'' is in the unlocked configuration.

As in the previously described example, the locking ring 130'' comprises a plurality of apertures 131'' successively aligned with the locking mechanism 120''
30 thereby allowing the locking mechanism 120'' to arrest the movement of the locking ring 130'' and therefore the fairlead by means of a locking pin (not visible).

Although apertures 131'' are used in the presently described example, detents or recesses may be provided in other examples. The purpose of the apertures 131'' is to receive a locking device to arrest the pivotal movement of the fairlead. Therefore, it will

be apparent to a person skilled in the art that any known locking device receiving means may be provided instead of the apertures 131'' shown in the presently described example.

5 Similarly, although the locking device is a locking pin in the presently described example, it will be understood that there are myriad of solutions to provide mechanical locking of an aperture 131'' (or recess, detent etc.) of the locking ring 130''. For example, the locking mechanism 120'' may displace the locking pin by means of hydraulic actuation into an aperture 131'', as will be easily understood by a person skilled in the art. As another non-limiting example, the locking mechanism 120'' may be provided with
10 a small motor to mechanically drive the pin into an aperture 130'' when required. In some examples there may be an electrical and/or hydraulic connection to the operations deck on the rig or vessel. In some other non-limiting examples not shown, there may be a wireless connection to the locking mechanism 120'' through any known wireless communications protocol, thereby allowing the locking mechanism 120'' to be remotely
15 controlled.

It can be seen in the figures that using the locking mechanism 120'', a fairlead attached thereto can be locked in a plurality of possible positions. In this regard, the fairlead can be neatly secured substantially in line with the hull and in a locked configuration such that the fairlead will not become damaged or damage the hull or any
20 other equipment by moving violently during moving of the rig or in severe weather.

When it is desired to move a fairlead between two positions, there is a risk that the fairlead may swing violently. Extreme weather or erratic sea states may increase the risk of violent movement of the fairlead. Furthermore, the fairlead may be left to swing violently if there is mechanical failure of the locking mechanism 120'' or if the operator
25 forgets to re-lock the locking mechanism 120'' after unlocking the locking mechanism 120'' to pivot the fairlead.

It is highly desirable to ensure that the fairlead does not collide with the vessel to which it is mounted. Collision of the fairlead against the vessel may cause damage to the fairlead and/or the vessel.

30 Still referring to Figures 3a and 3b, it can be seen that in the presently described example the locking plate 130'' is provided with first 132'', second 133'', third 134'' and fourth 135'' stopper pins. The first 132'' and second 133'' stopper pins are located at one end of rotational travel of the locking plate 130'' and the third 134'' and fourth 135'' stopper pins are located at another end of rotational travel of the locking plate 130''. The

stopper pins 132'', 133'', 134'', 135'' are arranged such that a fairlead attached to the locking plate 130'' will not be able to collide with the vessel to which the fairlead locking system 100'' is mounted in use. In this connection, when the locking system 100'' is moved to an unlocked position, the fairlead cannot collide with the vessel, thereby
5 damage to the fairlead and/or the vessel is avoided.

It will be understood that the stopper pins 132'', 133'', 134'', 135'' may be provided as integrally formed features of the locking plate 130'' in alternative examples.

Still referring to Figures 3a and 3b, it can be seen that in the presently described example the attachment plate 110'' is configured to receive the stopper pins 132'', 133'',
10 134'', 135''. In this connection, the attachment plate 110'' comprises first 142'', second 143'', third 144'' and fourth (not visible) recesses which are each registered with a corresponding stopper pin 132'', 133'', 134'', 135'' such that the stopper pins 132'', 133'', 134'', 135'' do not damage the attachment plate 110''. Furthermore, registration of the recesses 142'', 143'', 144'' with the corresponding stopper pins 132'', 133'', 134'', 135''
15 ensures that the stopper pins 132'', 133'', 134'', 135'' do not become damaged on impacting the attachment plate 110''.

Although in the presently described examples, the locking ring 130'' and attachment plates 120'' are described as attached to the body of the fairlead and hull of the vessel in use, respectively, it will be understood that in some examples the locking
20 ring 130'' may be integrally formed with the body of the fairlead and the attachment plate 110'' may be integrally formed with the hull. Additionally, it will be understood that there may be intermediate components between the attachment plate 110'' and the hull for example an intermediate bracket or receiving fixture. Similarly, there may be intermediate components between the locking ring 130'' and the body 210'' for example
25 an intermediate bracket or receiving fixture. In some alternative examples (not shown) the stopper pins may be provided as removable pins configured to be received in one or more of the apertures 131'', thereby allowing the maximum pivoting of the locking plate 130'' to be adjusted.

Referring now to Figures 4a and 4b, an alternative example of a fairlead locking
30 system 100''' is provided. Figure 4a shows the fairlead locking system 100''' in an unlocked configuration and Figure 4b shows the fairlead locking system 100''' in a locked configuration. Similar components to the fairlead locking systems 100, 100', 100'' shown previously are given the same reference numeral with triple prime (''') added.

Referring firstly to Figure 4a, it can be seen that the locking mechanism 120''' comprises an activation member 123''' for activating the locking mechanism 120''' to locate a locking clamp 122''' around a tooth 131''' in a locking ring 130'''. In the presently described example, the activation member 123''' comprises a linkage arrangement 124'''
5 to translate a motion of the activation member 123''' to a motion of the locking clamp 122''' such that the locking clamp 122''' clamps around the tooth 131'''.

In this connection, it will be easily understood that starting from the unlocked configuration shown in Figure 4a, an upwards pull of the activation member 123''' will result in a downwards motion of the locking clamp 122'''. Similarly, once in the locked
10 configuration shown in Figure 4b, a downwards push of the activation member 123''' will result in an upwards motion of the locking clamp 122'''.

It will be understood that a myriad of available linkage arrangements 124''' would be suitable and may be used to transfer the motion of the activation member 123''' to a locking of the locking mechanism 120'''. Although not visible in Figure 4a, the activation
15 member 123''' provides a short handle which can be manually activated to lock the locking mechanism 120'''. It will be easily understood that the handle may be operated by a human, a robot or a remotely operated vehicle or the like.

In an alternative example not shown, the activation member 123''' extends to an operation deck on the vessel or rig. In this arrangement, the activation member 123'''
20 may be operated directly from an operation deck, rather than requiring lowering of personnel or remotely operated vehicles or the like. The described activation member 123''' reaching to the operation deck may provide a more reliable means of activation over wireless control previously discussed.

In Figure 4b the locking mechanism 120''' is in a locked configuration, that is to
25 say the locking clamp 122''' has been brought down around the tooth (not visible in Figure 4b) such that the tooth, and therefore the locking ring 130''' and fairlead 200'', cannot move horizontally. To provide secure locking of the locking clamp 122''' over the tooth 131'', the internal dimensions of the locking clamp 122''' are preferably closely registered with the external dimensions of the tooth 131''. Precise registering of said
30 dimensions ensures that tooth 131''' cannot make small movements horizontally within the locking clamp 122''' when in the locked configuration shown in Figure 4b. Such small movements may reduce the service life of the locking system 100''' as the locking clamp 122''' and/or the tooth 131''' may be subject to wear. Alternatively, in some examples the locking clamp 122''' may be provided with internal dimensions that are slightly larger

than the external dimensions of the tooth 131''', thereby allowing the locking clamp 122''' to be brought down over the tooth 131''' without the need for precise vertical alignment of the locking clamp 122''' and the tooth 131'''.

5 Still referring to Figure 4b, in the locked configuration shown, the fairlead 200''' is not free to move horizontally in a pivotal fashion as previously explained.

In the presently described example the locking ring 130''' is attached to the body 210''' of the fairlead 200''', it will be understood that in some examples the locking ring 130''' may be integrally formed with the body 210''' of the fairlead 200'''. Alternatively, there may be intermediate components between the locking ring 130''' and the body 10 210'', for example an intermediate bracket or receiving fixture.

Referring again to Figure 4a, it can be seen that the locking ring 130''' comprises second 1312'', third 1313'', fourth 1314'', fifth 1315'', sixth 1316'' and seventh 1317''' teeth. It will be understood that the plurality of teeth allow the fairlead locking system 100''' to lock the fairlead 200''' in a plurality of different positions. In alternative examples 15 there may be any number of locking teeth provided.

In the presently described example, the locking teeth are provided as substantially rectangular cuboidal protrusions. It will be understood that in alternative examples, the locking teeth may be provided with any form registered with the internal form of the locking clamp 122''' such that the locking clamp 122''' can be brought into 20 engagement with the teeth to lock the fairlead 200''' as previously described.

Although not shown in the described example, it will be understood that stopper pins may be provided on the locking ring 130''' in a similar way as to that previously explained with reference to Figures 3a and 3b. In one such example, the locking ring 130''' may be provided with stopper pins (not shown) adjacent the second 1312'' and 25 seventh 1317''' teeth, such that the fairlead 200''' attached to the locking plate 130''' will not be able to collide with the vessel to which the fairlead locking system 100''' is mounted in use. In this connection, when the locking system 100''' is moved to an unlocked position, the fairlead cannot collide with the vessel, thereby damage to the fairlead and/or the vessel is avoided, as previously explained.

30 It will be understood that the stopper pins may be provided as integrally formed features of the locking plate 130''' in alternative examples.

Referring to Figures 4a and 4b, the attachment plate 110''' is configured to be attached to an external surface of the hull 300''' by any suitable securing means, preferably by welding. By welding the attachment plate 110''' to an external surface of

the hull 300''' on the same face of the hull 300''' as the fairlead 200'', an aperture in the hull 300''' need not be formed, thereby protecting the integrity of the hull 300''' and making installation faster and easier.

5 It can be seen in Figures 4a and 4b that the attachment plate 110''' further comprises first 111''' and second 112''' guides arranged to guide the locking clamp 122''' between the locked and unlocked configurations. When in the locked configuration shown in Figure 4b, the guides 111''', 112''' ensure that the locking clamp 122''' cannot move horizontally.

10 It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an
15 element does not exclude the presence of a plurality of such elements.

CLAIMS

1. A fairlead locking system (100, 100', 100'', 100''') for providing pivotal locking and unlocking of a fairlead (200, 200', 200'') mounted on an external face (300, 300', 300'') of a vessel, comprising:
 - 5 an attachment means (110, 110', 110'', 110''') for providing attachment of the locking system (100, 100', 100'', 100''') to the external face (300, 300', 300'') of the vessel in use;
 - a locking plate (130, 130', 130'', 130''') for locating wholly externally of the vessel in use and for providing attachment of the locking system (100, 100', 100'', 100''') to the fairlead (200, 200', 200'') in use; and
 - 10 a locking mechanism (120, 120', 120'', 120''') configured to lock and unlock the fairlead (200, 200', 200'') in use;
 - wherein the locking plate (130, 130', 130'', 130''') comprises a locking device receiving means (131, 131', 131'', 131''') and the locking mechanism (120, 120', 120'', 120''') comprises a locking device (122, 122', 122'') configured to engage
 - 15 the receiving means (131, 131', 131'', 131''') to lock the fairlead (200, 200', 200'') to arrest pivotal motion of the fairlead (200, 200', 200''), and disengage the receiving means (131, 131', 131'', 131''') to unlock the fairlead (200, 200', 200'') to allow pivotal motion of the fairlead (200, 200', 200'').
 - 20
2. The fairlead locking system (100, 100', 100'', 100''') of claim 1, wherein the locking plate (130, 130', 130'', 130''') is a locking ring of semi-circular or arcuate shape.
- 25 3. The fairlead locking system (100, 100', 100'', 100''') of claim 1 or 2, wherein the attachment plate (110, 110', 110'', 110''') is configured to be welded to the external surface (300, 300', 300'') of the vessel.
- 30 4. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking plate (130, 130', 130'', 130''') is configured to be welded to the fairlead (200, 200', 200'').

5. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking mechanism (120, 120', 120'', 120''') forms a gap (121, 121'') within which the locking plate (130, 130', 130'', 130''') can be received and freely pivot within in use.
- 5
6. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking device receiving means (131, 131', 131'', 131''') comprises at least one aperture or at least one detent or at least one tooth.
- 10
7. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking device receiving means (131, 131', 131'', 131''') comprises a plurality of apertures or a plurality of detents or a plurality of teeth.
- 15
8. The fairlead locking system (100, 100', 100'', 100''') of claim 7, wherein the plurality of apertures (131, 131', 131'') or detents or teeth (131''') are arranged in the locking plate (130, 130', 130'', 130''') such that as the fairlead (200, 200', 200'') pivots the apertures (131, 131', 131'') or detents or teeth successively align with the locking device (122, 122', 122''').
- 20
9. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking device (122, 122', 122'') comprises at least one locking pin or at least one locking clamp.
- 25
10. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking device (122, 122', 122'') is controlled by one or more of: hydraulic actuation; mechanical actuation; electrical actuation; remote actuation.
- 30
11. The fairlead locking system (100, 100', 100'', 100''') of any preceding claim, wherein the locking mechanism (120, 120', 120'', 120''') further comprises an activation member (123', 123'') for activating the locking mechanism (120, 120', 120'', 120'') to engage the locking device (122, 122', 122'') with the locking device receiving means (131, 131', 131'', 131''').

12. The fairlead locking system (100, 100', 100'', 100''') of claim 11, wherein the activation member (123', 123''') comprises a handle for operation by a human, a robot or a remotely operated vehicle.
- 5
13. The fairlead locking system (100, 100', 100'', 100''') of claim 11 or 12, wherein the activation member (123', 123''') is configured to extend to an operation deck on the vessel, such that in use the activation member (123', 123''') can be operated directly from the operation deck.
- 10
14. The fairlead locking system (100, 100', 100'', 100''') according to any preceding claim, wherein the locking plate (130, 130', 130'', 130''') comprises at least one stopper (132'', 133'', 134'', 135'') configured to abut the attachment means (110, 110', 110'', 110''') to arrest the pivoting of the locking plate (130, 130', 130'', 130''') in use.
- 15
15. The fairlead locking system (100, 100', 100'', 100''') according to claim 14, wherein the attachment means (110, 110', 110'', 110''') comprises at least one recess (142'', 143'', 144'') configured to receive the at least one stopper (132'', 133'', 134'', 135'').
- 20
16. A fairlead system comprising:
a fairlead (200, 200', 200''') comprising a guide device and at least one fixation (230a, 230b, 230a', 230b') for pivotally mounting the fairlead (200, 200', 200''') on the external face (300, 300', 300''') of the vessel; and
a fairlead locking system (100, 100', 100'', 100''') according to any of claims 1 to 15.
- 25
17. The fairlead system of claim 16, wherein the at least one fixation (230a, 230b, 230a', 230b') is at least one bracket configured to be welded to the external face (300, 300', 300''') of the vessel.
- 30

18. The fairlead system of claim 16 or 17, comprising a plurality of fixations (230a, 230b, 230a', 230b') for mounting on the external face (300, 300', 300'') of the vessel.

5 19. An offshore vessel comprising:
 an external face (300, 300', 300''); and
 the fairlead system of any of claims 16 to 18;
 wherein the fairlead (200, 200', 200'') is mounted on the external face (300, 300', 300'') of the vessel;
 10 the locking system (100, 100', 100'', 100''') is attached to the external face (300, 300', 300'') of the vessel by the attachment means (110, 110', 110'', 110''');
 the locking plate (130, 130', 130'', 130''') is located wholly externally of the vessel; and
 the locking device receiving means (131, 131', 131'', 131''') is aligned with the
 15 locking device (122, 122', 122'') such that in use the locking device (122, 122', 122'') can engage the receiving means (131, 131', 131'', 131''') to lock the fairlead (200, 200', 200'') to arrest pivotal motion of the fairlead (200, 200', 200''), and disengage the receiving means (131, 131', 131'', 131''') to unlock the fairlead (200, 200', 200'') to allow pivotal motion of the fairlead (200, 200', 200'').

20

20. A method of assembling a fairlead system for providing pivotal locking and unlocking of a fairlead (200, 200', 200'') mounted on an external face (300, 300', 300'') of a vessel, comprising the steps of:

25 a. providing a fairlead system according to any of claims 16 to 18;

 b. attaching the at least one fixation (230a, 230b, 230a', 230b') of the fairlead (200, 200', 200'') to the external face (300, 300', 300'') of the vessel such that the fairlead (200, 200', 200'') is pivotally mounted to the external face (300, 300', 300'');

30 c. attaching the attachment means (110, 110', 110'', 110''') of the locking system (100, 100', 100'', 100''') to the external face (300, 300', 300'') of the vessel;

 d. attaching the locking plate (130, 130', 130'', 130''') to the fairlead (200, 200', 200''); and

- 5 e. locating the locking plate (130, 130', 130'', 130''') in the locking mechanism (120, 120', 120'', 120''') such that the locking plate (130, 130', 130'', 130''') can freely rotate within the locking mechanism (120, 120', 120'', 120''') and such that the locking device (122, 122', 122''') can be aligned with the locking device receiving means (131, 131', 131'', 131''') in the locking plate (130, 130', 130'', 130''') in use.

- 10 21. A method of pivotally locking a fairlead (200, 200', 200'''), comprising the steps of:
- a. providing a fairlead system according to any of claims 16 to 18;
 - b. moving the locking device (122, 122', 122''') into engagement in or with the locking device receiving means (131, 131', 131'', 131'''), thereby stopping the pivotal movement of the fairlead (200, 200', 200''').
- 15 22. A method of pivotally unlocking a fairlead (200, 200', 200'''), comprising the steps of:
- a. providing a fairlead system according to any of claims 16 to 18;
 - b. moving the locking device (122, 122', 122''') out of engagement in or with the locking device receiving means (131, 131', 131'', 131'''), thereby
- 20 allowing pivotal movement of the fairlead (200, 200', 200''').
23. Use of a fairlead system according to any of claims 16 to 18 on an offshore vessel.