

WORKPIECE MANUPULATING APPARATUS

TECHNICAL FIELD

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The present invention relates to an apparatus for manipulating workpieces. In particular, the present invention relates to an apparatus for manipulating workpieces having weights beyond the handling capacity of manual operation.

10 BACKGROUND

Vessel manufacturing often involves building of construction modules. Such construction modules are typically made of steel material and weight far beyond the handling capacity of manual operation, e.g. in at least several tons to over tens of tons. To
15 manipulate such construction modules, e.g. changing the positions and orientation, moving from one location to the other at the production line or the ship-building yard, it is necessary to utilize heavy equipments such as gantry cranes and/or crawler cranes. Taking the operation of flipping a construction module as an example, a construction module of about 12.5 meters long, 2.5 meters wide and 1.25 meters thick at a weight of about 80 tons
20 requires two cranes, one hangs the module stationary to serve as the fulcrum, and the other will move the module around the fulcrum to turn the module by stretching and releasing.

As cranes are meant for performing load-lifting operations along vertical direction only, turning, flipping and rotation of such heavy construction module often requires two
25 cranes and together with manual assistance to complete the task. Flipping of such a heavy construction module typically takes several hours. Such process raises safety concerns to operators and is labour-intensive. In addition, as crane availability constitutes a major role in the operational capacity of a shipyard, alleviating the demands for cranes is greatly desirable for yard operations.

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It is therefore desirable to provide a solution to ease the construction module flipping operation, increase safety level and reduce the crane occupation hours.

SUMMARY OF THE INVENTION

Embodiments of the present invention provide workpiece manipulating
5 apparatuses which eases the operation procedure, increased the safety level and
productivity. In one embodiment, a workpiece manipulating apparatus has:
first and second support frames disposed spaced apart from each other. Each support
frame rotatably supports a fixture thereon. The fixtures are to clamp opposite end portions
of the workpiece thereto. The fixtures are rotatable relative to the first and second support
10 frames about a horizontal axis to turn the workpiece.

Other aspects and advantages of the present invention will become apparent from
the following detailed description, illustrating by way of example the inventive concept of
the present invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the present invention will be described in detail with reference to the accompanying drawings, in which:

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Fig. 1 is a schematic perspective view showing a workpiece manipulating apparatus according to one embodiment of the present invention;

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Fig. 2 is an exploded perspective view showing the apparatus of Fig. 1 together with a workpiece to be clamped for manipulation;

Fig. 3 is an exploded perspective view showing a modification of the apparatus of Fig. 1, when a workpiece is seated thereon and to be clamped for manipulation;

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Fig. 4 is an enlarged front partial view showing the driving mechanism of the apparatus of Fig. 1;

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Fig. 5 is a perspective view showing a work piece clamped to an apparatus of Fig. 1 and in the process of being manipulated;

Fig. 6 is a perspective view showing a work piece clamped to an apparatus according to another embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in Figs. 1, 2 and 3, a workpiece manipulation apparatus 100 according to one embodiment of the present invention includes a base in the form of support frames 110, 130 arranged spaced-apart from each other, and fixtures 120, 140 each being rotatably supported on a respective support frame 110, 130. Fixture 120 includes an upper clamping plate 122 and a lower clamping plate 124. When being fixed together, clamping plates 122 and 124 serve to clamp one end portion 12 of a workpiece 10 therebetween. Fixture 120 has a cylindrical external surface 120a formed by clamping plates 122, 124. Fixture 120 is engaged to support frame 110 by cylindrical external surface 120a such that fixture 120 is rotatable relative to support frame 110, about a horizontal axis 104 of fixture 110. Similarly, fixture 140 includes an upper clamping plate 142 and a lower clamping plate 144. When being fixed together, clamping plates 142, 144 serve to clamp the opposite end portion 14 of workpiece 10 therebetween. Fixture 140 has a cylindrical external surface 140a formed by clamping plates 142, 144. Fixture 140 is engaged to support frame 130 by cylindrical external surface 140a such that fixture 140 is rotatable relative to support frame 130 about the same horizontal axis 104 of fixture 110.

Upper clamping plates 122 and 142 may be connected together by one or more upper linking beams 150. Lower clamping plates 124 and 144 may also be connected together by one or more lower linking beams 160. Connected in this way, upper clamping plates 122, 142 and lower clamping plates 124, 144 each forms an integral structure with higher structural strength and rigidity which are suitable for manipulating workpieces with greater weight and dimension.

Apparatus 100 may further include a driving mechanism to drive the rotation of fixtures 120, 140. In one embodiment, as shown in Fig. 4, fixture 120 includes a plurality of pins 180 fixed to upper and lower clamping plates 122, 124 (only lower clamping plate 124 is partially shown in Fig. 4), along a circumference 128 of fixture 120 which is defined by a diameter 129. The plurality of pins 180 are aligned along a direction parallel to the horizontal axis 104.

The driving mechanism includes a gear or sprocket 170 engaged to the plurality of pins 180. Gear 170 is connected to a motor through a gear box (not shown). As such, rotation of gear 170 will cause rotation of fixture 120 which, in turn, will rotate workpiece 10 clamped to fixtures 120, 140. Manipulation operation of the workpiece can be carried out accordingly, e.g. to turn over the workpiece about horizontal axis 104, as show in Fig. 5.

Pins 180 may be distributed along the full circle of circumference such that gear 170 can drive the rotation of workpiece 10 by a full circle. Alternatively, in applications where a work piece is required to be turn in an upside-down manner, pins may be distributed along a half circle of the circumference by which, gear 170 will drive the rotation of the workpiece by a half-circle.

To increase the structural stability during the rotation process, support frames 110 and 130 may include one or more bearing rollers 172 which are rotatably engaged to external surface 120a of fixture 120, and to external surface 140a of fixture 140. Additionally, one or more of the support frames 110, 130 may also include platforms 116, 136 to allow access by an operator for, e.g. assisting and monitoring the workpiece manipulation process and/or for maintenance purpose.

Fig. 6 shows a workpiece manipulation apparatus 200 according to another embodiment of the present invention. Apparatus 200 has first and second support frames 210, 230 each of which supports a fixture 220, 240 in a manner to allow rotation of fixture 220, 240 relative to support frames 210, 230, about a horizontal axis 204. Each of fixture 220, 240 includes an opening 226, 246 into which a portion of workpiece 10 is disposed. A distance 218 between first and second support frames 210, 230 is variable such that apparatus 200 can be suitable for manipulating workpieces with different length. Based on the length of workpiece 10, workpiece 10 can be clamped by fixtures 220, 240 at appropriate locations to ease the manipulation operation.

Although embodiments of the present invention have been illustrated in conjunction with the accompanying drawings and described in the foregoing detailed

description, it should be appreciated that the present invention is not limited to the embodiments disclosed. Therefore, the present invention should be understood to be capable of numerous rearrangements, modifications, alternatives and substitutions without departing from the spirit of the invention as set forth and recited by the following claims.

CLAIMS

1. A workpiece manipulating apparatus comprising:
first and second support frames disposed spaced apart from each other;
5 first and second fixtures each being rotatably supported on a respective one of
the first and second support frames;
wherein the first and second fixtures are to clamp opposite end portions of the
workpiece thereto, and
wherein the first and second fixtures being rotatable relative to the first and
10 second support frames about a horizontal axis to turn the workpiece.
2. The apparatus of claim 1, wherein the first and second fixtures having cylindrical
external surfaces engaged to the first and second support frames to support rotation
of the first and second fixtures.
- 15 3. The apparatus of claim 2, wherein each of the first and second fixtures including a
pair of clamping plates movably coupled to each other for clamping the workpiece
therebetween.
- 20 4. The apparatus of claim 3, further including a first linking portion to fix the first
clamping plates together, and a second linking portion to fix the second plates
together.
- 25 5. The apparatus of claim 2, further comprising a driving mechanism engaged to at
least one of the first and second fixtures to rotate the fixture.
- 30 6. The apparatus of claim 5, wherein said at least one of the first and second fixtures
including a plurality of pins attached thereon, said plurality of pins being disposed
along a circumference of said at least one of the first and second fixtures, each pin
being aligned parallel to the horizontal axis, wherein the driving mechanism
having a gear engaged to the plurality of pins to rotate the fixture.

7. The apparatus of claim 6, wherein the plurality of pins are distributed along a full circle of the circumference.
- 5 8. The apparatus of claim 6, wherein the plurality of pins are distributed along a half circle of the circumference.
9. The apparatus of claim 1, wherein a distance between the first and second support frames being variable.
- 10 10. The apparatus of claim 1, wherein at least one of the support frames includes a platform to allow operator access.