Feb. 24, 1970 J. SLACK 3,496,728

METHOD AND APPARATUS FOR FIELD REINFORCEMENT OF COLUMNAR STRUCTURES, PARTICULARLY OFFSHORE DRILLING AND PRODUCTION PLATFORMS

Filed Aug. 10, 1967 4 Sheets-Sheet 1

Fig. 1.

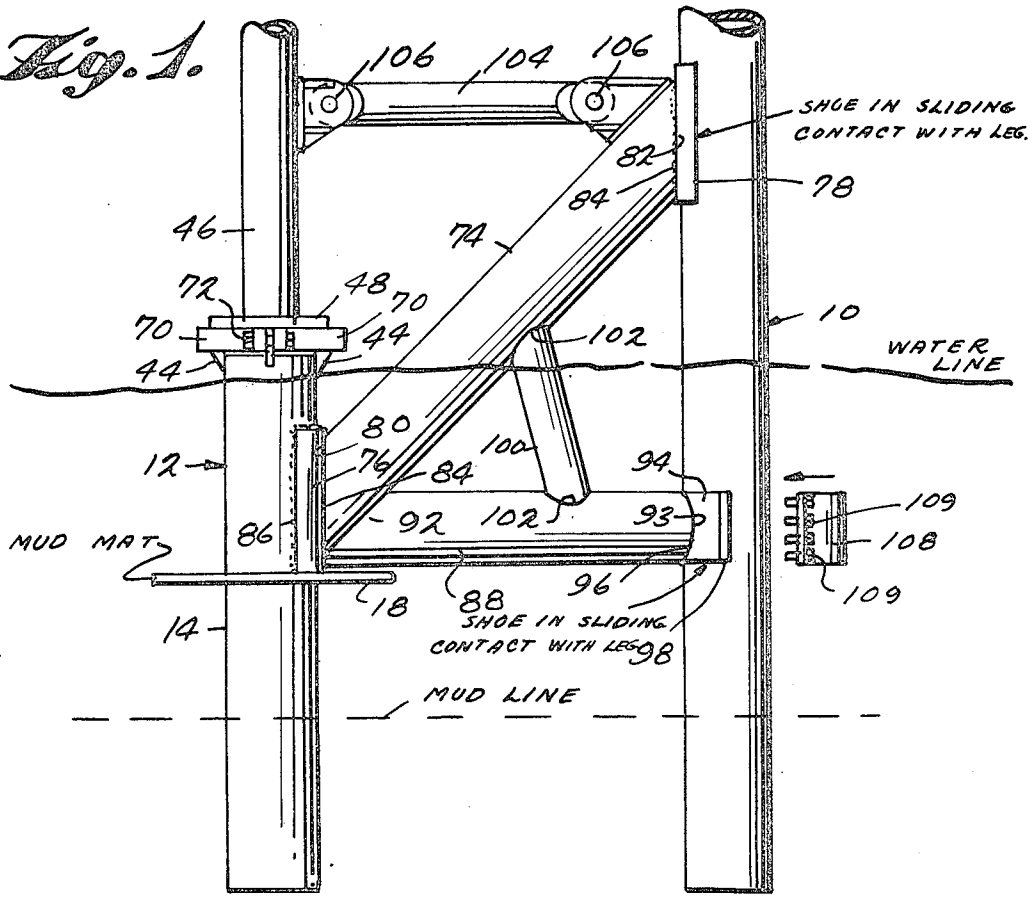
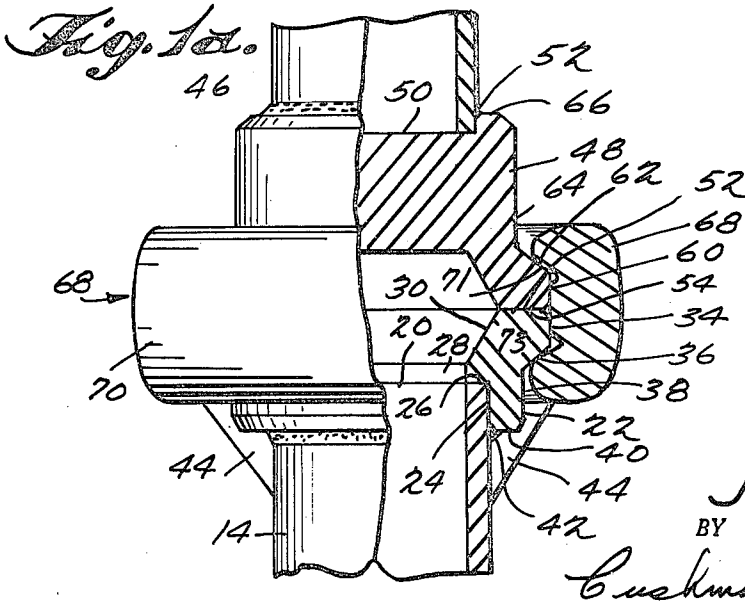


Fig. 1a.



INVENTOR.
JOHN SLACK
BY
Cushman, Darby & Cushman
ATTORNEYS

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Fig. 2.

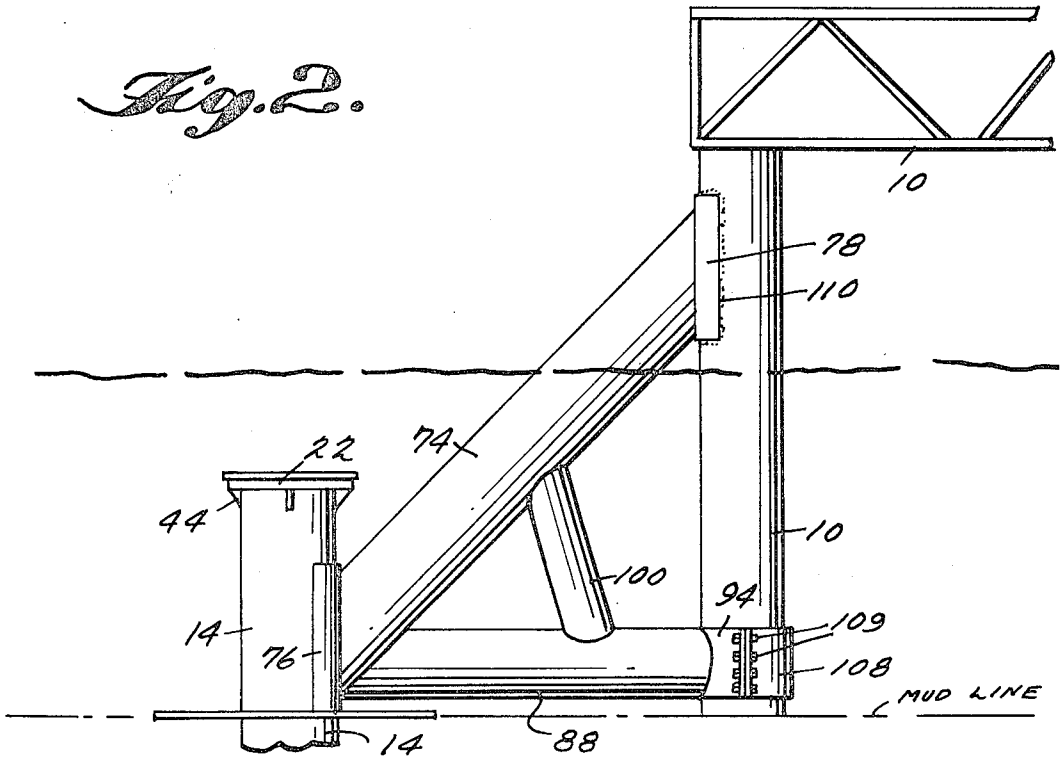
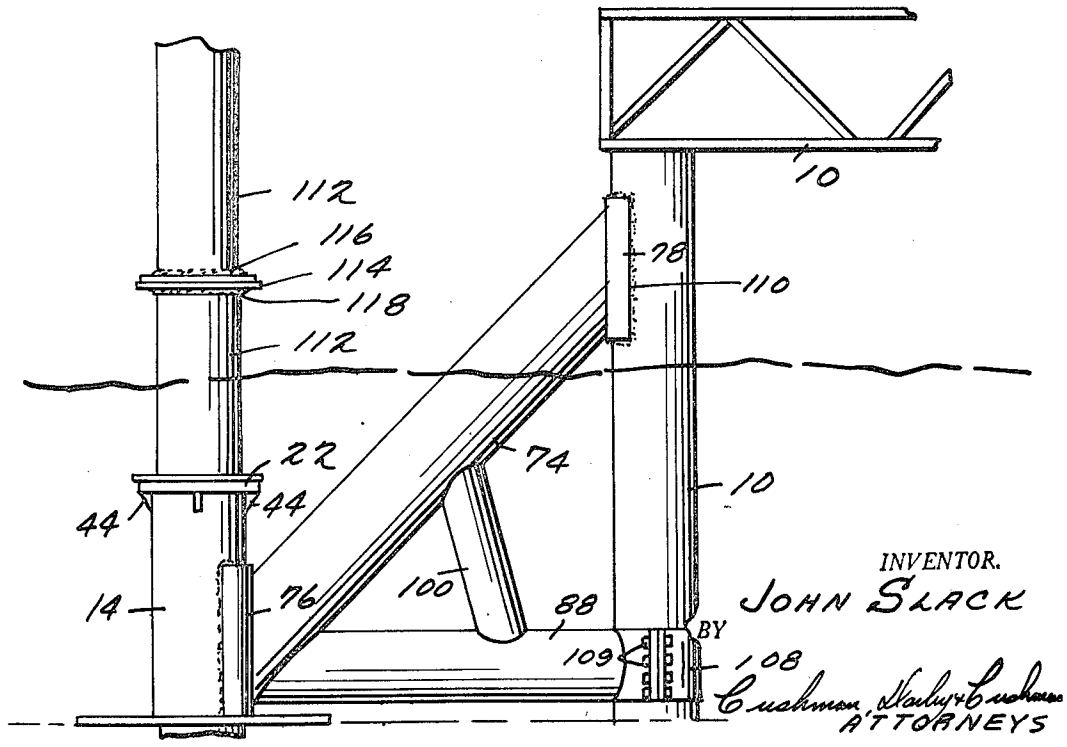


Fig. 3.



INVENTOR.
JOHN SLACK
BY
Cushman, Darby & Cushman
ATTORNEYS

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Fig. 4.

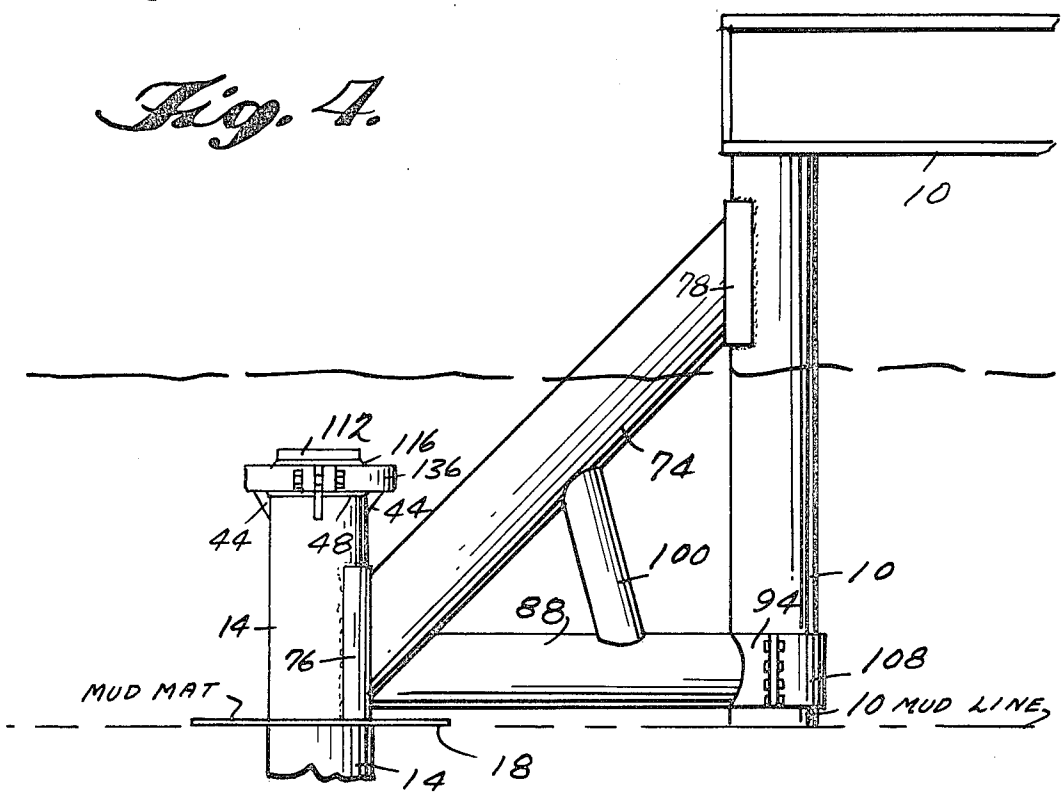
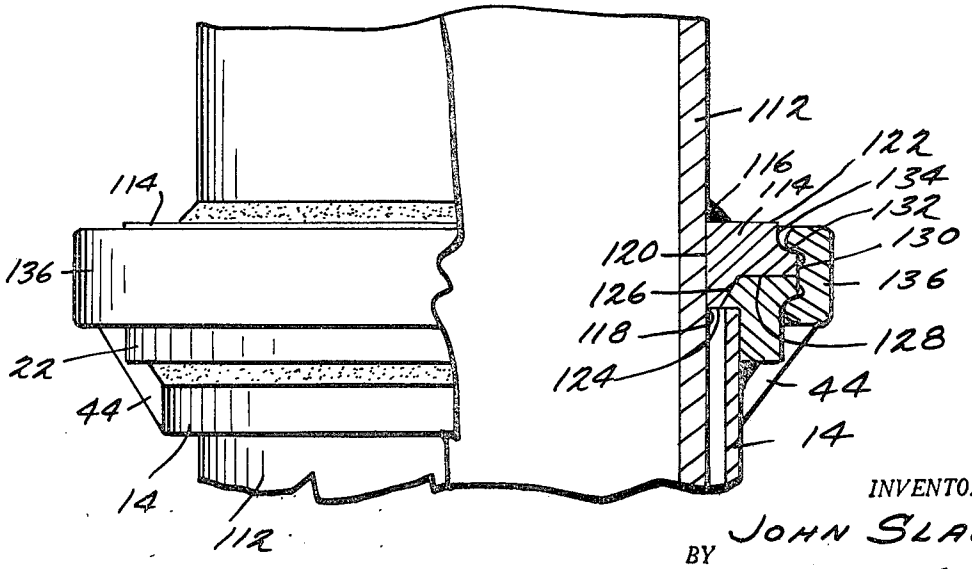


Fig. 5.



INVENTOR.
JOHN SLACK
BY
Cushman, Darby & Cushman
ATTORNEYS

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METHOD AND APPARATUS FOR FIELD REINFORCEMENT OF COLUMNAR STRUCTURES, PARTICULARLY OFFSHORE DRILLING AND PRODUCTION PLATFORMS

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Fig. 7.

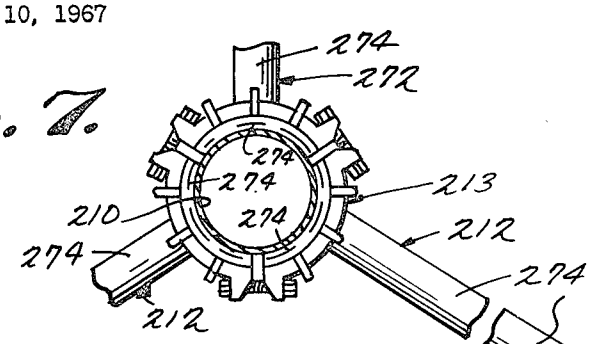


Fig. 6.

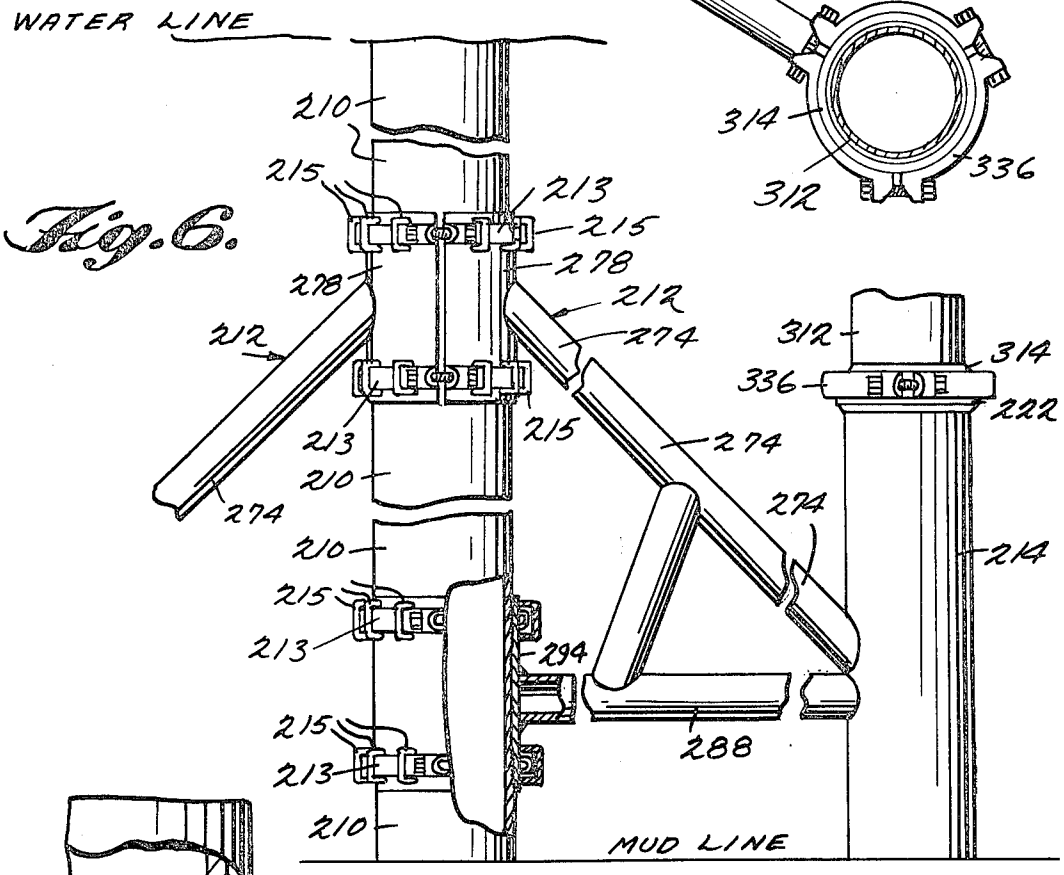
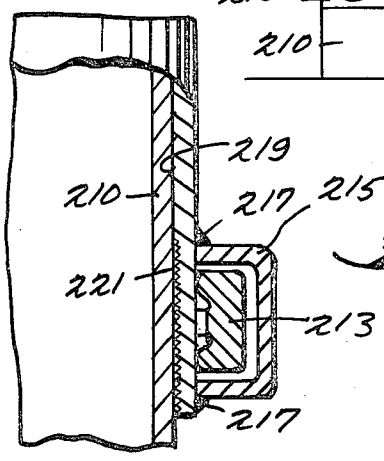


Fig. 8.



INVENTOR.
JOHN SLACK
BY
Cushman, Darby & Cushman
ATTORNEYS

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3,496,728

METHOD AND APPARATUS FOR FIELD REINFORCEMENT OF COLUMNAR STRUCTURES, PARTICULARLY OFFSHORE DRILLING AND PRODUCTION PLATFORMS

John Slack, Houston, Tex., assignor to Gray Tool Company, Houston, Tex., a corporation of Texas

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Int. Cl. E02d 37/00; E02b 17/00; E04c 3/04
U.S. Cl. 61—46 16 Claims

ABSTRACT OF THE DISCLOSURE

For reinforcing an offshore platform column against additional loading, lowering a templet to the mud line beside the column driving the templet into the mud until its mud mat contacts the mud line; disconnecting the lowering and driving pipe from the templet; rigidly securing the templet to the column; driving a piling into the ocean floor through the templet and circumferentially clamping the piling to the templet, thus reinforcing the column against horizontal and vertical movement. The clamping arrangement includes special hubs securely mounted on the templet and piling and an annular expansible contractile clamp adapted to circumferentially engage the hubs.

The foregoing abstract is not intended to be a comprehensive discussion of all of the principles, possible modes or applications of the invention disclosed in this document and should not be used to interpret the scope of the claims which appear at the end of this specification.

BACKGROUND OF THE INVENTION

Upon occasion, structures such as offshore drilling and production platforms erected on one or more large columns driven into the ocean floor require additional structural reinforcement for protection from hurricanes and to accommodate added operational loadings. Also, single petroleum well completions employing one columnar piling extending to the surface must be reinforced to protect against hurricanes and accommodate additional operational loading.

SUMMARY OF THE INVENTION

The present invention provides means and a method for reinforcing such structures, the apparatus including simple structural components that require a minimum of field welding and underwater personnel work, such as by divers. The system provided makes use of simple, shop fabricated shapes that may be mechanically joined in the field, thus being economical and reducing safety hazards otherwise present.

In practicing the invention, a templet is lowered to the mudline beside the column to be braced and driven into the mud until the mud mat secured thereon is at the mudline. The lowering and driving pipe is then detached from the templet and the latter rigidly secured to the column. A piling is then driven into the ocean floor through the templet. After the piling has been driven into place, it is clamped to the templet thus reinforcing the column against horizontal and vertical movement. The clamping arrangement includes special hubs mounted on the templet and piling and an annular expansible-contractile clamp adapted to circumferentially engage the special hubs.

The principles of the invention will be further hereinafter discussed with reference to the drawings wherein preferred embodiments are shown. The specifics illustrated in the drawing are intended to exemplify, rather than limit aspects of the invention as defined in the claims.

IN THE DRAWINGS

FIGURES 1, 2, 3 and 4 are side elevation views of successive stages in field installation of a column reinforcement anchor in accordance with the present invention;

FIGURE 1*a* is a larger scale fragmentary elevation view of the region of the connection of the drive pipe to the templet sleeve at the stage of installation depicted in FIGURE 1, with parts broken away and sectioned to expose details;

FIGURE 5 is a larger scale fragmentary side elevation view, with parts broken away and sectioned to expose details of the clamps and hubs securing the piling to the templet;

FIGURE 6 is a side elevation view, similar to FIGURE 4, of a modified embodiment stabilizing a single conductor casing in deep water;

FIGURE 7 is a fragmentary plan view looking downwardly from the cutting-plane 7—7 of FIGURE 6; and

FIGURE 8 is a larger scale sectional view of the region circled in FIGURE 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the describing of the preferred embodiments hereinbelow, with reference to the drawings, several references are made to pipe diameters and other equipment sizes. These are quoted to aid those skilled in the art to more rapidly understand the preferred modes of the invention and should not be taken in a limiting sense, since, within reason, the various parts may be scaled larger and smaller, proportionately and/or disproportionately.

In FIGURE 1, the leg of an existing offshore drilling and/or production platform or the like appears at **10**, standing in the water. The rest of the platform is not shown. The remainder of the apparatus illustrated in FIGURE 1 is a prefabricated locating templet unit **12**, for instance, constructed and assembled at a manufacturing plant, then shipped, for instance, by barge or helicopter to the site of the platform to be reinforced. As illustrated, the unit **12** includes a section of 34 inch O.D., 32 inch I.D. pipe **14** forming the sleeve of the templet. The sleeve **14** is, for instance, 16 feet long and has an annular mud mat **18** of steel plate welded circumferentially thereabout approximately eight feet from the lower end of the sleeve **14**.

Referring for the moment to FIGURE 1*a*, the upper end **20** of the sleeve **14** has an annular box hub **22** socket welded thereon. The box hub **22** circumferentially surrounds the sleeve **14** at **24** adjacent the end **20** and (proceeding clockwise from **24** at the right of FIGURE 1*a*) has an internal downwardly facing annular shoulder **26** abutting the end **20**, a radially inner cylindrical curved surface **28** flush with the internal surface of the pipe **14**, a frustoconically curved upwardly and radially inwardly facing seat surface **30**, an upwardly facing annular end surface **32**, an annular radially outwardly facing outer surface **34**, a downwardly and radially outwardly facing, downwardly tapering annular wedging surface **36** leading to an annular relieved portion **38** and the lower end surface **40** of the box hub **22**. The axial height of the box hub **22** is five inches.

The box hub **22** is circumferentially welded to the pipe **14** at **42**. In order to aid concentric location of the box hub **22** on the pipe **14**, prior to welding, guides or landing brackets **44** of triangular form may be preliminarily welded on the hub **22** or pipe **14** as illustrated in FIGURE 1.

At the stage depicted in FIGURE 1, the pipe **14** and box hub **22** are topped by a 20 inch O.D. lowering, land-

ing and drive pipe **46**, having a 36 inch diameter blind hub **48** secured on the lower end thereof. In the embodiment shown, the upper surface **66** of the blind hub has been centrally counterbored to provide a 20 inch diameter socket **50**, one inch deep in which the lower end of the pipe **46** is received. The pipe is secured to the blind hub by circumferential welding **52** at the mouth of the one inch deep socket.

The radially outer periphery of the blind hub **48**, starting at the juncture with the lower end surface **54**, has an annular radially outwardly facing outer surface **60**, an upwardly and radially outwardly facing, downwardly flaring annular wedging surface **62** leading to an annular relieved portion **64** and the upper end surface **66** of the blind hub. The axial height of the blind hub is eight inches.

The pipes **14** and **46** are maintained in the axially aligned relationship shown in FIGURES 1 and 1*a* by an annular radially expansible-contractile clamp **68** having opposed wedging surfaces **71**, **73**, respectively, complementarily engaging the wedging surfaces **36** and **62**, thus holding the end surfaces **32** and **54** in abutment. In general terms, the clamp **68** preferably comprises three complementary arcuate segments **70**, adjacent ends being bolted at **72** and/or pivotably secured to one another for at least sufficient expansibility and contractility to permit installation of the clamp on the box hub and blind hub, and makeup of the connection as illustrated in FIGURE 1*a*. Further details of the clamp **68** can be seen on page 2105 (Figure 110, Table 81) of the Composite Catalogue of Oil Field Equipment & Services, 1966–1967 edition, Gulf Publishing Co. One or more of the bolts **72** may be conventional explosive bolts in order to permit removal of the clamp **68** from above water intermediate the stages illustrated in FIGURES 1 and 2. Otherwise, divers may be used to loosen the bolts **72** sufficiently to allow the disconnection of the drive pipe from the templet sleeve. Three part remotely operable clamps also usable in the place of the three bolt clamp are illustrated in Gray Tool Company catalogue 10466 entitled "Grayloc Pipe Connections" on page 11 under the heading "Grayloc Quick Disconnect Units" (Grayloc is a registered trademark owned by Gray Tool Company), and in the U.S. Patents of Watts, 3,181,901 and of Watts et al., 3,231,297.

Returning to FIGURE 1, the prefabricated unit **12** also includes a diagonal structural brace **74**, shown comprising a 30 inch O.D. casing pipe, although an H-beam or the like could be used. The brace has parallel, oppositely outwardly facing, arcuate shoes **76**, **78** secured to the respective ends **80**, **82** thereof, for instance, by welding at **84**. The ends **80**, **82** are cut at about 45 degree angles to the longitudinal axis of the brace **74** so that when the shoes **76**, **78** are in place, their axes of curvature are essentially vertical. In prefabricating the unit **12** the shoe **76** is secured facewise to the sleeve **14** below the box hub **22**, for instance, by welding at **86**.

The bracing of the prefabricated unit **12** further includes a horizontal brace **88**, shown comprising a 24 inch O.D. casing pipe having one end **90** thereof cut curvilinearly about a 45 degree axis to match the exterior of the diagonal brace near the left, lower end thereof and welded at **92** to the diagonal brace. The right end **93** of the brace **88** is in vertical alignment with the right end of the diagonal brace **74**, and has an outwardly opening shoe **94** secured thereon, for instance, by welding at **96**. The shoe **94** is in vertical alignment with the shoe **78** and is substantially identical thereto except for having at opposite arcuate ends of its curved portion a pair of diametrically opposed and extending flanges **98** for receiving bolts. Accordingly, the shoe **94** is generally omega shaped.

The prefabricated unit is completed by a secondary brace **100** extending between the mid-regions of the horizontal brace **88** and diagonal brace **74**, being canted at least slightly, in an opposite sense to the brace **74** and welded at each end at **102** to the braces **74** and **88**. In the equipment illustrated, the brace **100** is a 16 inch O.D. casing pipe.

To aid in preventing damage to the prefabricated unit during shipping and handling prior to use, a further temporary horizontal brace **104** may be provided extending between the upper end of the diagonal brace **74** and the drive pipe **46**, attached to each via slotted ear and pin arrangements **106**. The brace **104** may be removed prior to the stage depicted in FIGURE 1 or, preferably, with the drive pipe as the drive pipe is disconnected, between the stages depicted in FIGURES 1 and 2 as will now be described.

The prefabricated unit **12** is lowered into the water via the drive pipe **46** with the shoes **78** and **94** in sliding contact with the platform **10** leg to be braced. Where the bottom is firm, driving upon the drive pipe is necessary to sufficiently lower the unit **12**. After the mud mat **18** has contacted the mud line, an omega-shaped leg clamp **108** is coupled to the shoe **94** about the platform leg or column via bolts **109** and the shoe **78** is welded to the platform column at **110** (see FIGURE 2). It should be noted that the shoe **78** could be similarly bolted to a leg clamp and/or the shoe **94** could be welded to the platform column, depending upon the availability of divers and the relative prospects, under the circumstances, for making junctures via either method which would have sufficient integrity.

The clamp **68** is then expanded or disassembled as explained hereinbefore, and the drive pipe **46** removed to the surface with the blind hub **48** leaving the 34 inch O.D. sleeve **14** implanted in the ocean floor and the mud mat **18** at the mud line.

The equipment as shown in FIGURE 2 awaits the driving of a piling through the bore of the sleeve **14**.

If the condition of the earth's crust beneath the ocean floor is unknown, a test piling (not shown) may be driven near the platform **10**. A pile driver mounted on a derrick barge and having a conventional steam or diesel hammer may be used. The test pile should be driven into the ocean floor until about 150–200 blows are required to sink the pile a foot. Based on Atlantic and Gulf Coast experience, this point will be reached when the test piling has penetrated 85–200 feet in the ocean floor.

A 30 inch O.D. pipe **112** (FIGURE 3) is then driven through the bore of the sleeve **14** into the ocean floor using the pile driver. Obviously, where the necessary penetration will be great, the piling **112** will be made up in sections welded or otherwise secured together as needed. At the appropriate time (as indicated by the test piling) an annular pin hub **114** is slipped over the upper end of the piling **112**, slid down to the indicated level and welded circumferentially at **116** and **118** to the piling **112**.

Referring to FIGURE 5, the pin hub **114** has a cylindrical bore **120** of a size to allow initial sliding of the hub **114** down the piling **112** to the predetermined desired position. The bore **120** upwardly intersects the exterior of the hub **114** at a radially directed, annular, upper end surface **122** and downwardly intersects the exterior at a radially directed, annular, lower end surface **124** of lesser outward radial extent than the surface **122**. The radially outer periphery of the pin hub **114**, starting at its juncture with the lower end surface **124**, has a radially outwardly and downwardly facing, upwardly flaring, frustoconically curved seat surface **126**, a downwardly facing annular surfaces **128**, an annular radially outwardly facing outer surface **130**, an upwardly and radially outwardly facing, downwardly flaring annular wedging surface **132** leading to an annular relieved portion **134** and the upper surface **122**. The axial height of the pin hub **114** is five inches.

As shown in FIGURE 3, the pin hub **114** is still above the box hub **22**. However, as driving continues the pin hub **114** adjoins the box hub **22** as shown in FIGURE 5 when the piling has reached the desired depth. At this

point, the end surfaces **32** and **128** abut one another and the seats **30** and **126**, which, as appears from FIGURE 5, taper at slightly different angles, extensively engage circumferentially in a resilient, stressed manner, limited by the stop shoulders **32** and **128**.

Referring now to FIGURE 4, an expansible-contractile 36 inch clamp **136** (similar to clamp **68**), preferably having three arcuate clamp segments already loosely bolted to one another (or otherwise in an expanded condition), is lowered over the 30 inch drive pipe piling **112** onto the landing brackets **44** which serve to receive the clamp in a concentric, level manner with respect to the pin hub, box hub, sleeve and piling. The clamp **136** is then contracted (by tightening its bolting or otherwise forcing its segments radially inwardly) engaging the wedging surfaces **36** and **132**. The 30 inch O.D. drive pipe **112** is then cut off immediately above the 36 inch pin hub **114** and removed to the surface.

It should be apparent from FIGURES 4 and 5 that the structure remaining is rigidly attached from the column **10**, through the bracing to the ocean floor via the clamp **136** which ties the bracing through the sleeve **14** to the piling **112**. In this manner the column of the platform **10** has been greatly strengthened against vertical as well as horizontal movement. It should also be apparent that identical reinforcing could be provided on all of the columns of a platform, or on selected ones of such columns, such as those on the side or sides subject to greatest external loading during storms and hurricanes. Although the device and method just described are particularly well suited to the protection of offshore platforms, this does not rule out similar use of the device and method to strengthen columns of bridges, causeways and buildings extending out over water.

As noted in the "Background of the Invention" section above, protection against additional loading is also needed for many offshore petroleum wells. Such protection is especially necessary in instances where one well, or a small number of closely spaced wells, are drilled from a ship or platform through a single conductor casing, with intention of moving the ship or platform on to another location once the well, or wells, have been completed. The advantageous usefulness of the principles of the present invention in such instances will now be discussed with reference to FIGURES 6–8 wherein an example is illustrated.

In this embodiment a conventional jack-up type drilling rig has been used and the 36 inch conductor casing **210** driven with a pile driver. The 36 inch conductor casing is then braced to the drilling rig above the water and, with the rig supporting the 36 inch conductor casing, the well is drilled to the proper depth and conventionally completed, with the installation of the Christmas tree. Before the rig is moved off location, the conductor casing **210** is braced in accordance with the principles of the present invention.

Three prefabricated units **212** are assembled around the 36 inch O.D. conductor casing above the water. Each is substantially the same as the unit **12** of FIGURE 1; therefore, corresponding parts have been indicated by like numerals, raised by 200. Differences will be emphasized in the following discussion.

The shoes **278** and **294** each extend arcuately somewhat less than 120 degrees. The units **212** are associated via four initially loosely bolted three segment clamps **213** (similar to the clamp **68**) mounted circumferentially surrounding the assembled shoes **278** and **294**, one clamp near the upper ends of the assembled shoes **278**, another near the lower ends of the assembled shoes **278**, a third near the upper ends of the assembled shoes **294** and a fourth near the lower ends of the assembled shoes **294**. The loose clamps **213** are retained in the positions shown by a plurality of U-shaped straps **215** which loosely straddle the respective clamps and are secured to the respective shoes, for instance by welding at **217**. As shown, three arcuately spaced straps **215** are provided near each end of each shoe for retaining the respective clamps. The association of the three units **212** may be done prior to shipment from the manufacturing plant.

In the embodiment depicted in FIGURES 6–8, the shoes at the opposite ends of the diagonal braces have been eliminated and the diagonal braces **274** and horizontal braces **288** are directly welded to the three respective 34 inch O.D. sleeves **214**.

It should now be noticed, with reference to FIGURE 8, that the shoes **278** and **294** radially inner surfaces **219** are provided with rough serrations **221** near the upper and lower ends thereof generally underlying the clamps **213**.

When the assembled units **212** have been lowered to the position shown in FIGURE 6, the bolts on the clamps **213** are tightened with the aid of a diver, or the clamps otherwise contracted, if remote control tightening means are available. As the clamps **23** are tightened the serrations **221** engage the conductor pipe and aid in rigidizing the coupling of the assembled units **212** to the conductor pipe.

Pilings **312** are then driven through each sleeve **214** and the pin and box hubs **314**, **222** on the pilings **312** secured to one another when they adjoin via clamps **336** slid down the pilings in a loosely assembled condition and contracted in place as discussed above in relation to the embodiment of FIGURES 1–5. A diver with the aid of a cutting torch may then cut off the 30 inch O.D. drive pipe pilings **312** just above the respective 36 inch clamps **336**. With the conductor casing so braced and anchored, the rig may be moved off location, leaving the operators confident that the well will withstand wave and wind action.

Two embodiments of the invention having been discussed and shown at length, the principles of the invention should now be apparent to those skilled in the art.

The term "ocean floor" is used herein to broadly denote the crust of the earth beneath overlying water, and not in a narrow sense to indicate that the overlying water must be an ocean.

It should now be apparent that the method and apparatus for field reinforcement of columnar structures, particularly offshore drilling and production platforms as described hereinabove possesses each of the attributes set forth in the specification under the heading "Summary of the Invention" hereinbefore. Because the method and apparatus for field reinforcement of columnar structures, particularly offshore drilling and production platforms of the invention can be modified to some extent without departing from the principles of the invention as they have been outlined and explained in this specification, the present invention should be understood as encompassing all such modifications as are within the spirit and scope of the following claims.

I claim:

1. A method for field reinforcement of an offshore columnar structure comprising:

(a) lowering a templet to the mud line a predetermined distance from a column of the columnar structure;

(b) rigidly securing the templet to the column;

(c) driving a piling into the ocean floor through the templet; and

(d) circumferentially clamping the piling to the templet to reinforce the column against horizontal movement.

2. The method of claim **1** comprising the initial steps of: rigidly securing lateral bracing via one end thereof to said templet; securing at least two vertically aligned guide shoes on said bracing at points laterally spaced thereon from said one end; and in step (a) lowering the templet with said shoes engaging the column to thereby provide spacing of said templet said predetermined distance from said column.

3. The method of claim **2** wherein step (b) comprises welding at least one of the guide shoes to the column.

4. The method of claim **3** wherein step (b) comprises

circumferentially clamping at least one of the guide shoes to the column.

5. The method of claim 1 wherein steps (c) and (d) include providing a circumferential enlargement on the templet near the upper extent thereof; providing a circumferential enlargement on the piling at a predetermined distance upwardly from the lower end thereof; driving the piling down into the ocean floor until the two circumferential enlargements adjoin one another; lowering an expansible-contractile clamp down the piling in an expanded condition, circumferentially surrounding the piling until the clamp lies radially adjacent the two circumferentially enlargements; and contracting the clamp into engagement with the two circumferential enlargements.

6. The method of claim 1 further comprising the initial step of circumferentially clamping and connecting a lowering and driving pipe to the templet; then following step (b), unclamping and disconnecting the lowering and driving pipe from the templet; and withdrawing the lowering and driving pipe to the surface.

7. The method of claim 1 including: concurrently with step (a), lowering a second templet to the mud line a predetermined distance from said column of the columnar structure, the second templet being angularly spaced about the column from the first-mentioned templet; concurrently with step (b), rigidly securing the second templet to the column; subsequently, driving a piling into the ocean floor through the second templet; and circumferentially clamping the last-mentioned piling to the second templet.

8. A device for field reinforcement of an offshore columnar structure comprising:

(a) a templet having means defining an opening therethrough of a size to receive a piling driven therethrough;

(b) flange means on said templet peripherally of said opening adapted to circumferentially receive an expansible-contractile clamp for securing the driven piling to the templet;

(c) a brace secured at one end to said templet and extending laterally therefrom;

(d) a guide shoe secured on the other end of said brace, adapted to slide down along a column of the columnar structure as the device is lowered to the mud, for achieving predetermined spacing of the templet from the column; and

(e) said guide shoe being constructed and arranged for rigid securement to the column after lowering of the device to the mud;

the templet comprising a metal sleeve having a box hub secured on the upper end thereof; said box hub being provided with an external, frustoconically curved clamp receiving wedging surface providing said flange means; said brace being secured to said metal sleeve below said box hub.

9. A device for field reinforcement of an offshore columnar structure comprising:

(a) a templet having means defining an opening therethrough of a size to receive a piling driven therethrough;

(b) flange means on said templet peripherally of said opening adapted to circumferentially receive an expansible-contractile clamp for securing the driven piling to the templet;

(c) a brace secured at one end to said templet and extending laterally therefrom;

(d) a guide shoe secured on the other end of said brace, adapted to slide down along a column of the columnar structure as the device is lowered to the mud, for achieving predetermined spacing of the templet from the column; and

(e) said guide shoe being constructed and arranged for rigid securement to the column after lowering of the device to the mud;

the brace comprising: an oblique brace element extending upwardly as it extends outwardly from said templet, a generally horizontal brace element being below said oblique element and forming a vertical plane with the oblique brace element; said guide shoe being on said oblique brace element; a second guide shoe on the outer end of the horizontal brace element; said guide shoes being in vertical registry, each guide shoe having a cylindrically arcuate portion curved about a vertical axis so as to be concave away from the respective brace.

10. The device of claim 9 wherein at least one of the guide shoes is constructed and arranged for welded securement to the column.

11. The device of claim 9 wherein at least one of the guide shoes includes a pair of diametrically opposed bolt receiving ears at the angular extremes of the curved portion thereof; and a leg clamp having a cylindrically arcuate portion curved about a vertical axis and a pair of diametrically opposed bolt receiving ears at the angular extremes of the curved portion thereof; and bolts being received through respective ones of said ears of said guide shoe and leg clamp for securing the guide shoe to the column.

12. A device for field reinforcement of an offshore columnar structure comprising:

(a) a templet having means defining an opening therethrough of a size to receive a piling driven therethrough;

(b) flange means on said templet peripherally of said opening adapted to circumferentially receive an expansible-contractile clamp for securing the driven piling to the templet;

(c) a brace secured at one end to said templet and extending laterally therefrom;

(d) a guide shoe secured on the other end of said brace, adapted to slide down along a column of the columnar structure as the device is lowered to the mud, for achieving predetermined spacing of the templet from the column; and

(e) said guide shoe being constructed and arranged for rigid securement to the column after lowering of the device to the mud;

(f) a second templet having means defining an opening therethrough of a size to receive a second piling driven therethrough;

(g) flange means on said second templet peripherally of said opening adapted to circumferentially receive a second expansible-contractile clamp for securing the second driven piling to the second templet;

(h) a brace secured at one end to said second templet and extending laterally therefrom;

(i) a guide shoe secured on the other end of said second templet brace, adapted to slide down along the column angularly beside the first-mentioned guide shoe as the device is lowered to the mud, for achieving predetermined spacing of the templet from the column;

(j) a plurality of angularly spaced bracket loops secured on the outer faces of said guide shoes in alignment angularly of the guide shoes;

(k) a radially expansible-contractile clamp mounted to said guide shoes via passage through each of said device to the mud with said clamp circumscribing the column and said guide shoes, said clamp may be contracted to secure the device to the column.

13. The device of claim 12 further including rough serrations formed on the forward faces of the guide shoes for engagement with the column.

14. The device of claim 12 wherein the clamp comprises three arcuate segmental sections, ends of adjacent sections being secured by at least one bolt to one another; said clamp being so constructed and arranged that loosening of the bolts expands the clamp and tightening of the bolts contracts the clamp.

15. In combination: an offshore columnar structure

having at least one column; a templet sleeve supported on the ocean floor near said column; a brace secured at one end to said templet sleeve and at the opposite end to said column, said brace extending obliquely upwardly from said templet sleeve to said column; a piling driven through said templet sleeve into the ocean floor and extending upwardly a short distance above the upper end of the templet sleeve; a box hub mounted on the upper end of the templet sleeve and having a radially outwardly extending circumferential clamp-receiving flange thereon; a pin hub secured to said piling, circumferentially surrounding said piling immediately above said templet sleeve upper end; said pin hub being at least partly received within and abutting said box hub; said pin hub having a radially outwardly extending circumferential clamp-receiving flange thereon; and a radially expansible-contractile clamp circumferentially engaging said clamp-receiving flanges rigidly securing said templet sleeve to said piling.

16. The combination of claim **15** wherein said clamp comprises three arcuate segmental sections, ends of adjacent sections being secured by at least one bolt to one another; said clamp being so constructed and arranged that loosening of the bolts expands the clamp and tightening of the bolts contracts the clamp, whereby in installation of the clamp, the clamp may be lowered over the piling to radial adjacency with the clamp-receiving flanges in an expanded condition, then contracted.

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