

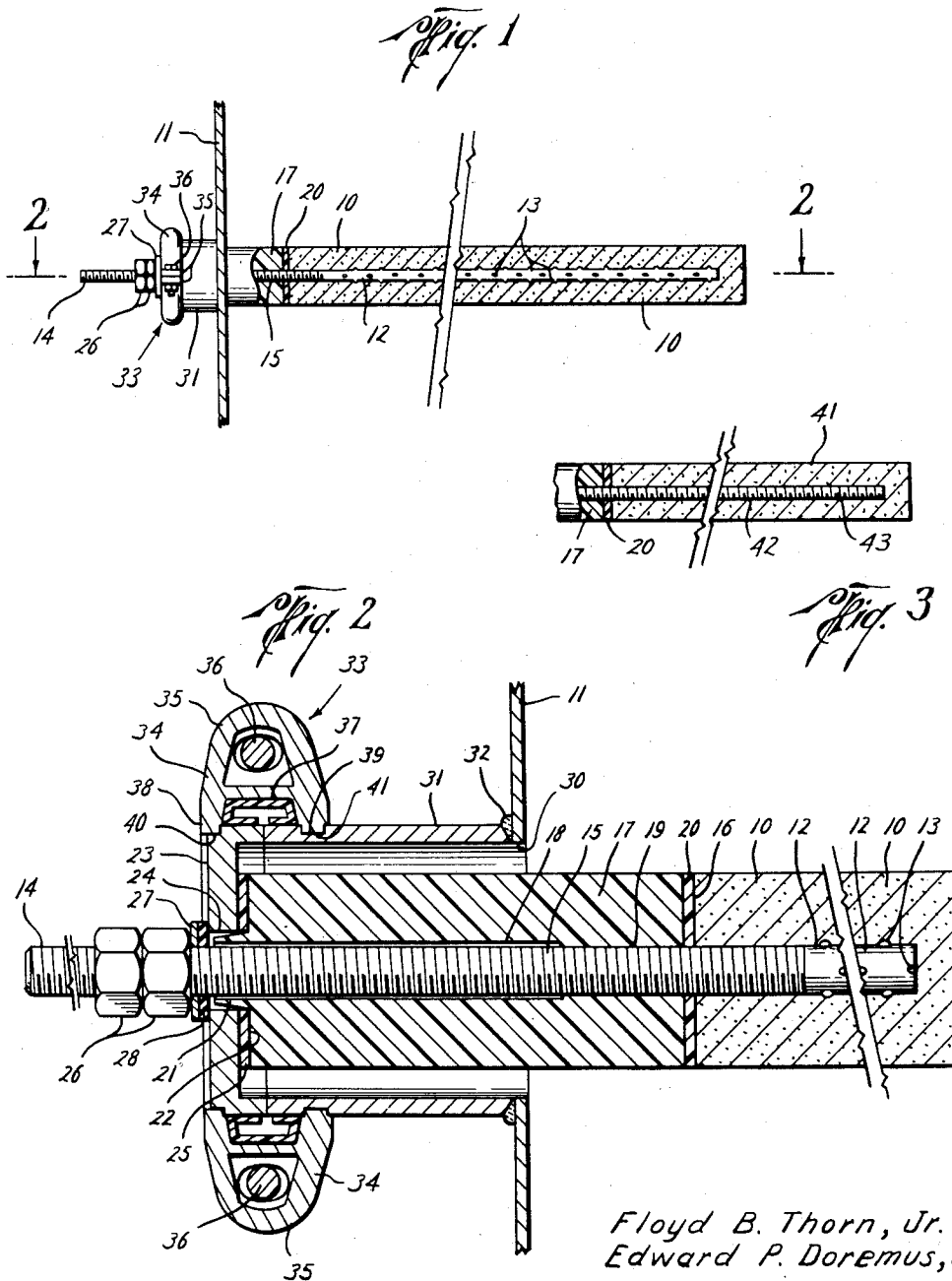
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ANODE ASSEMBLY FOR CATHODIC PROTECTION SERVICE

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ANODE ASSEMBLY FOR CATHODIC PROTECTION SERVICE

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This invention relates to an improved anode assembly for use in the cathodic protection of metal vessels.

In many instances, particularly in the cathodic protection of large metal vessels and tanks, such as industrial boilers, water heaters, and the like, it is found necessary or desirable by reason of the structural form of the vessel or tank to install the anode in a horizontal position. Since the demands for such large installations will usually require anodes of substantial length and size, for example, thirty to sixty inches in length and three inches or more in diameter, the resulting length and weight makes their installation difficult without the use of some type of internal support which will usually be undesirable because of greater cost, greater complication in construction and installation, and greater difficulty in assuring optimum insulation and electric resistance properties in the connections between the anode assembly and the vessel or tank.

Also, since both galvanic anodes and those employing impressed current are usually of the sacrificial type, including materials such as magnesium, zinc or aluminum, which, by their very nature, will be destroyed in use, and replacement of which must be made at appropriate intervals, it is desirable to provide an anode assembly which is easily installed and permits simple and ready replacement.

Accordingly, it is a primary object of this invention to provide an anode assembly which is relatively simple in construction, easy to install, and includes improved insulating arrangements by which the useful life of the anode is extended, by preventing or reducing undercutting by high current densities near the tank surface and by resistance to the current flow between the anode and the vessel to be protected.

A more specific object is to provide an anode assembly in which the anodic metal such as magnesium is cast directly on a rigid steel core of sufficient strength to provide the mechanical support for the anode when the latter is mounted horizontally and secured by one end to a tank wall.

In accordance with a preferred embodiment of this invention, the steel core is made substantially longer than the anodic metal body cast thereon, to provide an elongate extension which is externally threaded to threadedly receive an elongated insulating sleeve and spacer which bears against one side of a mounting cap through which the outer end of the core extends, the outer end of the core being secured to the mounting cap by one or more jam nuts. A mounting collar, which is rigidly secured to the wall of the vessel, is provided to receive and secure the mounting cap whereby the entire assembly may be secured in the desired position to the vessel or tank to be protected.

A further object is to provide an anode assembly in which the steel core is threaded throughout its length to receive a bored and tapped body of graphite which constitutes the anodic material.

Other and more specific objects and advantages of this

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invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates a useful embodiment in accordance with this invention.

In the drawing:

Fig. 1 is a view, partly in elevation and partly in section, showing an anode assembly in accordance with one embodiment of this invention mounted in horizontal position in a portion of the wall of a tank to be protected by the anode;

Fig. 2 is an enlarged view taken generally along line 2—2 of Fig. 1 illustrating the details of construction of the anode assembly; and

Fig. 3 is a fragmentary longitudinal view of another embodiment employing graphite as the anodic material.

Referring to the embodiment illustrated in Figs. 1 and 2 of the drawing, the anode 10 is of the galvanic type and comprises a solid, preferably cylindrical body of metal anodic to the metal side wall 11 of a tank (shown fragmentarily) to which it is to be connected. Preferably, the metal employed for the anode will be magnesium, in this case where the tank metal is steel, but it will be understood that the anode may be made of other metal such as zinc, aluminum or the like, as is well understood in this art.

The metal comprising anode 10 is cast directly on an elongated core 12 constructed as a solid steel bar of sufficient thickness and rigidity to provide the necessary support for the anode as will be more fully described hereinafter. Core 12 will be provided with a plurality of surface irregularities 13 which are spaced apart longitudinally and circumferentially throughout the portion of the core embedded in the anode metal. The irregularities may be in the form of projections, enlargements, pits or recesses of various shapes, which will serve to bond the anode metal tightly and securely to the core. The embedded end of core 12 extends to a point just short of the end of anode 10 so that this end of the core will be completely encased within the body of anode metal.

Core 12 is made sufficiently longer than anode 10 so as to provide the elongate extension 14 which is provided with external threads 15 to its outer end. Since anode 10 is necessarily larger in diameter than core 12, an annular shoulder 16 is provided at the end of the anode from which extension 14 projects. A rigid tubular insulating sleeve 17, constructed of any suitable dielectric material, is mounted on extension 14, having a bore 18 to receive the extension. A portion of bore 18 adjacent the end of anode 10 is internally threaded at 19 to engage threads 15 on the extension. A compressible sealing gasket 20 is mounted about extension 14 between the inner end of sleeve 17 and shoulder 16, so that when sleeve 17 is screwed down tightly over extension 14 it will compress gasket 20 against shoulder 16 and form a fluid-tight seal between these elements and about extension 14.

The outer end of sleeve 17 terminates in centrally positioned short tubular boss 21, thereby providing the outwardly facing annular shoulder 22 on the outer end of sleeve 17. Boss 21 is preferably of outwardly tapering generally frusto-conical shape. A generally circular metal cap 23 is mounted over the outer end of sleeve 17 being provided with a central opening 24 adapted to receive boss 21 and extension 14 which projects beyond the outer face of cap 23. A sealing gasket 25 is positioned about the exterior of boss 21 between shoulder 22 and the inner face of cap 23 to form a fluid-tight seal between cap 23 and sleeve 17 when compressed against shoulder 22 by cap 23 when assembly of the structure is completed in the manner to be described hereinafter.

One or more jam nuts 26—26 are screwed on the end of extension 14 to bear against the outer face of cap 23

which is herein referred to as the mounting cap. A metal washer 27 is mounted on extension 14 between the inner jam nut 26 and cap 23 and a sealing gasket 28 is mounted about extension 14 between washer 27 and the outer face of cap 23 and serves to form a fluid-tight seal for the outer end of opening 24 when the jam nuts are screwed down tightly on extension 14. It will be evident that when jam nuts 26 are screwed down tightly toward mounting cap 23, the parts of the anode structure will be drawn tightly together, mounting cap 23 being tightly compressed against the outer end of insulating sleeve 17 which, as previously described, has been screwed down on extension 14 tightly against the adjacent end of anode 10.

To mount the anode structure in tank wall 11, the latter may be provided with an opening 30 through which the anode assembly is inserted into the tank. Opening 30 is enclosed by a tubular nipple 31 (herein termed the mounting collar), which is rigidly secured to the tank wall in any suitable manner as by welding 32.

The anode assembly will be inserted through mounting collar 31 and mounting cap 23 secured thereto by any suitable and well known connector means, designated generally by the numeral 33. For convenience and ease in installing and removing the anode assembly, the connector means of the illustrative embodiment may be the well known "Victaulic" coupling which comprises a two-part annular body 34, the body sections having bolt ears 35 through which bolts 36 extend for joining the parts of the coupling together. Coupling body 34 is channel shaped in cross-section to define the annular recess 37 and spaced apart marginal flanges 38-39 which are adapted to be received in appropriately spaced circumferential grooves 40 and 41 provided respectively in mounting cap 23 and mounting collar 31. A gasket 42 is positioned in recess 37 to form a fluid-tight seal about the juncture between mounting cap 23 and the abutting end of mounting collar 31.

By way of example, magnesium anodes constructed in accordance with this invention for use in various industrial installations, comprise structures having an overall length ranging from about 3½ feet to about 6 feet, the portions comprising anode 10 ranging from about 30 inches to 60 inches in length and having a diameter of about 3 inches. Sleeve 17 will usually be about 7 inches in length and will have an external diameter substantially the same as that of anode 10. For such size anodes core 12 may be ¾ inch steel rod and extension 14 may be a steel rod which is threaded and cadmium plated and joined to the core rod by welding.

By employing the rigid steel core directly bonded to the anode metal and the mounting arrangement described, it will be evident that this invention provides an anode assembly which may be effectively supported in horizontal position without auxiliary supports internally of the tank or vessel in which the structure is installed, and which may be installed and removed with a minimum of effort and time. By providing the solid elongate dielectric spacer sleeve 17, which will preferably have a length of from one to three times its diameter, the anode may be positioned inside the vessel at a substantial distance from the vessel wall thereby preventing undercutting of the metal by high current densities which would otherwise develop adjacent the vessel surfaces. Moreover, the spacer sleeve provides insulation between the metal core and the vessel which permits interposition of appropriate resistance in the conductor circuit (not shown) conventionally provided between the outer ends of the core and the vessel, which will reduce the current flow and thereby extend the useful life of the anode. Boss 21 serves to interpose effective insulation between extension 14 and the surrounding wall of opening 24 in cap 23.

Fig. 3 illustrates a modification of the anode assembly adapted particularly for use with a graphite anode. In this modification, a steel core 42 is threaded throughout

its length, as at 43, and a graphite anode 41 is axially drilled and tapped to be screwed directly on core 42, compressively abutting gasket 20 and sealing sleeve 17. In all other respects the anode assembly is identical in details of construction, including mounting and insulating elements, to the embodiment illustrated in Figs. 1 and 2, being mountable in the tank or vessel to be protected in exactly the same manner as the galvanic anodes previously described.

It will be understood that numerous other alterations and modifications may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of the invention.

What we claim and desire to secure by Letters Patent is:

1. A galvanic anode assembly for insertion through the wall of a metal vessel to be protected cathodically, comprising an elongate body of a galvanically active metal anodic to the metal of the vessel insertible through the vessel wall, a rigid steel rod embedded in said body of metal and bonded directly thereto, said rod extending axially of said body to a point just short of the inner end thereof, said rod having an elongate externally threaded extension projecting axially from the opposite end of said body of metal to the exterior of said wall, a generally circular cap member slidably mounted on the exteriorly projecting portion of said extension, a dielectric spacer sleeve mounted on said extension between the cap member and said body, means for drawing the cap member and said body of metal toward each other, a mounting collar secured to the exterior of the vessel wall and surrounding the exteriorly projecting portion of said extension, and connector means releasably securing said cap member to said collar whereby to support said anode assembly in operative position in the vessel.

2. A galvanic anode assembly for insertion through the wall of a metal vessel to be protected cathodically, comprising, an elongate body of a galvanically active metal anodic to the metal of the vessel insertible through the vessel wall, a rigid steel rod embedded in said body of metal and bonded directly thereto, said rod extending axially of said body to a point just short of the inner end thereof, said rod having an elongate externally threaded extension projecting axially from the opposite end of said body of metal which thereby defines an annular shoulder about said extension, said extension having a portion projecting exteriorly of said wall, a tubular spacer sleeve comprising a dielectric material threaded on said extension to abut said shoulder, a generally circular cap member slidably mounted on said exteriorly projecting portion of said extension in abutting relation to the outer end of said sleeve, nut means threaded on the extension to urge said cap member axially against the outer end of said spacer sleeve, a mounting collar secured to the exterior of the vessel wall and surrounding the exteriorly projecting portion of said extension, and connector means releasably securing said cap member to said collar whereby to support said anode assembly in operative position in the vessel.

3. A galvanic anode assembly for insertion through the wall of a metal vessel to be protected cathodically, comprising, an elongate body of a galvanically active metal anodic to the metal of the vessel insertible through the wall of the vessel, a rigid steel rod embedded in said body of metal and bonded directly thereto, said rod having an elongate externally threaded extension projecting axially from one end of said body of metal whereby to define an annular shoulder about said extension, said extension having a portion projecting exteriorly of said wall, a tubular spacer sleeve comprising a dielectric material threaded on said extension to abut said shoulder, an axially projecting generally tubular boss on the outer end of said sleeve, a generally circular cap member slidably mounted on the exteriorly projecting portion of said extension in abutting relation to the outer end of said sleeve,

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said cap member having an axial opening through which said extension passes, said opening having a diameter to receive said boss, nut means threaded on said extension to urge said cap member axially against the outer end of said spacer sleeve, a mounting collar secured to the exterior of the vessel wall and surrounding the exteriorly projecting portion of said extension, and connector means releasably securing said cap member to said collar whereby to support said anode assembly in operative position in the vessel.

4. A galvanic anode assembly for insertion through the wall of a metal vessel to be protected cathodically, comprising, an elongate generally cylindrical body of metal comprising magnesium, a steel rod axially embedded in said body of metal and bonded directly thereto, said rod having a plurality of surface irregularities thereon to reinforce the bond with said metal, said rod having an elongate externally threaded extension projecting axially from one end of said body whereby to define an annular shoulder about said extension, a generally tubular spacer sleeve comprising a dielectric material threaded on said extension to abut said shoulder, said spacer sleeve having an external diameter substantially equal to that of said body of metal and a length of from one to three times its external diameter, an axially projecting generally tubular boss on the outer end of said spacer sleeve, a generally circular cap member having an axial opening to slidably receive said extension and said boss, and nut means threaded on said extension to urge said cap member axially against the outer end of said spacer sleeve, a mounting collar secured to the exterior of the vessel wall and surrounding the exteriorly projecting end portion of said rod, and connector means releasably securing said cap member to said collar, whereby said rod when secured at its outer end to said

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wall being adapted to provide substantially the entire support for maintaining said elongate body of metal in horizontal position in said vessel.

5. An anode assembly for insertion through the wall of a metal vessel to be protected cathodically, comprising, an elongate body of a material anodic to the metal of said vessel insertible through the wall thereof, an elongate rigid steel core rod on which said body is directly mounted, said core extending axially of said body to a point just short of one end thereof and being bonded directly to said material, said rod having an elongate externally threaded extension projecting axially from the other end of said body to the exterior of said wall, a generally circular cap member slidably mounted on the exteriorly projecting portion of said extension, a dielectric spacer sleeve mounted on said extension between the cap member and said body, means for drawing the cap member and said body toward each other, a mounting collar secured to the exterior of the vessel wall and surrounding the exteriorly projecting portion of said extension, and connector means releasably securing said cap member to said collar whereby to support said anode assembly in operative position in the vessel.

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