The present invention relates generally to anode mounting apparatus and more particularly to anode mounting apparatus adapted to support and carry in operative position the anodes of a corrosion prevention system.

The use of sacrificial metal anodes for the cathodic protection of structures subject to galvanic corrosion is well known in the prior art. Such anodes are characteristically electrically interconnected by means of a suitable electrical conductor to the structure to be protected, and are immersed in the electrolyte along with such structure. The galvanic couple thus created causes the sacrificial anode to corrode while the less anodic or cathodic metal of the structure is protected.

Thus, for example, in the corrosion protection of the hull of a ship or vessel it is common practice to secure the anodes below the water line in an array at the bilge keels or at the transom, and in a manner designed to minimize drag on the vessel as it moves through the water. Such structure of mounting arrangement is described in my copending patent application, Serial No. 485,908, filed January 31, 1955, now Patent No. 2,826,543, and it will be noted therein that a plurality of such sacrificial anodes are electrically interconnected by metallic member which are axially disposed completely through the anodes. These metallic members are provided not only to support the anodes in position, but also to insure good electrical contact between each of the anodes and the remainder of the anode-cathode circuit. Minimization of electrical resistance in this circuit is particularly important to efficient operation since electrical potential to drive the corrosion prevention system is derived from the anodes, and this potential is characteristically quite low. Further, it will be obvious that as the anodes are expended or eroded away in operation the factor of electrical resistance becomes even more important since there is less and less available electrical potential for driving the system.

Insofar as is known, all corrosion prevention systems which utilize expendable metallic anodes have been designed in a manner generally similar to that just described, in that there is always provision for metallic center members, or wires, tubes, or rods or the like disposed within the anodes so as to achieve the desired low resistance electrical contact. Thus, pipe lines are protected by anodes which are buried in the adjacent earth and connected by wires to the pipe lines; metal ships' hulls are protected by anodes which are carried at the bilge keels and connected in electrical circuit by means of connectors which include rods and conduits rigidly disposed through the anodes; metal water tanks are protected by anodes which are suspended in the water and connected to the tank walls by wires; and wooden ships' hulls are protected by anodes which are carried along the keel and connected to an internal circuit of the ship through the use of rigid metal cores integrally cast within the anodes.

In each case, it will be evident that replacement of an expended anode with a fresh anode entails the disconnection of at least a certain amount of wiring and in most instances, particularly aboard ships, it entails the disconnection and dismantling of rigid semi-permanent mounting rods, cores and other structures. Further, the partial consumption of an anode after a period of operation may warrant leaving it in mounted position for its remaining period of operation along with the replacement anodes to thereby derive maximum efficiency. However, the retention of such partially consumed anodes provides an additional and undesirable drag on the ship since additional anodic material must be mounted elsewhere to meet the complete needs of the cathodic protection system during the period before the next overhaul replacement of anodes.

The disadvantage of having to periodically remove partially consumed anodes and replace them with fresh anodes is very evident in the shipping industry. The expense of ship overhaul is already great and reduction of the time in drydock is highly desirable. Thus, elimination of the present practice of making welded, semi-permanent installations of anodes, and later removing the anode mounts by cutting torches or the like, would effect a significant economy in the operation of a shipboard corrosion prevention system.

Accordingly, the anode mounting apparatus of the present invention is adapted to provide a rigid, semi-permanent base or platform for maintaining the sacrificial anodes of a corrosion prevention system in operative position, while yet maintaining good electrical contact between the anodes and the circuit of the corrosion prevention system to thereby reduce electrical resistance to a minimum. The mounting apparatus is rigidly secured near, adjacent, or upon the structure to be protected and, if mounted upon a metallic structure, preferably insulated therefrom to avoid the disadvantages and inefficiencies of direct coupling, as is well known to those skilled in the art.

For purposes of brevity and clarity of description, the mounting apparatus of the present invention will be herein described as being mounted to a wooden vessel for operation with a cathodic protection system in the prevention of corrosion of metallic components carried externally upon the ship's hull.

The apparatus of the invention includes a metal grid or basket upon which the wooden vessel rests or is moored, and this metal basket provides the desired electrical contact and obviates any necessity for a metallic element carried upon or within the anode. A chunk or block of the anodic material need merely be placed upon the metal basket and secured in position, as will be seen. The metal basket structure is compact, occupies little space, and thus imposes minimum drag upon the ship. It is part of the cathodically protected structure of the corrosion prevention system and is therefore not subject to corrosion.

The anodes carried in the present structure may be quickly and expeditiously replaced without disconnection of wires or rods or the like, and the removal is so readily accomplished that a diver may install or remove anodes without any necessity for dry docking the ship. Partially consumed bits of anodic material may be left in the metal basket until completely consumed, and fresh anode material added to the anode storage compartment of the present anode mounting apparatus.

It is to be understood, of course, that the description of the present invention with reference to a ship, and particularly to a wooden ship, is not intended to be limiting since the apparatus is readily adapted for use in a wide variety of applications wherein the advantages herein described are desired. The apparatus when used with steel ships, for example, may be carried along the sides of the hull on the rolling chocks or bilge keels, or wherever else is convenient. In steel barge installations the apparatus may be conveniently carried adjacent the side of the hull of the barge and below the side
guards. Thus, it will be apparent that the manner of mounting the anodes, and not the mounting of the apparatus in any particular location, is what is important. Further, the invention may be used to mount anodes made of magnesium or any of the various other sacrificial materials, and the particular shape of such anodes is not critical. It is therefore an object of the present invention to provide a unique anode mounting apparatus which is characterized by the ready accessibility of the anode or guards. Thus, it will be apparent that the manner of mounting the anodes, and not the mounting of the apparatus in any particular location, is what is important. Further, the invention may be used to mount anodes made of magnesium or any of the various other sacrificial materials, and the particular shape of such anodes is not critical.

It is therefore an object of the present invention to provide a unique anode mounting apparatus which is characterized by the ready accessibility of the anode or guards. Thus, it will be apparent that the manner of mounting the anodes, and not the mounting of the apparatus in any particular location, is what is important. Further, the invention may be used to mount anodes made of magnesium or any of the various other sacrificial materials, and the particular shape of such anodes is not critical.

Another object of the invention is the provision of a novel anode mounting apparatus which is comparatively compact, adapted for external mounting upon a ship's hull, and rugged in construction.

A further object of the invention is to provide an improved anode mounting structure wherein there is embodied a metal grid upon which the anodes may rest or be brazed and which provides electrical contact between said anodes and the circuit of a corrosion prevention system.

Another object of the invention is to provide a novel anode mounting apparatus for shipboard use, and which is accessible to a diver for insertion and removal of anodes without the use of cutting torches or the like.

A still further object of the invention is the provision of an improved anode mounting apparatus which embodies a metallic storage tray which is within the protection of a cathodic protection system and which forms a part of the electrical circuit of such cathodic protection system.

Another object of the invention is to provide a novel anode mounting structure which is simple and economical in manufacture and adapted to efficiently support and carry anodic material for use in a galvanic corrosion prevention system.

Other objects and features of the present invention will be readily apparent to those skilled in the art from the following specification and appended drawings wherein is illustrated a preferred form of the invention, and in which:

Figure 1 is a perspective view of the anode mounting apparatus of the present invention mounted upon the transom of a wooden vessel, which is indicated only partially for brevity;

Figure 2 is a front elevation view of the mounting apparatus, looking toward the stern of the vessel;

Figure 3 is a view taken along side III—III of Figure 2; and

Figure 4 is a partial detail front elevation view of the structure shown in Figure 3;

Figure 5 is a view taken along line V—V of Figure 4; and

Figure 6 is a detail cross-sectional view of the closing strap of the basket assembly.

The description hereinafter made will be directed to an embodiment of the anode mounting apparatus of the present invention which is particularly adapted for use in connection with the cathodic protection system of a wooden ship. However, it is to be understood that this is merely illustrative and not intended to limit the scope of the present invention. Thus, for example, if the apparatus of the present invention were used on a metallic structure such as a hull, and direct coupling of the anodes thereto was not desired, such apparatus could of course readily be insalubrately mounted to the hull in contrast with the direct attachment herein described.

Referring to the drawings and particularly to Figs. 1 and 2, there is illustrated an anode mounting structure or apparatus 11 which is rigidly secured to and carried by the transom 12 of a wooden ship 13, only a portion of ship 13 being illustrated for reasons of brevity. Apparatus 11 is carried below the waterline of ship 13, and is preferably mounted at substantially a right angle to the inwardly inclined face of transom 12 whereby a desirable upwash of water is carried through apparatus 11.

Apparatus 11 comprises, generally, a comparatively sturdy wooden support or upper member 14, which is disposed across the rear of the transom 12 from one side of ship 13 to the other; a grid, tray or basket assembly 15 in vertically spaced relationship beneath upper member 14, substantially coextensive therewith, and adapted, as best illustrated in Figures 4, 5 and 6, to support plurality of anodes 16; a plurality of vertically spaced wooden blocks 17 along the lengths of upper member 14 and basket assembly 15 and serving to maintain the vertically spaced relationship therebetween; a pair of formed end blocks 18 and 19, Figures 1 and 2, which also serve to space member 14 and assembly 15, and which additionally function as end fairs for guiding the end contours of apparatus 11 into the hull configuration of ship 13; and a closing element or strap 21 which is disposed transversely across and substantially coextensive with member 14 and assembly 15, strap 21 serving to assist in maintaining anodes 16 in position within basket assembly 15.

Upper assembly or support 14 provides the primary support for apparatus 11, support 14 being rigidly secured at spaced intervals along its length to a plurality of transom frames 22, best viewed in Figures 3 and 5, by a plurality of support bolts 23. Bolts 23 are such counterbored within the face of support 14, disposed therethrough, and next disposed through planking 24 and a frame 22 or other suitable structure of transom 12. Bolts 23 are secured in position by nuts 25, as illustrated and the counterbored holes therefor in the face of support 14 are preferably filled with usual wooden plugs.

Support 14 includes a steel strip or facing 26 which is secured along its length to support 14 to provide a bumper or wearing surface for apparatus 11, the lower portion of apparatus 11 thus being protected from rough handling and the like. The ends of support 14 are faired, as illustrated, to conform with the shape of the hull of ship 13 and also provide a workman-like appearance.

Basket assembly 15 which is located beneath upper assembly 14 includes a series of transversely spaced horizontal metallic plates or sections 27, Figure 3, which are in vertical alignment with blocks 17 and with end blocks 18 and 19. Sections 27 are welded or otherwise integrally connected to an adjacent one of a plurality of metal basket or grid sections 28, Figure 5, located between sections 27 so that sections 27 serve to electrically interconnect sections 28.

Sections 28 are each designed to support and carry an anode 16, and it will be apparent that as the anodes 16 are expended they will sink into the grid or expanded metal construction of sections 28, constantly maintaining good electrical contact therewith. Bias means (not shown) may even be provided if desired to assure that anodes 16 are urged into electrical contact with basket assembly 15. The expanded metal construction for sections 28 is preferred since the fabrication of expanded metal inherently forms high and low points, and the high points act in an abrading manner, scraping away calcareous deposits which may form on the anode exterior to thereby assure good electrical contact with the anode.

Sections 28 have been satisfactorily fashioned of one eighth inch gauge expanded to form one inch openings, although other thicknesses and sizes will also operate acceptably.

To provide a sturdy enclosure for anodes 16, assembly 15 also includes an inner plate 29, Figure 3, and an outer plate 31, which plates are vertically disposed and substantially coextensive with the assembled combination of metallic and grid sections 27 and 28. Plate 29 is welded to sections 27 and 28 for rigidity, and thus takes the brunt of any damage which might otherwise occur to transom 12 by reason of movement of anodes 16. Further, plate 29 is secured to transom planking 24 by a plurality of screws 32,
plate 31 is secured to blocks 17, 18 and 19 by a plurality of screws 33, Figure 4. Plate 31 acts as a lip to prevent anodes 16 from sliding off grid sections 28.

Blocks 17 are rigidly secured in position by a plurality of long bolts 34 which are disposed upwardly through sections 27 of basket assembly 15, through blocks 17, and thence through upper member 14. The openings therefor in member 14 are preferably closed by usual wooden plugs. Blocks 17 thus serve to support basket assembly 15 and also serve to transversely space apart the anodes 16 carried by assembly 15. In addition, blocks 18 and 19 are secured to ship 13 by horizontally disposed bolts (not shown) which are substantially similar to bolts 23.

Closing strap 21 is removably secured by a plurality of screws 36 to blocks 17, 18 and 19, and serves to prevent anodes 16 from turning outwardly and falling out of basket assembly 15, strap 21 being designed to be readily removable to thereby permit easy installation and removal of anodes 16.

In order to reduce the amount of calcareous material collecting on certain of the metallic elements of apparatus 11, such elements, namely strap 21, inner plate 29 and outer plate 31, are preferably coated with a relatively impervious material 41, such as glass fiber impregnated with synthetic resins, as illustrated in Figure 6, for example.

A copper strap 37, Figures 1 and 2, is suitably secured at one end to facing 26, and at the other end to a grid section 28 so that a galvanic couple may be established therebetween to provide cathodic protection for facing 26.

An electrical conductor or copper bus bar 38, Figure 3, preferably tapped to reduce calcareous deposits, is rigidly secured, as by welding or silver-soldering, between one of grid sections 28 and a suitable through-hull fitting 39, so that fitting 39 acts as the anode terminal of the sacrificial anode system of ship 13. As is well known, such a system also includes a cathode terminal, which may be the hull itself in the case of a metallic hull, and an electrical circuit between such terminals, the circuit conventionally including variable terminals, the circuit conventionally including variable resistance means to permit adjustment of the level of cathodic protection provided by the anode array.

The construction of the apparatus 11 above described thus provides a structure for mounting anodes 16 in a manner readily permitting installation and removal of such anodes 16, as desired, without the necessity of having to assemble or dismantle semi-permanent electrical connections to the anodes 16.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

1. In combination, a floating hull anode mounting apparatus secured to the exterior of the hull below the water level, said anode mounting apparatus comprising a substantially horizontal tray of conducting material secured to the vessel, a plurality of block-like anodes loosely resting on the tray and detachable means secured to the tray for retaining said anodes on said tray, said detachable means permitting insertion of the anodes onto the tray, the anodes being free to rest on the tray at all times so that they are continuously in contact with the tray as they are consumed.

2. A combination as in claim 1 together with a bumper block mounted on said hull above the tray and extending at substantially right angles from the portion of the hull to which it is secured and wherein said tray is suspended from said bumper block, said bumper block serving to protect said tray from damage.

3. In combination, a floating hull, a bumper block mounted on said hull above the tray and extending at substantially right angles from that portion of the hull to which it is secured, and anode mounting apparatus secured to the hull below said bumper block, said anode mounting apparatus comprising a substantially horizontal tray of conducting material, means for suspending said tray from said bumper block, a plurality of block-like anodes loosely resting on the tray and detachable means securing to the tray and disposed between said tray and the bumper block, said detachable means permitting insertion of the anodes onto the tray, the anodes being free to rest on the tray at all times so that they are continuously in contact with the tray as they are consumed.

References Cited in the file of this patent

UNITED STATES PATENTS

387,145 Clamer November 25, 1888
872,759 Schoneberger et al. December 3, 1907
2,485,684 Aldridge October 25, 1949
2,633,906 Bitzer September 29, 1953
2,666,026 Gibbs January 12, 1954

FOREIGN PATENTS

749,636 France May 8, 1933

OTHER REFERENCES