

CLAIMS

1. Interconnection unit (124) configured to connect modules of a cargo container coupling arrangement (120), the coupling arrangement (120) being configured to be releaseably 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 releaseably 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. The interconnection unit according to claim 3, wherein each locking arrangement of the one or more locking arrangements comprises at least:

a third locking member (1012), the third locking member (1012) being provided with two flanges arranged perpendicular to each other, wherein a first flange is provided with a through hole and the second flange is wedge shaped,

a fourth locking member (1015) in the form of a wedge shaped gib, the gib having a wedge shape matching the wedge shape of the second flange of the third locking member (1012),

a fifth locking member (1013) in the form of a rod arranged to be inserted through the through hole of the first flange of the third locking member (1012) and through a through hole of the head block fastening unit (1241, 1242),

wherein the wedge shape of the second flange of the third locking member (1012) is arranged in contact with the wedge shaped gib of the fourth locking member (1015).

9. The interconnection unit according to claim 8, further comprising a sixth locking member (1016), the sixth locking member (1016) being provided with two flanges arranged perpendicular to each other, wherein a third flange is provided with a through hole and a fourth flange is wedge shaped, the fourth flange having a wedge shape matching the wedge shape of the second flange of the third locking member (1012),

wherein the rod (1013) is further arranged to be inserted through the through hole of the third flange of the sixth locking member (1012),

wherein the wedge shape of the fourth flange of the sixth locking member (1016) is arranged in contact with the wedge shaped gib of the fourth locking member (1015).

10. 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 1-9, 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).

11. 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.
12. The system according to any of claims 10-11, 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.
13. The system according to any of claims 10-12, 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.
14. 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 1-9, 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.
15. A computer program comprising computer-executable instructions for causing a control unit (710), 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.

16. A spreader module (123) comprising the interconnection unit (124) according to any of claims 1-9.