

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN OR RELATING TO MOORING BUOYS

- (71) We NORTH BRITISH ELECTRIC WELDING COMPANY LIMITED, a British Company, of Whifflet, Coatbridge, Lanarkshire, Scotland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to mooring buoys and particularly to mooring buoys intended for the mooring of large ships.
- It is already known to provide a mooring buoy arranged to function mainly as a support for one end of a mooring cable permanently anchored at the other end to the sea bed. Such a buoy normally contains a float portion and a mooring shackle arm mounted in a support fixed to the float portion, one end of the shackle arm being attachable to a ship's mooring cable and the other end of the shackle arm being normally attached to the anchorage cable connected to the anchorage on the sea bed. It is also known to incorporate in the support means for restricting the shackle arm to swing in a vertical plane. In a buoy of the type described a small component only of the force required to hold the ship is borne by the buoy structure.
- In the known construction a transverse thrust on the shackle arm can cause high stresses, particularly bending stresses to be generated in the arm and/or in the pivot pin by which the shackle arm is normally mounted in the support, because it is this pin which provides the resistance to transverse movement of the arm. It is an object of the present invention to provide a buoy which permits the shackle arm enough transverse freedom of movement to enable it to absorb enough transverse thrust to prevent the stresses in the shackle arm and as a consequence in the ship's mooring cable from rising to dangerous values.
- A buoy according to the invention incorporates a float portion, a mooring shackle arm connected at one end to the float portion by way of a pivot pin connection arranged to permit the said one end of the shackle arm to move relatively to the float portion in a horizontal direction and guide means engaged with the shackle arm fixed to the float portion at a point remote from the said one end of the shackle arm, said guide means defining the horizontal position of the portion of the shackle arm engaged with the guide means.
- The shackle arm may be loosely mounted on the pin to be movable axially of the pin to a predetermined extent.
- In an alternative construction the shackle arm is fixed to the pin which latter is mounted loosely in brackets fixed to the float portion so that it is permitted movement in an axial direction. The shackle arm may be associated with centralizing springs urging the arm to assume a central position.
- In another alternative construction the shackle arm may be connected to the float portion by way of two flexible metallic bellows.
- The float portion may consist of two parallel spaced pontoons connected to one another by two hollow transoms located at opposite ends of the pontoons. One of the transoms may be so located that most of all of it is below the centre lines of the pontoons when the pontoons are floating, and the other transom may be so located that most or all of it is above the centre lines of the pontoons when they are afloat. In this construction the shackle arm is arranged to rest on the transom at the lower level when the shackle arm is not engaged with a ship's mooring cable and the cable connecting the shackle arm to the anchorage on the sea bed passes below the transom at the higher level.
- The shackle arm may be fitted with a known type of release mechanism or may be fitted with the release mechanism which is the subject of our prior patents Nos. 1165068 and 1154798.
- A practical embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a section on a vertical plane

through a buoy, Fig. 2 is an end elevation looking in the direction of the arrow in Fig. 1, and Fig. 3 is a plan view of the central portion of the buoy taken in the direction of the arrows 2—2 in Fig. 2.

In the drawings, 1 denotes generally a float portion consisting of two parallel spaced pontoons 2 connected to one another by two hollow transoms 3 and 4 located at opposite ends of the portion 2, the transom 3 being so located that most of it is below the centre lines of the pontoons when the latter are floating and the transom 4 being so located that most of it is above the said centre lines. 5 denotes a mooring shackle arm connected at one end to the float portion by way of a pin connection constituted by a pin 6 held by supporting means constituted by brackets 7 attached to the float portion 1. The shackle arm 5 is loosely mounted on the pin 6 so that it is permitted to move axially of the pin to a predetermined extent. The float portion supports guide means consisting of two abutment members 8 located on opposite sides of the arm 5 at a point on the arm between the pin 6 and the hook and presenting guiding surfaces 9 between which the arm 5 passes. The other end of the shackle arm is formed with a mooring hook. The shackle arm illustrated is shown fitted with the quick-release mechanism which is the subject of our patent No. 1165068. 10 denotes the cable connectible to the anchorage on the sea bed and 11 denotes a cable connected to the hook and usable for the purpose of towing the buoy.

In practice, when a ship is moored to the shackle arm 5 the pull of the moored ship passes through the shackle arm to the anchorage on the sea-bed by way of the cable 10, the only stress borne by the buoy being the component generated where the mooring changes direction i.e. at the mounting of the shackle arm constituted by the pin 6 and the brackets 7. Since the contained angle between the two parts constituting the complete mooring cable, i.e. the ship's cable and the anchorage cable 10, is large and in fact approaches a straight angle this component is small.

Any sideward thrust on the mooring cable or on the shackle arm 5 caused either by movement of the moored ship or by sideward movement of the buoy under sea conditions causes the shackle arm 5 to tend to swin substantially horizontally relatively to the float portion 1 about the guide means 8 as a fulcrum. Because a predetermined limited amount of horizontal movement relative to the float portion is allowed at the point where

the arm is supported on the float portion 1 by the pin 6 there is little or no bending moment generated at this point. The pull of the portion of the cable 10 connected to the anchorage on the sea bed tends to centralize the arm 5 and this action is assisted by centralizing the springs or bellows where such are provided. The use of bellows has the advantage that as bellows are completely sealed they require protection only on their surfaces to keep them in perfect working order.

WHAT WE CLAIM IS:—

1. A mooring buoy incorporating a float portion, a mooring shackle arm connected at one end to the float portion by way of a pivot pin connection arranged to permit the said one end of the shackle arm to move relatively to the float portion in a horizontal direction and guide means engaged with the shackle arm fixed to the float portion at a point remote from the said one end of the shackle arm, said guide means defining the horizontal position of the portion of the shackle arm engaged with the guide means.

2. A buoy as claimed in claim 1 in which the shackle arm is loosely mounted on the pin and is movable axially of the pin to a predetermined extent.

3. A buoy as claimed in claim 1 in which the shackle arm is fixed to the pin which latter is mounted loosely in brackets fixed to the float portion so that it is permitted movement in an axial direction.

4. A buoy as claimed in claim 1 in which the shackle arm is associated with centralizing springs urging the arm to assume a central position.

5. A buoy as claimed in claim 1 in which the shackle arm is connected to the float portion by way of two flexible metallic bellows.

6. A buoy as claimed in claim 1 in which the float portion consists of two parallel spaced pontoons connected to one another by two hollow transoms located at opposite ends of the pontoons.

7. A buoy as claimed in claim 6 in which one of the transoms is so located that most or all of it is below the centre lines of the pontoons when the pontoons are floating, and the other transom is so located that most or all of it is above the centre lines of the pontoons when they are afloat.

8. A buoy as claimed in claims 1 and 7 in which the shackle arm is arranged to rest on the transom at the lower level when the shackle arm is not engaged with a ship's mooring cable and the cable connecting the

through a buoy, Fig. 2 is an end elevation looking in the direction of the arrow in Fig. 1, and Fig. 3 is a plan view of the central portion of the buoy taken in the direction of the arrows 2—2 in Fig. 2.

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In practice, when a ship is moored to the shackle arm 5 the pull of the moored ship passes through the shackle arm to the anchorage on the sea-bed by way of the cable 10, the only stress borne by the buoy being the component generated where the mooring changes direction i.e. at the mounting of the shackle arm constituted by the pin 6 and the brackets 7. Since the contained angle between the two parts constituting the complete mooring cable, i.e. the ship's cable and the anchorage cable 10, is large and in fact approaches a straight angle this component is small.

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7. A buoy as claimed in claim 6 in which one of the transoms is so located that most or all of it is below the centre lines of the pontoons when the pontoons are floating, and the other transom is so located that most or all of it is above the centre lines of the pontoons when they are afloat.

8. A buoy as claimed in claims 1 and 7 in which the shackle arm is arranged to rest on the transom at the lower level when the shackle arm is not engaged with a ship's mooring cable and the cable connecting the



shackle arm to the anchorage on the sea bed
passes below the transom at the higher level.

- 9. A mooring buoy substantially as
described with reference to the accompanying
5 drawings.

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