June 25, 1968 G. E. MOTT ETAL 3,389,562

SALVAGEABLE MULTI-WELL OFFSHORE WELL PROTECTOR PLATFORM

Filed Oct. 31, 1966 2 Sheets-Sheet 1

Fig. 1.

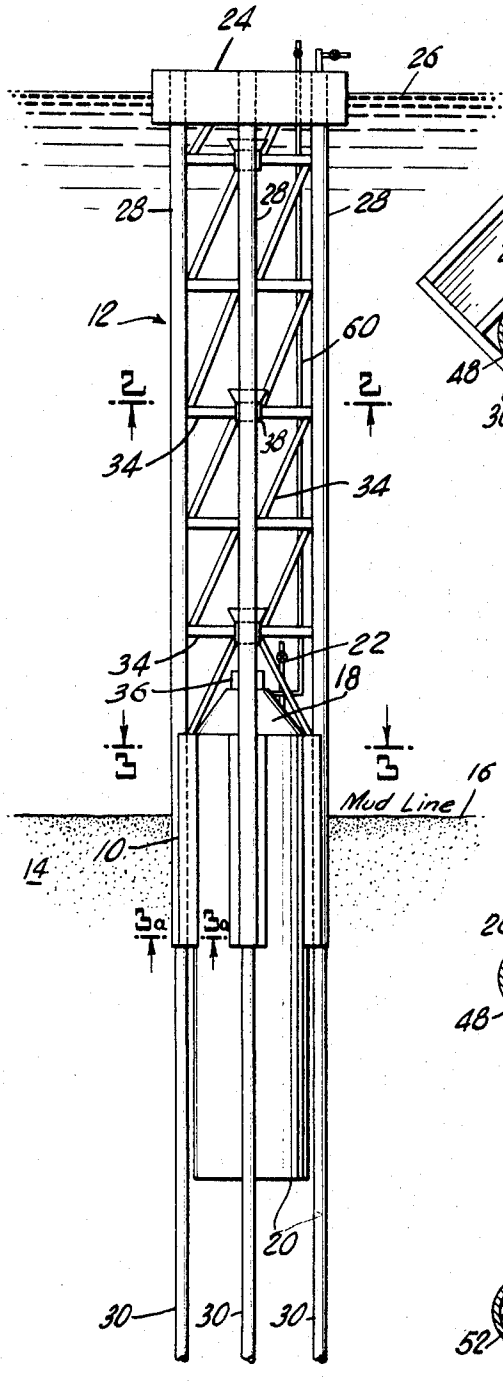


Fig. 2.

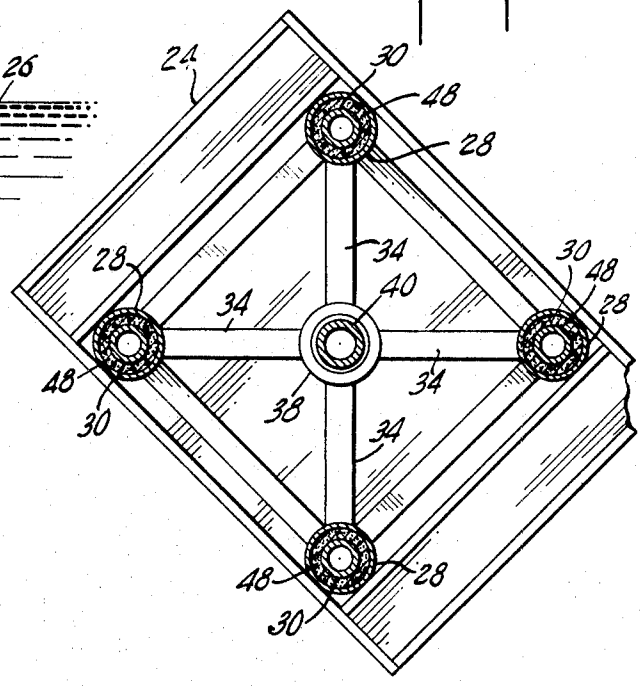
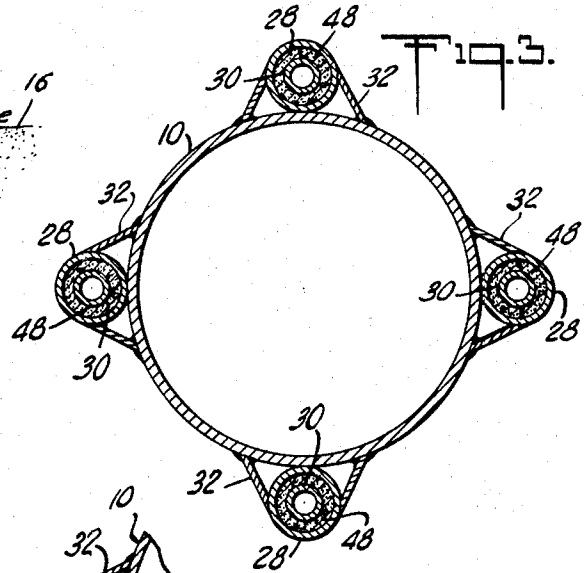


Fig. 3.



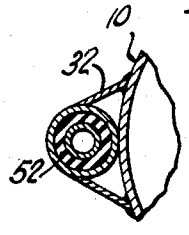


Fig. 3a.

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Fig. 4.

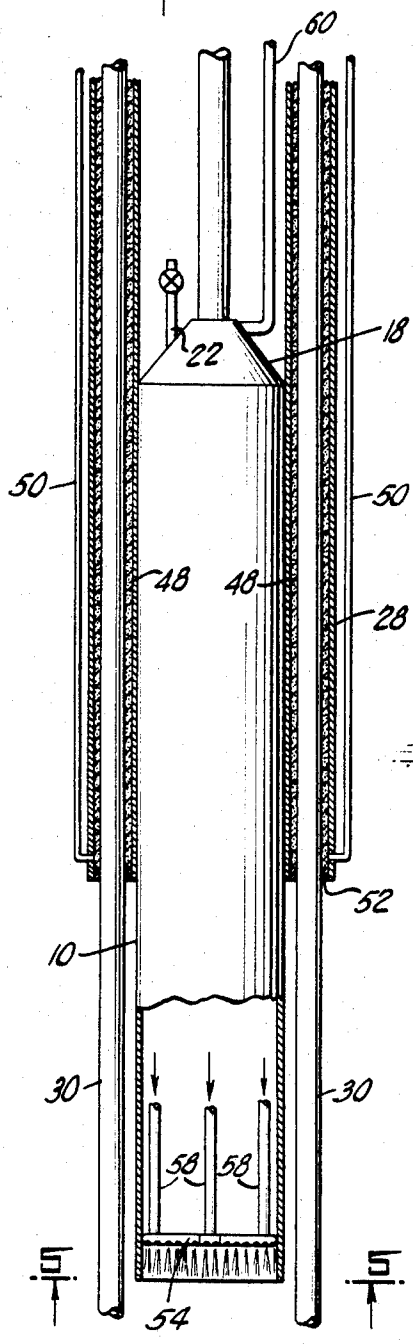


Fig. 5.

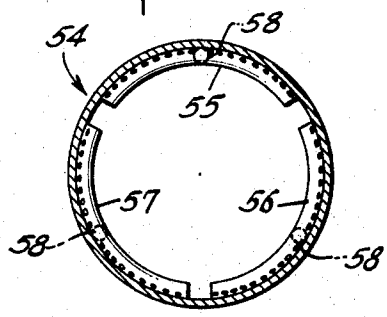
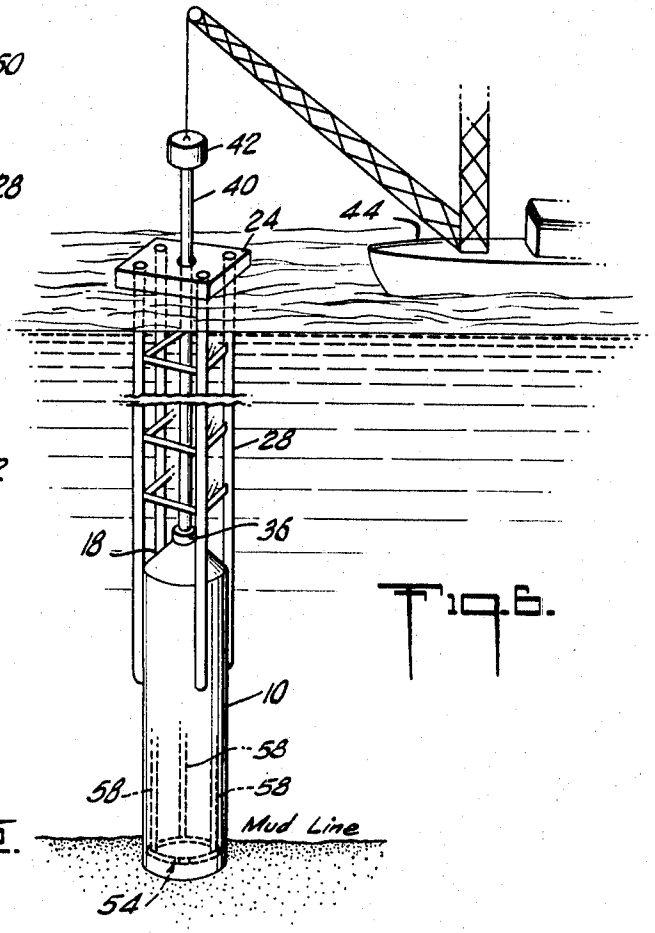


Fig. 6.



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SALVAGEABLE MULTI-WELL OFFSHORE WELL PROTECTOR PLATFORM

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10 Claims. (Cl. 61—46.5)

This invention relates to an offshore platform of the pile supported type. More particularly, the invention relates to a well protector platform by means of which a plurality of wells may be drilled from a single location with a mobile type drilling rig and which is salvageable for use with minimum modification in other locations having a wide range of water depths.

Offshore well protector platforms for supporting wells drilled in relatively shallow waters with above water well heads and blow out preventers have previously consisted of two basic types. The first type is the caisson structure which generally provides for the drilling of one well through the caisson structure itself. The caisson structure has the advantage that it can be designed for use in a moderate range of water depths without significant modification. This type structure can be installed with either a derrick barge or drilling rig, but it cannot be economically salvaged for reuse. Salvaging caissons is usually done by blowing off the caisson below the mud line with explosives. The use of explosives normally limits salvage operations to the use of derrick barges. The second type is the jacket type structure which can be designed to accommodate more than one well from the same location, but must be fabricated for a specific pretermined water depth. The cost of salvaging and modifying a jacket type structure for use in another water depth is usually only slightly less than the cost of building a new structure for the desired water depth.

Accordingly, it is the main object of the present invention to overcome the disadvantages of the prior art by providing a salvageable multi-well offshore well protector platform which can be used in a wide range of water depths without significant modification.

It is another object of the present invention to provide a multi-well offshore well protector platform which is easily salvageable by means of either a drilling rig or derrick barge.

It is a further object of the present invention to provide a salvageable multi-well offshore well protector platform which is lightweight and relatively inexpensive.

According to the invention, there is provided a salvageable well protector platform for drilling a plurality of wells from the same location into the ocean bottom. The structure is comprised of a caisson having a closed upper end and an open lower end and a jacket structure having at least three substantially parallel hollow legs trussed and welded together. The legs are located about the circumference of a circle the center of which corresponds to the middle longitudinal dimension of said jacket structure. The jacket legs extend below the truss work and are rigidly connected to the outer wall of the caisson parallel to the longitudinal dimension thereof, thereby transferring the loads and moments from the jacket structure to the caisson. A deck is supported at the upper end of the jacket structure. Means are provided for sinking the open end of the caisson into the ocean bottom to a depth which in conjunction with the length of the jacket structure will maintain the deck at the desired height above the water surface. A valve is located on the top of or above the caisson for releasing the water from within the caisson during sinking of the caisson into the ocean bottom. Means are also provided for pressurizing the interior of

the caisson to provide an upward force on the caisson to aid in removal thereof from the ocean bottom.

In the event that a well is discovered and the well protector platform is to be left in place permanently, the conductor pipe can be cemented into the jacket leg by introducing cement in the annular space between the conductor pipe and jacket leg by means of an inlet provided therefor.

In the event that a dry hole results from the drilling operation and it is desired to salvage and reuse the well protector platform, the caisson can be pressurized internally by pumping water or air therein. The internal pressure provides an upward force which can be calculated and which in conjunction with the pull provided by a mobile drilling unit or derrick barge will cause the caisson to overcome the soil friction along the sides of the structure and be ejected for reuse at a new location. It will be appreciated that the conductor pipe is cut by conventional internal cutting means before the caisson is pulled.

A jetting means is also provided inside the caisson near the bottom end which can be used to wash away sand or stiff clay materials thereby reducing the energy required to drive the caisson. This jet is broken up into equal circumferential segments. By controlling the flow of water into these segments, the caisson can be straightened if it should deviate from the vertical.

The above-mentioned and other features and objectives of this invention and the manner of obtaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic side view of a salvageable multi-well offshore well protector platform in place in the ocean bottom showing the conductor pipes extending from the jacket legs into the ocean bottom formations.

FIG. 2 is a sectional view taken along line **2—2** of FIG. 1.

FIG. 3 is a further sectional view taken along line **3—3** of FIG. 1.

FIG. 3*a* is a sectional view taken along line **3***a* at the bottom of one of the legs of the jacket structure showing the grommet or seal.

FIG. 4 is a partial vertical sectional view showing the jet ring in the bottom of the caisson.

FIG. 5 is a sectional view taken along the line **5—5** of FIG. 4 showing the circumferentially sectioned jet ring.

FIG. 6 is a schematic view of the salvageable multi-well offshore drilling platform being driven into the ocean bottom by means of a pile driver operable from a derrick barge acting on a pipe follower.

Referring to FIG. 1 of the drawing, there is shown a composite caisson **10** and jacket structure **12** forming a multiple well offshore well protector platform shown in place at an offshore location. The caisson **10** is shown sunk into the ocean bottom **14** with a portion protruding above the mud line **16**. It will be appreciated that the platform shown can be utilized in varying depths of water without any modification by fixing the depth to which the caisson **10** is sunk below the mud line **16**, and by adding or cutting off one or more whole bays of the jacket portion of the structure. In the minimum water depth situation the mud line **16** will be at approximately the top of the caisson **10** and the jacket might contain only one or two bays while in the maximum water depth situation the top of the caisson **10** might be up to one bay height above the mud line **16** and the jacket might contain multiple bays. Of course, in any event the caisson **10** will have to be sufficiently below the mud line **16** to give a good strong support for the rest of the structure. The caisson **10** has a cap **18** closing the top thereof and

has an open bottom 20 for sinking into the ocean bottom. As the caisson 10 is driven into the ocean bottom the water collected therein is released by a quick acting relief pipe and valve 22 which can be controlled by a wire line extending above water. The valve 22 is connected to the cap 18 at the top of the caisson 10.

The jacket structure 12 extends from the deck 24 above the water surface 26 to the caisson 10 sunk in the ocean bottom. This jacket structure 12 consists essentially of a plurality of legs 28 and the truss members 34 connecting the legs together. The truss members 34 are strong thin cylindrical members. In the embodiment disclosed, the number of legs 28 is limited to four as can be seen from FIG. 2 of the drawings. These legs 28 are hollow and are of sufficient diameter that conductor pipe 30 of the desired diameter can be inserted therethrough. These legs 28 extend from the deck 24 to the caisson 10 and are rigidly attached to the outer circumference of the caisson 10 parallel to the longitudinal dimension thereof. This attachment is made by means of gusset plates 32 (see FIG. 3) which are welded to the caisson 10. The attaching of the jacket structure legs 28 to the caisson 10 transfers the loads and moments from the jacket structure 12 to the caisson 10. The legs 28 and truss members 34, are welded together to provide a strong open type of structure which provides the minimum of surface for reacting with water currents and wave action.

In order to drive the caisson 10 into the ocean bottom 14, a drive head 36 is located on cap 18 of the caisson 10. The jacket structure 12 contains central bell guides 38 (see FIG. 2) by means of which a drive pipe follower 40 may be inserted so that it rests in the drive head 36. The drive pipe follower 40 when in place extends up the center of the jacket structure 12 through the deck 24 so that the drive pipe follower 40 is available to receive blows from a pile driver 42 (FIG. 6) which force can be transferred via the drive pipe follower 40 to the caisson 10 for driving it into the ocean bottom. FIGURE 6 shows the drive pipe follower 40 extending above the platform 24 and a pile driver 42 connected to a derrick barge 44 for driving the caisson 10 into the ocean bottom 14.

Once the composite multi-well jacket-caisson structure is in place with the deck 24 located at the predetermined height above the ocean surface 26, the conductor pipe 30 can be inserted in the particular legs 28 by means of a mobile drilling rig or derrick barge 44. The conductor pipe 30 will be driven as a pile or drilled beyond the bottom of the legs 28 of the jacket structure 12 into the more consolidated ocean bottom formations. It will be appreciated that this conductor pipe 30 will provide further stability, rigidity, and support for the caisson 10 and rest of the platform structure. The various well head assemblies and blow-out preventers for each of the wells will be located above the platform deck 24.

Referring to FIG. 2, further structural details of the jacket structure 12 are shown. The conductor pipe 30 is shown in place in each one of the four legs 28 of the jacket structure 12. The conductor pipe 30 not only extends into the more consolidated ocean bottom formations below the jacket legs 28 but also extends thru the jacket legs 28 to the surface where the well head equipment is attached thereto. Also, there is shown the cement 48 in the annular space between the conductor pipe 30 and each of the legs 28. Alternatively, the conductor pipes 30 can be secured to the jacket legs 28 by welding instead of cementing if desired. This, provides the additional flexibility of being able to break the connection between the conductor pipe 30 and the jacket leg 28, thus, leaving a reusable jacket leg after salvage. It will be appreciated that the legs 28 of the jacket 12 not only serve as guides but also serve as well casing. The cement 48 can be applied to the annular space between the leg and the conductor pipe via grout lines 50 each of which extends from the platform deck 24 to one of the annular spaces. To prevent the cement 48 from running out the bottoms of the legs 28 along the conductor pipes 30 a rubber grommet or seal 52 is provided at the bottom of each leg 28. A detailed sectional view of the grommet 52 is shown in FIG. 3*a*.

Referring again to FIG. 4, there is shown inside the bottom of the caisson 10 a jet ring 54. This jet ring 54 is segmented into equal circumferential segments 55, 56 and 57 as can be seen more clearly in FIG. 5. Each segment has a separate pipe input means 58 which extends to the ocean surface for supplying fluid thereto so that the amount of fluid to each segment can be controlled from the surface. Thus, if the caisson should deviate from its vertical orientation, the amount of fluid to the various segments of the jet ring can be so controlled that it will provide a righting action to the caisson. The jetting ring 54 alone can be used for inserting the caisson 10 in the ocean bottom 14 where the ocean bottom is sufficiently soft so that the caisson can be jetted in.

In the event that oil or gas is found when a well is drilled thru one leg, directional wells can be drilled through the other legs of the structure. If the first well is a dry hole, the conductor pipe 30 can be cut below the bottom of the leg 28 with conventional inside cutting tools. To aid in pulling the platform structure from the ocean bottom by means of a derrick, the caisson 10 is pressurized by pumping water or oil through a pipe 60 extending from the deck to the top of the caisson 10. The caisson 10 is, of course, designed to withstand the internal pressure required to extract the caisson under given soil conditions. Thus, the entire structure is salvageable.

Obviously, many modifications and variations of the invention as hereinabove set forth, may be made without departing from the spirit and scope thereof, and therefore, only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A salvageable offshore well protector platform for drilling a plurality of underwater wells from the same location into the ocean bottom comprising a caisson having a closed upper end and an open lower end, a jacket structure having at least three parallel hollow legs located along the circumference of a circle whose center corresponds to the center of said jacket structure, rigid connecting means comprising truss members for connecting said legs together, said legs extending below the top of said caisson, means for rigidly connecting the lengths of said legs extending below the top of said caisson to the outer wall of said caisson parallel to the longitudinal dimension thereof thereby transferring the loads and moments from the jacket structure to the caisson, a deck supported at the upper end of said packet structure, means for sinking the open end of said caisson into said ocean bottom, said caisson being sunk in said ocean bottom to a depth which in conjunction with the length of the jacket structure will maintain the deck at the desired height above the water surface, valve means located on the top of said caisson for releasing the water from within said caisson during sinking of the caisson into the ocean bottom, and means for pressurizing the interior of the caisson to provide an upward force on said caisson to aid in removal thereof from the ocean bottom.

2. Apparatus according to claim 1, wherein said legs located about the circumference of a circle are spaced such that the spacing between adjacent legs subtend equal angles at the center of said circle.

3. Apparatus according to claim 1, wherein said truss members are cylindrical in order to provide minimum resistance to ocean currents and waves.

4. Apparatus according to claim 1, wherein said means for rigidly connecting the length of said legs extending below the top of said caisson to said caisson comprise gusset plates welded to said caisson.

5. Apparatus according to claim 1, wherein said caisson has a driving head located at the top thereof, a driving

pipe follower fitting at its lower end into said driving head and extending up through said deck of said platform, guide means in the center of said jacket structure for guiding said pipe follower vertically thru said jacket structure, and pile driving means for driving said pipe follower and caisson so that the caisson sinks into the ocean bottom.

6. Apparatus according to claim 1, wherein a jetting ring is provided connected near the lower end inside of said caisson for jetting said caisson into said ocean bottom.

7. Apparatus according to claim 6, wherein said jetting means has at least three equal circumferential sections and separate pipe means connected to each circumferential section so that the fluid provided to each circumferential section can be controlled thereby providing a righting operation in the event the caisson is tilted from the vertical during sinking into the ocean bottom.

8. Apparatus according to claim 1, wherein conductor pipe is located within said legs of said jacket structure concentric therewith and extending from the bottom of said legs into the earth formations to serve as a drilling guide and to supply further stabilization of said salvageable offshore drilling platform.

9. Apparatus according to claim 8, wherein cement lines are provided for inserting cement into the annular space between the inner surface of said legs and the respective conductor pipe located therein, and a seal is provided at the bottom of each of said legs to contain the cement in said annular space.

10. A salvageable offshore well protector platform for drilling a plurality of above water wells from the same location into the ocean bottom comprising, a caisson having a closed upper end and an open lower end, a jacket structure having at least three vertically extending hollow legs, truss means interconnecting said legs to form said jacket structure, the vertical legs of said structure extending below the top of said caisson and connected to said caisson, gusset plates rigidly connecting each of said legs to the outer circumferential surface of said caisson to transfer the loads and moments supplied to the jacket structure to the caisson, a deck supported at the upper end of said jacket structure, said caisson and jacket structure being of sufficient vertical extension to maintain said deck above the water level when said caisson is positioned in the ocean bottom, a drive head located at the top of said caisson, a drive pipe follower inserted at its lower end into said drive head, guide means in the center of said jacket structure for guiding said pipe follower in a vertical orientation, said pipe follower being of sufficient length to extend above said deck and serve as a driving head for a pile driving hammer to drive the caisson into the ocean bottom, valve means located at the top of said caisson for releasing the water from within said caisson during sinking of the caisson into the ocean bottom, a pipe extending from said caisson to said surface platform, pump means for inserting water into said caisson thru said pipe to pressurize the interior to produce an upward force on said caisson to aid in removal thereof from the ocean bottom, each of said legs of said jacket structure serving as a guide for inserting conductor pipe for drilling a well therethrough.

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