

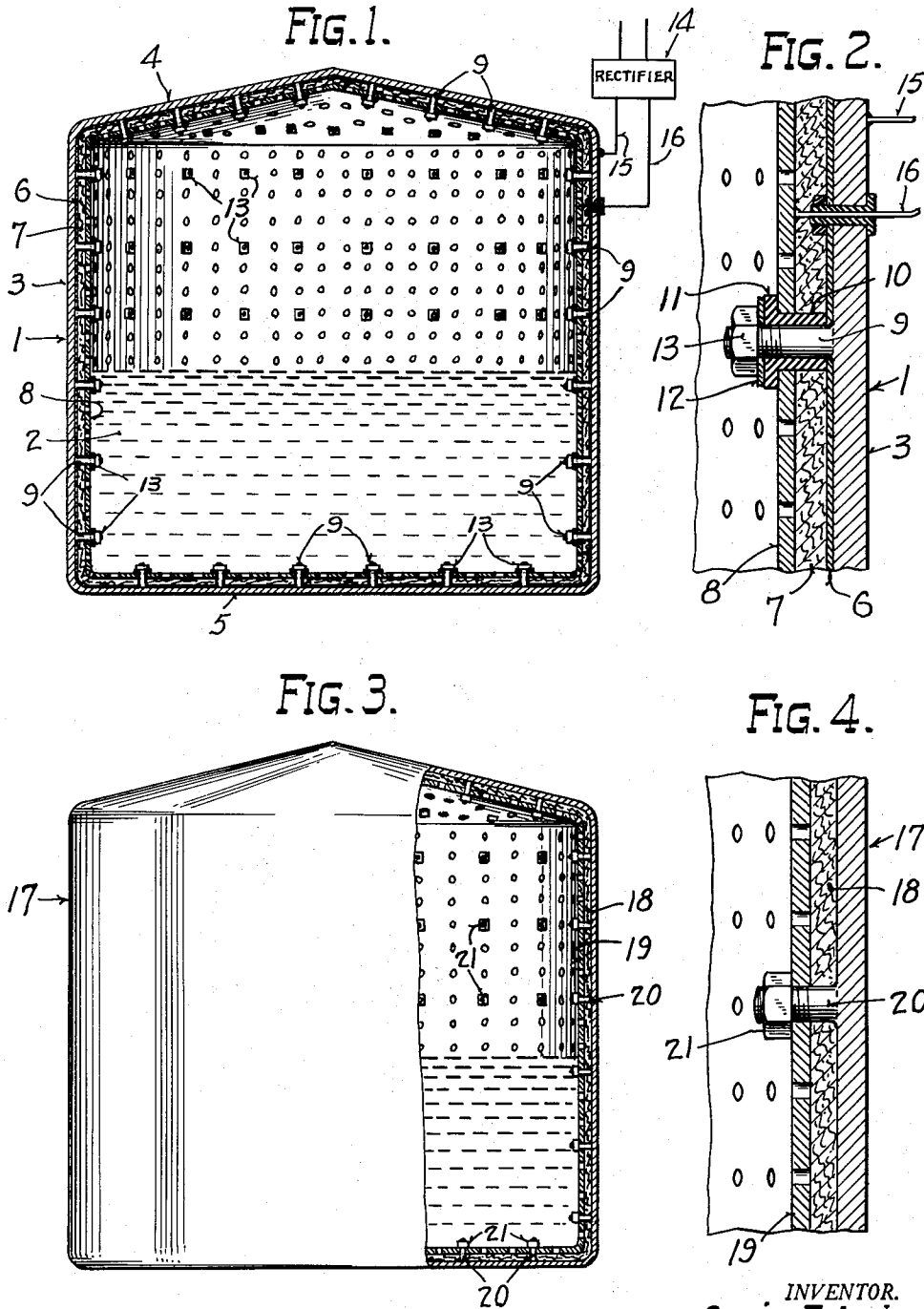
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CATHODIC PROTECTION OF METAL IN VAPOR SPACE

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CATHODIC PROTECTION OF METAL IN VAPOR SPACE

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This invention relates to cathodic protection of metals to prevent corrosion thereof and more particularly to cathodic protection of metal articles which are normally exposed to corrosive condensate in a vapor region, or exposed to a liquid spray.

As cathodic protection of metal surfaces to prevent corrosion thereof is dependent upon ionized liquids, its application was heretofore limited to situations wherein the metal surface to be protected was submerged in an electrolyte or the surface was in contact with a substance, such as earth or soil, bearing an electrolyte. Surfaces in contact with vapors have not been protected cathodically in a commercial manner.

The present invention is directed to a means of cathodically protecting metal surfaces which are in contact with a vaporous medium that is capable of conducting an electric current when condensed. To carry out the invention, the metal surface to be protected is initially coated with an absorbent material such as felt, asbestos fiber, or the like. An expendable perforated metal liner is applied to the coated surface with the intermediate absorbent coating serving to separate one metal surface from the other.

The corrosive condensate in the vapor region passes between the liner plates and is absorbed in the insulating coating to form an electrolyte therein.

Corrosion of the expendable liner may then be promoted by either applying a low voltage current to the unit with the liner being made the anode and the surface to be protected, the cathode, or secondly, by employing a metal which is anodic to the surface to be protected as the liner and providing electrical contact between said surface and the liner, such as by a number of retaining studs.

One object of the present invention is to provide an effective means of cathodically protecting a metal surface in contact with a vaporous medium which is capable of conducting an electrical current when condensed.

Another object of the invention is to provide an electrolyte in the vapor or spray region which establishes electrical contact between the metal surface to be protected and a second expendable metal surface.

Still another object is to provide a simple and inexpensive method of protecting metal surfaces exposed to corrosive condensate in the vapor region whereby the condensate is absorbed in an insulating material and functions as an electrolyte.

In the drawings:

Figure 1 is a vertical section of a storage tank containing the present invention;

Fig. 2 is an enlarged fragmentary sectional view showing the attachment of the invention to the tank surfaces;

Fig. 3 is a second embodiment of the invention showing a side elevation partially in section of a tank containing the invention; and

Fig. 4 is an enlarged fragmentary sectional view showing the attachment of the embodiment of Fig. 3 to the tank surface.

Referring to the drawings, there is shown in Figures 1 and 2 an embodiment of the present invention as applied to a tank 1 which is to be protected cathodically from corrosive vapors.

Tank 1 is adapted to contain water or any other liquid 2 which will evaporate and saturate the air above the liquid level with vapor which in itself is capable of conducting an electrical current when condensed. Tank 1 comprises a generally cylindrical body section 3 having the upper end thereof enclosed by a roof member 4 and the bottom thereof enclosed by a floor 5.

Roof member 4 and floor 5 are secured to body section 3 by welding to provide an integral leak-tight container. Tank 1 is constructed of steel or any high-strength metal and is designed with a thickness to withstand the force of the internal pressure exerted by the contained water or liquid.

As shown in the first embodiment of the invention the inner surface of tank 1 is covered with a protective coating 6, such as glass, plastic, enamel or the like. Coating 6, as applied, may contain minute imperfections, cracks or discontinuities. The vapor contained within tank 1 may condense at the tank surface and penetrate into these imperfections causing intensified corrosion of the tank at the point of penetration.

To protect the tank from this corrosion, a porous absorbent insulating material 7, such as felt, asbestos fiber, glass wool or the like is applied to the inner surfaces of tank 1 which are to be exposed to the condensed vapor.

A metal liner 8 is disposed against the insulating material 7 to confine the same, and the material 7 serves to separate and insulate the metal tank 1 from the metal liner 8.

Liner 8 may consist of large or small areas of scrap steel or other metal, or it may consist of sections of perforated metal plate, as shown in the drawings. Since the liner 8 is not intended to give physical strength to the tank or to prevent loss of fluid therefrom, it is convenient and practical to butt the edges of the liner plates without joining or sealing the same.

The corrosive condensate in the vapor region of tank 1 may thus reach the absorbent insulating material 7 and be absorbed therein. Liner 8 functions as an expendable anode, as will be hereinafter described.

Liner 8 is secured to tank 1 by a plurality of studs 9 which are welded to the inner surface of the tank. Studs 9 project inwardly through coating 6, insulating material 7, and extend through suitable openings in liner 8. A sleeve 10 composed of an insulating material is disposed around each stud 9 and the annular flange 11 of sleeve 10 bears against the outer surface of liner 8. Sleeves 10 serve to maintain studs 9 out of contact with liner 8 and prevent electrical conduction by metallic contact therebetween. The outer threaded end of each stud 9 receives a metal washer 12 and is engaged by a nut 13. A portion of the vapor forming at the liquid level in tank 1 tends to penetrate behind liner sheets 8 and condense on the inner surface of tank 1 and wet insulating material 7. This condensed vapor which is absorbed in the insulating material functions as an electrolyte and provides electrical contact through defects in coating 6 between tank surfaces 1 and liner 8.

A source of low-voltage current, such as a rectifier or generator 14, may be employed to apply direct current to the tank 1 and liner 8. A lead 15 connects the generator or other source of current to a suitable terminal on the tank 1. A second lead 16 extends from generator 14 through an insulated opening in tank 1 and coating 6 and is connected to a terminal on liner 8. As tank 1 is the surface which is to be cathodically protected against

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corrosion, it is made the cathode, and liner 8 is made the anode.

The insulating material 7 and liner 8 is applied to all the tank surfaces 1 which are apt to be continually or intermittently exposed to the contained vapor through the defects in coating 6. If the liquid in tank 1 is to be maintained at a constant level, the insulating material need only extend upwardly from a point slightly below the fixed liquid level in order to embrace the tank surfaces exposed to the vapor. In this case the tank surfaces below the liquid level may be cathodically protected by commonly known means. However, if the liquid level in tank 1 is apt to fluctuate or if the tank is periodically emptied and filled, the entire internal surface of tank 1 will, at one time or another, be exposed to the vapor and thus should be coated with the insulating material 7 and liner 8.

A second embodiment of the present invention is shown in Figs. 3 and 4 as applied to a tank 17 bearing no protective coating, such as glass or plastic but otherwise corresponding to tank 1 in the previous embodiment.

An absorbent insulating material 18, such as glass fiber, felt or the like, is applied to the inner surface of tank 17.

An expendable metal liner 19, similar to liner 8 previously described, is disposed against insulating material 18 and secured to tank 17 by a plurality of studs 20.

Studs 20 are welded to the inner surface of tank 17 and provide electrical contact between tank 17 and liner 19. Studs 20 extend inwardly through insulating material 18 and through suitable openings in liner 19. The outer end of each stud 20 is engaged by a retaining nut 21 or is otherwise secured.

Liner 19 may consist of separate pieces of aluminum, magnesium, zinc or any metal which is anodic to the metal of the tank 17, or liner 19 may consist of a number of perforated plates of the aforementioned class of metals. The condensed vapor which is absorbed in material 18 functions as an electrolyte and is capable of conducting an electrical current. Thus the anodic metal liner 19 is corroded by galvanic action and the tank 17 is protected from corrosion until the liner 19 is expended.

To promote corrosion of the expendable liner 19, it may be preferred to insulate liner 19 from tank 17 instead of providing electrical contact therebetween through studs 20 and to apply a low voltage current to the system, as described in the first embodiment, with the liner being made the anode and the tank the cathode.

Conversely, in the first embodiment, electrical contact between tank 1 and liner 8 may be provided through uninsulated studs and a dissimilar anodic metal used as the anode to promote corrosion of the expendable liner.

The present invention may be employed to protect metal surfaces from any type of vapor which will conduct an electric current when condensed, such as water, salts, acids or the like.

The metal surfaces to be protected may include such articles as pier piles or dredge boats and equipment which are intermittently subjected to water spray and varying water levels due to tides, or to any type of metal tanks, such as petroleum storage tanks which are to be protected from hydrogen sulfide and water vapor.

Various embodiments may be employed within the scope of the following claims.

I claim:

1. A cathodically protected metal article, which comprises a first metallic member having a surface subject to corrosion when exposed to a liquid capable of conducting an electric current, a second metallic member extending substantially coextensively with said first member and in spaced relation thereto and having a plurality of openings therein, a plurality of spaced metal means extending from one member to the other said member to support the members in fixed spaced relation and provide a clearance between the members into which the openings in the second member communicate for passage of said liquid, electrically insulating absorbent material confined within

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the clearance between the members and adapted to absorb said liquid with the absorbed liquid functioning as an electrolyte to provide an electrical connection between the members through said electrolyte, and means electrically connecting said first and second members other than said electrolyte to provide a second electrical connection between the members and to complete the electric circuit between said members, the said first member being the cathode and the second member the anode in said circuit to thereby promote corrosion of the second member and inhibit corrosion of the first member.

2. A cathodically protected storage structure comprising, a metallic container having an inner surface exposed to corrosive condensate in a vapor region, a metallic liner disposed within the container and extending generally coextensive with said inner container surface and being spaced from said surface to provide a clearance therebetween, said liner having a series of discontinuities extending therethrough and communicating with said clearance, means for attaching said liner in spaced relation to said container, a layer of fibrous absorbent electrically insulating material confined within said clearance and adapted to absorb condensed vapors with the condensate serving as an electrolyte therein, and means for electrically connecting said liner and said container to complete an electric circuit through said container and liner and electrolyte, with said container being disposed as the cathode in the circuit and the said liner the anode in the circuit to thereby inhibit corrosion of said container and promote corrosion of said liner.

3. A cathodically protected metal article, which comprises a first metallic member having a surface subject to corrosion when exposed to a liquid capable of conducting an electric current, a second metallic member extending substantially coextensively with said first member and in spaced relation thereto and having a plurality of openings therein, a plurality of spaced metal means extending between each of said members and secured thereto to support the members in spaced relation and provide a clearance between the members into which the openings in the second member communicate for passage of said liquid, said spaced metal means providing an electrical connection between the members, and electrically insulating absorbent material confined within the clearance between the members and adapted to absorb said liquid with the absorbed liquid functioning as an electrolyte to provide an electrical connection between the members through the electrolyte and to complete the electrical circuit between the members, the said first member being of a metal cathodic to the second member to thereby promote corrosion of the second member and inhibit corrosion of the first member.

4. A cathodically protected metal article, which comprises a first metallic member having a surface subject to corrosion when exposed to a liquid capable of conducting an electric current, a second metallic member extending substantially coextensively with said first member and in spaced relation thereto and having a plurality of openings therein, a plurality of spaced metal means extending between each of said members to support the members in spaced relation and provide a clearance between the members into which the openings in the second member communicate for passage of said liquid, electrically insulating absorbent material confined within the clearance between the members and adapted to absorb said liquid with the absorbed liquid functioning as an electrolyte to provide an electrical connection between the members through said electrolyte, means electrically connecting said first and second members to complete the electric circuit between the members and the electrolyte, and a source of low voltage current connected to said connecting means to provide a current to said connecting means with the first member being the cathode and the second member the anode in said circuit to

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thereby promote corrosion of the second member and
inhibit corrosion of the first member.

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