Dec. 27, 1966 J. T. DEAN 3,293,867

METHOD AND APPARATUS FOR MARKING, RELOCATING, AND RE-ESTABLISHING CONTACT WITH A SUBMARINE WELLHEAD

Filed Sept. 30, 1965 2 Sheets-Sheet 1

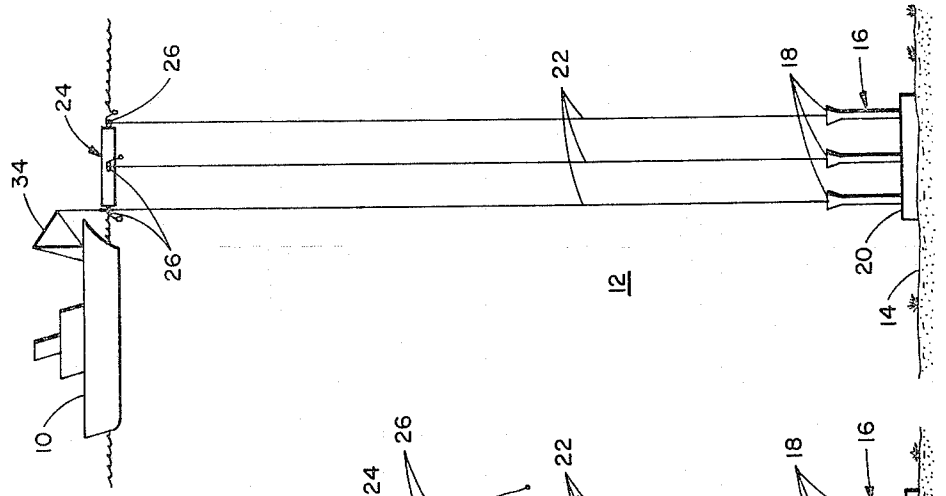


FIG III

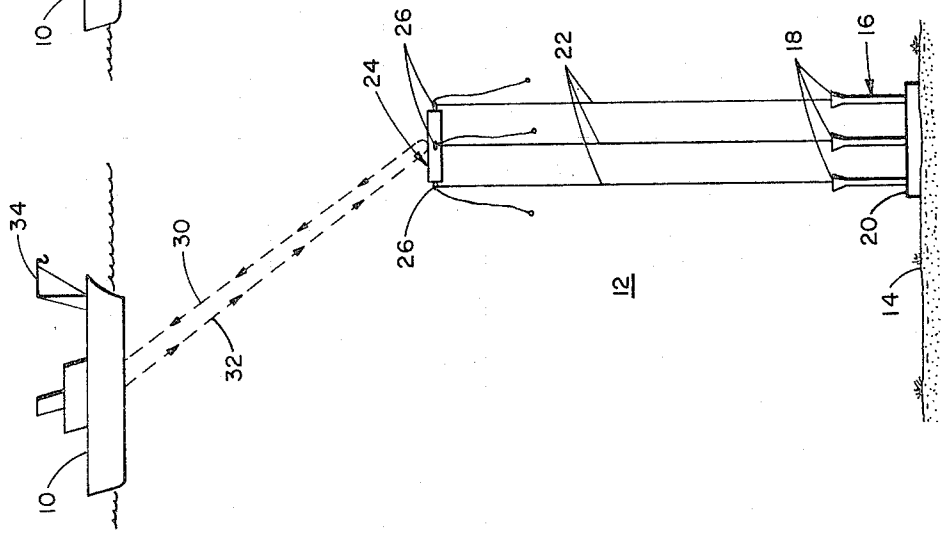


FIG II

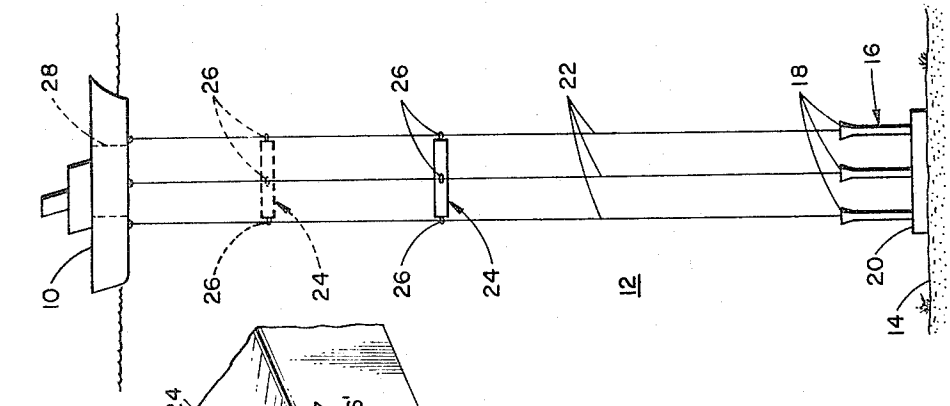


FIG I

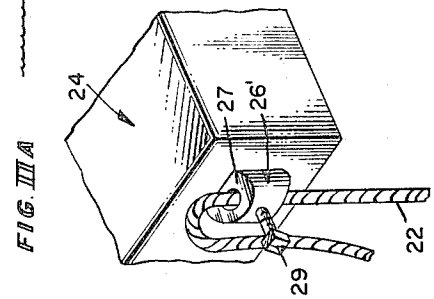


FIG. III A

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Filed Sept. 30, 1965 2 Sheets-Sheet 2

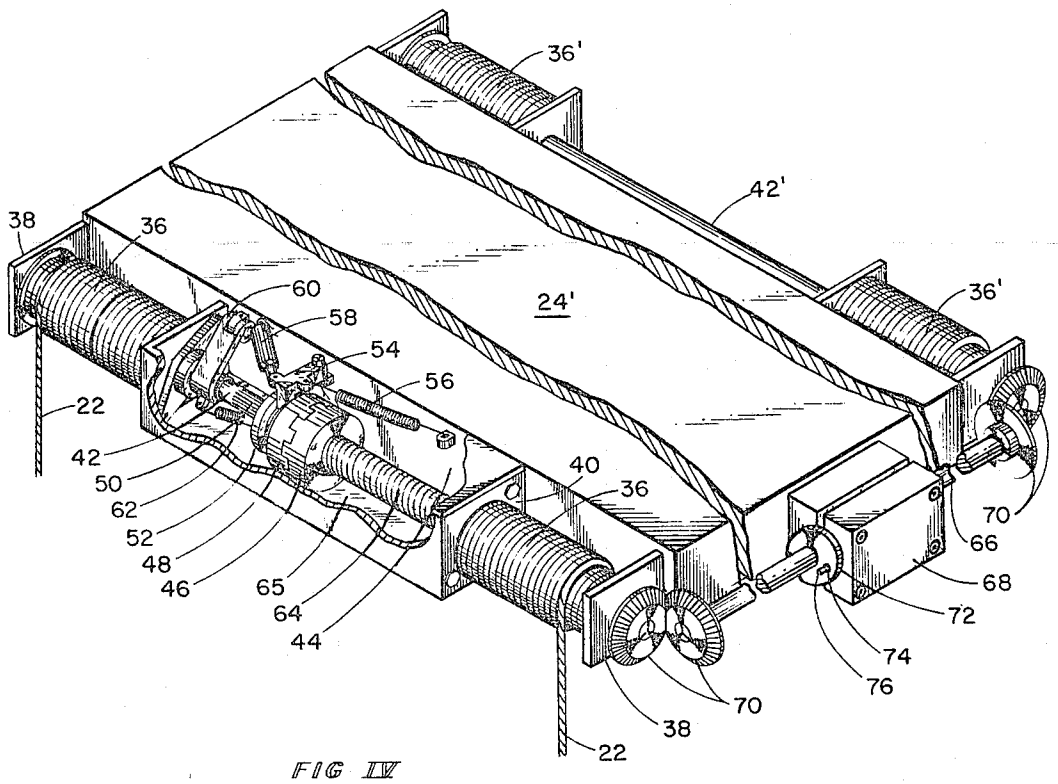


FIG IV

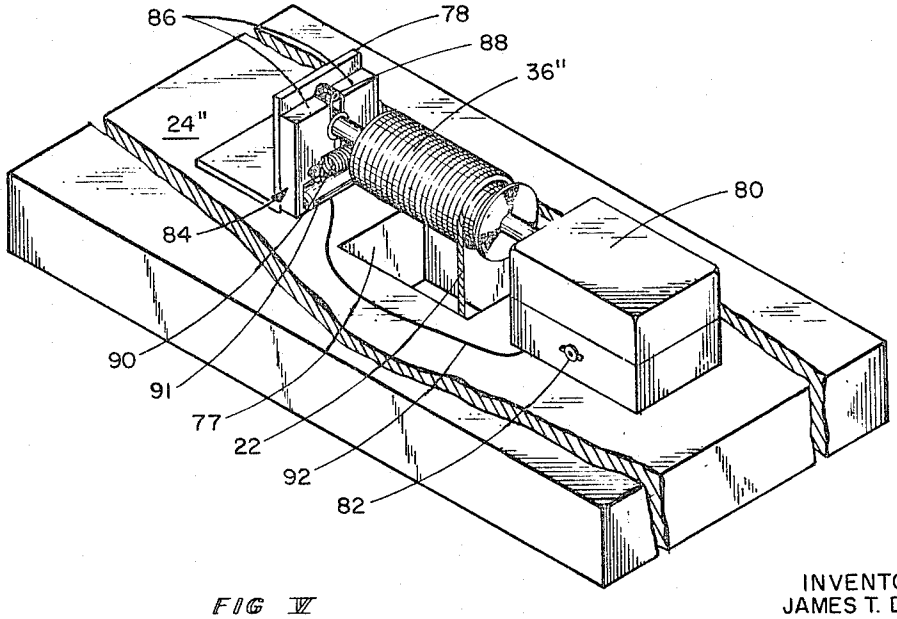


FIG V

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3,293,867

Patented Dec. 27, 1966

3,293,867

METHOD AND APPARATUS FOR MARKING, RELOCATING, AND RE-ESTABLISHING CONTACT WITH A SUBMARINE WELLHEAD

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Filed Sept. 30, 1965, Ser. No. 491,773
16 Claims. (Cl. 61—72.3)

This application is a continuation-in-part of copending application, Serial No. 311,679, filed September 26, 1963 and now abandoned.

This invention relates to deepwater marine drilling techniques. More specifically, this invention relates to method and apparatus for marking, relocating, and re-establishing contact with a submarine wellhead positioned on the subaqueous bottom beneath a large body of water.

In recent years, the search for new sources of petroleum has extended to many of the water-covered areas of the earth's surface. Wells are being drilled and, in some cases, gas and/or oil is being produced from wells at locations covered by water ranging in depth to a thousand or more feet. Such extreme water depths make drilling and production from fixed surface platforms impractical, and thus it is necessary that the required operations be carried out from floating structures. Among the most successful proposals for carrying out drilling operations from floating vessels is the use of a submarine wellhead positioned on the subaqueous bottom, and the connection of such a wellhead to the floating vessel by one or more guidelines for directing the necessary tools for drilling and completing the well to and from the wellhead.

One of the principal problems inherent in the use of the guideline system with a submarine wellhead is encountered when it is necessary to relocate and re-establish contact with the wellhead. During the drilling of the well, surface conditions, such as stormy weather, may require the floating vessel to move temporarily off location, necessitating disconnection of the guidelines during the absence of the vessel. Also, when the well is completed and placed in production, it may be later necessary that the well be re-entered for various reasons. It has been proposed that at least one guideline be secured to and retained in position by a buoy and thereafter used to guide a jig carrying the other guidelines and reconnecting apparatus to the wellhead. While it would be advantageous to leave a guideline secured to the wellhead and extended to the surface, where it would be connected to a floating buoy, this is not always possible due to the navigational hazard that this solution entails. As a result, the guidelines are usually disconnected at the wellheads and withdrawn. A television camera and remote controlled tool are then needed for the later re-establishment of the connections.

The principal object of the present invention is to provide a method and apparatus whereby a submarine wellhead having at least one guideline connected thereto may be marked by submarine means so that it can be relocated and contact re-established therewith by a floating servicing vessel, while not presenting a hazard to surface navigation when not in use.

The invention and its principal objects will be understood from the following specification, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is an elevational view of the apparatus of the invention illustrating the positioning of the buoy along the guidelines;

FIGURE 2 is an elevational view showing the buoy secured on the guidelines at a safe depth for navigational purposes and illustrating the step of relocating the buoy from a floating vessel;

FIGURE 2A is an enlarged pictorial view of the buoy of FIGURE 2, showing a particular clamp that may be used for securing the buoy on the guidelines at a safe depth for navigational purposes;

FIGURE 3 is an elevational view illustrating the buoy at the surface in position for retrieval of the guidelines;

FIGURE 4 is a perspective view of a mechanical arrangement for submerging the buoy by reeling up the free guideline ends; and

FIGURE 5 is a perspective view of a buoy connected to a single guideline, extending upward from the wellhead, by an electrically driven reel on the buoy.

The invention disclosed encompasses a method of marking, relocating, and re-establishing contact with submerged equipment such as a submarine wellhead with at least one guideline and a bouyant element or submersible buoy which includes the steps of securing the surfaced buoy to the guideline extending from the wellhead, moving the buoy down the guideline to submerge it to a safe navigational level, holding the guideline taut between the buoy and the wellhead while the buoy is submerged, relocating the submerged buoy, raising the buoy to the surface while moving the buoy up the guideline, and retrieving the guideline. Another aspect of the invention is apparatus for marking, relocating, and re-establishing contact with the submarine wellhead, comprising: at least one guideline secured adjacent the submarine wellhead and of a length sufficient to extend to the surface, and a buoy having means thereon to permit the buoy to be connected to and raised and lowered along the guideline, while the guideline remains taut between the buoy and the wellhead.

The drilling vessel may be any one of the numerous types of floating structures that is currently used in deepwater drilling, such as a barge which is towed to location or one of the recently constructed special drilling ships which may be either towed to location or may be propelled under its own power. Positioned on the subaqueous bottom is a submarine guidance and alignment system, hereinafter referred to as the G&A system. The G&A system, as illustrated, comprises three columns which are mounted on a base secured to the upper end of a string of surface casing, which is jetted into the bottom through the base by known procedures and is located substantially at the center of a triangle formed by the vertical columns. The term wellhead as used hereafter applies to that portion of the casing and connected apparatus extending above the subaqueous bottom, into the body of water, and includes both drilling and production equipment. The G&A system is similar to the one illustrated in more detail in U.S. Patent 3,050,139 to W. J. Hayes. It is to be understood that the invention is not limited to G&A systems having only three columns; and, also, more or less, guidelines may be used depending upon the particular G&A system employed. Furthermore, the aligning columns may be completely omitted and the guidelines instead secured to the base.

Extending between the G&A system and the drilling vessel are guidelines, one of which extends into, and is connected near, the bottom of each one of the vertical columns. Tools utilized in performing the many steps in drilling, completing, operating, and working over a submarine well may be directed along the guidelines from the floating vessel to the wellhead and so long as the vessel remains on location, with the guidelines extending between it and the G&A system, there is no problem regarding communication between the vessel and the wellhead. The method and apparatus of the present invention are applicable at those times when it is either not possible or practical for the drilling vessel to remain on location, and connected to the G&A system by the guidelines. By use of the method and apparatus of the invention, the submarine wellhead may readily be marked, re-

located, and guideline connections reestablished therewith.

A submersible buoy serves a dual function of both, providing a readily locatable means for marking the submarine wellhead and the G&A system and a means for supporting the guidelines and bringing their free ends to the surface. The buoy may be of any form which is capable of supporting the guidelines and may be readily submerged and brought to the surface. The buoyancy of the buoy may be of a fixed value, preferably near neutral, or it may be constructed in such a manner that its buoyancy may be varied. For example, carbon dioxide cartridges may be positioned within the buoy in such a manner that water will be exhausted therefrom upon release of the carbon dioxide to increase the lifting capacity of the buoy in the water. A near-neutral buoyancy may be provided by filling the buoy with oil or some other fluid having a specific gravity only slightly less than one.

The submerging of the buoy can be accomplished in several different ways. The buoy can be simply pushed down to the desired depth by utilizing one or more strings of drill pipe pressing against the upper face thereof to force it downwardly along the guidelines. A socket may be provided on the top of the buoy to facilitate keeping the drill pipe engaged therewith. Another manner of lowering the buoy may be by way of adjusting its buoyancy, either by remote control means or by having a diver riding the buoy and adjusting its buoyancy mechanism until the desired depth has been reached.

Secured around the outer wall of the buoy are a plurality of clamps, one clamp being provided for engaging each of the guidelines. The clamps may be any form which, when released or opened, will allow a guideline to slide readily therethrough and when closed will fixedly grip the guideline so that relative movement will not occur.

A "rope guard" as shown in the Composite Catalog of Oil Field and Pipe Line Equipment, 19th . . . 1952–53 edition, vol. 1, published by World Oil on page 1018, would be an ideal clamp, having an overcenter cam device which tends to tighten when pressure is applied after it has been actuated. In the 1957 edition of the Composite Catalog of Oil Field Equipment and Services, published by World Oil, on page 4389, a series of Polish rod clamps are shown. Any one of these might be easily adapted for use on the buoy of the present invention. Models **2**, light, medium, and heavy, illustrate hand-actuated clamps, while models **8**, **50**, and **146** all show clamps designed to be actuated by a wrench. Another clamp that can be utilized with this invention is the "midline wire rope clamp" illustrated in the McMaster-Carr Supply Company Catalog 71 on page 241. Even more simple arrangements are envisioned, such as an eye guide or even just a vertical hole through the corner of the buoy, with a wire rope clip tightened around the rope just above the buoy to hold it down. Such clips are shown at the top of page 241. By reciting the above specific clamps which may be utilized with the buoy of the invention, it is not meant to limit the scope of the invention to a buoy utilizing only clamps of these designs. Clamps to perform this function are very old in the art, having been used in the oil industry for at least fifty years.

With the upper ends of all of the guidelines being held taut by the vessel, the buoy is submerged or lowered along the guidelines until a predetermined depth is reached, at which it will not be affected by surface conditions and where it will allow the safe passage of ships thereover. Once the buoy is at the desired depth, the clamps are securely closed so that they will be firmly affixed to the guidelines, allowing no slippage between the guidelines and the clamps. The clamps are closed by the diver or, if remote control means are provided, they may be closed from the surface. With the clamps firmly affixed to the guidelines, the upper ends thereof are disconnected from the surface vessel and dropped into the water so that they will hang free. The buoy will maintain that portion of the guidelines between the clamps and the G&A system in a taut, spaced-apart, parallel state which will tend to minimize entanglement of the guidelines. The surface vessel may now be removed from location and the submarine wellhead left with its buoy marker and guidelines supported in the position, in which they will remain until re-entry into the well is desired. Rather than allowing the upper ends of the guidelines, hereinafter referred to as the "free ends," to hang free in the water, they may be stored on the buoy in wind-up reels adjacent each clamp. Such a reel would be spring-biased to wind up its respective guideline thereon as the guideline slides through its clamp, but would not have enough force to impede substantially the surfacing of the buoy when the clamps are released.

Another method of submerging the buoy is by using power driven take-up reels mounted on the buoy, one reel connected to each guideline. A power driven take-up reel would serve the double function of drawing down the near-neutrality-buoyant buoy and storing the free ends of the guidelines. An electric motor, a mechanical motor, and a fluid motor are a few of the possible means for driving the reels, with the prime power source being a battery, a prewound spring, or a fluid pressure accumulator, respectively, mounted on the buoy. Alternatively, the prime power source could be on the surface vessel with an interconnection effected by a diver.

The next step is the relocation of the submarine wellhead when further operations on it are necessary. The vessel is maneuvered to the general vicinity of the well by use of standard navigational procedures. Once it is determined that the vessel is in the general vicinity of the well, the particular procedure of locating the specific position of the well begins. The specific objective is to find the buoy. One way of detecting the buoy is by the use of sonar apparatus. Obviously, there are other mechanisms and methods which may be employed for purposes of locating the buoy. The buoy may be equipped with a sonic signal generator which will emit a signal detectable on the vessel, as illustrated in U.S. Patent 2,545,179 to V. Voorhees. Another manner of locating the buoy is illustrated in U.S. Patent 2,520,520 to S. W. Woodard where a buoy is disclosed as equipped with a tuning fork which is energized by a signal sent from the surface vessel and in turn discharges a return energy impulse which may be detected on the surface vessel.

When the buoy has been relocated, it must be brought back to the surface. If clamps were used to position the buoy they must now be released to permit the buoy to be brought to the surface. If the clamps are manually operable, a diver is sent from the surface vessel to the buoy for purposes of releasing the clamps. If the clamps are of a type which may be remotely controlled, such as by the use of an acoustic signal from the ship, the clamps are actuated from the vessel to open them. With the clamps in an open position, the guidelines will again readily slide through the clamps, so that the free ends of the guidelines are raised to the surface along with the buoy. The guidelines can be disconnected from the buoy and reconnected to the vessel to re-establish contact between the vessel and the wellhead.

It is at this point that it will be evident that a very slight positive buoyancy is to be preferred. With the clamps released, the buoy is free to rise to or be brought to the surface. If the buoy has a great deal of positive buoyancy, it will rapidly rise to the surface in an explosive manner which may be dangerous to both personnel and apparatus. With a very slight positive buoyancy, the buoy will slowly rise to the surface with complete safety for both personnel and apparatus. If the buoyancy of the buoy is controllable, its rate of ascent may be varied as desired. As an alternative to controlling the ascent rate by the buoyancy of the buoy, the clamps

may be only partially released so that some degree of friction will exist between the clamps and guidelines to slow down the rate of rise of the buoy.

Referring to the drawings, vessel **10** is shown floating at the surface of a body of water **12** above a marine bottom **14**. The water **12** represents any body of water, of substantial depth, in which guidelines are used. Positioned on the bottom **14** is a G&A system **16** generally comprising three columns **18** which are mounted on a base **20**. The columns are oriented in triangular fashion with a column **18** at each of the corners of the triangle. A guideline **22** is connected to each column **18** and extends to the vessel with a buoy **24** secured intermediate the ends of the lines.

The buoy **24** has a plurality of releasable clamps **26** spaced around the periphery thereof, one clamp being provided for each of the guidelines **22**. A specific clamp **26'** is illustrated in FIGURE 2A. This clamp consists of a padeye **27** welded to a vertical face of the buoy **24** through which a guideline **22** may be slidably entrained. A bolt or set screw **29** is threaded into a tapped hole extending into the padeye **27** perpendicular to the direction of travel of the guideline **22** so that when the bolt **29** is turned down against the entrained guideline, the guideline will be locked in position with respect to the buoy **24**. When the bolt **29** is threaded out, away from the guideline **22**, the line can slide freely through the padeye **27**.

The first step in the method of the invention is illustrated in FIGURE 1. Buoy **24** is placed in the water and each of guidelines **22** is engaged with one of clamps **26**. If the drilling ship **10** is of the type having a well extending completely through the center portion of the ship, such as shown at **28**, the buoy **24** is lowered through the well **28** into the water **12** and each of the guidelines **22** is disconnected from the vessel **10**, threaded through one of the clamps **26**, and then reconnected to the vessel **10**. Clamps **26** may be so designed that the buoy can be placed in position and engaged with the guidelines **22** without the necessity of disconnecting the guidelines **22** from the vessel **10**. It is also possible to place the buoy **24** in the water **12** alongside the vessel **10** and individually disconnect the guidelines **22** and engage them with the clamps **26**. After the engagement of each of the clamps **26** with its respective guideline **22**, the guidelines, if they have been disconnected from the vessel **10**, should be reconnected in order that a reasonably taut condition of the guidelines **22** may be maintained during the lowering of the buoy. With all of the guidelines being held taut by vessel **10**, buoy **24** is submerged along the guidelines **22** to the predetermined depth. Once the buoy **24** is at the predetermined depth, the clamps **26** are secured so that they will be firmly affixed to the guidelines **22**, allowing no slippage between the guidelines **22** and the buoy **24**.

With the clamps **26** firmly affixed to the guidelines **22**, the upper ends of the guidelines are disconnected from the surface vessel **10** and dropped through the water so that they hang free, in the manner illustrated in FIGURE 2, that buoy **24** maintaining that portion of the guidelines **22** between the clamps **26** and the G&A system **16** taut. In relocating the submarine wellhead, the vessel **10** is maneuvered to the general vicinity of the well, and a sonar signal, as represented by the broken line **30**, is transmitted through water **12** from vessel **10**. When the signal strikes the buoy **24**, it will be reflected along the broken line **32** back to the vessel **10**; and by means of instrumentation on the vessel the exact position of the buoy may be determined. Since buoy **24**, in order to support the guidelines **22** and maintain them in an untangled condition, must necessarily be fairly substantial in size, it serves as an excellent sonar reflector.

Looking at FIGURE 3, when the buoy **24** has been located, the clamps **26** are released to permit the guidelines **22** again readily to slide through the clamps **26** and rise to the surface along with the free ends of the lines. With the buoy **24** back at the surface, the free ends of the guidelines are readily reached from the vessel **10** by a derrick **34**. The guidelines are disconnected from the buoy **24** and reconnected to the vessel **10**.

The buoy **24'**, as shown in FIGURE 4, has a self-contained lowering system consisting of a powered take-up reel **36** associated with each guideline **22**. The reels **36** are each journalled in outstanding outer and inner plates **38** and **40**, respectively, aligned and fixed to the periphery of the buoy **24'**. The shaft **42**, interconnecting the two reels **36** that are shown, has a dog clutch **44** mounted thereon. The clutch **44** consists of a driving element **46** loosely journalled on the shaft **42** and a splined-driven element **48** axially slidable on a series of splines **50** on shaft **42**. A throwout bearing **52**, mounted on the shaft behind the driven element **48**, is actuated by a lever **54** pivoted on the buoy **24'**. A tension spring **56**, extending between the lever **54** and a point on the buoy, holds the elements of the clutch **44** in engagement, while an opposing solenoid **58** similarly fixed on the far side of the lever **54** tends to separate the clutch elements when activated. A one-way wrap-around brake band **60** is anchored to the buoy **24'** and is biased into contact with a tension spring **62** similarly anchored. A prewound coil spring **64** is anchored between the driven element **46** of the clutch **44** and the adjacent inner shaft-journalling-plate **40**. A watertight casing **65**, partially broken away in the view, covers the drive mechanism between the inner plates **40**. The drive shaft **42** is operatively connected to a second reel drive shaft **42'** having spaced reels **36'** thereon, on the opposite side of the buoy **24'**, by an idler shaft **66** journalled in a pillow box **68** mounted on the intermediate face of the buoy **24'** and interconnected with the drive shafts by pairs of bevel gears **70**. A plate **72**, fixed on the idler shaft has an aperture **74** therethrough which coincides with an aperture in the near face of the pillow box, when the two apertures are aligned. By pressing a removable pin **76** into the aligned apertures, the mechanism can be prevented from rotating once the spring **64** has been wound.

When it is necessary to lower the buoy **24'**, the pin **76** is removed from the aligned apertures and the drive shafts may rotate under the impetus of the prewound spring **64** and the engaged clutch **44**. The near-neutral buoyancy of the buoy permits a small bias on the spring to pull down the buoy to the desired depth. The buoy holds its position beneath the surface until the solenoid **58** is activated from the vessel **10**. The resulting disengagement of the clutch **44** allows the buoy to rise slowly. The one-way engaging brake band **60** is an added precaution against the buoy rising at an excessive rate of speed. The solenoid **58** may be sonar actuated and is retracted under the power of a storage battery (not shown) mounted in the buoy. The solenoid could also be fluid actuated. In an emergency the lever **54** could be hand actuated by a diver.

The buoy **24''**, shown in FIGURE 5, is connected to the G&A system by only one guideline **22**. The guideline **22** is entrained through a slot **77** extending through the buoy **24''**, and fixed to a take-up reel **36''** journalled over the slot between an end plate **78** and a reversible electric motor **80**. A watertight connection **82** is mounted on the side of the motor **80** so that a diver can connect a power line thereto from the vessel **10**. Since the speed of an electric motor can be controlled, precautions against excessive surfacing speed need not be taken. To hold the buoy at the desired depth, a brake **84**, consisting of a pair of blocks **86**, is pivoted at **88** on the end plate **78**. The blocks **86** are biased together to lock the reel **36''** by an interconnecting tension spring **90**. An opposing solenoid **91**, also interconnecting the blocks **86** of the brake **84**, draws its power to drive the blocks apart from the source of power of the electric motor **80** through an interconnecting wire **92**.

Although the present invention has been described in

connection with details of the specific embodiments thereof, it is to be understood that such details are not intended to limit the scope of the invention. The terms and expressions employed are used in a descriptive and not a limiting sense and there is no intention of excluding such equivalents in the invention described, as follow in the scope of the claims. Now having described the apparatus herein disclosed, reference should be had to the claims which follow.

What is claimed is:

1. In a method of marking, relocating, and re-establishing contact with a submarine wellhead, said wellhead being associated with at least one guide line secured adjacent thereto and of a sufficient length to extend to the surface of the water in which the wellhead is submerged, said method comprising the steps of:

(a) engaging a buoyant buoy with said guideline near the upper end thereof;

(b) submerging said buoy along said guideline to a predetermined depth;

(c) securing said buoy on said guideline with the portion of said guideline between said buoy and said wellhead being maintained in a taut state;

(d) thereafter, relocating said buoy in said water;

(e) releasing the connection between said buoy and said guideline; and

(f) raising said buoy along said guideline to the surface of said water whereby the upper end of said guideline is raised to the surface.

2. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 1 including the following step:

(g) maintaining the portion of said guideline between said buoy and said wellhead taut during the step of submerging said buoy.

3. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 2 wherein said guideline portion is maintained taut by keeping said guideline secured to a surface vessel while submerging said buoy.

4. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 3 including the following step:

(h) releasing the surface ends of said guideline to allow said surface end to hang free in said water from said buoy.

5. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 1 wherein said relocating of said buoy in said water is accomplished by detecting energy impulses from said buoy.

6. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 1 wherein said relocating of said buoy in said water is accomplished by the reflection by said buoy of a signal emitted from a surface vessel.

7. In a method of marking, relocating, and re-establishing contact with a submarine wellhead as recited in claim 1 wherein said means for securing said buoy on said guideline is a powered take-up reel on said buoy for submerging said buoy and storing the free upper end of said guideline thereon.

8. In a method of marking the location of a submarine wellhead, said wellhead being associated with a plurality of spaced-apart guidelines, the lower end of each guideline being secured adjacent said wellhead, said guidelines being of sufficient length to extend to the surface of the water in which said wellhead is positioned, said method comprising the steps of:

(a) positioning a buoy in said water substantially above said wellhead, said buoy being provided with a plurality of releasable clamps spaced apart one from the other, each of said clamps being adapted to engage one of said guidelines;

(b) engaging each of said clamps in sliding relationship with one of said guidelines;

(c) lowering said buoy along said guidelines to a predetermined depth while maintaining said guidelines in a substantially taut state;

(d) securing said clamps on said guidelines to retain said buoy in a fixed position on said guidelines after said buoy has been lowered to the predetermined depth whereby the portion of said guidelines between said buoy and said wellhead is maintained in a taut, untangled state while said buoy is submerged; and

(e) releasing the ends of said guidelines at the surface of the water to allow the portions of said guidelines between the surface of the water and said buoy to hang free from said buoy within said water.

9. In a method of locating and re-establishing contact with a submarine wellhead which is associated with a plurality of spaced-apart guidelines, the lower end of each guideline being secured adjacent said wellhead, said guidelines being of sufficient length to extend to the surface of the water in which said wellhead is positioned, said guidelines being secured to a buoy positioned at a predetermined depth below the surface of the water and above said wellhead, the portions of said guidelines between said buoy and said surface of said water hanging free in said water, said method comprising the steps of:

(a) locating said buoy in said water;

(b) loosening the connection between said buoy and said guidelines to permit said buoy to slide along said guidelines;

(c) raising said buoy to the surface of said water whereby the free ends of said guidelines are lifted to said surface;

(d) disengaging the free ends of said guidelines from said buoy; and

(e) securing the free ends of said guidelines to a floating vessel whereby tools may be directed along said guidelines to said submarine wellhead.

10. Apparatus for marking, relocating, and re-establishing contact with equipment fixedly positioned, with respect to the marine bottom, far beneath the surface of a body of water, the combination which consists of:

(a) a submersible buoy having means for providing buoyancy thereof, whereby said buoy is buoyant in water; and

(b) at least one releasable guideline engaging clamp fixed to said buoy, said clamp having means for permitting an engaged guideline, secured at one end to said equipment and free at the other end, to slide therethrough when said clamp is released, and being fixedly gripped by said clamp when said clamp is secured.

11. Apparatus as recited in claim 10, which further consists of:

(c) equipment fixedly positioned, with respect to the marine bottom, far beneath the surface of a body of water; and

(d) at least one guideline secured at a first end adjacent said equipment and free at the other end, said guideline being of a length sufficient for said other free end to extend substantially to the surface of said body of water in which said equipment is positioned; said guideline being entrained through said releasable clamp fixed to said buoy whereby when said buoy is to be used for marking, and later relocating, and re-establishing contact with said equipment, said buoy is fixedly secured to said guideline at a position intermediate the ends thereof at a depth providing no hazard to surface navigation, the portion of said guideline between said equipment and said buoyant submersible buoy being supported in a taut, untangled condition and said portion of said guideline between said buoy and said other end of said guideline being free in said body of water.

12. Apparatus as recited in claim 11, which further consists of:

(e) means connected to said buoy for transmitting energy impulses to locate said guideline clamped to said buoy when said buoy is secured to said guideline at said intermediate position and said guideline does not extend to said surface of said body of water.

13. Apparatus as recited in claim 11 wherein said buoy is hollow and is filled with a fluid having a specific gravity, less than one, for providing said buoy with a minor degree of positive buoyancy in said water whereby when said buoy, secured to said guideline at said intermediate position, is released, said buoy will rise slowly through the body of water to the surface and along and guideline to the free end of said guideline.

14. Apparatus as recited in claim 11 wherein said equipment is, at least in part, a submarine wellhead, and said apparatus further consists of:

(f) a submarine guidance and alignment system having a plurality of vertically oriented columns spaced apart from each other and secured to a submarine base member fixed with respect to said marine bottom, said wellhead extending through said base member; a plurality of guidelines, one of said guidelines secured to each of said columns; and a plurality of clamps on said buoy, each of said clamps engaging one of said plurality of guidelines, whereby when said buoy is released from its submerged position, intermediate the ends of said guidelines, at which intermediate position said buoy had been fixedly secured to said guidelines by said clamps, the buoy then floats to the surface to support said free ends of said guidelines at said surface so that a tool can be guided down said guidelines, and said guidance and alignment system, for performing repair and/or maintenance operations at said submarine wellhead.

15. Apparatus for marking, relocating, and re-establishing contact with equipment fixedly positioned with respect to a marine bottom, far beneath the surface of a body of water, the combination which consists of:

(a) means for fixedly locating one end of a guideline adjacent said equipment fixedly positioned far beneath said surface of said body of water;

(b) a guideline, said guideline secured to said guideline locating means by a first end thereof, said guideline being of a length sufficient for the other free end of said guideline to extend substantially to said surface of said body of water in which said equipment is submerged; and

(c) a buoyant element, a clamp connected to said buoyant element for releasably engaging said guideline along the length thereof, said guideline being entrained through said clamp, said clamp being secured to said guideline intermediate the ends thereof to restrain said buoyant element at a depth beneath said surface of said body of water that will not present a hazard to surface navigation, said guideline portion between said guideline locating means and said buoyant element being supported in a taut, untangled condition and said portion of said guideline between said buoyant element and said free end of said guideline being stored beneath said surface of said body of water whereby when said clamp is released said buoyant element will rise to the surface while said guideline slides through said clamp and said free end of said guideline is at said surface of said body of water with said buoyant element for re-establishing contact with said submarine equipment.

16. Apparatus as recited in claim 15 wherein said portion of said guideline between said buoyant element and said free end of said guideline is stored by permitting said last mentioned portion to hang freely in said body of water from said clamp.

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