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T. WATKIN ET AL
ANTENNA BASE APPARATUS WITH HYDRODYNAMICALLY
ACTUATED LOCKING MEANS

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2 Sheets-Sheet 1

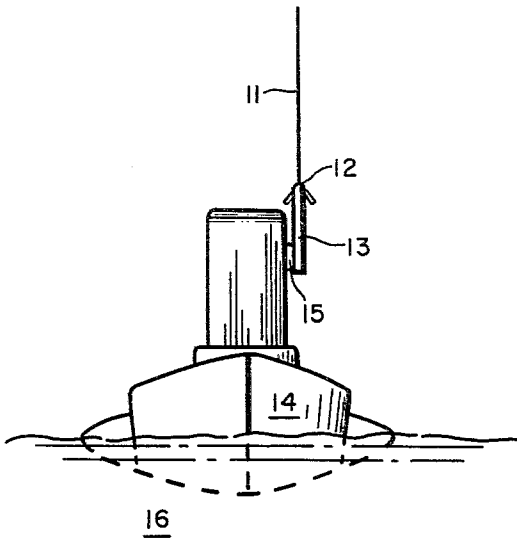


Fig. 1

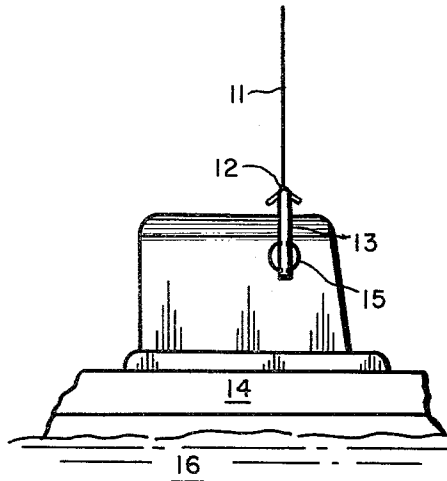


Fig. 2

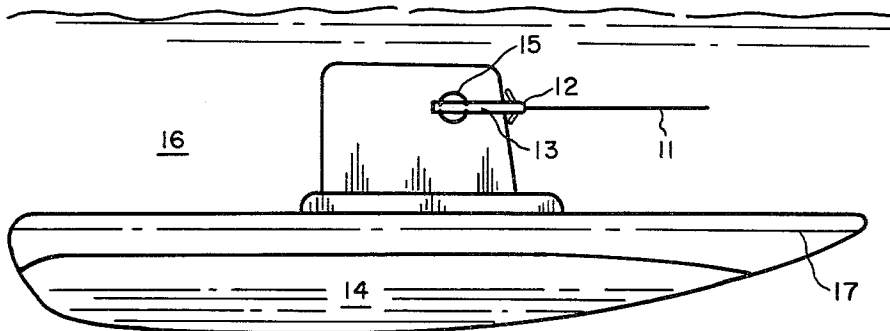


Fig. 3

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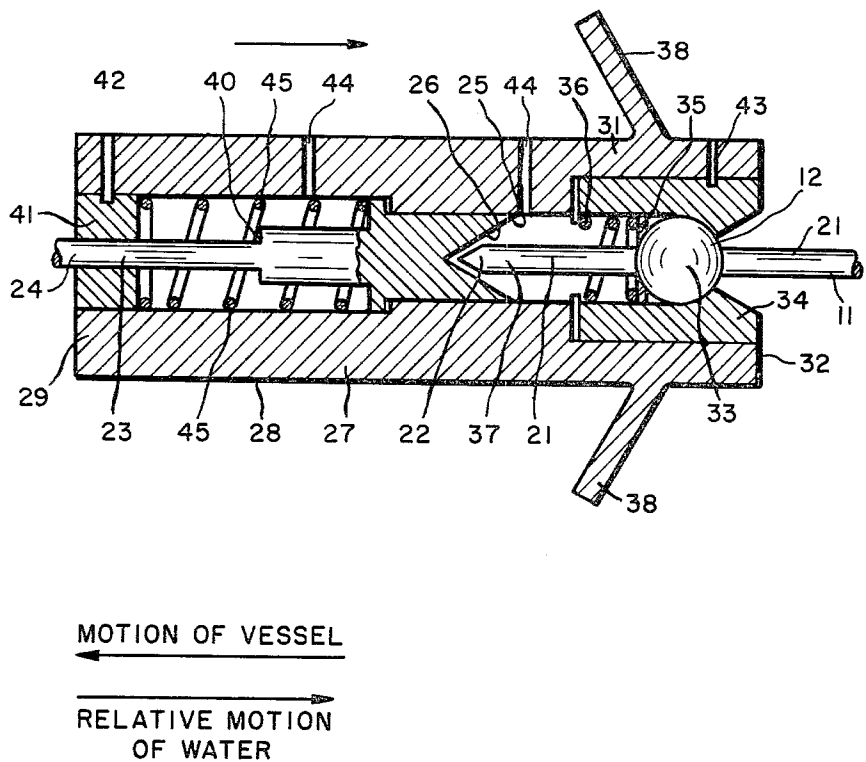


Fig. 4

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ANTENNA BASE APPARATUS WITH HYDRODYNAMICALLY ACTUATED LOCKING MEANS

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The present invention relates to an antenna base apparatus. More particularly, the invention relates to base apparatus for a whip type antenna.

In submarine vessels, a whip type radio antenna is affixed to a movable antenna base on the conning tower. When the submarine vessel is running on the surface of the sea the antenna base is kept in a position which is transverse and substantially perpendicular to the fore and aft line or beam of the vessel. When the submarine vessel is running submerged beneath the surface of the sea the antenna base is kept in a position which maintains the antenna in a position which is substantially parallel to the fore and aft line of the vessel. The whip type antenna has a tendency to snap when the vessel is submerged and in undersea motion due to the intense strains imposed upon said antenna by vibrations in said antenna produced by hydrodynamic forces. Thus, when the vessel is in undersea motion, the hydrodynamic forces created by such motion force the rigidly supported antenna to vibrate to such an extent that the antenna is severely weakened at its base and is likely to snap either then or at a later time. This is a serious problem due to the great importance of military communications and especially due to the communications requirements of submarine vessels which run submerged for great periods of time, possibly at high speeds, and whose only contact with the outside world is by radio.

The principal object of the present invention is to provide a new and improved antenna base apparatus.

An object of the present invention is to provide an antenna base apparatus which prevents strain on the antenna due to external forces on the antenna.

Another object of the present invention is to provide an antenna base apparatus for a submarine vessel which prevents strain on the antenna due to hydrodynamic force on the antenna.

Still another object of the present invention is to provide an antenna base apparatus for a submarine vessel which prevents damage or loss of the antenna due to hydrodynamic force on the antenna.

The antenna base apparatus of the present invention comprises an antenna seating member affixed to a movable antenna base of a submarine vessel having a base end affixed to the movable base and an opposite end. A universal mounting positioned in proximity with the opposite end of the seating member universally mounts the antenna at its base area. Locking apparatus is mounted in cooperation with and includes the opposite end of the seating member. The locking apparatus normally locks the base area of the antenna in a substantially rigid position and responds to hydrodynamic force created by undersea motion of the submarine vessel to unlock the base area of the antenna to free the antenna to float in the universal mounting under hydrodynamic force.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a front view of a submarine vessel running on the surface of the sea showing the mounting of the antenna base apparatus of the present invention thereon;

FIG. 2 is a side view of a portion of a submarine vessel running on the surface of the sea showing the

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mounting of the antenna base apparatus of the present invention thereon;

FIG. 3 is a side view of a submarine vessel running submerged beneath the surface of the sea showing the mounting of the antenna base apparatus of the present invention thereon; and

FIG. 4 is a schematic diagram, partly in section, of an embodiment of the antenna base apparatus of the present invention.

In the figures, the same components have the same reference numerals.

The antenna base apparatus of the present invention is described and illustrated for use on a submarine vessel. The antenna base apparatus of the present invention may, however, be used on any vehicle, and indeed, on a stationary structure where the antenna is subjected to winds of extraordinary velocity. The antenna base apparatus of the present invention may thus be used on such vehicles as aircraft and marine vessels, for example, and on structures in the Arctic or Antarctic regions, for example.

In FIGS. 1, 2 and 3, a whip type antenna 11 is universally mounted in a universal mounting 12 of an antenna base apparatus 13 of the present invention. The antenna base apparatus 13 is affixed to a submarine vessel 14 by means of a movable antenna base 15.

In FIGS. 1 and 2, the submarine vessel 14 is running on the surface of the sea 16 and the movable antenna base 15 is kept in a position which maintains the antenna 11 in a position which is transverse and substantially perpendicular to the fore and aft line 17 of said vessel.

In FIG. 3, the submarine vessel 14 is running submerged beneath the surface of the sea 16 and the movable antenna base 15 is kept in a position which maintains the antenna 11 in a position which is substantially parallel to the fore and aft line 17 of said vessel.

In FIG. 4, the whip type antenna 11, which is of elongated rod-like configuration, has a base area 21 and a base end 22. The antenna 11 is universally mounted at its base area 21 in the universal mounting 12 of the antenna base apparatus of the present invention.

The antenna seating member 23 is of elongated substantially cylindrical configuration having a base end 24 and an opposite end 25. The antenna seating member 23 is affixed to the submarine vessel (not shown in FIG. 4) via the movable antenna base 15 (not shown in FIG. 4) at its base end 24 and has a seating bore or recess 26 formed in its opposite end 25. The seating recess 26 of the antenna seating member 23 is preferably of substantially conical configuration.

A housing 27 of substantially tubular configuration is coaxially movably or slidably mounted on the antenna seating member 23. The housing 27 has an outer surface 28, a base end 29, an outlet area 31 and an outlet end 32. The housing 27 is slidably mounted on the antenna seating member 23 with the outlet area 31 of said housing extending a predetermined distance beyond the opposite end 25 of said antenna seating member.

The universal mounting 12 is positioned in the outlet area 31 of the housing 27 and universally mounts the antenna 11 at its base area 21. The universal mounting 12 includes a spherical member 33, a spherical seat 34, a semi-spherical bearing 35 and a mounting spring 36. The mounting spring 36 urges the semi-spherical bearing 35 toward the spherical seat 34 to hold the spherical member 33 in universally revolvable position with a force sufficient to maintain said spherical member in position but which permits the said spherical member to float under external force under the conditions hereinafter described.

The antenna 11 is mounted in the universal mounting 12 in a manner whereby a portion 37 of the base area 21 of said antenna normally extends into the bore of

the recess 26 formed in the antenna seating member 23 with the base end 22 of said antenna seated in said bore. In this normal position, the base area 21 of the antenna 11, and thus the antenna, is locked in a substantially rigid normal position, as shown in FIG. 4.

A hydrodynamic surface 38 extends transversely from the outer surface 28 of the housing 27. The hydrodynamic surface area 38 may be integrally formed with the housing 27 or may be a sleeve or collar affixed to said housing and is preferably of flaring configuration constituting a skirt extending at an angle from the outer surface 28 of said housing. The hydrodynamic surface area 38 is of any suitable configuration known to provide a hydrodynamic surface which functions as a target or receiver of hydrodynamic forces and attempts to convert such hydrodynamic forces into a mechanical force or motion. Since the hydrodynamic surface area 38 is on the housing 27, hydrodynamic forces applied to said hydrodynamic surface area urge said housing to move in the direction of such forces.

If the antenna base apparatus of the present invention is used on an aircraft, marine vessel, or stationary structure, the hydrodynamic surface area 38 is of any suitable configuration known to provide an aerodynamic surface which functions as a target or receiver of aerodynamic forces and attempts to convert such aerodynamic forces into a mechanical force or motion.

The hydrodynamic surface area 38 extends from the outer surface 28 of the housing 27 in a direction whereby undersea motion of the submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction 39 urging the outlet area 31 of the housing 27, and thus said housing, a distance beyond the opposite end 25 of the antenna seating member 23 greater than the predetermined distance. Thus, the base end 22 of the antenna 11 is unseated from the bore 26 formed in the antenna seating member 23. This unlocks the base area 21 of the antenna 11 and the antenna is free to float in the universal mounting 12 under hydrodynamic force.

More than one hydrodynamic surface area 38 may be utilized, of course, to increase the motion effect created by the hydrodynamic forces received by the hydrodynamic surface areas.

The housing 27 preferably includes a closing member 41 of substantially annular configuration which closes the base end 29 of said housing. The closing member 41 cooperates with the surface 40 of the antenna seating member 23 to limit the motion of the housing 27 under hydrodynamic force. When the housing 27 is moved in the direction of the arrow 39 by hydrodynamic force the surface 40 eventually abuts the closing member 41 and prevents the housing from being moved completely off the antenna seating member 23. The closing member 41 may be held in position by a first pin or plurality of pins 42. The universal mounting 12 may be held in position by a second pin or plurality of pins 43. The housing 27 may be provided with a plurality of breather holes 44 formed therethrough.

In a preferred embodiment of the antenna base apparatus of the present invention, a housing spring 45 of substantially helical configuration is coaxially positioned around the antenna seating member 23 and inside the housing 27. The housing spring 45 functions to hold the antenna 11 in its normal position and the housing spring bias is counteracted by hydrodynamic force applied to the hydrodynamic surface area 38. Thus, upon removal of hydrodynamic force, the housing spring 45 functions to return the antenna 11 to its normal position.

When the submarine vessel 14 is not submerged, and is therefore not subjected to hydrodynamic force, the antenna 11 is locked in a substantially rigid normal position, shown in FIGS. 1 and 2, due to the action of the housing spring 45 in maintaining the housing 27 with its outlet area 31 extended a predetermined distance beyond the opposite end 25 of the antenna seating mem-

ber 23 so that the base end 22 of the antenna 11 is seated in the bore 26 of said antenna seating member.

When the submarine vessel 14 submerges and runs or moves submerged, as shown in FIG. 3, the undersea motion of said vessel creates hydrodynamic forces on the antenna 11. The hydrodynamic forces act to vibrate the antenna 11 and hydrodynamic force acts on the hydrodynamic surface area 38 to move the housing 27 against the spring bias of the housing spring 45. The outlet area 31 of the housing 27 is moved by the hydrodynamic force a distance greater than the predetermined distance away from the opposite end 25 of the antenna seating member 23. This unlocks the antenna 11 by lifting the antenna base area 21, and more specifically, the base end 22 of said antenna, out of the seating bore 26 to free said antenna to float in the universal mounting 12. The hydrodynamic force continues to force the antenna 11 in the same direction so that said antenna floats in the universal mounting 12 in a substantially parallel position with relation to the fore and aft line 17 of the submarine vessel or to an angle of substantially zero degrees with said fore and aft line of the submarine vessel.

The antenna base apparatus of the present invention thus functions to permit the antenna 11 to float free under the pressure of hydrodynamic force and thus prevents damage or fracture of said antenna.

While the invention has been described by means of a specific example and in a specific embodiment, we do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What we claim is:

1. Antenna base apparatus for an elongated rod-like antenna having an axis, a base area and a base end comprising, in combination,
 - an antenna seating member affixed to a vehicle and having an opposite end;
 - universal mounting means positioned in proximity with the opposite end of said seating member universally mounting said antenna at its base area; and
 - locking means mounted in cooperation with and including the opposite end of said seating member for normally locking the base area of said antenna in a substantially rigid position and for responding to external hydrodynamic force pushing away from said universal mounting means in a direction substantially parallel to the axis of said antenna to unlock the base area of said antenna to free said antenna to float in said universal mounting means under external force.
2. Antenna base apparatus for an elongated rod-like antenna having an axis, a base area and a base end comprising, in combination,
 - an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end;
 - universal mounting means positioned in proximity with the opposite end of said seating member universally mounting said antenna at its base area; and
 - locking means mounted in cooperation with and including the opposite end of said seating member for normally locking the base area of said antenna in a substantially rigid position and for responding to hydrodynamic force pushing away from said universal mounting means in a direction substantially parallel to the axis of said antenna created by undersea motion of said submarine vessel to unlock the base area of said antenna to free said antenna to float in said universal mounting means under hydrodynamic force.
3. Antenna base apparatus for an elongated rod-like antenna having an axis, a base area and a base end comprising, in combination,
 - an antenna seating member affixed to a submarine

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vessel having a base end affixed to said submarine vessel and an opposite end;

a housing coaxially movably mounted on said seating member and having a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing in proximity with the opposite end of said seating member universally mounting said antenna at its base area; and

locking means mounted in cooperation with and including the opposite end of said seating member and said housing for normally locking the base area of said antenna in a substantially rigid normal position and for responding to hydrodynamic force in a direction substantially parallel to the axis of said antenna created by undersea motion of said submarine vessel to unlock the base area of said antenna to free said antenna to float in said universal mounting means under hydrodynamic force.

4. Antenna base apparatus for an elongated rod-like antenna having an axis, a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end;

a housing coaxially movably mounted on said seating member and having a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing in proximity with the opposite end of said seating member universally mounting said antenna at its base area;

locking means mounted in cooperation with and including the opposite end of said seating member and said housing for normally locking the base area of said antenna in a substantially rigid normal position and for responding to hydrodynamic force pushing away from said universal mounting means in a direction substantially parallel to the axis of said antenna created by undersea motion of said submarine vessel to unlock the base area of said antenna to free said antenna to float in said universal mounting means under hydrodynamic force; and

return means coupled to said antenna seating member for returning said antenna to its normal position upon the removal of hydrodynamic force applied to said antenna.

5. Antenna base apparatus for an elongated rod-like antenna having a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end having seating means;

a housing coaxially movably mounted on said seating member and having an outer surface, a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending a predetermined distance beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing universally mounting said antenna at its base area in a manner whereby a portion of the base area of said antenna normally cooperates with the seating means of said seating member to lock the base area of said antenna in a substantially rigid normal position; and

a hydrodynamic surface area extending transversely from the outer surface of said housing in a direction

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whereby undersea motion of said submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction away from said universal mounting means urging the outlet area of said housing a distance beyond the opposite end of said seating member greater than said predetermined distance so that the base area of said antenna is disengaged from the seating means of said seating member to unlock the base area of said antenna and the said antenna is free to float in said universal mounting means under hydrodynamic force.

6. Antenna base apparatus for an elongated rod-like antenna having a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end having seating means;

a housing coaxially movably mounted on said seating member and having an outer surface, a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending a predetermined distance beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing universally mounting said antenna at its base area in a manner whereby a portion of the base area of said antenna normally cooperates with the seating means of said seating member to lock the base area of said antenna in a substantially rigid normal position;

a hydrodynamic surface area extending transversely from the outer surface of said housing in a direction whereby undersea motion of said submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction away from said universal mounting means urging the outlet area of said housing a distance beyond the opposite end of said seating member greater than said predetermined distance so that the base area of said antenna is disengaged from the seating means of said seating member to unlock the base area of said antenna and the said antenna is free to float in said universal mounting means under hydrodynamic force; and

return means coupled to said antenna seating member for returning said antenna to its normal position upon the removal of hydrodynamic force applied to said antenna.

7. Antenna base apparatus for an elongated rod-like antenna having a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end having seating means;

a housing coaxially movably mounted on said seating member and having an outer surface, a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending a predetermined distance beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing universally mounting said antenna at its base area in a manner whereby a portion of the base area of said antenna normally cooperates with the seating means of said seating member to lock the base area of said antenna in a substantially rigid normal position; and

a hydrodynamic surface area extending from the outer surface of said housing at a predetermined angle with said outer surface of said housing in a direction whereby undersea motion of said submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction away from said universal mounting means urging the outlet area of said hous-

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ing a distance beyond the opposite end of said seating member greater than said predetermined distance so that the base area of said antenna is disengaged from the seating means of said seating member to unlock the base area of said antenna and the said antenna is free to float in said universal mounting means under hydrodynamic force.

8. Antenna base apparatus for an elongated rod-like antenna having a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine vessel having a base end affixed to said submarine vessel and an opposite end having a substantially conical bore formed therein;

a substantially cylindrical housing coaxially movably mounted on said seating member and having an outer surface, a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending a predetermined distance beyond the opposite end of said seating member;

universal mounting means positioned in the outlet area of said housing universally mounting said antenna at its base area in a manner whereby a portion of the base area of said antenna normally extends into the conical bore formed in said seating member with the base end of said antenna seated in said conical bore to lock the base area of said antenna in a substantially rigid normal position;

spring means cooperatively engaging said antenna seating member and said housing for locking the base area of said antenna in its substantially rigid normal position; and

a hydrodynamic surface area extending transversely from the outer surface of said housing in a direction whereby undersea motion of said submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction away from said universal mounting means urging the outlet area of said housing a distance beyond the opposite end of said seating member greater than said predetermined distance in opposition to the force of said spring means so that the base area of said antenna is unseated from the conical bore formed in said seating member to unlock the base area of said antenna and the said antenna is free to float in said universal mounting means under hydrodynamic force.

9. Antenna base apparatus for an elongated rod-like antenna having a base area and a base end comprising, in combination,

an antenna seating member affixed to a submarine ves-

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sel having a base end affixed to said submarine vessel and an opposite end having a substantially conical bore formed therein;

a housing coaxially movably mounted on said seating member and having an outer surface, a base end, an outlet area and an outlet end, said housing being slidably mounted on said seating member with the outlet area of said housing extending a predetermined distance beyond the opposite end of said seating member, said housing having a substantially cylindrical configuration having ventilating apertures formed therethrough and closing means closing the base end thereof;

universal mounting means positioned in the outlet area of said housing universally mounting said antenna at its base area in a manner whereby a portion of the base area of said antenna normally extends into the conical bore formed in said seating member with the base end of said antenna seated in said conical bore to lock the base area of said antenna in a substantially rigid normal position;

spring means cooperatively engaging said antenna seating member and said housing for locking the base area of said antenna in its substantially rigid normal position; and

a hydrodynamic surface area extending transversely from the outer surface of said housing in a direction whereby undersea motion of said submarine vessel creates hydrodynamic force upon said hydrodynamic surface area in a direction away from said universal mounting means urging the outlet area of said housing a distance beyond the opposite end of said seating member greater than said predetermined distance in opposition to the force of said spring means so that the base area of said antenna is unseated from the conical bore formed in said seating member to unlock the base area of said antenna and the said antenna is free to float in said universal mounting means under hydrodynamic force.

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