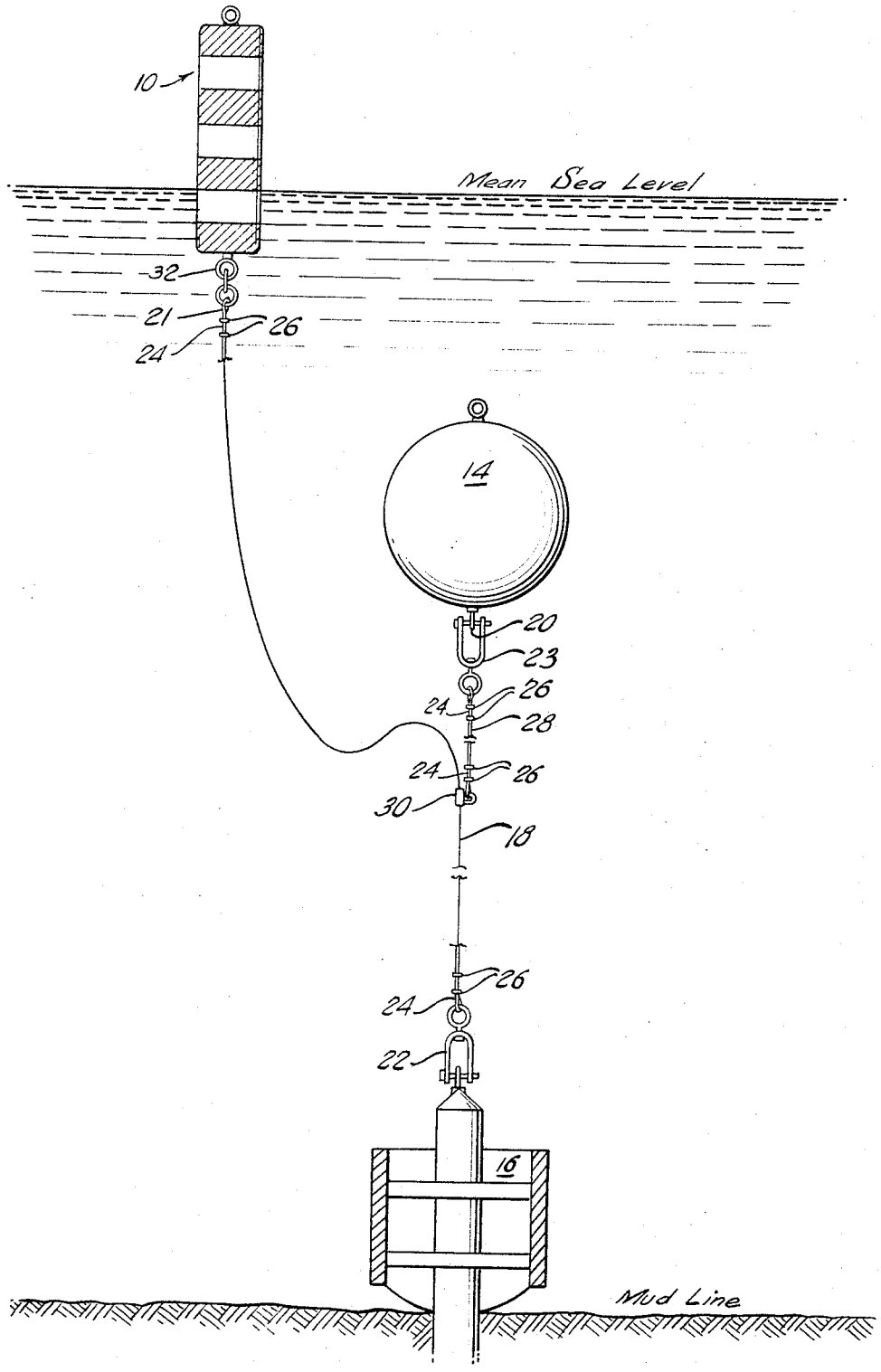
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DUAL BUOY MARKER SYSTEM

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DUAL BUOY MARKER SYSTEM

George E. Mott, Metairie, La. (% Texaco Inc., P.O. Box 60252, New Orleans, La. 70160)

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1 Claim. (Cl. 9—8)

ABSTRACT OF THE DISCLOSURE

A system of dual buoys for marking the location of underwater well heads wherein an intermediate buoy is attached to a line connecting a surface buoy to the well head to maintain the lower portion of the connecting line under constant tension to prevent fouling.

Cross-reference to related applications

This is a continuation-in-part of application Ser. No. 474,091, filed July 22, 1965.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a buoy marker system for indicating the location of an object submerged in deep water.

Description of the prior art

The ability to maintain a marker buoy indicating the location of an underwater object has become particularly important with the drilling of more and more underwater oil and gas wells especially in deep water locations. There is considerable expense in relocating an underwater well in deep water when a marker buoy indicating the location has been lost. The loss is usually caused by severe storm conditions which are fairly frequent in off-shore locations where most underwater wells have been drilled. The expense involved will better be appreciated when it is realized that the relocation and remarking of the well entails the services of surveyors, marine equipment and deep water divers.

The known buoy type marker systems consist of a surface buoy directly connected to the underwater well with a chain or steel cable. The losses encountered with a directly connected buoy have been numerous since the slack in the cable caused by surface variations such as waves, tide changes, etc. allows entanglement of the cable with the underwater well head apparatus which not only endangers the well but effectively shortens the cable thereby increasing the impact on the cable which increases the possibility of breakage thereof. One solution to the problem has been to enclose the underwater well head structure with a cage thereby eliminating the possibility of entangling the buoy cable with the underwater well head structure. However, this is costly and introduces other problems.

SUMMARY OF THE INVENTION

In accordance with the present invention a dual buoy marker system is provided for indicating the location of an object or obstruction submerged in deep water which comprises a surface buoy floating on the water surface and sufficiently emerged so as to be highly visible. The surface buoy is connected to the submerged object by a continuous connecting means which has an auxiliary buoyancy means attached thereto at a predetermined depth intermediate the surface buoy and the underwater object. The auxiliary buoyancy means has a net positive buoyancy so as to keep tension under all conditions in the portion of the connecting means between the auxiliary buoyancy means and the underwater object.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a schematic diagram of the buoy marker system indicating the location of an underwater well.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown schematically a buoy marker system indicating the location of a deep water well head **16**. Deep water usually refers to a depth of 125 feet or more. The surface indication of the well head location is provided by buoy **10** which is connected to well head **16** by continuous line or cable **18**. Buoy **10** is an elongated cylindrical shaped buoy generally known in the prior art as a spar buoy and as can be seen on the drawing, when it is floating a considerable extent of buoy **10** extends above the water surface **12** such that the buoy is easily visible from a considerable distance. To enhance the visibility of the buoy **10** it usually is made with alternate rings **13** of different colors, for example, alternately orange and white. Of course, buoys of different shapes can be utilized in the marker system of this invention, the only requirement being reliable buoyance and high visibility.

An auxiliary buoy **14** is provided which is connected by means of a clamp or similar suitable connecting device **19** to continuous cable **18** at an intermediate point on cable **18**. Auxiliary buoy **14** is designed to have a net positive buoyancy, that is a vertical upward buoyant force, such that the portion of connecting line or cable **18** between auxiliary buoy **14** the well head equipment **16** will be under constant tension. Auxiliary buoy **14** is preferably connected to cable **18** at a depth of 50 or 60 feet below the surface of the water. This depth is known to be below the most severe surface wave action and thus the auxiliary buoy **14** will be substantially unaffected by storm, high wave and wind conditions on the surface. Since the lower portion of cable **18** between auxiliary buoy **14** and underwater well head equipment **16** is maintained under constant tension by the buoy **14**, and since buoy **14** is below the surface wave action level, the lower portion of cable **18** will under no conditions be slack and, therefore, the danger of entanglement with the underwater well head equipment is eliminated. The actual connection of the cable **18** to the surface buoy **10**, the underwater well head equipment **16** and the spherical auxiliary buoy **14** is made by means of swivel jaw and eye connectors **21**, **22** and **23**, respectively, which are well known in the art. The use of swivel type connectors eliminates twisting of the cable and thus reduces failure of the system because of cable breakage.

Auxiliary buoy **14** has extending therefrom at opposite ends of a diameter therethrough an eye **20**, one of which is connected to swivel jaw and eye **23**, which in turn is connected by means of a short length of cable **28** to clamp **30** and clamp **30** is fastened at a predetermined intermediate point to continuous cable **10**. The cable may be attached to the swivel jaw and eye in each instance by overlapping the portion of the cable passed through the swivel eye section. This overlapping portion is surrounded by a thimble **24** which is held in place by clamp **26**.

The upper portion of continuous line or cable **18** is connected to auxiliary buoy **14**. This portion of cable **18** is made sufficiently long such that when surface buoy **10** is floating at mean sea level **12** there is no tension on the line and surface buoy **10** can drift with respect to auxiliary

buoy **14**. When the upper portion of cable **18** reaches the limit of its length so that tension is applied thereto, auxiliary buoy **14** acts as a shock absorber in the line because of its being pulled horizontally through the water before continuous line or cable **18** is pulled into a taut straight line between surface buoy **10** and well equipment **16**. The uppermost end of line **18** is connected to an eye extending from the bottom of surface buoy **10**. The connection is made by a swivel jaw and eye arrangement **21** similar to the connections made to auxiliary buoy **14** and well equipment **16**. These swivel type connections again, are to prevent twisting of the connecting line. In the event, surface buoy **10** should be lost the auxiliary buoy **14** is not effected and can still be much more easily located than the deep water well head equipment **16**. To aid in the locating of the auxiliary buoy **14**, it is usually colored, for example, white. This can be accomplished by coating the sphere with a gel-coating of appropriate color.

On the other hand, if for any reason auxiliary buoy **14** is damaged or loses its buoyancy it can readily be replaced by another buoy without in any way disconnecting line **18** from surface buoy **10** to well head **16**. In the systems of the prior art, separate lines are employed for connecting the auxiliary buoy to the well head and for connecting the surface buoy to the auxiliary buoy. In such a system should the auxiliary buoy become damaged or its buoyancy impaired, it is necessary to disconnect both lines at the auxiliary buoy in order to effect a replacement thereof. With such separate line system it is easily possible for an accident to occur while the lines are disconnected with the loss of contact with the upper end of the line connected to the well head. In such event, contact with the well head is lost completely and serious difficulties may

be incurred as a result. With the system of the present invention, the auxiliary or intermediate buoy may be disconnected from the moving line and replaced without any danger of loss of contact with the well head.

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

I claim:

1. A buoy marker system for indicating the location of the well head of an underwater well submerged in deep water, comprising a surface buoy floating on the water surface, continuous connecting means attaching said surface buoy to said well head, a tethered auxiliary buoyancy means having a fixed buoyancy and a swivel connector attached by a line and clamping device to said connecting means at a predetermined depth intermediate said surface buoy and said well head, said auxiliary buoyancy means having a net positive buoyancy to keep tension in the connecting means between the auxiliary buoyancy means and the well head.

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MILTON BUCHLER, *Primary Examiner.*

T. MAJOR, *Assistant Examiner.*