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CORROSION PREVENTING ELECTRODE

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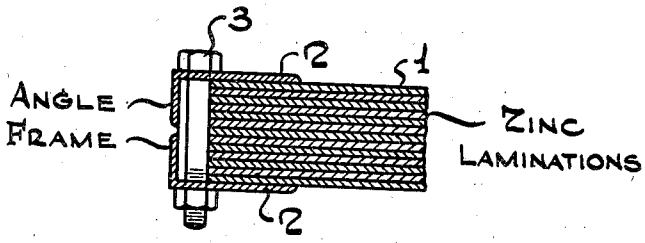

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CORROSION PREVENTING ELECTRODE

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5 Claims. (Cl. 204—148)

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This invention relates to the electrolytic protection of metallic surfaces against corrosion, and more particularly, it relates to an improved electrode for use in connection with such an electrolytic system.

In many solutions the corrosion of the common structural metals is associated with the flow of electric currents between various parts of the metal surface. In the case of ordinary carbon steel, the current flow is proportional to the rate of corrosion. In other words, the corrosion of common metals in solutions is electrochemical in nature rather than a simple dissolution or chemical action.

One of the principal ways by which this action occurs is through the dissimilarity of two metals in electric contact in an electrolyte. This action results from the fact that any metal, when submerged in an electrolyte, tends to assume a potential with respect to the electrolyte. This potential is called "solution potential" and every kind of metal has a definite and consistent solution potential. If two metals with different solution potentials are placed in contact with an electrolyte and also are connected through a metallic circuit, an electric battery cell is formed and current will flow impelled by a voltage equal to the difference between the solution potentials of the two metals. This current will flow through the electrolyte from the metal with a greater solution pressure, to the metal with the lesser solution potential. This current flow is accompanied by the movement of anions through the electrolyte to the less noble metal and the movement of hydrogen ions to the more noble metal where hydrogen may be liberated from the electrolyte.

It has been found that saline waters have a very great corrosive action on ordinary iron or steel tanks or other apparatus. This is particularly true in the case of cargo tanks in tankers during the ballast voyage. The oil tanks in these tankers are usually filled with sea water as ballast to take the place of the oil carried on the outgoing voyage. The salts contained in the sea water are particularly active in attacking the metal of the tanks. Furthermore, the ferrous products of corrosion themselves hasten the corroding action, because these products set up new galvanic couples with the surfaces of the tank on which the products of corrosion accumulate.

The purpose of electrolytic protection is to provide an artificial current which overcomes the small circulating current preventing or extinguishing the anodic areas and rendering most or all of the metallic areas cathodic. This can be

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done by providing artificial electrodes of a less noble metal whose solution potential is greater than that of the metal to be protected. Among the common metals whose solution potentials are greater than that of iron may be mentioned zinc and aluminum. Of these, zinc is preferred for the present process and apparatus as it is cheaply obtained, easily worked, and is in other respects particularly adapted to the present invention.

The use of zinc for the galvanic protection of ferrous objects against corrosive action of liquids is not broadly new. For example, one method of protection consists in suspending one or more bars of cast zinc in the corroding medium while maintaining the other end of the bars in direct metallic contact with the ferrous surface to be protected. This method of using cast zinc possesses the disadvantage that the surface of the zinc becomes badly pitted and is soon covered with a hard cement-like coating formed from the products of corrosion of the zinc. This gradually reduces the efficiency of the electrode and necessitates manual cleaning which is almost impossible due to the tenacity with which the scale adheres to the surface of the zinc. Furthermore, when the method is applied to cargo tanks the mechanical cleaning of the electrodes is even more expensive and often not feasible. Either the electrodes must be built very light and small so that they can be readily removed from the tank, or the cargo tanks themselves must be completely freed from gas so as to permit a man to enter the tanks and clean the anodes manually. Either of these expedients is difficult and inefficient as the cleaning must be done at comparatively short intervals. Furthermore, the electrodes may be inaccessible and time may not be available for the necessary gas freeing.

It is therefore one object of this invention to provide an improved electrode of a metal less noble than that to be protected which electrode can be used for long periods without replacement and without cleaning which will provide the maximum amount of protection per unit weight of zinc.

Thus this invention will provide an efficient method for the electrolytic protection of the interior of cargo tanks in seagoing oil tankers during the ballast voyage.

Referring to the drawing, the electrode according to the present invention comprises a plurality of thin sheets of zinc foil 1 held together mechanically with no binding material between the layers. The individual zinc foils should be very

thin, ranging in thickness between 0.014'' and 0.0014'', preferably about 0.01''.

Several sheets may be held together by a framework of any suitable material that is not less noble than the material used in the electrode sheets. Steel angles **2** and bolts **3** may be used to form the holding frame. The edges of the thin sheets should preferably be protected wth an insoluble coating of lacquer or varnish. In operation, the electrolyte will first attack the two outside sheets. As these are eaten away they become perforated and the next sheets are exposed and attacked in turn. The formation of scale between the outer layers of sheets and the perforations in the outer sheets combine to remove the remaining portions of the outer sheet in an exfoliating action which is progressive through the layers of thin sheets. This action will continue through the several layers of foil until practically the entire electrode is consumed.

It is therefore obvious that by this invention an electrode which will remain uniformly active throughout its life can be provided in a galvanic system for the electrolytic protection of metallic surfaces by utilizing as an electrode a multiplicity of thin sheets of a metal which is less noble than the metal to be protected, and which sheets or foils are held together mechanically with no binding material between them. It is also obvious that the electrode forming the subject matter of this invention is self-cleaning and no adjustment is needed until it is necessary to completely replace the anode.

This invention has been described in reference to the protection of tanks in seagoing oil tankers, but it should be understood that the novel electrode herein described is suitable for a great many other industrial applications. For instance, aluminum tanks used for crystallizing tartaric acid from solutions can be protected by a galvanic method using the laminated electrode of the present invention. Storage tanks, boiler and refinery equipment, cast iron gas coolers, condensers, power plant equipment and, in general, any metal subject to the corrosive action of an electrolyte can be protected in a like manner.

The nature and objects of the present invention having thus been set forth and a specific illustrative embodiment of the same given, what is claimed as new and useful and desired to be secured by Letters Patent is:

1. A method for protecting a tank composed of a metal more noble than zinc against the corroding influence of solution contained therein which cause adherent scale formation on zinc which comprises immersing in said solution a plurality of superimposed layers of zinc foil electrically connected to said metal tank and having a thickness between 0.004'' and 0.014'' whereby the corrosion of the exterior layers of zinc results in the exposing of succeeding layers of zinc.

2. A method for protecting a tank composed of a metal more noble than zinc against the corroding influence of solution contained therein which cause adherent scale formation on zinc which comprises immersing in said liquid a plurality of superimposed layers of zinc foil electrically connected to said tank and having a thickness of 0.01'' whereby the corrosion of the exterior layers of zinc results in the exposing of succeeding layers of zinc.

3. A device for protecting iron and steel tanks against the corroding influence of solutions contained therein which cause adherent scale formation on zinc comprising a laminated, protective zinc plate immersed in said liquid the individual laminations having a thickness between 0.004 and 0.014, and connected to said tank by means of suitable conductors whereby an electrical circuit is completed, said layers of zinc being adapted upon corroding to expose fresh surfaces.

4. A device for protecting iron and steel tanks against the corroding influence of solutions contained therein which cause adherent scale formation on zinc comprising a plurality of layers of zinc foil, each having a thickness between 0.004'' and 0.014'', and a reinforcing frame for said plurality of layers of zinc foil, said layers of foil being connected to said tank by means of suitable conductors whereby a galvanic circuit is completed, said zinc foils being adapted upon corrosion to exfoliate and expose fresh surfaces of zinc foil to the action of said saline liquid.

5. A device for protecting iron and steel tanks against the corroding influence of solutions contained therein which cause adherent scale formation on zinc comprising a plurality of layers of zinc foil, each having a thickness of 0.01'', and a reinforcing frame for said plurality of layers of zinc foil, said layers of foil being connected to said tank by means of suitable conductors whereby a galvanic circuit is completed, said zinc foils being adapted upon corrosion to exfoliate and expose fresh surfaces of zinc foil to the action of said saline liquid.

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