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FENDER SYSTEM FOR UNDERWATER DRILLING PLATFORMS

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1 Claim. (Cl. 61—48)

This invention relates to offshore drilling platforms, more particularly to apparatus for protecting the supporting columns for an offshore drilling platform from impact by surface vessels and has for an object the provision of a fender system for protecting the supporting columns of an underwater work platform which includes a plurality of vertically disposed cables laterally spaced around the periphery of the platform for supporting fender means which extend transversely around the periphery of the platform in the vicinity of the water line on the supporting columns. Means for placing said cables under tension to a predeterminable extent are provided to permit said fender means and said cables to absorb the impact of a surface vessel and prevent damage to the supporting columns of the platform.

In the drilling of oil wells, and the like, at an underwater or offshore location, it is common practice to support the drilling or work platform on a mobile foundation, such as a barge, which may be floated to location, then lowered into engagement with the underwater bottom. The platform remains above water level due to its support upon a plurality of columns extending between the foundation barge and the drilling platform. In such structures it is desirable and frequently necessary to supply drilling equipment and operating personnel to the platform at regular intervals by surface vessels which come alongside of the drilling structure. Each approach of a surface vessel of course entails a possibility of impact and damage to the columns supporting the work platform above the water level. In some cases, these supporting columns form hydraulic cylinders through which pistons operate to extend and retract stabilizing pontoons useful in submerging or raising the barge for movement to and from the drilling location. Such impact to the columns may thus require repair or replacement thereof in open water, and the damage may even be such as to endanger the drilling operation. Accordingly, it is important that the support columns be adequately protected from damage by surface vessels.

While particular care is taken by the servicing vessels to prevent impact with the stationary drilling platform, under conditions of low visibility or storms, it may be necessary to service the drilling platform, for example, to evacuate personnel therefrom. Thus, such precautions are not always sufficient to avoid impact damage to the supporting columns.

In other types of offshore drilling structures, protection of the supporting columns is also important where the drilling platform is supported by a few columns whose lower ends directly engage bottom. In such installations, the columns not only support the platform but also are used in the jacking operation wherein the working platform moves from a floating position into an elevated position through operation of jacks which permit the platform to climb the columns. Thus, the mobility of the entire structure, representing a capital investment in the range of over one million dollars, may be seriously affected if im-

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pact is permitted between surface vessels servicing the platform and the supporting columns.

In accordance with the preferred embodiment of the present invention, the danger of impact to the supporting columns of an offshore drilling structure is, to a great extent, alleviated by a provision of a plurality of vertical cables extending from substantially the working platform downwardly to a support means, such as the submerged barge, with a plurality of fender means extending transversely about the periphery of the drilling platform in at least the area serviced by surface vessels, said cables and said fender means being laterally displaced from the support columns for the purpose of absorbing through the vertically disposed cables the impact of surface vessels approaching the drilling structure.

In a preferred form of apparatus for carrying out the invention, the horizontally spaced and vertically disposed cables are pivotally connected at their lower ends to the submerged barge and pass upwardly to a clamping arrangement which permits a predetermined tension to be placed upon the cables. Further, said fender means supported between said cable preferably comprise a plurality of steel encased timbers extending substantially the length and breadth of the drilling structure, each of which is encased in a pair of steel channel members. A plurality of said fenders are disposed parallel to each other both above and below the water line to permit contact by surface vessels in the vicinity of their normal center of gravity.

Further objects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing which forms an integral part of the present specification.

Fig. 1 is a side elevation view illustrating a preferred embodiment of the present invention as applied to an offshore drilling structure of the elevated deck drill barge type.

Fig. 2 is an elevation view taken in the direction of arrows 2—2 in Fig. 1 illustrating, in detail, the cable and fender means and their cooperation with the drilling structure.

Fig. 3 is a cross-sectional view through one of the fender or bumper means taken in the direction of arrows 3—3 in Fig. 2 and particularly illustrates a preferred manner of construction of the fender and the preferred means for clamping said fender to the cable means.

Referring now to the drawing and, in particular, to Fig. 1, the preferred manner of carrying out the present invention is illustrated as being applied to a drilling structure of the type known in the art as an elevated deck drill barge, identified generally as 10. In this type of drilling structure, drilling platform 11 is supported by a plurality of tubular columns 13, a fixed distance above a submergible barge 12 which is normally floated to position and then submerged into engagement with the underwater bottom. In the arrangement of Fig. 1, pontoon members, identified as 14, are utilized in maintaining stability of the barge during the lowering and raising thereof, and are adapted to be extended and retracted by hydraulic operators which utilize the columns 13 directly thereabove as hydraulic cylinders. Drilling, of course, proceeds, as indicated schematically, by means of drill derrick 15, illustrated as being supported on the drilling deck 11.

As indicated by the surface vessel 16, drilling supplies and personnel are transported to and from the drill barge 10 at regular intervals and, of course, it is necessary for surface vessels, such as boat 16, to approach the barge close enough to permit transfer of materials and personnel. As indicated hereinabove, the danger of impact between vessel 16 and any of the columns 13 is a serious hazard both to the drilling operations being performed

thereon and the ship, but more serious is the danger of damage to the drill platform by impact with the supporting columns. Accordingly, there is provided in accordance with the present invention an effective fender system for protecting the supporting columns from such damaging impact which includes a novel combination of steel cable means, identified as 17. As shown, cable means 17 extend vertically from a depth below the normal center of gravity of the surface vessels to a position substantially above the water line.

As more particularly shown in Fig. 2, the laterally spaced plurality of cables 17 are each pivotally connected through a cable connector 18 and a pivot pin 19 to the top of barge hull 12. As best seen in Fig. 1, these laterally spaced vertical cable means are arranged at spaced intervals around the periphery of the barge where ships normally service the platform, but preferably surround barge 12. Each cable is arranged to be drawn taut by the sleeve clamps 21 which connect the upper end of the cables to the elevated drilling deck 11. Through the cable tensioning by clamp means 21, the degree or extent of tautness of the cables may be suitably predetermined. This predeterminable extent of tautness will, of course, vary with the size and type of steel cable. With a standard hard core cable, a greater degree of pretensioning has been found desirable as compared to the degree of tautness required for bridge strand cables which have a greater degree of twist in their original spinning.

As further illustrated in the drawing, the impact of surface vessels, such as ship 16, is desirably transmitted to the spaced plurality of cable means 17 by plurality of bumper or fender elements, identified as 24. In the present embodiment, three individual fender elements, or bumpers, extend transversely to the cables and are supported thereon in the vicinity of the water line. As further shown, at least one of said fenders is positioned slightly above the water line and parallel to another fender located a short distance below the water line. A third fender is supported by cable 17 substantially along the water line.

In Fig. 3 there is illustrated a preferred manner of constructing fenders, or bumpers 24. As there shown, the core of the elongated bumper is preferably constructed of timber, such as oak beam 26. Timber 26 is desirably clamped between a pair of steel channel members 27, welded together by a pair of elongated plates 28, which serve to enclose the beam. The combination of oak timber 26 encased in steel by channels 27 and plates 28, in the manner illustrated, yields a particularly desirable shock absorbing structure of relatively light weight and high impact resistance, so that only a portion of the shock of vessels contacting the fender is transferred to cables 17. As further shown in Fig. 3, fender means 24 are desirably attached to cable means 17 through a pair of upper and lower U-bolts, identified as 30, which clamp rear steel plate 28 against a split, steel sheath 32 in the manner shown in Fig. 3.

From the foregoing description it will be seen that a high degree of protection for the supporting columns 13 is provided by the fender cable assembly illustrated and described hereinabove. Particularly, such columns are protected against damage during adverse weather conditions, when the approach of surface vessels has been extremely hazardous both to the drilling structure and the ship.

The protective system of the present invention has the additional advantage of being portable with the drilling structure, so that it may be assembled on the drilling

barge and then transported from location to location, with minimum interference to navigation of the drilling barge.

It will, of course, be apparent that the vertically disposed cable means, laterally displaced from the support columns for a drilling platform, may be readily adapted to any other type of offshore drilling structure of the portable or fixed type, whether such structure is supported on bottom by a pontoon or raft foundation, as illustrated in the preferred embodiment, or the structure supported by a plurality of columns or caissons directly engaging the underwater bottom. In the latter type of structure, arm members extending outwardly from the lower ends of the caissons provide the desired anchoring for the lower ends of cables 17. A plurality of such vertically hung cables will, of course, surround the circumference of the platform and support column system or each caisson will be surrounded. Fender members interconnecting at least two or more cables are secured thereto in manner similar to that described above.

It will be understood that various modifications and changes in the foregoing structure may be made without departing from the invention and all such modifications and changes falling within the scope of the appended claim are intended to be included therein.

I claim:

In a fender system for an offshore structure, in combination a platform supported above the surface of a body of water by a support structure which extends from said platform downwardly through said body of water, a plurality of vertically disposed laterally spaced-apart cables, a respective connector means affixed to one end of each of said cables, a respective complementary connector means for each of said cables affixed to said support structure in laterally spaced-apart relationship, means pivotally connecting the said respective connector means affixed to said cables to the said respective complementary connector means affixed to said support structure, a separate respective adjustable clamping means for each of said cables affixed to said platform in laterally spaced-apart relationship and clamping respectively each of said cables thereto, said clamping means comprising means for adjusting the tension of the respective cable clamped thereby, a plurality of bumper elements positioned transversely across said cables in vertically spaced-apart relationship, means adjustably securing each of said bumper elements to at least two of said cables, the latter said means comprising a split sleeve substantially surrounding a respective cable at the position of a said bumper element, and a clamping means affixed to said bumper element and clamping said split sleeve to its respective cable.

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