

SUPPORTING APPARATUS

Field of the Invention

5 The present invention relates to a supporting apparatus, and more particularly to a supporting apparatus for holding a measurement instrument during measurement operations.

Brief description of the drawings

10

Fig. 1 is a perspective view of a supporting apparatus according to one embodiment of the present invention;

15

Fig. 2 is a perspective bottom view of Fig. 1.

Fig. 3 is a perspective bottom view of Fig. 1 for mounting to a measurement instrument.

20

Fig. 4 is a perspective bottom view of Fig. 3 when a measurement instrument is mounted to the supporting apparatus.

Fig. 5 is a perspective view of Fig. 1 illustrating further detailed structure.

25

Fig. 6 is a cross sectional view of a bulk carrier cargo hold in which the apparatus of Fig. 1 may be used for supporting a measurement instrument for performing measurement operation.

30

Fig. 7 is a perspective view showing the apparatus of Fig. 1 when a measurement instrument is mounted to the supporting apparatus and ready for performing measurement operation.

Fig. 8 is a side view of Fig. 7.

Fig. 9 is an enlarged partial view of Fig. 7.

Fig. 10 is an enlarged partial view of Fig. 8.

5

Detailed Description Of Preferred Embodiments

As shown in Figs. 1 to 5, a supporting apparatus 100 according to one embodiment of the present invention includes a base 110 and a rope 140 connected to base 110. Base 110 is generally a flat frame structure having a top side 112 and a bottom side 114. Base 110 defines a symmetrical axis 110c which intersects top side 112 at a top side center 112a, and intersects bottom side 114 at a bottom side center 114a. Base 110 includes a center region, depicted by a center circle 116 of a small radius R1 and centered at axis 110c, and a co-axial peripheral circle 118 of a larger radius R2 surrounding center circle 116.

15

Base 110 has a plurality of primary supporting ends 120 and secondary supporting ends 130 extended outwardly from center axis 110c, along radial directions. Primary and secondary supporting ends 120 and 130 are preferably positioned along peripheral circle 118, with even angular pitch therebetween about center axis 110c, in an alternate manner. In the embodiment shown in Figs. 1, 2 and 3, base 110 has two primary supporting ends 120 and two secondary supporting ends 130 alternately and evenly distributed along the full 360-degree peripheral circle 118. Another words, the included angle 122 of two adjacent primary and secondary supporting ends 120 and 130 is 90-degree about center axis 110c. While the embodiment shown in the figures has total of four supporting ends, it should be appreciated that supporting apparatuses according other embodiment of the present invention maybe configured to have other numbers of supporting ends e.g. total of six, eight supporting ends, etc.

20

25

30

At each of the secondary supporting ends 130, there is connected a cross rod 150 which is oriented along a direction parallel to center axis 110c. Cross rod 150 has a first

end 152 positioned above top side 112, and a second end 154 positioned under bottom side 114.

5 Positioned in a triangle relationship, first end 152, second 154 of cross rod 150 and an adjacent primary supporting end 120 define a support plane 160 which has an effective supporting distance D1 from center axis 110c of base 110. In the present embodiment, D1 is greater than R1 such that when measurement instrument 10 is mounted to base 110, the primary and secondary supporting ends 120, 130 are positioned a certain distance spaced apart from center region 116 to avoid the interference between the measurement
10 instrument 10 and primary and secondary supporting ends 120, 130.

 Base 110 and cross rods 150 may be made of formed steel bars, and fixed together by welding or other fastening means e.g. bolts and nuts, rivet, etc. or a combination thereof. Structured in the above-illustrated manner, base 110 is of a geometrically
15 symmetrical frame about center axis 110c, and therefore center axis 110c passes through the center of gravity of base 110.

 In one application for measurement of sand volume in a bulk carrier cargo hold, as shown in Figs. 6 to 10, sand 44 is loosely loaded in chamber 42 of cargo hold 40. When
20 sand or other types of bulk materials are loaded in the cargo hold, it is inconvenient and unsafe, if not impossible, for the operator to stand on the sand 44 in cargo hold 40, to carry out the measurement operation. Instead, instrument operator can only access the chamber 42 via the top opening 46 of cargo hold 40, by supporting and extending the measurement instrument from platform 20 at the upper rim 48 of vertical wall 30 of cargo hold 40.
25

 As shown in further details in Figs. 6 to 10, according to an embodiment of the present invention, a measurement instrument 10 is firstly attached or mounted to base 110 of supporting apparatus 100, and centrally aligned with center axis 110c. Thereafter, measurement instrument 10 together with base 110 are lowered into chamber 42 of cargo
30 hold 40, by extending the length of rope 140. By adjusting the length of rope 140, the measurement instrument 10 may be positioned at an appropriate depth, i.e. beyond the

lower rim 32 of vertical wall 30, such that the measurement instrument 10 can obtain a full image or space data of the sand without being blocked by the lower rim 32.

During the process of lowering the measurement instrument 10 and base 110 into cargo hold chamber 42, rope 140 is held adjacent to vertical sidewall 30 of cargo hold 40 and upper rim 48 of vertical wall 30. In the meantime, one of the primary supporting end 120 and the first end 152, second 154 of an adjacent cross rod 150 are brought into contact with vertical wall 30.

As shown in further details in Figs. 7 to 10, since $D3 < D1$, the pulling force $F1$ acting on base 110 through rope 140 and the total weight W of base 110 and measurement instrument 10, generate a combined force $F2$ perpendicular to vertical wall 30. $F2$ pushes base 110 toward vertical wall 30, and causes one of the primary supporting end 120 and the first end 152, second 154 of an adjacent cross rod 150 to contact vertical wall 30 i.e. vertical wall 30 becomes the supporting plane 160 as illustrate above. While one of the primary supporting end 120 and the first end 152, second 154 of an adjacent cross rod 150 remain engaged with vertical wall 30, base 110 is held stationary relative to cargo hold 40. Measurement of sand volume can then be performed by measurement instrument 10. As the combined force $F2$ continuously acts on base 110, such a stationary relationship is ensured even if the cargo hold is tilted within a predetermined range following the bulk carrier's movement on water.

By arranging the primary and secondary supporting ends 120, 130 as well as the cross rod 150 in an alternate manner, as illustrated above in conjunction with the drawings, a supporting apparatus can be held stationary relative to a vertical wall at a cargo hold entrance, with any one of the primary supporting end 120 and an adjacent top and bottom ends 152, 154 in contact with the vertical wall.

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 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 supporting apparatus comprising:
 - a base having a top side and a bottom side, wherein the bottom side is to mount
 - 5 to a measurement instrument;
 - a rope connected to the top side of the base;
 - a plurality of supporting ends extending outwardly from the base, wherein the
 - supporting ends are to engage a surface.