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HYDRAULIC MOORING MEANS

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FIG. 1.

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TO JETTING FLUID SOURCE

FIG. 3.

TO RESERVOIR

HYDRAULIC PRESSURE

FIG. 2.

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CHECK VALVE
SPUD
This invention relates to offshore operations. More particularly, this invention relates to a hydraulically operated mechanism for providing underwater support for an overwater platform, such as a drilling platform used in offshore oil drilling operations.

Briefly described, the invention described herein includes a plurality of caissons attached to the overwater platform. Mounted for slidable movement in each caisson is an earth penetrating member. A jacking head is connected to the earth penetrating member. Means are provided for applying hydraulic pressure against the top of the jacking head and means are provided for applying hydraulic pressure against the underside of the jacking head. Thus, hydraulic pressure can be applied against the top of the jacking head to cause the earth penetrating member to penetrate the earth to provide support for the overwater platform. Application of hydraulic pressure against the underside of the jacking head causes the earth penetrating member to be moved out of the soil. By applying pressure to both the topside and underside of the jacking head, the relative position of the earth penetrating member with respect to the caisson can be controlled.

A second feature of this invention is the provision of means for permitting the measurement of the position of the earth penetrating member at all times.

When it is desired to remove the earth penetrating member from the soil, a water jetting mechanism is utilized to lift water against the soil to aid in loosening the earth penetrating member from the soil and removing the member therefrom.

A better understanding of the invention, as well as its many advantages, may be had by reference to the following detailed description of drawings, in which:

FIG. 1 is a plan view of an overwater platform to which the invention applies;
FIG. 2 is a sectional view taken along the line 2-2 of FIG. 1 showing the earth penetrating member in the retracted position;
FIG. 3 is a sectional view similar to FIG. 2 showing the earth penetrating member in an extended position.

As shown in FIG. 2, each caisson 12 may be cylindrical in shape and of large diameter. The earth penetrating member shown is a cylindrical spud 14 which is slidably mounted on axial movement inside the large diameter cylindrical caisson 12. The upper end of the spud 14 is fitted with a jacking head 16 which forms a sliding pressure seal between the spud 14 and the cylindrical caisson 12. The seal is formed by the large O ring 18.

The cylindrical caisson 12, having an internal diameter larger than the external diameter of the cylindrical spud 14, is open at its lower end 20 and fitted with a removable pressure-tight closure 22 at its upper end. Hydraulic pressure piping 24 is connected to the upper caisson closure 22. The upper closure 22, upper jacking head 16, and the inside of the cylindrical caisson 12 form an upper pressure chamber 26.

Attached to the upper caisson closure 22 by a rigid and detachable connection is a retractor pipe 28. The retractor pipe 28 has a closed lower end 30 and extends through the upper jacking head 16. A sliding pressure seal is formed between the retractor pipe 28 and the upper jacking head 16 by means of O rings 32.

A lowering jacking head 34 is rigidly attached to the lower end of the retractor pipe 28, and the connection is pressure tight. This head forms a sliding pressure seal inside the movable spud 14 by means of the O ring seal 36. The upper jacking member 16, lower jacking member 34, and the inside of the cylindrical spud 14 form a middle pressure chamber 38.

Hydraulic pressure piping 40 is connected to the upper end of the retractor pipe 28. Hence, fluid under pressure may be flowed through pressure piping 40 and retractor 28. Openings 42 are provided in the retractor pipe 28 so that the fluid flowing through the retractor pipe is flowed out of the holes 42 and into the middle pressure chamber 38 to apply hydraulic pressure against the underside of the upper jacking tube 16.

The lower end of the spud 14 is fitted with a permanent pressure tight closure 44 located inside the spud 14 and some distance from the bearing end 46 of the spud; the distance varying with the anticipated soil conditions at the location where the spud is to be used. The spud closure 44 is fitted with a check valve 48.

A second pipe 50, which may be housed within the retractor pipe 28, is connected by quick detachable connections to the upper caisson closure 22 and extends to a point below the lower jacking head 34. Pipe 50 functions as a combination sounding tube and jetting pipe and has a flared open lower end 52.

Spud stopping brackets 54 are mounted on the inside of the cylindrical spud 14 at a point below the lower jacking head 34 to limit the retractive movement of the spud 14.

The lower end of the caisson 12 is rigidly connected to a mat 56 which functions to lend rigid support to the caissons. A flushing line 58 is located in the mat 56 and extends into the caisson 12. Mat 56 (only a portion of which is shown) extends underneath the platform.

The operation of the device described above is accomplished by the hydraulic system which can supply and maintain fluid under pressure to the pressure piping 24, the pressure piping 40, or to both simultaneously.

To lower the spud, hydraulic fluid under pressure is introduced to the upper chamber 26 formed by the caisson 12, the upper caisson closure 22, and the upper jacking head 16. When this chamber is filled with fluid, the pressure acting on the movable upper jacking head 16 will extend the spud 14 relative to the caisson 12 and the retractor pipe 28. To retract the spud, hydraulic fluid under pressure is introduced to the middle chamber 38 formed by the spud 14, the movable upper jacking head 16, and the rigid lower jacking head 34. The hydraulic fluid enters the retractor pipe 28 through the piping 40 and flows into the middle pressure chamber 38 through the retractor pipe openings 42. When the pressure in the upper chamber 26 rises, the middle chamber 38 will cause the movable upper jacking head 16 and the spud 14 to retract relative to the caisson 12, the retractor pipe 28, and the lower jacking head 34. The spud will continue to retract as pressurized hydraulic fluid is introduced into the middle chamber 38 until the spud stopping brackets 54 come into contact with the lower jacking head 34, as shown in FIG. 2.

To maintain the spud 14 in any desired position relative to the caisson 12, hydraulic pressure is maintained in both the upper pressure chamber 26 and the middle pressure chamber 38.

The invention also includes means for measuring the relative position of the earth penetrating member, either by means of the pressure gages 70, or by means of a pressure sensitive fluid, such as a glycerine solution, which is located in a cylinder 72 and capable of being pressurized by means of the hydraulic pressure piping 24 and 40. This measuring means in this invention includes a dial gage 74, which indicates the relative position of the earth penetrating member.
pressure chamber 38. An accumulator (not shown) may be included in each chamber to make up any leakage which occurs past the seals in the jacking heads.

To determine the position of the spud 14 at any time, a conventional sounding tape or other suitable measuring device may be inserted in the tube 50 through an opening 60 (see FIG. 2) and permitted to drop through the flared opening 52 until it strikes the lower spud closure plate 44.

To force jetting or other fluid from a suitable pressurized supply (not shown) out the lower end of the spud, a suitable fluid connection 64 may be connected to the upper end of the tube 50. Fluid may then be pumped through the tube 50 into the lower chamber formed by the spud 14, the lower jacking head 34, and the lower spud closure 44. When this chamber is filled, the fluid pressure will open the check valve 48 and fluid may be forced through the lower spud closure 44 against the soil to aid in the penetration or removal of the lower portion 46 of the spud 14 from the soil.

It is to be understood that various modifications may be made without departing from the scope of this invention.

We claim:

1. A hydraulically operated mechanism for providing underwater support for an overwater platform comprising: a caisson attached to the platform; a hollow cylindrical spud slidably mounted within the caisson; an upper jacking head for closing off the spud connected across the top of the spud and in sealing engagement with the caisson; means for applying hydraulic pressure against the top of the upper jacking head; a pipe having a closed lower end extending into the caisson and also extending through the upper jacking head in slidable and sealing engagement with said upper jacking head; a lower jacking head rigidly mounted to the pipe and in sealing engagement with the cylindrical spud so that the upper and lower jacking heads and the sides of the cylindrical spud define a pressure chamber; and means for flowing fluid under pressure into the pipe, said pipe having openings into the pressure chamber.

2. A hydraulically operated mechanism for providing underwater support for an overwater platform comprising: a caisson attached to the platform; a hollow cylindrical spud slidably mounted within the caisson; an upper jacking head for closing off the spud connected across the top of the spud and in sealing engagement with the caisson; means for applying hydraulic pressure against the top of the upper jacking head; a pipe having a closed lower end extending into the caisson and also extending through the upper jacking head in slidable and sealing engagement with said upper jacking head; a lower jacking head rigidly mounted to the pipe and in sealing engagement with the cylindrical spud so that the upper and lower jacking heads and the sides of the cylindrical spud define a pressure chamber; and means for flowing fluid under pressure into the pipe, said pipe having openings into the pressure chamber.

3. A hydraulically operated mechanism in accordance with claim 2 wherein the second pipe is mounted within the first pipe with its lower end extending below the closed lower end of said first pipe.

4. A hydraulically operated mechanism for providing underwater support for an overwater platform comprising: a caisson attached to the platform; a hollow cylindrical spud slidably mounted within the caisson; an upper jacking head for closing off the spud connected across the top of the spud and in sealing engagement with the caisson; means for applying hydraulic pressure against the top of the upper jacking head; a pipe having a closed lower end extending into the caisson and also extending through the upper jacking head in slidable and sealing engagement with said upper jacking head; a lower jacking head rigidly mounted to the pipe and in sealing engagement with the cylindrical spud so that the upper and lower jacking heads and the sides of the cylindrical spud define a pressure chamber; and means for flowing fluid under pressure into the pipe, said pipe having openings into the pressure chamber, a spud closure plate mounted within the spud at a point upward from the lower extremity thereof and below the lower jacking head; and a second pipe within the caisson having an open lower end and extending from above water to below the lower jacking head so that a measuring device may be inserted into the second pipe to strike the spud closure plate.

3. A hydraulically operated mechanism in accordance with claim 2 wherein the second pipe is mounted within the first pipe with its lower end extending below the closed lower end of said first pipe.

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