

STATION KEEPING BUOY SYSTEM

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a buoy system capable of maintaining the buoy in a fixed position on the ocean or another body of water without the use of an anchoring device.

(2) Description of the Prior Art

Sonobuoys are used to collect various types of data. For example, some sonobuoys collect data about the oceanic environment. U.S. Pat. No. 5,283,767 to McCoy illustrates such a sonobuoy. As shown in the '767 patent, the McCoy sonobuoy is a portable free drifting package having a sensor suite for collecting selected environmental data relating to the surrounding medium, a data storage capacity, a dive control system for positioning the package at a desired depth, a data communications system, a locating system for determining the position of the package, a power system for providing power to the various components of the package, and a systems controller.

Other sonobuoys are used to collect acoustic data about underwater targets. When used to collect data about an underwater target, the sonobuoy must have a known position in order to enable effective calculation of the position(s) of the underwater targets. The present method for deploying sonobuoys used in shallow water range tracking systems requires that a surface buoy and associated electronics be anchored at a surveyed position. Thus an anchoring device is provided to insure that the sonobuoy is maintained in a desired position.

Most sonobuoys currently in use consist of a receiving hydrophone, amplifying circuits, and a radio frequency (RF) modulation unit for transmitting data back to a data processing facility. These components are typically enclosed within a watertight floatation package. The mooring system presently used with these sonobuoys consists of a surface float and chain or line to an anchor on the bottom. Once the mooring system is in place, the sonobuoy is attached to the surface float via a tether line. The problems with this type of system are primarily associated with the mooring system. First, the location of the mooring has to be precise to be compatible with the geometry required for the tracking algorithm. This can be difficult especially in deep water. In deep water, errors in placement can be significant. Other problems become apparent when wave action, tide changes, ocean currents, and storms generate large dynamic forces that cause maintenance problems. Also large buoys create navigation hazards which, if in U.S. territorial waters, must be reported to the U.S. Coast Guard.

The depth of the water also generates limitations that make a mooring system impractical. When a mooring system is engineered for deep water, the physical size, weight and complexity of installation become major issues. A large vessel with the means of deploying heavy anchors, long mooring lines, and large surface floats is required.

In a deep mooring system, there is always an amount of slack on the mooring system line. This translates into variation in the position of the surface buoy at any given time. The amount of position variation is called a watch circle. The watch circle increases as the depth of the water increases. The watch circle that results can be very large, i.e., greater than 20 feet in diameter for 100 foot water depth. This then limits the accuracy that any tracking system can achieve. The inability to maintain sonobuoys in an accurately known position significantly degrades the performance of the system.

Still another problem is that the number of moorings required to cover a typical portable range is approximately sixteen. The time needed to acquire and assemble all the hardware for a typical range limits the portability and flexibility of the system. The mooring systems are typically deployed on a long term basis and must be maintained at sea.

Efforts have been made to develop different types of buoys having propulsion systems associated therewith. One such effort is exemplified in U.S. Pat. No. 2,941,492 to Wilcoxon. The Wilcoxon patent relates to a self propelled, remotely controlled buoy having a hydrophone associated therewith to make underwater sound measurements. The propulsion system for the buoy includes a propeller for pulling the buoy through the water and an electric motor for driving the propeller via a shaft. The buoy also includes a rudder arrangement for steering the buoy. The rudder arrangement includes a second electric motor for driving a pair of rudder members. Both the propulsion system and the rudder system are controlled by a remote operator. Neither system is designed for station keeping.

U.S. Pat. No. 3,369,516 to Pierce relates to a station to be maintained at a fixed location. The station includes a hollow buoyant structure, a stabilizing structure depending from the buoyant structure, and a radio antenna fixed to a mast attached to the buoyant structure. The station further includes a propulsion and navigation system for maintaining the station at a desired location. The propulsion system includes a plurality of propellers or jets located around the circumference of the buoyant structure. The navigation system is formed by a sonar system affixed to the bottom of the stabilizing structure. The sonar system interacts with a passive or active reflector connected to an anchor resting on the ocean floor. In this way, a navigational point of reference for controlling the propulsion system is provided.

The use of jets such as those in Pierce is undesirable because of the noise that they make. Ideally, a buoy being used to detect acoustic signals wants to operate in a quiet environment.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a buoy which can be used in oceanic or other water environments to gather acoustical data.

It is a further object of the present invention to provide a buoy as above which has a system for maintaining it at a desired station without the use of an anchoring device.

It is still a further object of the present invention to provide a buoy as above which can be used in open ocean tracking ranges and in remote range sites.

The foregoing objects are attained by the station keeping buoy system of the present invention.

In accordance with the present invention, the buoy system comprises a buoy having a housing which is at least partially submerged in a body of water and which is not restrained