

Skidding system for an offshore installation or vessel

The invention relates to a skidding system for an offshore installation or vessel, such as an offshore wind turbine installation ship (OWTIS), comprising at least one set, e.g. a pair, of rails (also known as skid beams), and one or more carriages (also known as pallets or carts) for supporting loads and moving the loads along the rails, e.g. from a storage position to an operating position, in particular within the reach of a crane to offload the loads from the vessel, and/or *vice versa*. The invention further relates to a method of skidding loads on an offshore installation or vessel.

As explained in US 3,486,737, when it is desired to move a heavy load on a support in a straight line or in an arc, the moving sometimes is done by skidding the load. For example, when drilling wells from a platform at sea it is customary to skid the drilling rig on the platform from one well location to another. This is commonly done by means of double acting hydraulic cylinders that skid the rig in a series of short steps, between which the pistons are retracted in the cylinders for the next stroke. In the apparatus according to US 3,486,737, a load (6) is slid along a support (3) by a horizontally extendable device (10), a roller (18) being lifted on actuation of the device in one direction to transfer at least some of the load to the roller and thence through a friction shoe (20) to the support.

US 3,033,525 also addresses skidding and relates to a force-transmitting device for moving one member relatively to another.

In modern skidding systems, the handling of loads, such as subsea modules or heavy weight structures (e.g. Xmas trees, process modules, jacket foundations, PLEMs), on open deck demands a high degree of safety for both equipment and personnel. Existing deck skidding systems typically comprise

integrated or on-deck skid rails, push-pull, rack and pinion or winch driven carriages. Lay-out and integration with other systems are preferably optimized for efficient deck logistics. For each project, such as a jacket foundation installation project, new skidding carriages to support the loads on the skidding rails of the vessel have to be developed and built.

It is an object of the present invention to provide a more versatile skidding system.

To this end, at least one, preferably a plurality or all, of the carriages is (are) adaptable to different loads, e.g. loads having different footprints such as various jackets for wind turbines.

In an embodiment the carriage or carriages comprise a plurality of supports for a load and at least two of the supports, preferably all, are movable relative to each other.

In a refinement, at least two of the supports are interconnected, directly or indirectly, via at least one telescopic beam. E.g. the carriages comprise skid beams extending lateral to the set of rails and telescopic beams interconnecting the skid beams and extending parallel to the set of rails. Thus, the supports can be moved relative to each other by retracting or extending the telescopic beams.

In another refinement, the carriages comprise a frame and at least one of the supports, preferably a plurality of the supports, are releasably attached to the frame, e.g. bolted, pinned, wedged or welded to the frame.

The skidding system according to the present invention is versatile in that it can be (re-)used in different projects. The embodiments provide an adjustable frame, which can be varied in length and/or width, with the option of relative movement of the supports and/or a plurality of positions for attachment of supports.

In an embodiment, the supports are arranged in a triangle or square, e.g. with the triangles at different (rotational) orientations to facilitate efficient use of deck area.

5 In another embodiment, which is also useful with non-adaptable carriages, the carriages comprise one or more fasteners for securing the loads to the carriages. The fasteners provide e.g. a friction lock or a positive lock, e.g. by means of a pin or studs that in the locked state of
10 the fastener extend through or in the load. In a refinement, the fasteners are mounted on or integrated in a support or supports.

In another embodiment, the at least one carriage comprises one or more fasteners for securing the carriage or
15 the load to the rails or to an offshore installation or vessel, preferably in vertical direction, in the direction of the rails and transverse to the rails.

By securing the load to the carriage and the carriage to the rails or to an offshore installation or
20 vessel, the load is sea-fastened to the installation or vessel.

The skidding system according to the present invention is especially suitable to be fixed to, e.g. welded to or integrated in, the deck of an offshore installation or
25 vessel.

The invention also relates to a method of skidding loads on (deck of) an offshore installation or vessel, such as an offshore wind turbine installation ship (OWTIS), comprising at least one set of rails, and one or more
30 carriages for supporting loads and positioned on the rails. The method according to the present invention comprises the steps of selecting the load(s) to be skidded, adapting the carriage(s) to the load(s), and positioning the load(s) on the adapted carriage(s).

In an embodiment, the at least one carriage comprises a plurality of supports and the method comprises the step of repositioning at least two of the supports relative to each other.

5 In another embodiment, the carriage comprises a frame and at least one of the supports is releasably attached to the frame and the method comprises the step of removing at least one of the supports from the frame and re-attaching the support to the frame at a different location.

10 In another embodiment, the method comprises fastening the load(s) to the carriage(s).

Yet another embodiment comprises moving the carriages and the loads along the rails from storage positions to an operating position (such as a crane). In a refinement, the loads are removed from the carriages and the footprint of at least one of the carriages reducing after its load has been removed, e.g. by retracting telescopic beams (if present).

DE 10 2008 020965 relates to a device and a method for assembling and servicing underwater power stations. In an example, the "crane system 9 transfers the machine gondola 4 to a supporting device 10. Said device consists predominantly of two supporting devices 10.1, 10.2, which may run on a common guide rail system 11 along the deck of the barge 8. In the diagrammatic illustration of figure 1 the supporting device 10.1 and 10.2 include each gripping device 12.1, 12.2, with which the assembly components 13.1, 13.2 in a partially disassembled machine gondola may be run and positioned against one another along the guide rail system 11."

WO 2007/069081 relates to a skidding pallet for use on the skid rails of a vessel, the pallet comprising a supporting means such as a frame, a mounting means for the mounting of an object thereon, and at least one actuation means, such as a cylinder, attached to one of the supporting

means or mounting means. In use, the supporting means interfaces with the skid rails and the actuation means are actuatable to cause the mounting means to rotate in relation to said supporting means and the skid rails.

5 EP 2 444 656 relates to a securing member suitable for securing a heavy load, in particular a component of a wind turbine on a transport element, with at least one bolt element.

10 EP 2 559 614 relates to a "vessel (1) for removal and/or installation of at least a part of a sea platform comprising a support structure and a top side, said vessel comprising a hull (6) and two support arms (11,12) located at a distance from each other and attached to the hull (6), wherein the support arms in use extend beyond the hull in a
15 substantially horizontal direction."

The invention will now be explained in more detail with reference to the drawings, which schematically show embodiments of the skidding system according to the present invention.

20 Figure 1 is a perspective view of an offshore wind turbine installation ship (OWTIS) comprising a deck skidding system according to the present invention.

25 Figure 2 is a perspective view of a deck skidding system according to the present invention comprising differently configured carriages.

Figure 3 is a top view of another deck skidding system according to the present invention.

Figure 4 is a perspective view of a fastener for securing a load to a carriage.

30 Figure 5 is a perspective view of a fastener for securing a carriage to the deck of a ship.

35 Figure 1 shows an offshore wind turbine installation ship (OWTIS) 1 provided with a deck skidding system 2 according to the present invention and a crane 3 for on and off loading loads, such as subsea modules or

heavy weight structures 4. The skidding system comprises two sets of rails 5 extending in the longitudinal direction of the ship, a first set 5A extending alongside the crane 3 and a second set 5B juxtaposed to the first set and extending up to the crane. A plurality of skidding carriages 6, also known as e.g. pallets or carts, are supported on the rails 5 and in turn support loads, e.g. jacket foundations 4 for wind turbines.

As shown in Figures 2 and 3, the carriages 6 comprise a pair of structural (skid) beams 7, e.g. having a rectangular hollow cross-section and extending in a direction transverse to the rails 5 and supported by skid shoes 8 (see also Figure 5) resting on the rails 5. The skid beams 7 are interconnected via telescopic beams 9, e.g. extending parallel to the rails, and a truss 10 reinforcing the connection between one of the skid beams and the cylinder ends of the telescopic beams. The skid beams, telescopic beams and trusses together form a frame. Further, the carriages are provided, in a manner known in itself, with hydraulic push-pull units 11 to skid the carriages 6 along the rails 5.

The ends of the skid beams 7 provide discrete positions locations for supports 12, which are bolted to the positions. In this example, the system comprises three types of supports: supports (ears) 12A releasably attached to an end of a skid beam 7, supports 12B releasably attached to a middle portion a skid beam 7, and supports 12C comprising an additional beam 13 connected ends of two skid beams 7. All three types provide support for one leg of a load, such as a jacket foundation. Other examples of supports include supports for two or more legs of a load and supports positioned in or near the middle of the carriage 6.

The examples above provide an adjustable frame, which can be varied in length and/or width, with a plurality of positions for attachment of supports. Thus, the carriages

can be adapted to a large number of different footprints and orientations, e.g. triangular footprints with the triangles in different (rotational) orientations to facilitate efficient use of deck area. This is illustrated in Figure 2, which shows two juxtaposed carriages with identical triangular footprint but opposite orientations, i.e. rotated relative to each other over 180°. Figure 3 shows a carriage having a square footprint and two carriages having a triangular footprint but rotated relative to each other over 90°.

As shown in Figure 4, each of the supports comprises a fastener, e.g. a gripper 14, for securing the load 4 to the carriage 6. In this example, each of the fasteners comprises a pin 15 extending through a leg of a jacket providing a positive lock between the leg and the fastener.

Further, as shown in Figure 5, the carriages 6 comprise fasteners for securing the carriage to the deck 1A of the ship. In this example, the fasteners secure the carriage in all three degrees of freedom: a first set of eyes 16 on the deck 1A and on the carriage and links 17 joining the eyes, thus providing a secure connection in the vertical direction, a second set of eyes on the carriage 6 and on the deck, offset in the direction of the rails and a diagonal link 18 joining the eyes, thus providing a secure connection in a horizontal direction parallel to the rails 5, and a third set of eyes on the carriage and on the deck, offset in a direction transverse to that of the rails and a diagonal link 19 joining the eyes, thus providing a secure connection in a horizontal direction transverse to the rails.

The invention is not restricted to the above-described embodiments, which can be varied in a number of ways within the scope of the claims. In an example, the supports can also be slidably attached to the carriages,

enabling re-positioning by unlocking the supports, sliding the supports to a new position e.g. along a beam or a rail on the carriage, and again locking the supports to the carriage at the new position.

CLAIMS

1. Skidding system (2) for an offshore installation or vessel, such as an offshore wind turbine installation ship (1), comprising at least one set of rails (5), and one or more carriages (6), such as pallets or carts, for supporting loads (4) and moving the loads (4) along the rails (5), e.g. from a storage position to an operating position and/or *vice versa*, **characterised in that** at least one of the carriages (6) is adaptable to different loads (4), wherein the at least one carriage (6) comprises a plurality of supports (12) for a load (4) and wherein at least two of the supports (12) are movable relative to each other.

2. Skidding system (2) according to claim 1, wherein at least two of the supports (12) are interconnected, directly or indirectly, via at least one telescopic beam (9).

3. Skidding system (2) according to claim 1 or claim 2, wherein the carriage (6) comprises a frame (7, 9, 10) and at least one of the supports (12), preferably a plurality of the supports (12), is releasably attached to the frame (7, 9, 10).

4. Skidding system (2) according to claim 3, wherein at least one of the supports (12), preferably a plurality of the supports (12), is bolted to the frame (7, 9, 10).

5. Skidding system (2) according to any one of the preceding claims, wherein the supports (12) are arranged in a triangle or square.

6. Skidding system (2) according to the preamble of claim 1 or any one of the preceding claims, wherein the at least one carriage (6) comprises one or more fasteners (14) for securing the load (4) to the carriage (6).

7. Skidding system (2) according to claim 6, wherein the one or more fasteners (14) is (are) mounted on or integrated in a support or supports (12).

5 8. Skidding system (2) according to any one of the preceding claims, wherein the at least one carriage (6) comprises one or more fasteners (17; 18; 19) for securing the carriage (6) or the load (4) to the rails (5) or to a deck (1A) of an offshore installation or vessel (1).

10 9. Skidding system (2) according to any one of the preceding claims, wherein the system (2) is fixed to the deck (1A) of an offshore installation or vessel (1).

15 10. Method of skidding loads (4) on an offshore installation or vessel, such as an offshore wind turbine installation ship (1), comprising at least one set of rails (5), and one or more carriages (6), such as pallets or carts, for supporting loads (4) and positioned on the rails (5), the method comprising the steps of selecting the load(s) (4) to be skidded, adapting the carriage(s) (6) to the load(s) (4), and positioning the load(s) (4) on the
20 adapted carriage(s) (6), wherein the at least one carriage (6) comprises a plurality of supports (12), the method comprising the step of repositioning at least two of the supports (12) relative to each other.

25 11. Method according to claim 10, wherein the carriage (6) comprises a frame (7, 9, 10) and at least one of the supports (12) is releasably attached to the frame (7, 9, 10), the method comprising the step of removing at least one of the supports (12) from the frame (7, 9, 10) and re-attaching the support (12) to the frame (7, 9, 10) at a
30 different location.

12. Method according to claim 10 or claim 11, comprising fastening the load(s) (4) to the carriage(s) (6) and/or fastening the carriage(s) (6) to the rails (5) or to a deck (1A) of an offshore installation or vessel (1).

35 13. Method according to any one of claims 10-12, comprising moving the carriages (6) and the loads (4) along

the rails (5) from storage positions to an operating position, removing the loads (4) from the carriages (6) and reducing the footprint of at least one of the carriages (6) after its load has been removed.