My present invention relates to an offshore drilling apparatus and more particularly relates to an apparatus for positioning a pipe column which is lowered vertically from the drilling structure to a well on the ocean bottom, so that additional lengths of pipe may be joined to the upper end of said column. When a tubular member such as conductor casing is lowered in a column from a drilling structure through a body of water into a well on the ocean bottom, the wave action on the conductor casing causes considerable movement of the casing, particularly at the top end of the casing when it is not secured at the drilling structure. As this casing is lowered from the drilling structure to the well, additional lengths of conductor casing are added to the upper end of the casing by one of several joining means, e.g. welding, threading, mechanical connectors, etc. To effect such joining, the upper end of the conductor casing extending vertically out of the water may be held steady at the drilling structure since any movement of the lower joint of conductor being joined may break loose the initial weld or thread connection. Excessive sway in the upper end of the conductor due to water current and/or wave action can also result in damage to the drilling structure. In the past, installations of offshore well equipment such as conductor casings, under such conditions has resulted in much lost time and considerable expense.

In prior attempts to hold the upper end of the conductor casing, rig crews utilized cables and turnbuckles with weld braces to stop the movement of the conductor casing to the extent that it was possible. These attempts, if successful, required much extra time and effort when running and pulling lower tubular members such as conductor casing.

Accordingly, it is a prime object of the present invention to provide an apparatus for steadying the upper end of a tubular member being lowered from a drilling structure to an underwater well. It is a further object of the present invention to provide apparatus for holding the upper end of a column of pipe or casing extending from a drilling structure to a subaqueous formation while the bottom end of another length of pipe is joined to the upper end of said column. It is also an object of the present invention to provide a hydraulically operated means for laterally holding at a drilling structure, the upper end of a pipe extending from a drilling structure into a subaqueous well, with lateral pressure exerted against said pipe. It is a further object of this invention to provide a pipe holding means of the type described, which will also function to constrain vertical movement of the pipe through pipe holding means.

Other objects and a more complete understanding of the present invention will become apparent by reference to the following specification and the appended claims when taken in conjunction with the drawings, wherein:

FIG. 1 shows, in elevation, an embodiment of the invention employed on an offshore drilling structure;

FIG. 2 is an enlarged perspective view of the pipe holding apparatus shown in FIG. 1, showing a pipe section to be added to a conductor casing engaged for connection in accordance with my present invention;

FIG. 3 shows a plan view of the apparatus shown in FIG. 2;

FIG. 4 is an enlarged sectional view taken on line 4--4 of FIG. 3 showing the detail of one of the hydraulically operated rams of my present invention; and

FIG. 5 is a sectional view taken on line 5--5 of FIG. 3 showing the adjustable fixed ram used with my present invention.

With reference to FIG. 1, a drilling structure 10 is shown on a body of water 36 over an underwater well (not shown), with a conductor casing 13 extending through opening 16 in the keyway platform 14 of structure 10, to the well. The conductor casing 13 was lowered through the keyway platform opening 16 from the rig floor 18 and is engaged at its upper end with elevators 20. The upper end 12 of the casing 13 is held against lateral movement at the keyway platform by hydraulically actuated rams 22, 24, and 26 which are spaced circumferentially around the platform opening 16, as best shown in FIGS. 2 and 3. The outer end of each of the rams is provided with a roller, i.e., rollers 22a, 24a, and 26a which are arranged to engage the pipe at 12 but yet permit raising and lowering of the pipe through the platform opening 16 while the rams hold the pipe to prevent lateral movement thereof.

While pipe 13 is so held, the lower end 28 of the next section of pipe 30 is connected to the top end 12 of the pipe as shown in FIGS. 1 and 2.

The structure 10 shown in FIG. 1 is a jack-up drilling barge having rotary table 32 positioned on the rig floor 18. Drilling operations are conducted in a conventional manner from the rig floor 18 with the rotary table, and with conventional blowout prevention equipment (not shown) positioned on the rig floor of the jack-up type drilling structure. The legs 34 of the drilling structure are affixed to the formation underlying the body of water 36 and prevent relative movement between the rotary table 32 and the formation (not shown). While the embodiment shown herein is illustrated with respect to a jack-up barge it is to be understood that my present invention may be used with a conventional drilling platform, a semi-submersible platform, a floating drilling vessel. While the apparatus of my present invention is readily utilized on a drilling structure having an auxiliary platform below the rig floor such as keyway platform 14 which is positioned in keyway 38 at the back of the drilling structure 10 as best shown in FIG. 3, my present apparatus may also be employed with drilling structures having only a single working platform, i.e. the rig floor.

With reference to FIG. 2, the hydraulically operated rams 22, 24, and 26 are provided with supporting braces 11 or I-beams 22a, 24a, and 26a. The braces, for example brace 24, is fastened at one end to the ram frame 25 and at the other end to the keyway wall to provide stability for the ram support brace 26. Further bracing may also be provided as shown in FIG. 2.

With reference to FIG. 4, the ram 24 is shown slidably positioned within ram frame 25 and is movable in-
wardly toward the conductor casing 13 with a fluid driven piston 44 which is positioned within cylinder 46. As best shown in FIG. 3, the roller 24a is rollably mounted on the end of the ram fork-arms 23 with roller axle 21. Movement of the rams towards the pipe end 12 causes the roller to bear against the outer surface of pipe end 12 and exertion of pressure on rams 24 by further pressurization of cylinder 46a restrains vertical movement of pipe end 12.

The piston 44 is fluid actuated to move the ram 24 towards the conductor casing end 12 by pressurizing cylinder 46c with fluid pressure through hose 48a, such as, for example, by hydraulic or pneumatic fluid. The ram 24 is retracted from engagement with the conductor casing 13 by pressurizing cylinder 46b through fluid hose 48b. The ram frame 25 has an opening 27 at its top to provide access to the cylinder 46. Ram frame 25 is affixed to the ring 58 as by welding and the ring 58 which may conveniently be a circular I-beam as shown in FIG. 5, is affixed to the keyway platform 14. Ring 58 is positioned over the keyway opening 16 and has four circumferentially spaced openings therethrough through which the rams and ram frames extend to engage the conductor casing 13. The ring serves to prevent lateral movement of the rams and guide the rams into position against the conductor casing 13.

While a fourth fluid actuated ram may be employed in the apparatus shown, a fixed roller 50 is utilized in the embodiment shown to balance the pressure exerted by each fluid actuated ram. The position of roller 50 may be adjusted by moving the pin 52 for varying conductor casing sizes to different holes in the U-beam brace 54 which is affixed to the keyway ring 58 as shown in FIG. 5. The roller 50 is mounted on a frame 56 in which the roller axle 57 is rollably mounted.

In the operation of the device shown, a pipe section, with it being connected to the conductor casing 13, is lowered from the rig floor 18 with elevators 20 which engage a shoulder provided on the pipe adjacent the upper end 12 of the pipe. As shown in FIG. 1, the elevators 20 are supported from the rig floor 18. The elevators are left on the pipe end 12 after it is lowered to the position shown in FIG. 2 to prevent inadvertent loss of contact with the conductor casing 13. As the elevators lower the conductor casing the rollers 22a, 24a, 26a, and 50 restrain lateral movement of the conductor casing and sufficient hydraulic pressure may be exerted on the rams to keep the pipe in a substantially vertical position as it is being lowered. The hydraulic pressure may be regulated to permit the conductor casing to be lowered through the keyway platform, but still preventing lateral movement of the upper end 12 of the conductor pipe as it is lowered through the keyway platform opening 16. When the conductor casing end 12 reaches the position shown in FIG. 2, the next stand of pipe 30 is lowered with an elevator from the rig floor 18 and held in coaxial position with the conductor casing 13 while the lower end of the pipe 30 is connected to the upper end 12 of the pipe as by welding, threading, or with a conventional connector joint.

Sufficient pressure may be exerted by the roller on the pipe to also restrain or control the vertical movement of the conductor casing through the water. This control may be accomplished by regulating the hydraulic pressure in cylinder 46c.

After connection of pipe 30 to the conductor casing 13 is completed, the elevators 20 are removed from the elevator shoulder (not shown) of pipe end 12 and the conductor casing lowered by its new section of pipe 30, to the position of the conductor casing pipe shown where it is then connected to the next succeeding section of pipe and so on.

While my present invention has been described herein with respect to a specific embodiment in considerable detail in order to set forth the best mode of operations, it is to be understood that various changes in the apparatus and method of operation can be made without departing from the spirit of the invention. Accordingly, the scope of my present invention should not be limited to the details herein given, but should be afforded the full scope of the appended claims.

1. Apparatus for holding the upper end of a pipe extending from an opening in a floor of a structure positioned at the surface of a body of water, to the bottom underlying said body of water, comprising in combination:
(a) a plurality of rams supported around the circumference of said opening for engaging the outer circumference of said pipe;
(b) fluid actuated means for moving said rams into engagement with said pipe;
(c) ram positioning means adjacent said opening for circumferentially positioning each of said rams around said opening; and
(d) movable means carried by said rams for engaging the outer surface of said pipe and exerting pressure on said pipe, said movable means allowing vertical movement of said pipe through said opening while restraining lateral movement of said pipe when engaging same.

2. The apparatus of claim 1 wherein said ram positioning means is a ring.

3. The apparatus of claim 2 wherein said rams are held in radial openings through said ring.

4. Apparatus for steadying the upper end of a column of pipe made up of a drilling structure at the surface of a body of water and lowered through said body of water to a well drilled in the formation underlying said body of water, comprising in combination:
(a) a plurality of roller means positioned on said structure to engage said pipe at its outer circumference and to allow vertical movement of said pipe toward said well while restraining lateral movement of said pipe when said roller means engage and exert pressure transversely against said pipe,
(b) fluid operated means for moving said roller means toward said pipe to engage and exert pressure transversely against said pipe, and
(c) means for spacing said fluid operated means circumferentially around said pipe so that the force exerted by said rollers against said pipe will hold said pipe in a substantially vertical position.

5. The apparatus of claim 4 wherein said support means is a ring having radial openings therein through which said rollers extend on hydraulically actuated rams to engage said pipe within said ring.

6. The apparatus of claim 4 wherein said drilling structure has a rig floor with a rotary table mounted thereon and a platform beneath said rig floor with an opening therein coaxial with an opening through said rotary table and wherein additional sections of pipe are added to said column of pipe by inserting said section through said rotary table and into engagement with the top of said column extending to said formation, and wherein the lower end of said new section of pipe is joined to the top of said column at said lower platform and said pipe column steadying apparatus is positioned around the opening in said lower platform through which the top of said pipe column extends.

7. Apparatus for holding the upper end of a column of pipe extending from a drilling structure positioned at the surface of a body of water to a well drilled in a formation underlying said body of water, and wherein the upper end of said pipe extends through an opening in a platform of said structure, the combination comprising:
(a) a plurality of radially extending rams positioned around the circumference of said opening,
(b) a fluid actuated piston means for moving said rams radially inward to engage said pipe,
(c) means for anchoring said moving means with respect to said drilling structure whereby said rams may be moved inwardly against said anchor to exert pressure on said pipe to prevent lateral movement of the upper end thereof,

(d) a ring means surrounding said opening and said upper end of said pipe extending therethrough, said ring having transverse channels therethrough through which said rams extend and which prevent movement of said rams in other than a radial direction, said ring means being anchored to said platform and fixed with respect to said platform opening,

(e) rollers rotatably mounted on the end of said ram means, for engaging said pipe to facilitate vertical movement of said pipe through said platform opening while said fluid actuated rams cooperatively restrain lateral movement of said pipe.

8. The apparatus of claim 7 including elevator means releasably attached to the upper end of said pipe for lowering and raising said pipe through said opening.

9. The apparatus of claim 8 including a ram frame member for housing said ram means, said housing being affixed to said ring and said ram being moveable within said frame and actuated by a piston which is moved by pressurizing a cylinder in which said piston is movably disposed, and wherein a rod extends between said piston and said ram to move said ram with said piston.

10. The apparatus of claim 9 wherein said rams are hydraulically driven, and including means for balancing the hydraulic pressure exerted by each of said rams so that said pipe is maintained by said force exerted by said rams, in substantially vertical position.

11. The apparatus of claim 10 wherein said balance means includes at least one roller rotatably positioned proximate said pipe with a stationary radial position.

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