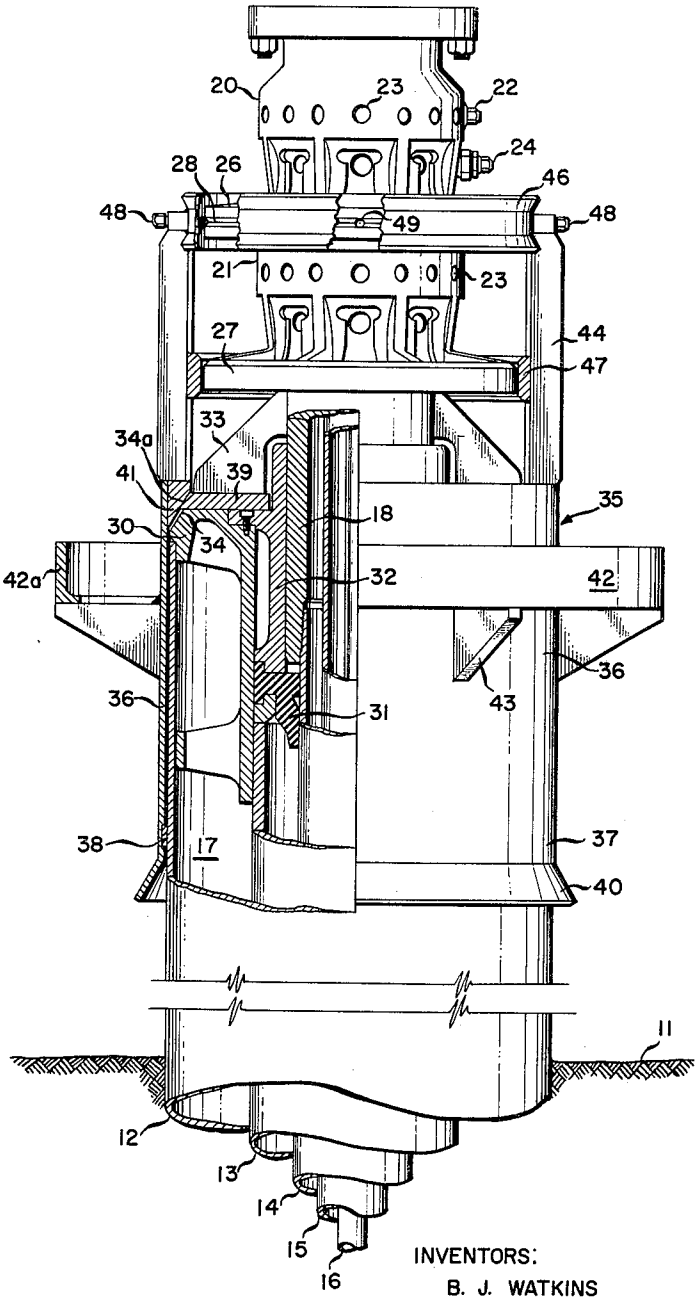
Feb. 2, 1965 B. J. WATKINS ETAL 3,168,142

WELLHEAD BASE ASSEMBLY

Filed Dec. 28, 1961



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United States Patent Office

3,168,142
Patented Feb. 2, 1965

3,168,142

WELLHEAD BASE ASSEMBLY

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Filed Dec. 28, 1961, Ser. No. 162,828
7 Claims. (Cl. 166—66.5)

This invention relates to the drilling, completion and working over of oil and gas wells, and pertains more particularly to apparatus whereby certain equipment used in well operations may be positioned for movement around a wellhead assembly that is positioned on the ocean floor or a considerable distance below the surface of a body of water.

In an attempt to locate new oil fields, an increasing amount of well drilling has been conducted at offshore locations, such, for example, as off the coast of Louisiana, Texas and California. As a general rule, the strings of casing in a well together with the tubing string or strings, extend to a point well above the surface of the water where they are closed in a conventional manner that is used on land wells, with the conventional wellhead assembly being attached to the top of the casing. Since the wellhead assembly is above the surface of the water, all connections and adjustments to equipment thereon are made manually. Methods have recently been developed for drilling and working on wells at offshore locations where the water depth is greater than that at which divers can readily operate. One such method and the apparatus used in the method is described in copending patent application Serial Number 118,949, filed June 22, 1961.

The method described in the above-identified copending patent application utilizes a remotely operable manipulator device adapted to be positioned on an underwater wellhead for making any necessary connections or adjustments of equipment thereto. Well drilling completion or work-over operations are carried out from a platform positioned above the surface of the body of water, the platform preferably being in the form of an operating platform of a vessel such as a well-drilling barge. Since any vessel on the surface of the ocean is subjected to considerable vertical motion, it is not possible to suspend therefrom a manipulator device which could be used to make the necessary connection to a wellhead during well drilling operations.

It is therefore an object of the present invention to provide an operating base assembly adapted to be positioned on a well casing of an underwater well whereby a manipulator device may be fixedly positioned relative to the wellhead or well casing against normal vertical movement.

A further object of the present invention is to provide an operating base assembly adapted to be removably positioned on a vertically extending underwater well casing and providing track means whereby a manipulator device may be seated thereon for movement around the well.

Another object of the present invention is to provide an operating base assembly adapted to be removably positioned on a well casing of an underwater well and fixedly secured to a wellhead assembly for removal therewith.

These and other objects of the present invention will be understood from the following description taken with reference to the drawing which illustrates a longitudinal view taken partly in cross-section of an underwater well.

Referring to the drawing, an underwater wellhead assembly is shown as being positioned adjacent to the ocean floor **11** and comprises concentric strings of casing **12, 13, 14, 15** together with an inner production tubing **16**. The outermost casing strings **12** and **13** may be arranged in a manner illustrated to form a double-wall conductor pipe

wherein the annulus **17** between the casings **12** and **13** may be filled with cement to give added rigidity to the structure. The casing string **14** may be a surface casing whose upper end is screw-threaded to a casinghead **18**. Upper and lower portions **20** and **21**, respectively, of a production wellhead assembly are illustrated as being positioned at the top of the casinghead **18**. The upper portion of the production wellhead assembly or the production bonnet **20** is secured by suitable horizontally extending bolts **22** to an upwardly extending portion of the lower portion **21** of the production wellhead. In a like manner the lower portion **21** of the production wellhead is fixedly secured to the casinghead **18** by bolts similar to bolt **22**. A bolt similar to bolt **22** would be positioned in each of the holes **23** in the upper and lower portions of the production wellhead.

The production wellhead assembly is also provided with a plurality of inwardly extending locking bolts **24** each of which is positioned in the series of holes (similar to holes **23** which receive bolts **22**, but at the level of bolts **24**) and extend inwardly to engage and hold down casing or tubing hangers (not shown). Since, the details of the production wellhead assembly represented by portions **20** and **21** do not form a part of the present invention they will not be further described in detail here. It is to be understood that the wellhead assembly could be a drilling wellhead assembly as well as a production wellhead assembly. The production wellhead assembly is preferably provided with a pair of guard rings **26** and **27** which protect the bolts on the wellhead against damage. One of the guard rings **26** and **27** may be provided with a circumferential groove **28** or other indexing means for fixedly positioning the base assembly of the present invention to the production wellhead.

The top of the conductor pipe formed by the casing strings **12** and **13** may be closed in any suitable manner, as by a closure member **30** which extends downwardly between the two casings **12** and **13** and is provided with a seal **31** for sealing against the casing string **14**. The seal **31** is held in place by a follower ring or bushing **32**. The casinghead **18** may be provided with a support base **35** adapted to seat on the closure member **30** at the top of the conductor pipe. The top of the conductor pipe and/or its closure member **30** is provided with a landing shoulder **34** which is preferably beveled downwardly and outwardly so that foreign material does not accumulate at an underwater location.

The wellhead or operating base assembly of the present invention is represented generally by numeral **35** and comprises a tubular housing member **36** of a diameter slightly larger than the outermost casing string **12** of the well which extends up to the casinghead **18**. The downwardly extending lower portion **37** of the housing member **36** forms stabilizer means for the housing member and is of a length sufficient to prevent the housing member from being tilted off the top of the casing string **12** when objects of substantial weight are hung on one side of the base assembly **35**.

The lower portion of stabilizing member **37** of the housing member **36** is slightly larger in diameter internally than the external diameter of the well casing **12** which is to be received therein. Preferably, a series of spacer blocks **38** are integrally formed on or fixedly secured to the inner wall of the stabilizer portion **37**, or to the outer wall of the upper end of the casing string **12**, so as to reduce the frictional contact area between the base asssembly **35** and the casing string **12**. The use of spacer blocks **38** is not essential in which case the stabilizer portion **37** would directly contact the casing string **12**. While the stabilizer portion **37** of the housing member **36** has been shown as a downwardly extending tubular member, it is to be understood that the stabilizer portion may take form

of a downwardly extending series of supporting arm elements. To facilitate the placement of the base assembly **35** in telescopic arrangement on the top of the well casing **12**, the lower end of the stabilizer portion **37** of the base assembly is preferably provided with aligning means which may be in the form of an outwardly flaring skirt **40**.

A landing shoulder **41** is fixedly secured to or formed on the inner wall of the housing member **36** and preferably extends therearound the internal periphery thereof. The landing shoulder **41** is of a diameter and shape to seat on the cooperating landing shoulder **34***a* on base plate **39** at bottom of ribs **33** attached to wellhead portion **21**.

Fixedly secured to the outer surface of the housing member **36** intermediate the ends thereof and disposed outwardly therefrom is a circular track **42** which extends peripherally the entire distance around the housing member **36**. It is to be realized that on some wellhead installations, all of the mechanically actuated elements, connections or adjustments may be positioned on one side of the production head so that it would not be necessary to have the track **42** extend all the way around. In such a case it would be sufficient to have a track extend over only a portion of the housing member **36**. The track **42** is fixedly mounted to the housing member **36** as by being welded to suitable support brackets **43**. Although the track **42** is shown as being in the form of an upwardly extending section **42***a* on which wheels of a manipulator device or other underwater device (not shown) may travel, the track may take any form in cross-sectional area. Preferably, the space between the track **42***a* and the housing member **36** is not provided with a horizontal plate at the bottom of the track, thus permitting solid matter, sand or sediment at an underwater location from settling in and filling the space between the track **42***a* and the housing member **36**. However, in some installations it may be preferred to put a bottom plate on the track so to allow wheels to run on the bottom plate while the upright portion **42***a* prevents the wheels from falling off the track. Additionally, the track **42***a* in cross-section could extend downwardly below the brackets **43** so as to permit clamping devices to ride underneath the track while wheels are running on top or within the track. The track **42***a* in cross-section may take any suitable form depending upon the type of wheels intended to cooperate with it.

The housing member **36** is provided with a plurality of upwardly extending arm elements **44** which are preferably secured together by means of reinforcing rings or bands **46** and **47** which are of a diameter slightly larger than the guard rings **26** and **27**, respectively, mounted on the production wellhead **20–21**. The upper ends of the arms **44** or the reinforcing ring **46** are provided with a suitable connector device, preferably in the form of horizontally extending bolts **48** which can be screwed inwardly to engage and seat in the peripheral groove **28** in the guard ring **26**, or may be fixedly secured to another portion of the production wellhead assembly **20–21**.

In using the operating base assembly **35** of the present invention, it may be secured by means of the bolts **48** to the production wellhead assembly **20–21** on a drilling barge above the surface of the water and subsequently lowered into place together with the production wellhead when the latter is lowered through the water and positioned on top of the conductor pipe formed by the well casing strings **12** and **13**.

Subsequently, the operating base assembly **35** of the present invention may be removed together with the production wellhead sections **20** and/or **21** or the bolt **48** may be unscrewed to release it from the production wellhead so that the production wellhead sections **20** and/or **21** may be retrieved from the ocean floor while the operating base assembly **35** remains in place. The internal dimensions of the operating base assembly **35** are preferably such that it could be independently removed or stripped upwardly over the production wellhead **20–21** without removing the latter from the well. The removable operating base assembly **35** of the present invention provides removable track means by which an underwater manipulator device (not shown) may be positioned on, hung from and/or travel around a wellhead to carry out any desired number of operations with the control of the manipulator being carried out from a remote location.

In the preferred form of the invention, the landing shoulder **41** is supported on landing surface **34***a* of base plate **39**. The plate **39** is in turn attached to support brackets **33** which are secured to the lower portion **21** of the wellhead assembly which is fixedly mounted on the top of casing **14**. Being so arranged the wellhead track base assembly is always in fixed relation with the wellhead assembly **20–21** regardless of possible relative movement of casing **14** to casings **12** or **13**.

It is to be understood that the arm elements **44** are positioned in a manner such that there is always free access to the screws **22** and **24** along the axis thereof. One form of an orienting device may be dimples or recesses **49** in the groove **28** of a size to receive the cone-pointed ends of at least one screw **48**. The orientation of the dimples **49** with respect to the control screws **22** and **24** is such that when the dimples **49** are engaged by the screws **48** the arms **44** are not axially aligned with any screw **22** or **24**. In operation, the assembly **35** may first be attached to the production bonnet or wellhead section **20** by means of screws **48** which engage dimples **49**. The entire assembly is then lowered along with casing **14** to the position illustrated.

In subsequent operations, should the assembly **35** be removed from the well with the upper portion **20** of the production wellhead assembly, the screw **48** and dimple **49** arrangement is re-established before lowering the assembly into position again, thus assuring proper orientation of the arms **44**.

We claim as our invention:

1. An operating base assembly adapted to be removably positioned on at least a portion of a wellhead assembly extending upwardly from an underwater well, said base assembly comprising
   - (*a*) a housing member having an opening extending vertically therethrough,
   - (*b*) stabilizer means for said base assembly carried by said housing member and adapted to engage the outer surface of a portion of said wellhead assembly,
   - (*c*) shoulder means carried on the inner wall of said housing member for seating on said wellhead assembly, and
   - (*d*) track means fixedly secured to said housing member and disposed radially outwardly therefrom, said track means having a smooth uninterrupted upper surface extending entirely around said housing member.

2. An operating base assembly adapted to be removably positioned on a wellhead assembly extending upwardly from an underwater well, said base assembly comprising
   - (*a*) a housing member having an opening extending vertically therethrough,
   - (*b*) stabilizer means for said base assembly formed by a portion of said housing member and adapted to engage the outer surface of a portion of said wellhead assembly,
     - (1) said lower portion of said base assembly being of an internal diameter substantially equal to but larger than the external diameter of said portion of said wellhead assembly to be received therein,
   - (*c*) shoulder means carried on the inner wall of said housing member for seating on said wellhead assembly, said shoulder means being carried at the top of said housing member,

(*d*) track means fixedly secured to said housing member and horizontally disposed radially outwardly therefrom, and

(*e*) releasable connector means carried by said housing member above said shoulder means thereof for engaging said wellhead assembly adapted to be positioned within said housing member.

3. The apparatus of claim 2 wherein said track means extends a substantial way around the periphery of said housing member.

4. The apparatus of claim 2 wherein said connector means comprises inwardly-extending releasably-engageable connector elements.

5. The apparatus of claim 4 wherein the connector elements are screw-threaded bolts.

6. The apparatus of claim 2 including aligning means carried on the lower end of said stabilizing means for centralizing the housing member as it is lowered on the top of said portion of said wellhead assembly.

7. An operating base assembly adapted to be removably positioned on the top of a large diameter pipe string extending upwardly from an underwater well, said base assembly comprising

(*a*) a housing member having an opening extending vertically therethrough,

(*b*) stabilizer means for said base assembly formed by the lower portion of said housing member with the top of a portion of said wellhead assembly,

(1) said lower portion of said base assembly being of an internal diameter substantially equal but larger than the external diameter of said

portion of said wellhead assembly to be received therein,

(*c*) shoulder means carried on the inner wall of said housing member for seating on said portion of said wellhead assembly, said shoulder means being carried at the top of said housing member,

(*d*) track means fixedly secured to said housing member intermediate the ends thereof and disposed radially outwardly therefrom,

(1) said track means extending a substantial way around the periphery of said housing member,

(*e*) connector means carried by said housing member above said shoulder means thereof for engaging a wellhead adapted to be positioned within said housing member,

(1) said connector means including inwardly-extending releasably-engageable connector elements,

(*f*) and aligning means carried on the lower end of said stabilizing means for centralizing the housing member as it is lowered on the top of said pipe string.

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