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[54] ANODE SYSTEM FOR CATHODIC PROTECTION OF STRETCHED CHAIN

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy**

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[52] **U.S. Cl.** **204/197**

[51] **Int. Cl.** **C23f 13/00**

[58] **Field of Search** 204/148, 197

[56] **References Cited**

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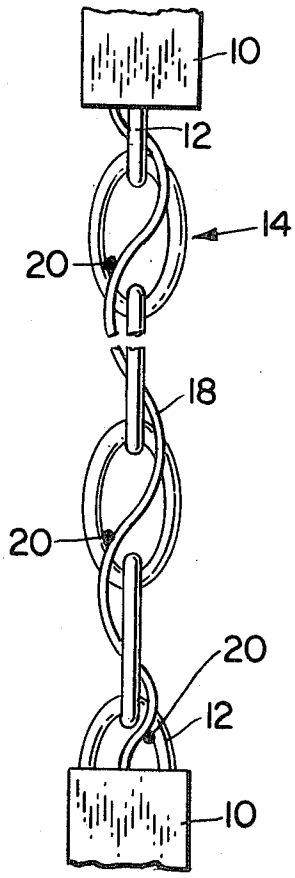
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[57] **ABSTRACT**

The invention comprises cathodic protection against corrosion of stretched chain immersed in an electrolyte (sea water) in which sacrificial anodes of pure zinc are cast onto independent and spaced links of the chain. In order to ensure electrical continuity between adjacent links, a cable may be stretched therealong connecting each link to the spaced anodes. Thus when the chains are positioned in water having a high conductivity, e.g., sea water, the sacrificial anodes are consumed and an electrical current passes along the chain links so as to produce electrical potential and cathodically protect the chain from corrosion.

1 Claims, 3 Drawing Figures



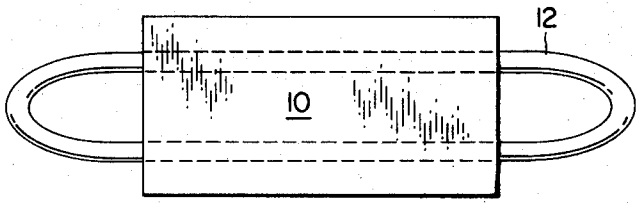


Fig. 1

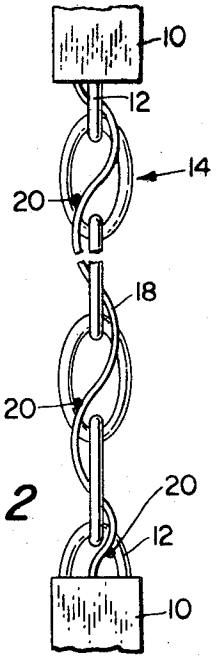


Fig. 2

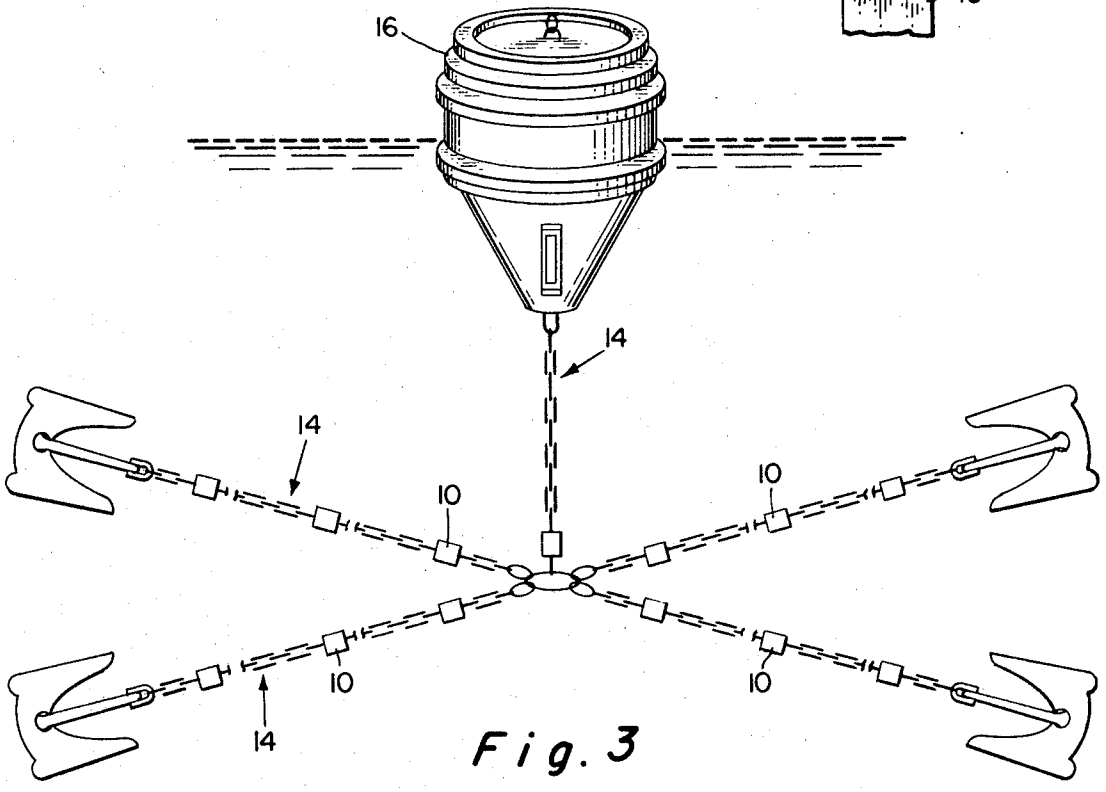


Fig. 3

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ANODE SYSTEM FOR CATHODIC PROTECTION OF STRETCHED CHAIN

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 in general to protection against the effects of corrosion. More particularly the invention relates to cathodic protection of stretched chain by the use of zinc sacrificial anodes to create a countercurrent sufficiently large to neutralize the currents responsible for corrosion.

2. Description of the Prior Art

Cathodic protection was originally used in the early part of the nineteenth century to thwart the effects of corrosion on the copper sheeting of ships. However it has only been within recent ears that this technique has been employed with any great success due primarily to enhanced understanding of the principles involved in the concept.

Although the prior art is fairly replete with work relating to cathodic protection of steel structures, such new concepts involve primarily only minor variations in design of anode configuration or suspension systems. There is nothing in the prior art which is applicable to cathodic protection of chain with its inherent difficulty in maintaining electrical continuity between adjacent links.

SUMMARY OF THE INVENTION

The present invention comprises the use of pure zinc anodes as integral parts of stretched chains, (buoy chains, anchor chains, etc.) so that cathodic protection may occur for benefit of the chain when it is immersed in an electrolyte (i.e., water). A suitable cable may be woven throughout the chain and attached thereto to ensure continuous electrical continuity between adjacent links.

STATEMENT OF THE OBJECTS OF THE INVENTION

It is an object of the present invention to provide a chain construction which is resistant to the effects of corrosion when immersed in water.

A further object is to provide a chain construction in which anodic zinc metal is an integral part of spaced individual links.

Another object is to provide a chain assembly of the character described which has a metal wire extending throughout the length thereof to assure continuous electrical connection between the chain links.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a view of one chain link having a zinc anode cast thereon.

FIG. **2** is a view of a chain in which zinc anode links are incorporated as an integral part thereof and with an electrically conductive cable extending the length of the chain and attached at intervals to the chain links.

FIG. **3** is a diagrammatic view of a buoy chain incorporating spaced anodic links.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Corrosion has been defined as destruction of metals by interaction with the environment and is a neutral cycle of events in which metals tend to return to the state from which they had originally come. Thus, since most metals are extracted from ores, corrosion will return them to their stable original state. Only the noble metals such as gold and silver are found in the metallic state in nature and are resistant to corrosion.

It is well known that the primary method by which metals are dissolved in water is electrochemical in nature and is basically a chemical reaction in which the passage of an electric current occurs. Therefore a potential difference must exist between one part of the structure and another and the reaction in the region of the lower anodic potential is the dissolution of metal in the form of ions.

There are many diverse methods for combating such corrosion and primary among these is the technique of cathodic protection. As is well known, cathodic protection is employed in protecting metals in watery environments and comprises the utilization of a counter electrical current large enough to neutralize the electrical currents which caUse corrosion. In such a technique, the surface which had been corroding becomes a cathode and the anodic process occurs on an auxiliary anode. The counter electrical current is effected by one of the electronegative elements such as magnesium, aluminum or zinc which forms the sacrificial anodes.

The present invention while utilizing cathodic protection technique employs novel structure in the stretched chain construction which is a necessary element in buoys, anchors, mines, etc. Referring now to the drawings, there is shown a high purity zinc anode casting **10** on an individual steel chain link **12**. This zinc anode may become an integral part of a chain such as the chain **14** attached to buoy **16** as shown in FIG. **3**. There may be a multiplicity of anodes **10** utilized in the chain **14** depending on the need for adequate current distribution to assure the maintenance of the electrical potential at a required value. Zinc is the preferred sacrificial metal since it provides a smaller potential difference and is more economical and efficient than other metals. Furthermore zinc anodes are largely self-controlling since the resistance is primarily controlled by the resistance at the surface of the protected metal (i.e., cathode) and the electric current output will vary according to the requirements of the cathode. Zinc also provides an even current distribution, lasts indefinitely and requires little, if any, maintenance. However, the use of other metals as sacrificial anodes is not excluded and they may also be employed if so desired. For example, magnesium anodes may be used if the resistance is fairly high and a high potential is necessary for adequate protection. Various alloys may also be employed. These may include a magnesium, zinc and aluminum combination or a combination of aluminum and calcium. Other alloys may similarly be used if desirable.

While steel is the preferable metal used in the manufacture of the chain links, obviously such links may also be constructed of any other suitable metal.

In order to ensure electrical continuity along the chain length for complete protection, a steel cable **18** may be woven through the chain **14** along its entire length and be secured to the chain links at intervals **20** by means of low electrical resistance devices such as by welding or by metal clamps.

Thus the chain **14** which had been corroding as an anode now becomes a cathode and the more electronegative zinc metal becomes the sacrificial anode **10**. The chain **14** will, therefore, be cathodically protected.

It should be pointed out that by painting the chain **14** the demand on the sacrificial anode is reduced thereby increasing anodic life and substantially decreasing replacement cost.

We claim:

1. In combination with stretched chain for utilization in aqueous environments, the improvement in cathodic protection comprising:

a metal anode located on said chain and having a higher electronegative value than the interconnected links of the chain, and;

a wire which is woven throughout the length of the chain, said wire being attached to each link to provide a low-resistance metal contact thus effecting a countercurrent through the length of the chain and providing adequate cathodic protection thereto.