May 1, 1962 F. T. FOCHT ETAL 3,032,106

HANDLING OF WELL EQUIPMENT

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FIG. 1.

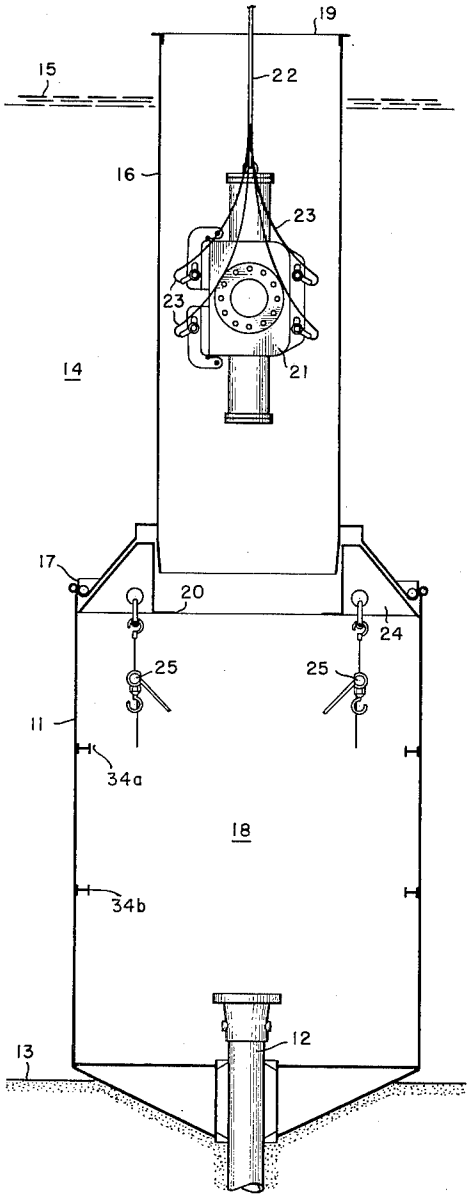
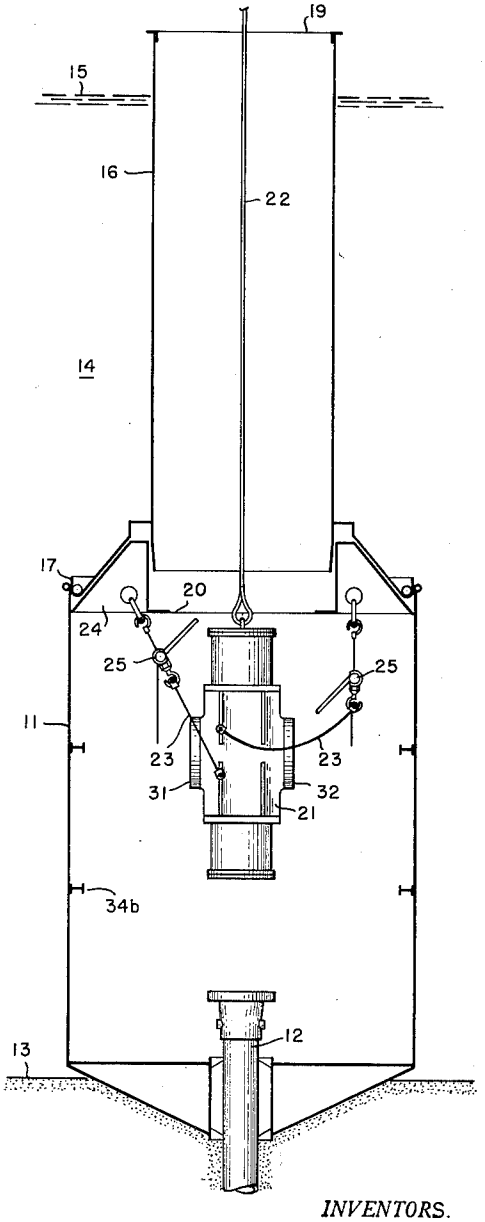


FIG. 2.



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FIG. 3.

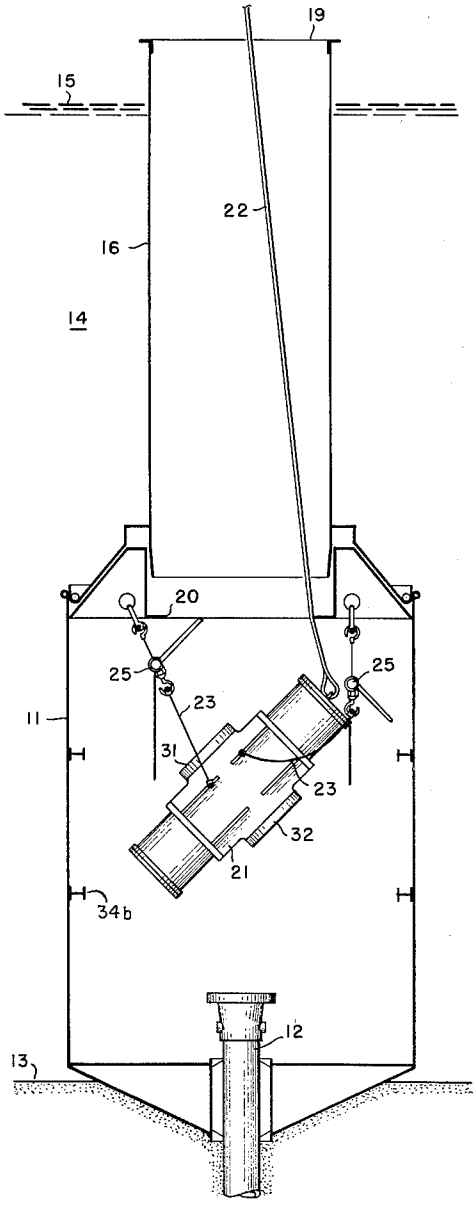
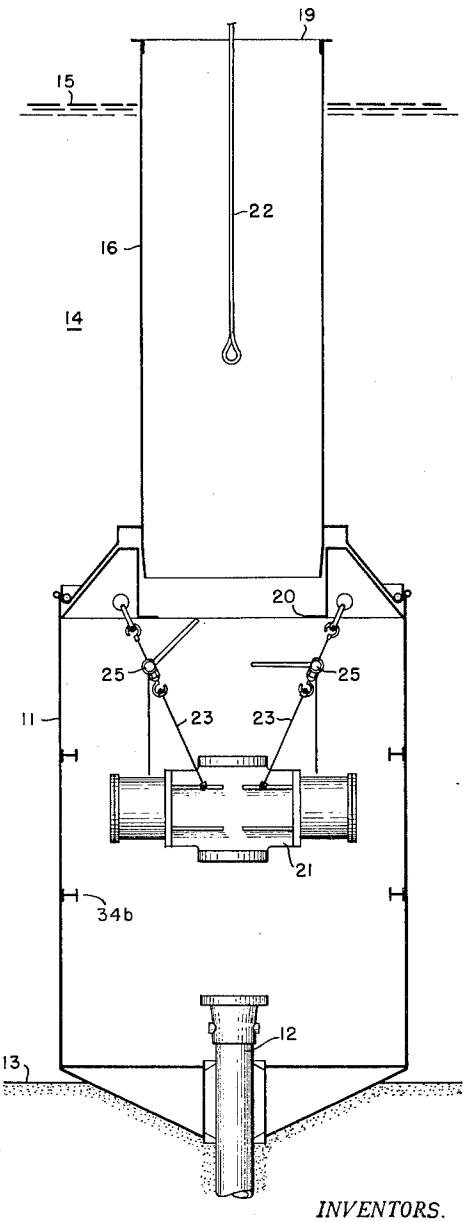


FIG. 4.



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FIG. 5.

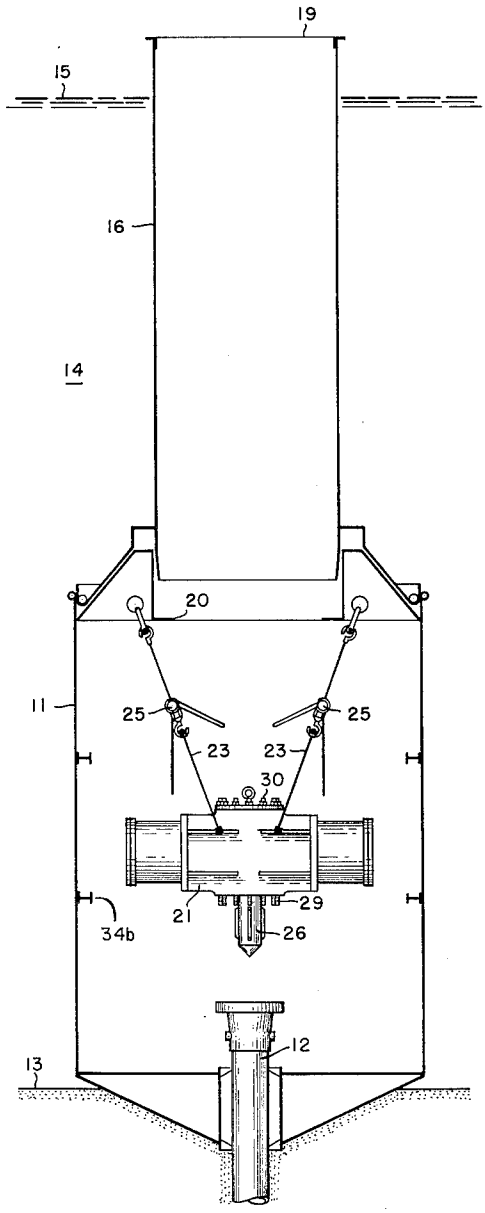
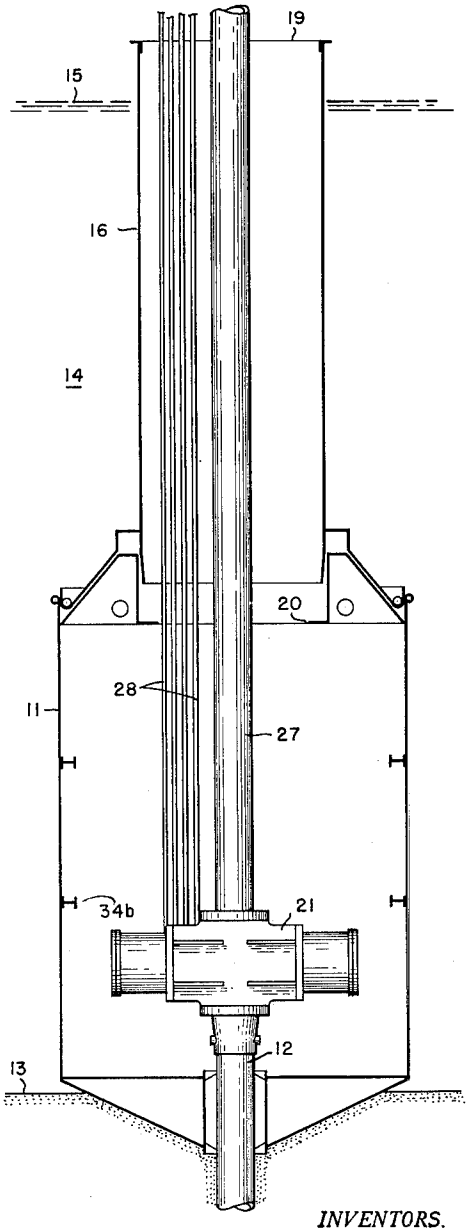


FIG. 5A.



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FIG. 6.

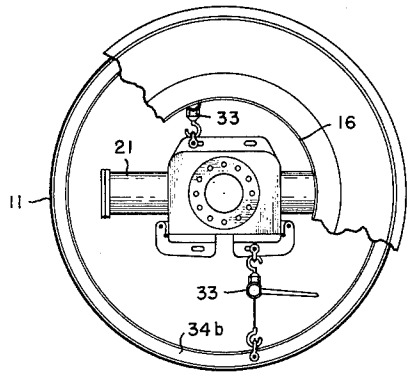
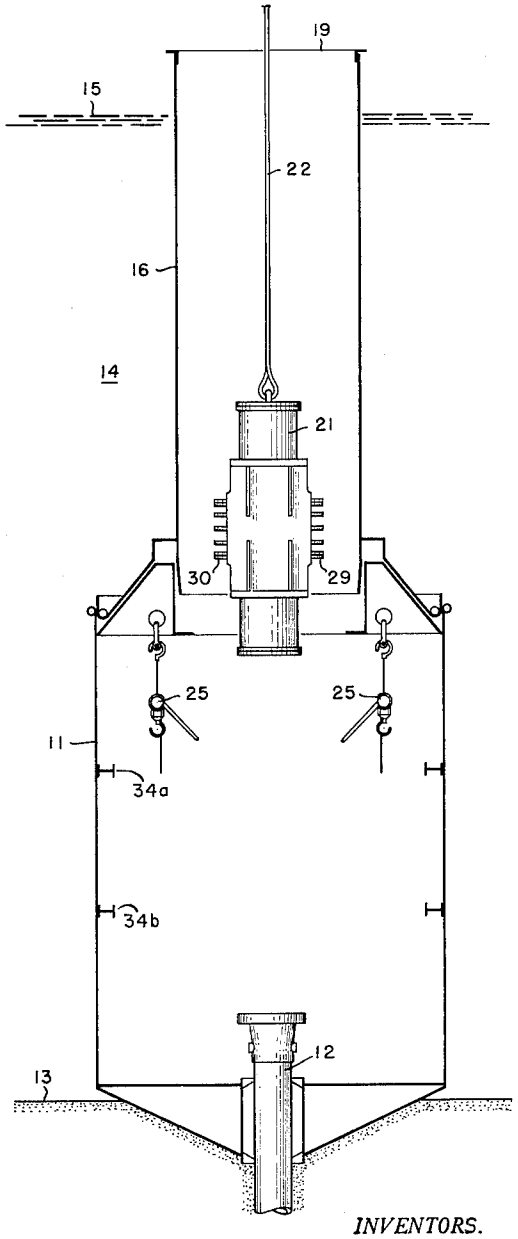


FIG. 7.



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United States Patent Office

3,032,106

Patented May 1, 1962

3,032,106

HANDLING OF WELL EQUIPMENT

Frank T. Focht, Bellaire, and James R. Sims, Houston, Tex., assignors, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware

Filed Dec. 15, 1958, Ser. No. 780,454
7 Claims. (Cl. 166—46)

The present invention is directed to a method for handling well equipment. More specifically the invention has to do with lowering and placing well equipment onto a well casing in a confined space. In its more particular aspects, the invention is concerned with lowering and placing well equipment such as a blowout preventer onto a well casing in a confined space underwater.

The present invention may be briefly described as a method for lowering and placing well equipment such as a blowout preventer onto a well casing in a confined space in which the well equipment such as a blowout preventer has a length greater than the dimension of an opening into said confined space while maintaining personnel in a safe position above said well equipment as it is being lowered and placed. Specifically the method comprises lowering the well equipment through the opening into the upper portion of the space in a position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of the space. The well equipment or blowout preventer is flexibly supported in the space and rotated to a position such that its greatest longitudinal axis is substantially parallel to the horizontal axis of the space. Thereafter, the well equipment or blowout preventer is guidingly lowered concentrically with and onto the well casing while maintaining the well equipment with its greatest longitudinal axis substantially parallel to the horizontal axis of the space.

In the practice of the present invention, it is contemplated that the invention will also include the raising of the well equipment such as a blowout preventer from the well casing. When this is contemplated, the blowout preventer or well equipment is guidingly raised from the well casing concentrically therewith while maintaining the blowout preventer with its greatest longitudinal axis substantially parallel to the horizontal axis of the space. The blowout preventer is then flexibly supported in the space above the well casing and rotated to a position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of the space and thereafter in that position, the blowout preventer is raised from the space through the opening.

The present invention will be further illustrated by reference to the drawing in which:

FIGS. 1 to 7, inclusive, illustrate a preferred mode of practicing the invention. Referring now to the drawing in which identical numerals will be employed to designate identical parts, numeral **11** designates an underwater chamber which is fixedly attached to a well casing **12** which penetrates the water bottom **13** of a body of water **14** having a surface **15**. It is to be noted that the underwater chamber **11** extends with its upper end below the water surface **15**. Releasably attached to the underwater chamber **11** is a second chamber **16**. The second chamber **16** is sealed by a sealing means **17** to the upper end of the underwater chamber **11**. The underwater chamber **11** and the chamber **16** are freed of water and enclose a confined space **18** around the well casing **12** and provides access thereto through the opening **19** in the chamber **16** and the opening **20** in the chamber **11**. Since the opening **20** is such that it has a lesser dimension than the greatest dimension of well equipment such as a blowout preventer **21** a method must be provided for lowering well equipment such as the blowout preventer **21** through the opening **20** and openings **20** and **19** and place it safely on the well casing **12** without endangering the safety and life of personnel used to install well equipment. In accordance with the present invention a blowout preventer such as **21** is attached to a lifting cable such as **22** in turn attached to a suitable hoisting means not shown and lowered in a vertical position through the opening **19**. Thus the locking stems of the blowout preventer are in a vertical position as shown in FIG. 1.

It is to be noted that there are attached to the blowout preventer **21** a plurality of flexible support cables **23** which are four in number to be used in a manner to be described hereinafter. Also, it is to be noted that there is attached to stiffening brackets **24** a plurality of hoists **25** which may be four in number to correspond to the support cables **23** to be used in a manner which will be described further hereinafter.

Referring now to FIGS. 2 and 3, the blowout preventer **21** is lowered through the opening **20** attached to the lifting cable **22** and after it has passed through the opening **20**, the support cables such as **23** attached to the blowout preventer **21** are attached to the hoists **25** as shown. Thereafter, as shown in FIG. 3, lowering is continued on the cable **22** and by means of the two lower support cables as shown in FIG. 2 the blowout preventer **21** begins to rotate from the vertical position as shown in FIG. 2 to a horizontal position as shown in FIG. 4. As shown in FIG. 4, the hoists **25** are all attached to the blowout preventer **21** by the cables **23** which now bear the full load of the blowout preventer **21** since the support lifting cable **22** is disengaged. With the full weight of the blowout preventer **21** carried by the hoists **25**, the blowout preventer is now in a position to be lowered onto the well casing **12**. Before finishing the lowering of the blowout preventer **21** onto the well casing **12**, a blowout preventer stabilizing bar such as **26** is placed within the opening of the blowout preventer **21** to act as a guide for the further lowering of the blowout preventer **21** and to prevent lateral movement. The stabilizing bar **26** is described and claimed in pending application Serial No. 780,455, filed December 15, 1958 for R. C. Cole and F. T. Focht and entitled "Aligning Means for Well Equipment," now U.S. Patent 2,963,090.

With the stabilizing bar **26** in the opening of the blowout preventer **21**, further lowering of the blowout preventer **21** with the hoisting means **25** causes the blowout preventer **21** to be placed on the well casing **12** as shown in FIG. 5A. In the event it becomes necessary to horizontally rotate the blowout preventer **21** to align the studs **29** with the well head **12**, jacking hoists **33** are attached between the blowout preventer **21** and the most adjacent stiffening ring **34*b*** as shown in FIG. 6. The blowout preventer **21** may then be rotated clockwise or counterclockwise by manipulation of the jacking hoists **33**. The stiffening rings **34*a*** and **34*b*** also add strength to the chamber or vessel **11**. Although not shown in FIG. 6, it is to be understood that the blowout preventer **21**, during the above-mentioned manipulation, is still supported by cables **23** and hoists **25**. Thereafter, the blowout preventer **21** is bolted to the well casing **12** and a mud return line such as **27** attached to the upper end of the blowout preventer **21** with blowout preventer control lines **28** also attached to the blowout preventer and extending through the openings **19** and **20** in the vessels **16** and **11**, respectively.

During all the operations such as described in FIGS. 1 through 5A, personnel handling the blowout preventer **21** for lowering and placing on the well casing **12** remain above the blowout preventer **21**. By thus providing the method of the present invention for handling the blowout preventer **21**, there is no danger of personnel being crushed or maimed by working in the chamber **11** below

the blowout preventer 21 if some mischance should happen. In other words, the method of lowering and placing a blowout preventer or well equipment in a confined space such as described allows complete safety for the working personnel.

When it is desired to remove the blowout preventer from the well casing 12, the operations as described in FIGS. 2 to 5A, inclusive, are reversed and the blowout preventer 21 is removed from the well casing 12 and hoisted through the openings 20 and 19 by reattachment of the lifting cable 22 to the blowout preventer rotated to a vertical position as shown in FIGS. 2 and 3, the hoists 25 having been reinstalled on the lifting ring and stiffening bracket 24 as shown in the several figures of the drawing.

FIG. 6 shows the blowout preventer 21 arranged on the well casing 12 prior to installation of the mud return line 27. After the blowout preventer 21 has been suitably placed on the well casing 12 the support cables 23 are removed and the hoists 25 are also removed from the chamber 11.

In the several figures of the drawing, the studs 29 and 30 of the blowout preventer 21 during the lowering operation are protected by stud protectors 31 and 32. These stud protectors are described in pending application Serial No. 780,604, filed December 15, 1958. in the names of F. T. Focht, J. R. Sims and R. P. Knapp. Briefly the stud protector protects the studs 29 and 30 from mechanical damage during the lowering operation.

The present invention is of great utility and advantage in handling well head equipment such as a blowout preventer in underwater completion operations such as described and claimed in Serial No. 629,878, filed December 21, 1956, for Richard P. Knapp, James D. Moore, and Mercer H. Parks; now U. S. Patent 2,906,500, in which first and second vessels are arranged on a well head such that completion operations may be conducted underwater without requiring the use of divers and the like. In such operations it is necessary to lower well equipment such as blowout preventers through an opening whose greatest dimensions are less than the length of the blowout preventer. In apparatus as described in pending application Serial No. 629,878 supra and as described herein employing a blowout preventer such as one of the Shaffer Tool Works as described in the Composite Catalog of Oil Field and Pipeline Equipment, 19th Edition, pages 4611 to 4623, operations were conducted such as described herein. In such operations, a shackle was used in a stiffening bracket in the upper end of the chamber and four hoists such as has been described with respect to the drawings were installed. Attached to the blowout preventer were four support cables about five feet long as shown in the drawing. The stud protectors were installed on the studs of the blowout preventer and the lifting cable was attached to the end of the blowout preventer by means of a shackle and the blowout preventer lowered in a vertical position through the opening. When the blowout preventer reached a position in the upper portion of the underwater vessel, a man enters the chamber above the blowout preventer and releases the support cables from their temporary securement and attaches them to the hoist. The two supports on the same side of the blowout preventer are attached to the two hoists which are 45° apart. Lowering of the blowout preventer is then continued and the two lower support cables begin to rotate the blowout preventer as shown in the drawing. Lowering is continued and finally the blowout preventer is carried by the four support cables as shown in the drawing. The lifting cable is then removed from the blowout preventer.

Stud protectors are removed by a man standing on top of the blowout preventer and then the blowout preventer centralizer or stabilinzing bar is lowered through the blowout preventer and installed as shown in the drawing Four men standing on top of the blowout preventer, each operating a hoist, lower the blowout preventer such that the blowout preventer is lowered concentrically onto the well casing. The stabilizing bar prevents lateral movement. When the studs almost touch the flange on the casing head, the blowout preventer is rotated into final position until the studs line up with the holes in the flange, the stabilizer bar or centralizer preventing lateral movement. The blowout preventer is then lowered the rest of the way and the nuts are made up on the studs and the hoists, support cables, and stabilizing bar are removed.

In removing the blowout preventer from the underwater vessel or chamber, the jrocedure is reversed excepting that the stabilinz bar is not required in this operation. The stud protectors are not used as this would require a man to work under the blowout preventer while it is suspended on the support cables. When the support cables are removed from the hoists, they are allowed to hang from the blowout preventer.

The method of the present invention of installing well equipment such as blowout preventers is very advantageous and useful. The personnel perform all their work while staying above the blowout preventer until it is completely restrained by the support cables and the centralinzing bar. In a word, it is unnecessary for the personnel to get below the blowout preventer until it is restrained and supported by the well casing and the cables 23 from the hoists 25.

While the present invention has been described and illustrated by reference to handling of a blowout preventer, it is also useful in the placement of other well equipment which may have a dimension greater than the dimension of the openings through which it must be lowered.

The nature and objects of the present invention having been completely described and illustrated, what we wish to claim as new and useful and secure by Letters Patent is:

1. A method for lowering and placing well equipment onto a well casing in a confined space defined by a vessel enclosing the upper end of said well casing in which the well equipment has a length greater than the dimension of an opening in the upper end of said vessel into said confined space while maintaining personnel in a safe position above said well equipment as it is being lowered and placed which comprises lowering said well equipment suspended by a first flexible line attached to one end of said well equipment through said opening into the upper portion of said vessel in a first position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of said vessel, flexibly interconnecting said well equipment and said vessel by a plurality of separate flexible lines attached to said vessel at a plurality of peripherally spaced-apart points in the upper end thereof and to said well equipment at spaced-apart points on its greatest longitudinal axis longitudinally removed from the center of said well equipment, flexibly supporting said well equipment in said space by said first flexible line and by said lines attached to said well equipment at a plurality of points below the center of said well equipment in said first position, further lowering said well equipment by said first flexible line until it is also supported by said lines attached to said well equipment at a plurality of points above the center of said well equipment in said first position thereby rotating said well equipment to a second position such that its greatest longitudinal axis is substantially parallel to the horizontal axis of said vessel, and then guidingly lowering said well equipment supported by said separate flexible lines concentrically with and onto said well casing while maintaining said well equipment with its greatest longitudinal axis substantially parallel to the horizontal axis of said vessel.

2. A method for lowering and placing a blowout preventer onto a well casing in a confined space defined by

a vessel enclosing the upper end of said well casing in which the blowout preventer has a length greater than the dimension of an opening in the upper end of said vessel into said confined space while maintaining personnel in a safe position above said blowout preventer as it is being lowered and placed which comprises lowering said blowout preventer suspended by a first flexible line attached to one end of said blowout preventer through said opening into the upper portion of said vessel in a first position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of said vessel, flexibly interconnecting said blowout preventer and said vessel by a plurality of separate flexible lines attached to said vessel at a plurality of peripherally spaced-apart points in the upper end thereof and to said blowout preventer at spaced-apart points on its greatest longitudinal axis longitudinally removed from the center of said blowout preventer, flexibly supporting said blowout preventer in said space by said first flexible line and by said lines attached to said blowout preventer at a plurality of points below the center of said blowout preventer in said first position, further lowering said blowout preventer by said first flexible line until it is also supported by said lines attached to said blowout preventer at a plurality of points above the center of said blowout preventer in said first position thereby rotating said blowout preventer to a second position such that its greatest longitudinal axis is substantially parallel to the horizontal axis of said vessel, detaching said first flexible line from said blowout preventer, and then guidingly lowering said blowout preventer supported by said separate flexible lines concentrically with and onto said well casing while maintaining said blowout preventer with its greatest longitudinal axis substantially parallel to the horizontal axis of said vessel.

3. A method for lowering and placing onto and removing a blowout preventer from a well casing in a confined space defined by a vessel enclosing the upper end of said well casing in which the blowout preventer has a length greater than the dimension of an opening in the upper end of said vessel into said confined space while maintaining personnel in a safe position above said blowout preventer as it is being lowered and placed which comprises lowering said blowout preventer suspended by a first flexible line attached to one end of said blowout preventer through said opening into the upper portion of said vessel in a first position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of said vessel, flexibly interconnecting said blowout preventer and said vessel by a plurality of separate flexible lines attached to said vessel at a plurality of peripherally spaced-apart points in the upper end thereof and to said blowout preventer at spaced-apart points on its greatest longitudinal axis longitudinally removed from the center of said blowout preventer, flexibly supporting said blowout preventer in said space by said first flexible line and by said lines attached to said blowout preventer at a plurality of points below the center of said blowout preventer in said first position, further lowering said blowout preventer by said first flexible line until it is also supported by said lines attached to said blowout preventer at a plurality of points above the center of said blowout preventer in said first position thereby rotating said blowout preventer to a second position such that its greatest longitudinal axis is substantially parallel to the horizontal axis of said vessel, detaching said first flexible line from said blowout preventer, then guidingly lowering said blowout preventer supported by said separate flexible lines concentrically with and onto said well casing while maintaining said blowout preventer with its greatest longitudinal axis substantially parallel to the horizontal axis of said vessel, guidingly raising said blowout preventer supported by said separate flexible lines concentrically with and from said well casing while maintaining said blowout preventer with its greatest longitudinal axis substantially parallel to the horizontal axis of said vessel, reattaching said one end of said blowout preventer to said first flexible line, raising said blowout preventer by said first flexible line while supporting said blowout preventer by said separate lines attached to said blowout preventer at a plurality of points below the center of said blowout preventer in said first position thereby rotating said blowout preventer from said second to said first position such that its greatest longitudinal axis is substantially perpendicular to the horizontal axis of said vessel, and then raising said blowout preventer from said vessel through said opening with said first flexible line.

4. A method in accordance with claim 3 in which said separate flexible lines are detached from said blowout preventer and from said vessel after said blowout preventer has been lowered onto said well casing and in which said separate flexible lines are reattached to said blowout preventer at spaced-apart points on its greatest longitudinal axis longitudinally removed from the center of said blowout preventer and to said vessel at peripherally spaced-apart points in the upper end thereof before said blowout preventer is raised from said well casing.

5. A method in accordance with claim 1 in which the first flexible line is detached from said well equipment after said well equipment has been rotated from its first to its second position.

6. A method in accordance with claim 1 in which said separate flexible lines are detached from said well equipment after said well equipment has been lowered onto said well casing.

7. A method in accordance with claim 1 in which the vessel is submerged in water and access thereto is had through a second vessel matingly and releasably attached to said vessel at the opening therein and extending to above the surface of the water, said well equipment being lowerable by said first flexible line through said second vessel in said first position with its greatest longitudinal axis substantially perpendicular to the horizontal axis of said vessel.

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