Sept. 2, 1952 R. E. McMAHON ET AL 2,609,340

CORROSION INHIBITOR FOR HEAT EXCHANGERS AND THE LIKE

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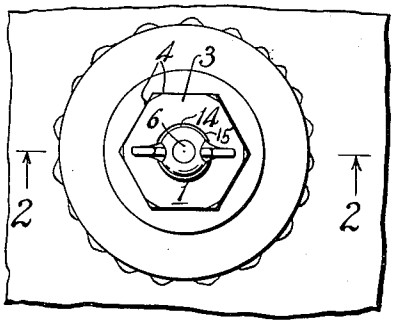

Fig. 1

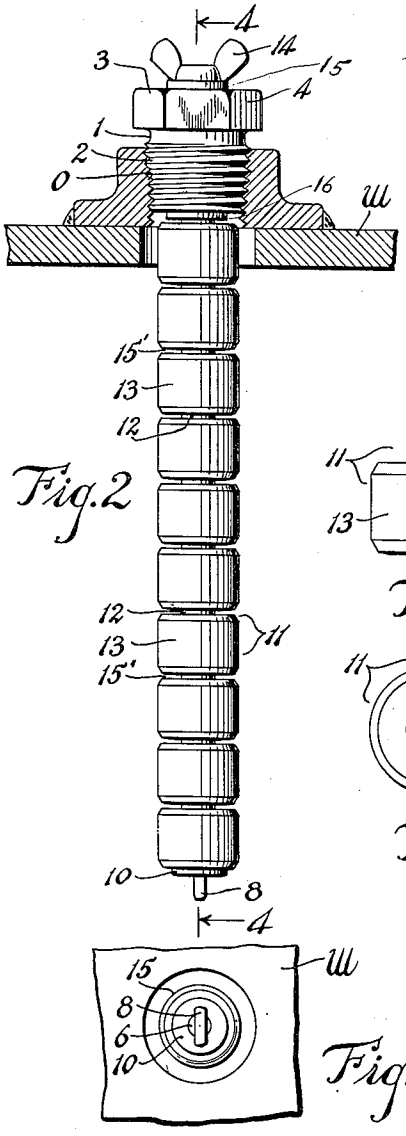

Fig. 2

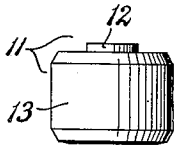

Fig. 5

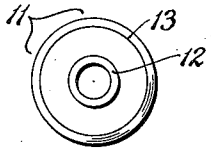

Fig. 6

Fig. 3

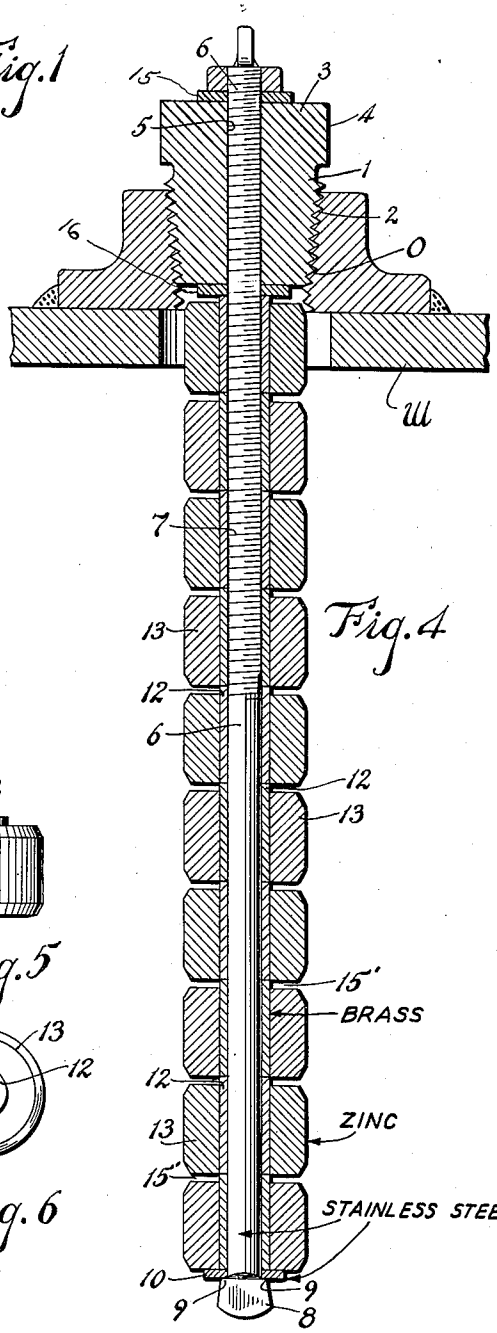

Fig. 4

INVENTORS,
Robert E. McMahon & Edward F. McMahon
BY
Harold J. LeVesconte
ATTORNEY.

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CORROSION INHIBITOR FOR HEAT EXCHANGERS AND THE LIKE

Robert E. McMahon and Edward F. McMahon,
Seattle, Wash.

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4 Claims. (Cl. 204—197)

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This invention relates to corrosion preventing or inhibiting means for use on the sea water side of heat exchangers and similar devices such as are used on ships or in power or other plants in which sea water is employed as a cooling medium. Examples of such heat exchangers are oil coolers, refrigeration condensers, steam condensers and the like and these devices together with the pumps, tubing, piping and valves are formed of metals which differ in their standing in the replacement series of metals. Sea water is acid and the acid content increases in the warmer climates. The result of introducing this acid water in a system formed of different metals is that a galvanic action will be set up with resultant eating away or corrosion of the metal that is lowest in the replacement series. Usually this is the steel forming the wall of the sea water side of the exchanger or the tubing therein since the steel is lower in the replacement series than is the copper or bronze found in the valves and other fittings and the corrosion will be greatest in those portions of the system in which the movement of water is greatest. The remedy for this condition is to mount a bar of a metal, for example, zinc, which is lower in the metals replacement series than any metal contacted by the sea water on the wall of the sea water side of the vessel exchanger so that all galvanic action and consequent dissolving of metal will be concentrated on that metal with consequent diminution of corrosion on the metal of the exchanger.

Heretofore, such bars have consisted of zinc rods of various lengths cast or otherwise rigidly fixed to pipe plugs screwed into openings in the wall of the exchanger with the zinc bar extending into the sea water side thereof. When first installed, such devices are satisfactory, but as they corrode they present several disadvantages. First, the corrosion does not proceed uniformly and often eats through the zinc at a point well back from the end thereof allowing a portion of the bar to drop off and to become a menace to the safe operation of the circulation system for the sea water. Second, the bar must be replaced before it is entirely consumed and the plug and the remaining zinc are incapable of further use Third, if the bar as manufactured, is too long for a particular installation, the end is sawed off and the cut off part is thus wasted.

With the above considerations in mind, it is the principal object of the invention to provide a corrosion inhibitor in which the portion thereof subject to galvanic action is formed of a plurality of zinc units assembled together to form a bar

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like structure so that inhibitors of varying lengths can be formed by varying the number of such units in the assembly.

Another object of the invention is to provide a corrosion inhibitor which can be installed in the openings provided for the installation of inhibitors in existing exchangers and which is so constructed and arranged that portions thereof cannot drop off and become a potential source of damage to the circulating system.

Still another object of the invention is to provide a corrosion inhibitor comprising a supporting screw plug and a series of interchangeable and replaceable elements carried thereby and arranged so that in replacement, only those elements which are most completely eaten away need be replaced with resultant saving of material.

A still further object of the invention is to provide a replaceable corrosion inhibiting element comprising a mass of metal which is readily subject to corrosion mounted on a supporting metal element formed of metal less subject to corrosion and to which the corrodible metal is firmly bonded so that in the event of irregular corrosion the corrodible metal will not drop off the supporting element.

A still further object of the invention is to provide a corrosion inhibiting means comprising a readily corrodible metal mass which is so shaped as to present a greater surface area to the action of the sea water than the previously employed cylindrical bars.

With the above objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts, and in the construction, combination and arrangement of parts hereinafter described, by way of example, in the following specification; reference being had to the accompanying drawings forming a part thereof and in which:

Fig. 1 is an end view of the exterior end of a corrosion inhibiting device embodying the present invention as installed in the wall of a heat exchanger or similar apparatus,

Fig. 2 is a side elevation of the inhibitor shown in Fig. 1 with the exchanger wall and flange shown in section along the line 2—2 of Fig. 1,

Fig. 3 is an elevation of the inner end of the inhibitor shown in Figs. 1 and 2,

Fig. 4 is an enlarged, transverse sectional view taken on the line 4—4 of Fig. 2, and

Figs. 5 and 6 are side and end elevations, respectively, of one of the corrodible elements employed with the inhibitor.

In the illustrated form of the invention, the

device comprises a base plug 1 having external pipe threads 2 adapted to engage a threaded opening O in the wall W of a heat exchange vessel and further having a head portion 3 provided with hexagonal sides 4 adapted for engagement by a wrench for insertion and removal from the vessel. This base plug is formed from some metal such as brass or stainless steel which is higher in the metals replacement series than the metal comprising the wall and tubes of the exchanger and the surface of the plug is preferably further protected by suitable plating such as cadmium. The base plug is provided with an axial bore 5 in which is located one end of a rod 6 which over a considerable portion of its length from the end within the bore 5 is threaded as indicated at 7. At its other end the rod 6 is flattened as at 8 to provide shoulders 9, 9 for a washer 10 (see Fig. 4). The rod 6 and washer 10 are preferably formed from a metal having an extreme resistance to corrosion such as stainless steel.

Mounted in end to end relation on the rod 6 is a plurality of corrodible elements 11 which are identical in form so that a description of one will serve for all. Each element comprises a sleeve 12 formed of, for example, brass, adapted to loosely engage the rod 6 and firmly bonded to the exterior of the sleeve is a sacrificial anode comprising a cylindrical body 13 of zinc which is slightly shorter than the sleeve. In assembly, the desired number of elements 11 are threaded on to the rod 6, the rod is inserted in the bore 5 in the base plug 1 and the elements are clamped together between the washer 10 and the end of the base plug by a thumb screw 14 threaded on the end of the rod 6 at the outer end of the base plug, sufficiently tightly to effect a good electrical connection with each other and the screw threads will likewise effect the proper connection between the wall of the exchanger and the plug 1. For installations where the vessel or cavity is under considerable pressure, it is desirable to seal the juncture of the plug 1 and rod 6 by the inclusion of washers 15 and 16 at each end of the plug. The ends of the sleeves which extend beyond the zinc bodies carried thereby serve to space the ends of the zinc bodies from each other and to form annular recesses 15' whereby additional surface of the zinc bodies is presented to the action of the sea water. The rod 6 and washer 10 are higher in the replacement series of metals than either the sleeve 12 or the anode 13 and thus are proof against localized corrosion thereof resulting in the loss of any solid portion of the device within the container, while the anode 13 is formed of a metal which is lower in the replacement series of metals than the sleeve 12 to insure that corrosion will be confined to the anode so long as there is any anode metal left on the sleeve; the firm bonding of the anode to the sleeve serving to prevent the dropping off of any portions of the anode due to uneven and localized consumption thereof.

After a unit has been in use for some time, it is removed and disassembled and any of the elements in which the zinc is completely or substantially eaten away are removed and replaced by new elements and the unit is then replaced in the exchanger. The sleeves that are replaced can then be returned and have new zinc bodies cast or otherwise applied thereto. Consequently there is no waste of material since any zinc remaining on a removed sleeve will unite with any zinc that is added to rebuild the element.

Since the elements are identical, it is unnecessary to carry a stock of various lengths of plugs for replacement purposes and the only loss of zinc is that which is actually dissolved in the water. It is particularly to be noted that the device is so constructed that inhibitors of different lengths can be made by varying the number of elements. In the illustrated form of the invention ten elements are shown mounted on the rod 6, but it will be noted that the length of thread on the rod is sufficient so that only four elements may be placed thereon and clamped in place by the thumb screw 14. It will of course be understood that the rod 6 may be of any desired length and that it may be threaded along its full length or any part thereof as may be found most suitable in practice. In this connection attention is directed to the fact that the mode of clamping the elements on the rod 6 is so constructed as to impart rigidity to the assembly in that the rod is placed under tension and the sleeves 12 are under compression. For this reason, a relatively small and less costly rod can be employed to support a given weight of elements than would otherwise be required. Still further, since the rod 6 and the sleeves 12 are formed of corrosion resisting metal and since the zinc bodies are bonded to the sleeves there is no chance that portions of the zinc will drop off to become a potential danger to the safe operation of the circulating system for the sea water. While in the foregoing description reference has been made to the usefulness of the invention in connection with inhibiting the corrosive effects of sea water, it will be understood that the invention is useful also in any condition where the water is acid or alkaline and where it is used under conditions and in equipment that is apt to be damaged by electrolytic action.

While we have described one mode of execution of our invention, we do not intend thereby to limit ourselves to the exact form disclosed since many variations and modifications will suggest themselves to those skilled in the art, and the invention includes all such modifications in the parts and in the composition, construction and arrangement of the parts as shall come within the purview of the appended claims.

We claim:

1. A corrosion inhibiting device for containers of water having corrosive tendencies; said device comprising a base plug having means externally of one end thereof operable to effect self-supporting attachment of said plug in an opening in a wall of the container, a rod carried by and disposed axially of said plug projecting therefrom into the interior of the container, a plurality of replaceable anode elements carried by said rod; each of said anode elements comprising a metal sleeve component through which said rod extends and a sacrificial component comprising an annular body of another metal of less length than said sleeve component surrounding and firmly bonded to the exterior of said sleeve component, means on the distal end of said rod engagable with the distal end of the anode element most remote from said plug, and other means including a screw thread on the proximal end of said rod operable to draw said distal end of said rod toward said plug with resultant clamping of said anode elements in aligned end to end relation on said rod between said distal end thereof and the end of said plug; said sleeve components of said anode elements being formed of a metal which is higher in the replacement series of metals

than said sacrificial components thereof and which is lower in said series than said rod.

2. A corrosion inhibiting device as claimed in claim 1 in which the sleeve component of each anode element is brass and the sacrificial component thereof is zinc.

3. A corrosion inhibiting device as claimed in claim 2 in which the anode supporting rod is stainless steel.

4. A corrosion inhibiting device as claimed in claim 1 in which the proximal end of the anode supporting rod is threaded for a length which is greater than the length of one of said anode elements with resultant capacity of said rod to clampingly support different numbers of said anode elements.

ROBERT E. McMAHON.
EDWARD F. McMAHON.

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