INTERCONNECTION UNIT CONFIGURED TO CONNECT MODULES OF A CARGO CONTAINER COUPLING ARRANGEMENT

TECHNICAL FIELD

The present disclosure generally relates to an interconnection unit configured to connect modules of a cargo container coupling arrangement. The disclosure further relates to a system and a control unit.

BACKGROUND

When handling cargo containers, typically when loading or unloading a container ship at a seaport, the containers are typically moved using a cargo container coupling arrangement. The coupling arrangement is typically configured to be releasebly attached to a lifting arrangement. Lifting arrangements may e.g. be cranes lifting containers on/off a ship, cranes handling the containers in a yard or other mobile units or vehicles, such as straddle carriers, reach stackers, Rubber Tired Gantry Cranes (RTG) or Rail Mounted Gantry Cranes (RMG), which are lifting and/or moving containers within a cargo area, yard or seaport.

The coupling arrangement typically comprises modules, such as a head block module and a spreader module. The lifting arrangements use coupling arrangements to grip and secure a cargo container when lifting and moving the cargo container. In the coupling arrangement, the spreader module is typically capable to adjust itself to the length of a cargo container to be lifted or moved. This is usually performed by telescoping beams provided with gripping arrangements or anchor points, such as twist-locks.

The head block module could be seen as the “interface” of the lifting arrangement, e.g. a cable crane, to which the spreader module needs to connect to, to be able to move cargo containers. The connection is typically made by matching and connecting anchor points of the spreader module to correspondingly positioned anchor points of the head block module.

Document KR950031875A shows a lifting arrangement with a sheave block welded or otherwise fixed onto a head frame or headblock module with a fixed XY position of anchor points for a particular crane hoisting system configuration. However, the document fails to show an adjustable interconnection between spreader module and the head frame or headblock module.

Document CN101891109 discloses a lifting arrangement not adapted for a spreader module. The arrangement does not allow for a quick change of spreader, and appears to be equipment typically used for massive construction assembly or building erection purposes which requires high leveling control to ensure precision installation.

Document KR20130072571 discloses arrangements for movement of a headblock module relative to a lifting arrangement/crane. The anchor points are fixed and are not adaptable/adjustable relative to each other.

Document US2014/034597 discloses a loading device for containers, which is provided with a travel carriage, which can move on a rail. The travel carriage is provided with two load handling devices that can be raised or lowered. A distance sensor is assigned to each of the load handling devices, with which the distance of the load handling devices from the travel carriage can be determined.

CLAIMS

1. Interconnection unit (124) configured to connect modules of a cargo container coupling arrangement (120), the coupling arrangement (120) being configured to be releasebly attached to a lifting arrangement (110) and configured to couple a cargo container (130) with the lifting arrangement (110), wherein the modules comprise at least a head block module (122) and a spreader module(123), the interconnection unit (124) comprising:

one or more head block fastening units (1241, 1242), each head block fastening unit being provided with an anchor point (1243, 1244) arranged in a first plane, wherein a first reference axis (X) and a second reference axis (Y) are mutually orthogonal to one another and extending along the first plane, wherein the anchor point (1243, 1244) is configured to releasebly attach to the head block module (122) of the lifting arrangement (110) using an anchor point matching the head block module (122), each head block fastening unit (1241, 1242) movably coupled to a corresponding displacement unit (1245, 1246) and arranged to displace the provided anchor point (1243, 1244) along an axis parallel to the first reference axis (X),

the interconnection unit (124) further comprising the one or more corresponding displacement units (1245, 1246), each displacement unit (1245, 1246) being movably coupled to the corresponding head block fastening unit (1241, 1242) and movably coupled to a spreader fastening unit (1247), the displacement unit (1245, 1246) being arranged to displace the provided anchor point (1243, 1244) of the corresponding head block fastening unit (1241, 1242) along a axis parallel to the second reference axis (Y),

the interconnection unit (124) further comprising the spreader fastening unit (1247) configured to be attached to the spreader module (123), wherein the spreader fastening unit (1247) is movably coupled to the one or more displacement units (1245, 1246), and

the interconnection unit (124) further comprising a plurality of locking arrangements, each locking arrangement being configured to prevent each displacement unit (1245, 1246) from moving relatively to the spreader fastening unit (1247), or to prevent each head block fastening unit (1241, 1242) from moving relatively to the corresponding displacement unit (1245, 1246).

2. The interconnection unit according to claim 1, wherein each anchor point (1243, 1244) comprises a twist-lock pin connection (401) or a pin trough connection (402).

3. The interconnection unit according to any of the preceding claims, further comprising a plurality of locking arrangements configured to:

prevent each displacement unit (1245, 1246) from moving relatively to the spreader fastening unit (1247), and to

to prevent each head block fastening unit (1241, 1242) from moving relatively to the corresponding displacement unit (1245, 1246).

4. The interconnection unit according to claim 3, wherein each locking arrangement of the one or more locking arrangements comprises at least:

a first locking member (511, 514) of a displacement unit (1245, 1246) having a through hole and arranged to align with one of a plurality of holes of the spreader fastening unit (1247) when moved relatively to the spreader fastening unit (1247), and

a second locking member (512, 513) of a corresponding head block fastening unit (1241, 1242) having a through hole and arranged to align with one of a plurality of holes of the displacement unit (1245, 1246) when moved relatively to the displacement unit (1245, 1246),

wherein the locking arrangement further comprises a first lock down pin (501, 504) arranged to protrude through the first locking member (511, 514) and extend into the one of a plurality of holes of the spreader fastening unit (1247), and a second lock down pin (502, 503) arranged to protrude through

the second locking member (512, 513) and extend into the one of a plurality of holes of the displacement unit (1241, 1242).

5. The interconnection unit according to claim 3, wherein each locking arrangement of the one or more locking arrangements comprises at least:

an actuator unit, wherein each actuator unit comprises an actuator (601, 603, 605, 607) and a linkage member (603, 604, 606, 608)

6. The interconnection unit according to claim 5, wherein the one or more actuator units each comprises a first axis actuator, wherein the linkage member (604, 608) of the first axis actuator is coupled to a first actuator (603, 607), a displacement unit (1245, 1246) and a corresponding head block fastening unit (1241, 1242), wherein the first actuator (603, 607) is configured to displace the head block fastening unit (1241, 1242) relatively to the displacement unit (1245, 1246) in a first direction in response to a control signal.

7. The interconnection unit according to claim 5 or 6, wherein the one or more actuator units each comprises a second axis actuator, wherein the linkage member (602, 606) of the second axis actuator is coupled to a second actuator (601, 605), a displacement unit (1245, 1246) and the spreader fastening unit (1247), wherein the second actuator (601, 605) is configured to displace the displacement unit (1245, 1246) relatively to the spreader fastening unit (1247) in a second direction in response to a control signal.

8. A system (700) for providing micro motion between modules of a cargo container coupling arrangement (120), wherein the coupling arrangement is configured to be releaseably attached to a lifting arrangement (110) and configured to couple a cargo container (130) with the lifting arrangement, the system comprising:

a coupling arrangement (120) comprising a plurality of modules, wherein the modules comprise at least a head block (122) module, a spreader (123) module and one or more interconnection units (124) according to any of claims 1-7, and,

a control unit (710) communicatively coupled to actuators (601, 603, 605, 607) of the one or more interconnection units (124), wherein the control unit is configured to transmit control signals to the actuators (601, 603, 605, 607) of the one or more interconnection units (124), causing the one or more interconnection units to displace the head block (122) module relatively to the spreader (123) module in response to the control signals and provide micro motion between the modules of the cargo container coupling arrangement (120).

9. The system according to claim 8, wherein the control unit (710) further comprises a user interface, the user interface comprising user input device (717) and a display (718), wherein the control unit is configured to receive an indication from a user indicative of micro motion, such as skew, list and trim movements, and send control signals indicative of displacement of actuator units corresponding to the micro motion.

10. The system according to any of claims 8 or 9, wherein the system further comprises a server (730), wherein the control unit (710) is configured to receive an indication from the server (730) indicative of micro motion, such as skew, list and trim movements, and send control signals indicative of displacement of actuators (601, 603, 605, 607) corresponding to the micro motion.

11. The system according to any of claims 8-10, wherein the server (330) is configured to receive control signals comprising sensor data from the sensors of the cargo container coupling arrangement (120), and generate the indication from the server (330) indicative of micro motion using a computer implemented trained model.

12. A control unit (710) communicatively coupled to actuators (601, 603, 605, 607) of one or more interconnection units (124) according to any one of claims 1-7, wherein the control unit (710) is configured to transmit control signals to the actuators (601, 603, 605, 607) of the one or more interconnection units (124), causing the one or more interconnection units to displace one or more anchor

points (1243, 1244) of the one or more interconnection units (124) in response to the control signals.

13. A computer program comprising computer-executable instructions for causing a control unit (710) according to claim 12, when the computer-executable instructions are executed on a processing unit circuitry (812) comprised in the control unit (710), to perform the method steps:

receiving an indication indicative of desired micro motion of a cargo container coupling arrangement (120), such as skew, list and trim movements, and

sending control signals indicative of displacement of actuators (601, 603, 605, 607) corresponding to the indicated micro motion.

14. A spreader module (123) comprising the interconnection unit according to any of claims 1-7.