

Feb. 27, 1973

I. GELD

3,718,570

CATHODIC PROTECTION ANODE WITH SECTIONS REPLACEABLE UNDERWATER

Filed June 1, 1970

3 Sheets-Sheet 1

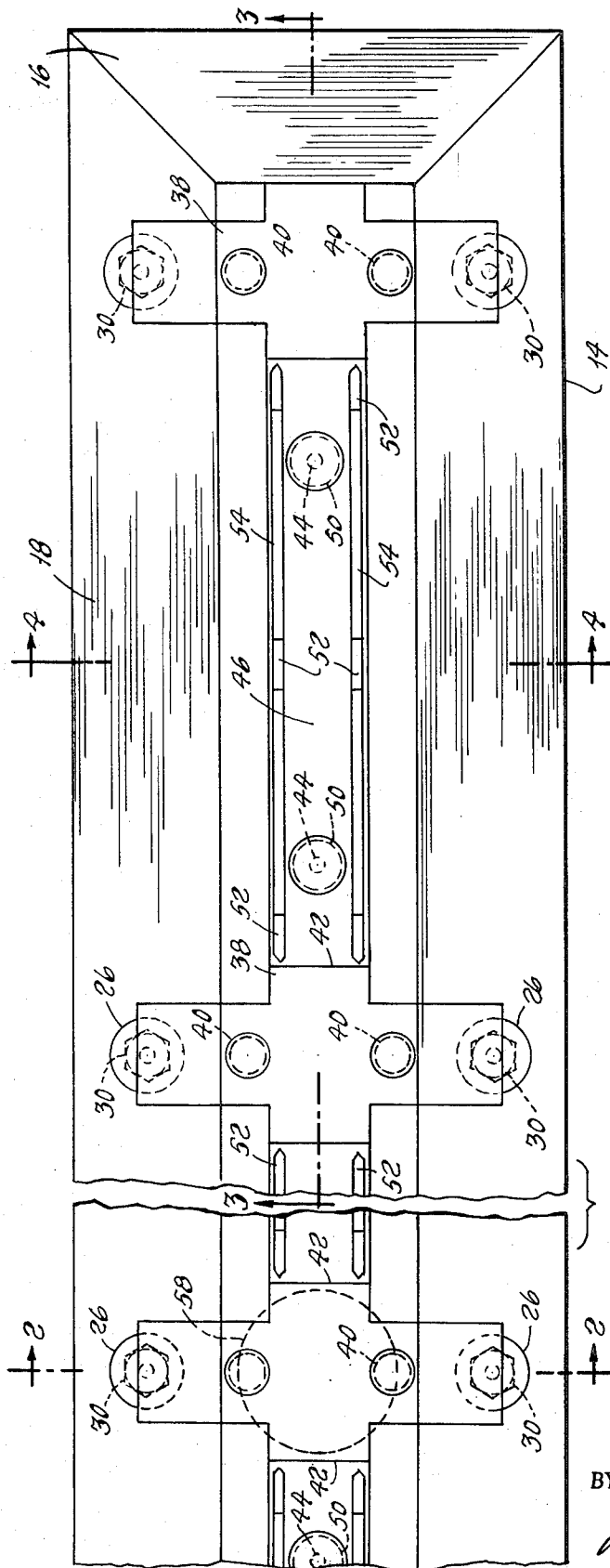


Fig. 1

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3 Sheets-Sheet 2

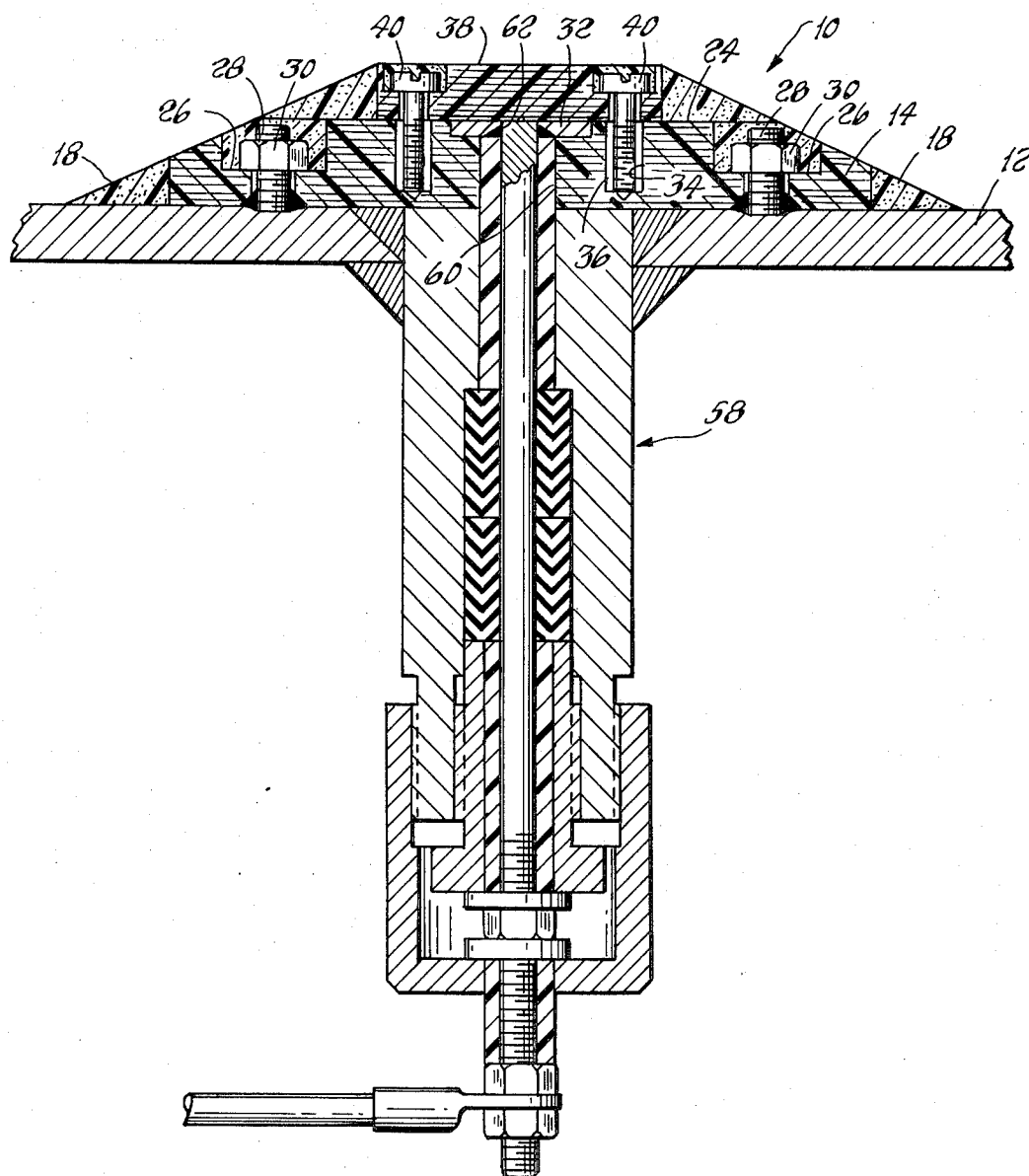


Fig. 2

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3 Sheets-Sheet 3

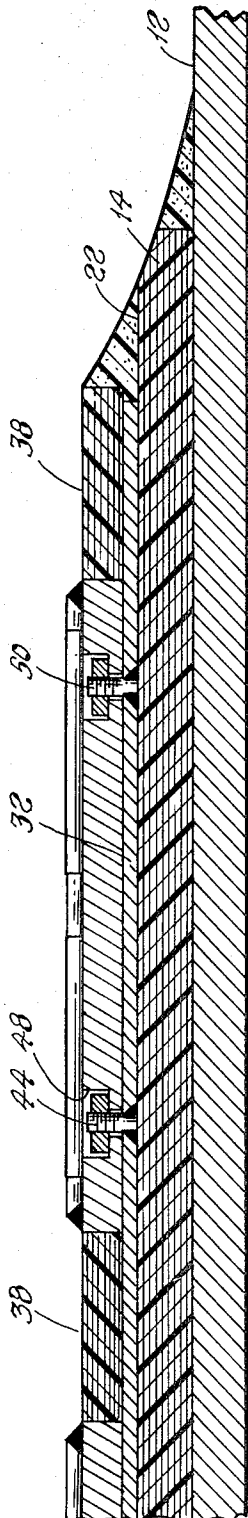


Fig. 3

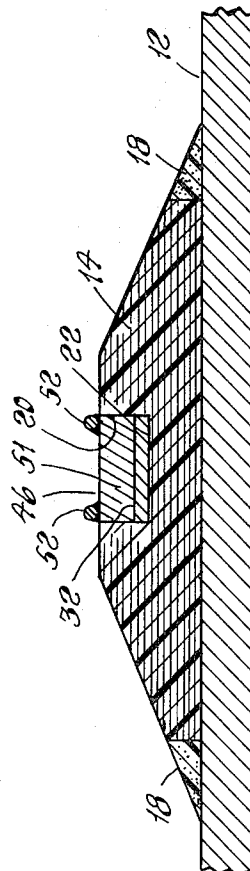


Fig. 2

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CATHODIC PROTECTION ANODE WITH SECTIONS REPLACEABLE UNDERWATER

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U.S. Cl. 204—196

1 Claim

ABSTRACT OF THE DISCLOSURE

An impressed current anode assembly for cathodic protection that includes several anode sections clamped to a bus conductor in the assembly. Each anode section is separable from the anode assembly and replaceable by a scuba diver equipped with simple hand tools.

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

Cathodic protection impressed current anodes of carbon, lead-silver alloy, platinum-clad tantalum and other commonly used materials are well known in the art. The platinum clad anodes are functionally superior to anodes of other materials but are substantially more expensive. Damage to anodes results from electrochemical dissolution, abrasion and impact. Additionally, clad anodes, particularly platinum clad anodes are damaged by peeling of the cladding. Anodes could not be replaced underwater. Replacement was carried out in drydock. When replaced, they had to be replaced in toto though damage or deterioration may have been partial. The expense of full replacement of platinum clad anodes, plus the loss of function of some ship's anodes while at sea, plus the cost of removal and replacement of anodes in drydock has been a problem.

SUMMARY OF THE INVENTION

This invention concerns underwater replacement of damaged or eroded anode sections while the ship is afloat and eliminating the expense of replacing an entire anode. The anode assembly includes a bus conductor against which are clamped a number of separate identical anode sections, each of which can be unclamped and re-oriented for more uniform electrochemical dissolution, several of which can be removed and their positions interchanged, each of which can be removed and replaced underwater without disturbing watertight integrity of the hull and without preparation of the anode structure prior to receiving replacement anode sections. The use of anode sections introduces a high degree of flexibility in anode design. Also, the use of small sections makes cladding unnecessary; platinum wire or platinum-clad wire is secured to the periphery of the small anode sections. The advantage of platinum cladding on tantalum, titanium, or niobium are realized at much lower cost using smaller anode sections compared to the cost of a completely platinum-clad surface of a full anode.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of an embodiment according to this invention;

FIG. 2 is a section taken on the line 2—2 of FIG. 1;

FIG. 3 is a section taken on the line 3—3 of FIG. 1; and

FIG. 4 is a section taken on the line 4—4 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIGS. 1-4 a cathodic protection anode assembly 10 affixed against a steel hull 12 of a ship. The anode assembly is carried by a rectangular mounting plate 14 of impregnated fiber glass laminate or any other material that is nonconductive and generally stable and inert in seawater. The outer side of the mounting plate is graded at the ends and sides as at 16, shown in FIG. 1 and along the sides 18, as shown in FIG. 4. A longitudinal channel 20 is molded or cut into the outer face of the mounting plate. The channel 20 has a flat bottom 22 and extends for essentially the entire length of the mounting plate. Severally equally spaced transverse channels 24 are formed out cut into the face of the mounting plate but of somewhat lesser depth than the longitudinal channel 20. Counterbored holes 26 are formed on the mounting plate at opposite ends of the transverse channels 24. Threaded studs 28 shown in FIG. 2, welded to the hull 12, register with the counterbored holes 26; nuts 30 are assembled onto the studs 28 fastening the mounting plate against the hull.

A bus strip 32 of tantalum, titanium, niobium or other suitable metal non-corrosive in seawater is nested on the bottom of the longitudinal channel 20 and is approximately coextensive with the flat bottom of the channel. The thickness of the bus strip is essentially equal to the difference in depth between the bottom 22 of the channel 20 and the bottom of transverse channels 24. Holes 34 are formed in the bottom of each transverse channel of the mounting plate and an internally threaded slave 36 is force fitted into each hole 34. A bus strip retainer 38 of the same material as the mounting plate or other suitable insulating material is secured in place with machine screws 40 in each transverse channel 24 to clamp the bus strip. The retainers have side projections 42 intermediate the ends and that extend into the longitudinal channel 20 of the mounting plate.

Threaded studs, 44, preferably of the same metal as the bus strip, are welded to the bus strip and project outward from the upper face of the bus strip. Detachable anode sections 46 of the same width as the channel 20, of length equal to the space between retaining strips 38 and having counterbored holes 48 for registration with studs 44 is nested in the channel 20 of the mounting plate and clamped with circular nuts 50 threaded onto the studs 44 of almost the diameter of counterbores 48 and formed with holes, not shown, to be engaged by a spanner wrench. The thickness of each anode section 46 plus the thickness of the bus strip 32 is essentially equal to the depth of the channel 20 in the mounting plate. Each anode section includes a bar 51 of tantalum or other suitable material that carries a pair of rods 52 along its side edges. The rods 52 each have a core of the same material as the rest of the anode section and are clad with thin sleeves 54 of platinum swaged to the rods. The ends of the rods are welded to the bar 51. The center portion of each rod may be welded also if the rods are too long to be supported adequately at the ends only.

All cavities except counterbores 48 may be filled with epoxy cement or other suitable filler material for shielding against erosion and for eliminating turbulence. The ends of the longitudinal channel and transverse channels as well as the perimeter of the mounting plate are filled, faired, and graded with the same filler material. Each of the anode sections are removable and reversible 180 degrees, or interchangeable with another anode section, or replaceable with another anode section by a scuba-equipped swimmer provided with a spanner wrench or a

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pneumatic motor of the type used for changing a tire for rotating the spanner tool.

Anode sections having configurations other than rectangular as shown in the drawing are contemplated within the scope of the invention. The anode sections may be circular, polygonal or of other design.

Watertight connection through the hull to a current supply is provided by any suitable construction known in the art. A construction as shown in FIG. 2 or a construction disclosed in U.S. Pat. 3,133,873 or other suitable hull penetrating watertight electrical connections for impressed current anodes may be used. To accommodate the anode assembly to the power connection 58, the mounting plate is formed with a hole 60. The power connection assembly is in place in the hull when the mounting plate is secured to the hull. The bus strip 32 has a hole 62 to receive the tip of the power supply conductor. After the bus strip is nested in the channel of the mounting plate, the tip of the conductor is welded in the hole 62. Then the retaining strips and anode sections are assembled in place. Epoxy or other filler material is applied where indicated in the figures. Removable protective caps, not shown may be pressed in place over each screw 40.

Cost, simplified maintenance, expeditious correction of faults as well as other advantages are realized by this invention.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

I claim:

1. In combination with a ship having a steel hull, an anode assembly secured to the hull, such assembly including

a plurality of identical paralleled anode elements, each of which is removable independently of the other and replaceable under water,

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each anode element including a rectangular bar and a comparatively thin rod of the same material as the rectangular bar welded to an edge of the exposed face of the rectangular bar and wherein

the thin rod is at least partially clad with a thin platinum sleeve,

a mounting plate of a material that is electrically nonconductive and essentially stable in seawater,

a bus conductor,

said mounting plate being formed with a channel in the side remote from the hull and in which said bus conductor is recessed and secured,

said plurality of anode elements being separately attached and clamped to said bus conductor, nested in said channel in butting engagement with said bus conductor and individually detachable and replaceable underwater, and

a power supply connection extending through the hull to the anode assembly and electrically joined to said bus conductor.

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REUBEN EPSTEIN, Primary Examiner

U.S. Cl. X.R.

204—290 F