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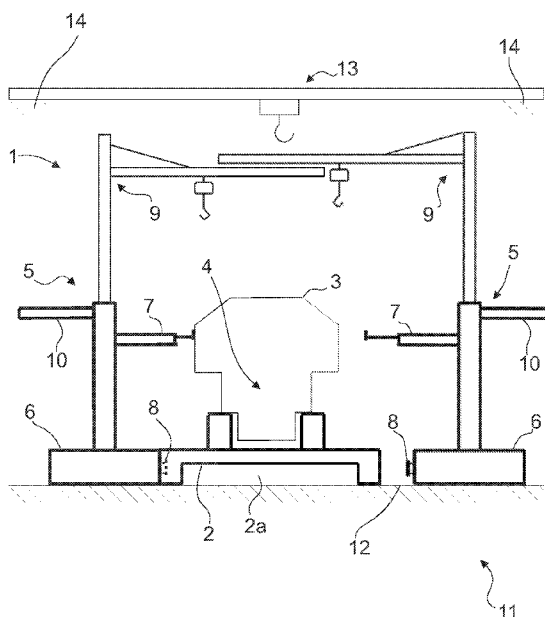


Fig. 1

(57) Abstract: An assembly arrangement (1), comprising a support base (2) for supporting a product (3) to be assembled, wherein a product space (4) for accommodating the product (3) being defined above the support base (2). The arrangement (1) further comprises an assembly platform module (5), having an assembly platform base (6), and an assembly platform (7) supported, the assembly platform (7) being arranged adjacent to a lateral side of the product space (4) to provide assembly access to the product (3) to be assembled. The arrangement (1) further comprises base coupling means (8) detachably coupling the assembly platform base (6) to the support base (2) in a rigid manner. The assembly platform module (5) comprises a lifting device (9) horizontally extendable at least to a position in which the lifting device (9) extends above the product space (4). An assembly workshop (11) having such an arrangement (1) is also concerned.

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AN ASSEMBLY ARRANGEMENT AND AN ASSEMBLY WORKSHOP

FIELD OF THE DISCLOSURE

The present disclosure relates to assembly arrangements for facilitating assembly of relatively large products, such as reciprocating internal combustion piston engines for marine and power plant applications. More particularly, the present disclosure relates to an assembly arrangement having a support base for supporting a product to be assembled, and an assembly platform for providing assembly access to the product to be assembled. The present disclosure further concerns an assembly workshop having such an assembly arrangement.

BACKGROUND OF THE DISCLOSURE

When assembling relatively large products, such as reciprocating internal combustion piston engines for marine and power plant applications, assembly platforms are needed for enabling safe assembly. Assembly of such relatively large products also require lifting of heavy components, thereby necessitating lifting equipment for enabling assembly.

To this end, assembly workshops have conventionally been provided with fixed assembly stations with floor mounted assembly crane structures. Additionally, such assembly stations are typically by facility structure mounted overhead cranes for heavy lifting, i.e. lifting components exceeding the capacity of the assembly cranes.

However, such fixed assembly stations and floor mounted assembly cranes structures do not allow for flexible utilization of the workshop environment. Additionally, each assembly station, including their floor mounted assembly crane structures, must be designed around a certain product or product family, often leading to non-optimal utilization of the workshop environment. Particularly, such conventional arrangements do not allow the assembly workshop to be modified depending of nature of products and capacity needs without structural changes of the workshop.

BRIEF DESCRIPTION OF THE DISCLOSURE

An object of the present disclosure is to provide an assembly arrangement and an assembly workshop so as to overcome the above problems associated to conventional assembly stations and workshops.

The object of the disclosure is achieved by an assembly arrangement and an assembly workshop which are characterized by what is stated in the independent claims. The preferred embodiments of the disclosure are disclosed in the dependent claims.

The disclosure is based on the idea of providing an assembly platform module releasably attachable to a support base laying under the product to be attachable. In such an arrangement, the assembly platform module, the support base and the product itself together form a sufficiently rigid structure that a lifting device for enabling assembly may be provided on the assembly platform module instead of instead of mounting on the workshop floor.

An advantage of the assembly arrangement and assembly workshop according to the present disclosure is that the assembly platform location or assembly cell size is no longer dependant of floor mounted structures or lifting device assembly crane availability in the workshop, while still allowing utilization of overhead cranes support for heavy lifting. This way, the flexibility of the workshop may be increased. Particularly the workshop layout can be easily modified depending on the nature of product, process and capacity needs, e.g. from cell assembly to line assembly or vice versa, without the need to structurally modify the workshop itself.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following the disclosure will be described in greater detail by means of preferred embodiments with reference to the accompanying drawings, in which:

Fig. 1 schematically illustrates a side view of an assembly arrangement and an assembly workshop according to an embodiment of the present disclosure, as seen along a longitudinal direction of the product space.

DETAILED DESCRIPTION OF THE DISCLOSURE

According to a first aspect of the present disclosure, an assembly arrangement 1 is provided.

The assembly arrangement comprises a support base 2 for supporting a product 3 to be assembled on a planar surface, such as a workshop floor 12. Moreover, a product space 4 for accommodating the product 3 to be assembled is defined above the support base 2. Suitably, the product 3 to be assemble may be a reciprocating internal combustion piston engine for marine and power plant applications.

The assembly arrangement 1 further comprises an assembly platform module 5. The assembly platform module 5, in turn, further comprises an assembly platform base 6, and an assembly platform 7 supported by the assembly platform base 6, such that the assembly platform 7 is elevated from the assembly platform base 6. The assembly platform

7 is further arranged adjacent to a lateral side of the product space 4 so as to provide assembly access to the product to be assembled 3.

Particularly, the assembly platform arrangement 1 further comprises base coupling means 8 for detachably coupling the assembly platform base 6 to the support base 2 in a rigid manner.

Most suitably, the base coupling means are configured to provide mechanical attachment between the assembly platform base 6 and the support base 2, such that mechanical forces may be transmitted between the assembly platform base 6 and the support base 2. Fixing the assembly platform base 6 together with support base 2 supporting the product to be assembled 3 ensures that a sufficient counterweight is achieved so that a lifting device 9 may be provided, and safely operated, on the assembly platform module 5, as discussed in more detail hereafter.

For example, the base coupling means may be provided as a plug-and-socket -type attachment, in which one or more pin, and respectively, one or more recesses in which the pins are receivable, are provided. Alternatively, the base coupling means could be provided as one or more profiled rail pieces, and respectively, one or more counter pieces in which the rail pieces are receivable, are provided.

Preferably, the base coupling means are further provided with a securing arrangement for securing the base coupling means in place to ensure that the coupling means are not unintentionally detached from each other.

Preferably, the base coupling means are provided on the corresponding mating surfaces of the assembly platform base 6 and the support base 2

In addition, the assembly platform module 5 further comprises a lifting device 9 horizontally extendable at least to a position in which the lifting device 9 extends above the product space 4. For example, if a jib crane is used as the lifting device 9, the horizontally extending boom thereof may be pivotable to reach over the product space. Naturally, any other well-known type of lifting device may be used.

In this kind of assembly arrangement 1, the support base 2 and the platform base 6 attached to it, along with the weight of the product 3 itself, provide sufficient structural rigidity allowing the lifting device 9 to be mounted on the assembly platform base 6 without risk of tipping.

Mounting the lifting device 9 on the assembly platform module 5 removes the need for floor mounted assembly cranes, and subsequently enables the workshop layout to be easily

modified depending on the nature of product, process and capacity needs, without the need to structurally modify the workshop itself.

In an embodiment according to the first aspect of the present disclosure, the assembly platform 7 extends along a longitudinal direction of the product space 4. Preferably, but not necessarily, the assembly platform 7 is arranged to extend along over the whole length of the product space 4, or the product 3 to be assembled. Particularly, if the product 3 to be assembled is a reciprocating internal combustion piston engine, the product space 4 is preferably configured to receive the engine such that the longitudinal direction of the product space 4 is aligned with the longitudinal direction of the engine (i.e. the longitudinal direction of the crankshaft), while the assembly platform 7 suitably extends along the whole length of the engine.

In another embodiment according to the first aspect of the present disclosure, the assembly platform module 5 further comprises an auxiliary platform 10 for receiving and holding components of the product 3 to be assembled. Such an auxiliary platform 10 is preferably arranged on a side of the assembly platform 7 opposite to the product space 4. Suitably, the auxiliary platform 10 is supported by the platform base 6 and elevated therefrom. This enables a buffer storage for components to be provided on the auxiliary platform 10, and consequently minimises any waiting time due to an overhead crane 13 of the associated workshop 11 being in other use.

Preferably, but not necessarily, in such an embodiment the lifting device 9 is additionally horizontally extendable at least to a position in which the lifting device 9 extends above the auxiliary platform 10. This enables the lifting device 9 to pick up components from the auxiliary platform 10 so as to be moved into position with the product 3 for assembly

In another embodiment according to the first aspect of the present disclosure, the assembly platform module 5 may comprise multiple lifting devices 9, spaced apart from one another along a longitudinal direction of the product space 4. In a similar manner, each lifting device 9 is suitably horizontally extendable at least to a position in which the lifting device 9 extends above the product space 4.

Should the assembly platform module 5 be equipped with an auxiliary platform 10, each lifting device 9 is preferably additionally horizontally extendable at least to a position in which they extend above the auxiliary platform 10.

In another embodiment according to the first aspect of the present disclosure, the assembly arrangement 1 further comprises an opening 2a arranged to receive a moving device below either, or both, of the support base 2 and the assembly platform base 6 for

moving the assembly arrangement 1 along a planar surface, such as a workshop floor 12. Naturally, the assembly arrangement 1 may comprise multiple such openings 2a for receiving a corresponding number of moving devices.

5 In such a case, the assembly arrangement 1 may comprise a moving device accommodated in the opening 2a and arranged to move the assembly arrangement 1 along a planar surface, such as a workshop floor 12. Naturally, the assembly arrangement 1 may comprise multiple moving devices accommodated either in a single opening 2a, or in multiple respective openings 2a.

10 Preferably, such a moving device comprises an air bearing for applying an air film between the planar surface and the moving device so as to enable the assembly arrangement to glide on the planar surface. Such moving devices are often referred to as air casters or air film movers.

15 In another embodiment according to the first aspect of the present disclosure, the assembly arrangement 1 comprises two assembly platform modules 5, as discussed above, arranged on opposite sides of the product space 4. This allows assembly access to both longitudinal sides of the product space 4 simultaneously. Naturally, such opposing assembly platforms modules 5 may be configured to suit the assembly requirements of the product 3 to be assembled. For example, such opposing assembly platform modules 5 may be identical, so that any assembly platform module 5 may be used on either side of
20 the product space 4. Alternatively, the opposing assembly platform modules 5 may vary from each other. For example, the opposing assembly platform modules 5 may have their respective assembly platforms 7 arranged at different elevations, thereby allowing a wider range of supported assembly heights by interchanging the opposing assembly platform modules 5 as per required assembly height.

25 According to a second aspect of the present disclosure, an assembly workshop 11 is provided. Such an assembly workshop 11 comprises a floor 12 having a planar surface.

Moreover, the assembly workshop 11 further comprises an overhead crane 13 supported by a support structure 14 of the assembly workshop 11. The overhead crane is configured to have a reach corresponding to at least a portion of the workshop floor 12.

30 Particularly, the assembly workshop 11 further comprises an assembly arrangement 1 according to any of the embodiments, or variations thereof, as discussed above in connection with the first aspect of the present disclosure. The assembly arrangement 1 is positioned within the assembly workshop 11 supported on the portion of the workshop floor 12 corresponding to reach of the overhead crane 13.

Preferably, but not necessarily, a plurality of assembly arrangements 1 may be provided within the assembly workshop 11 on the portion of the workshop floor 12 corresponding to the reach of the overhead crane 13.

CLAIMS

1. An assembly arrangement (1), comprising

a support base (2) for supporting a product (3) to be assembled on a planar surface, such as a workshop floor, a product space (4) for accommodating the product (3) to be assembled being defined above the support base (2), and

an assembly platform module (5), further comprising:

— an assembly platform base (6), and

— an assembly platform (7) supported by the assembly platform base (6) and and elevated therefrom, the assembly platform (7) being arranged adjacent to a lateral side of the product space (4) so as to provide assembly access to the product (3) to be assembled,

characterized in that the assembly platform arrangement (1) further comprises base coupling means (8) detachably coupling the assembly platform base (6) to the support base (2) in a rigid manner,

wherein the assembly platform module (5) further comprises a lifting device (9) horizontally extendable at least to a position in which the lifting device (9) extends above the product space (4).

2. The assembly arrangement (1) according to Claim 1, **characterized** in that the assembly platform (7) extends along a longitudinal direction of the product space (4).

3. The assembly arrangement (1) according to Claim 1 or 2, **characterized** by the assembly platform module (5) further comprising an auxiliary platform (10) for receiving and holding components of the product (3) to be assembled, the auxiliary platform (10) being supported by the platform base (6) and elevated therefrom, and arranged on a side of the assembly platform (7) opposite to the product space (4).

4. The assembly arrangement (1) according to Claim 3, **characterized** in that the lifting device (9) is additionally horizontally extendable at least to a position in which the lifting device (9) extends above the auxiliary platform (10).

5. The assembly arrangement (1) according to any of the preceding Claims 1-4, **characterized** in that the assembly platform module (5) comprises multiple lifting devices (9), spaced apart from one another along a longitudinal direction of the product space (4), each lifting device (9) being preferably horizontally extendable at least to a position in which the lifting device (9) extends above the product space (4).

- 5 6. The assembly arrangement (1) according to any of the preceding Claims 1-5, **characterized** by further comprising an opening (2a) arranged to receive a moving device below either or both of the support base (2) and the assembly platform base (6) for moving the assembly arrangement (1) along a planar surface, such as a workshop floor.
7. The assembly arrangement (1) according to Claim 6, **characterized** by further comprising a moving device accommodated in the opening (2a) and arranged to move the assembly arrangement (1) along a planar surface, such as a workshop floor.
- 10 8. The assembly arrangement (1) according to Claim 7, **characterized** in that the moving device comprises an air bearing for applying an air film between the planar surface and the moving device so as to enable the assembly arrangement (1) to glide on the planar surface.
- 15 9. The assembly arrangement (1) according to any of the preceding Claims 1-8, **characterized** by comprising two assembly platform modules (5) arranged on opposite sides of the product space (4).
- 20 10. An assembly workshop (11), comprising a floor (12) having a planar surface, **characterized** by comprising:
--- the assembly arrangement (1) according to any of the preceding Claims 1-9 supported on the floor, and
--- an overhead crane (13) supported by a support structure (14) of the assembly workshop, the overhead crane (13) having a reach corresponding to at least a portion of the workshop floor,
wherein the assembly platform arrangement (1) being positioned within the portion of the workshop floor corresponding to the overhead crane (13) reach.
- 25 11. The assembly workshop (11) according to Claim 10, **characterized** by comprising a plurality of assembly platform arrangements (1) according to any of the preceding Claims 1-9 supported on the floor (12), within the portion thereof corresponding to the overhead crane reach.

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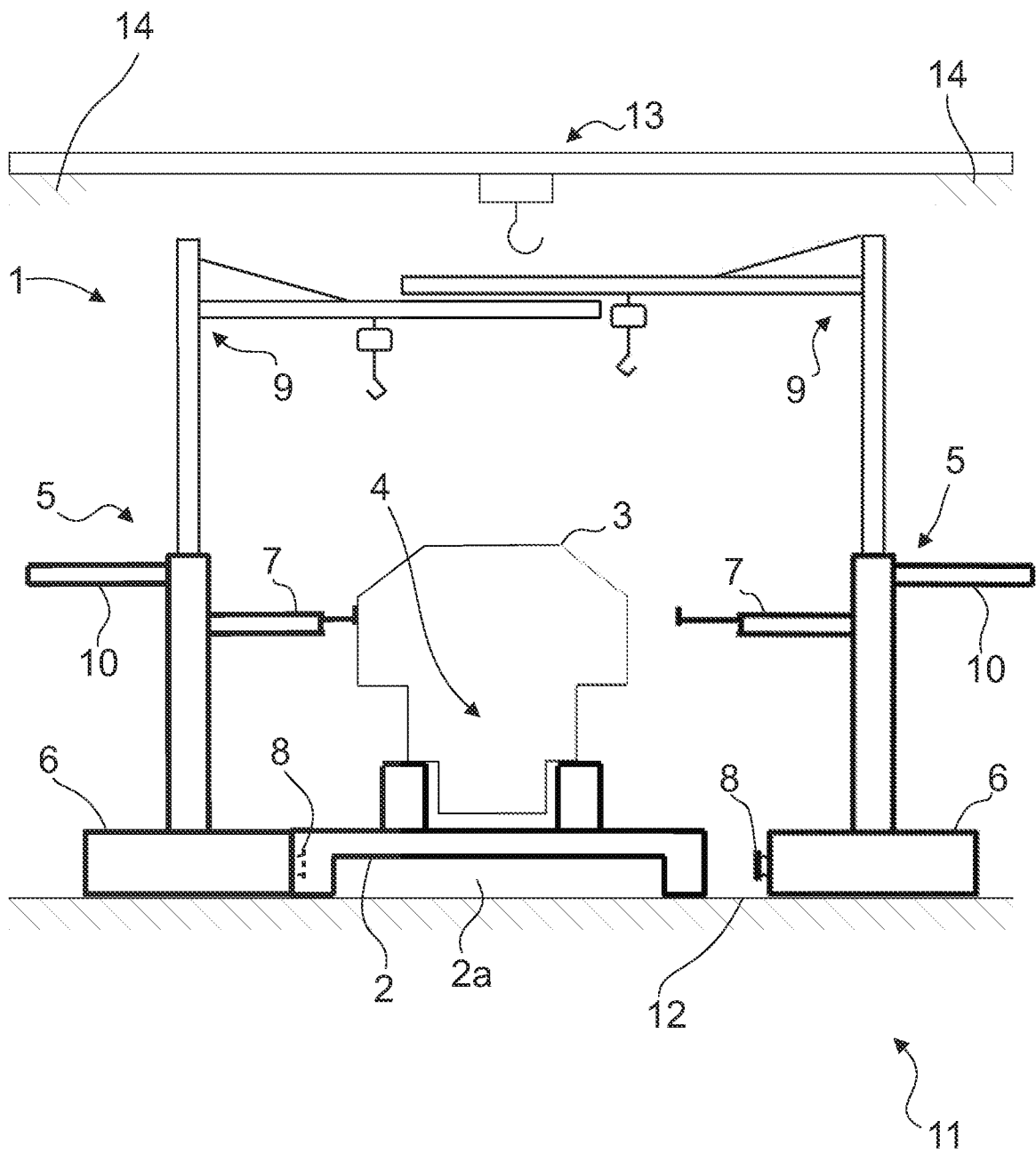


Fig. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2019/050441

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23P21/00 B66C23/18
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B23P B66C B25H B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 513 231 B1 (HAFENRICHTER JOSEPH L [US] ET AL) 4 February 2003 (2003-02-04) column 5, line 13 - line 21 column 6, line 41 - line 60; figures column 7, line 46 - column 8, line 41 -----	1-11
A	US 6 467 117 B1 (LANTZ LELAND L [US] ET AL) 22 October 2002 (2002-10-22) abstract; figures column 1, line 6 - line 56 -----	1-11
A	JP H09 169495 A (SHIMIZU CONSTRUCTION CO LTD) 30 June 1997 (1997-06-30) abstract; figures -----	1-11
A	CN 108 100 959 A (BEIJING INST SPECIALIZED MACHINERY) 1 June 2018 (2018-06-01) abstract; figures ----- -/-	1-11



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12/02/2020

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 203 680 251 U (CSR LUOYANG CO LTD) 2 July 2014 (2014-07-02) abstract; figures -----	1-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/FI2019/050441

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