

[54] **WATER TANK ANODE SUSPENSION**

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2,666,027 1/1954 Vallet 204/197
2,700,649 1/1955 Hosford 204/196
1,034,711 8/1912 Ives 204/297 R

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

[58] Field of Search 204/147, 148, 196, 197, 204/286, 297 R, 297 W, 297 M

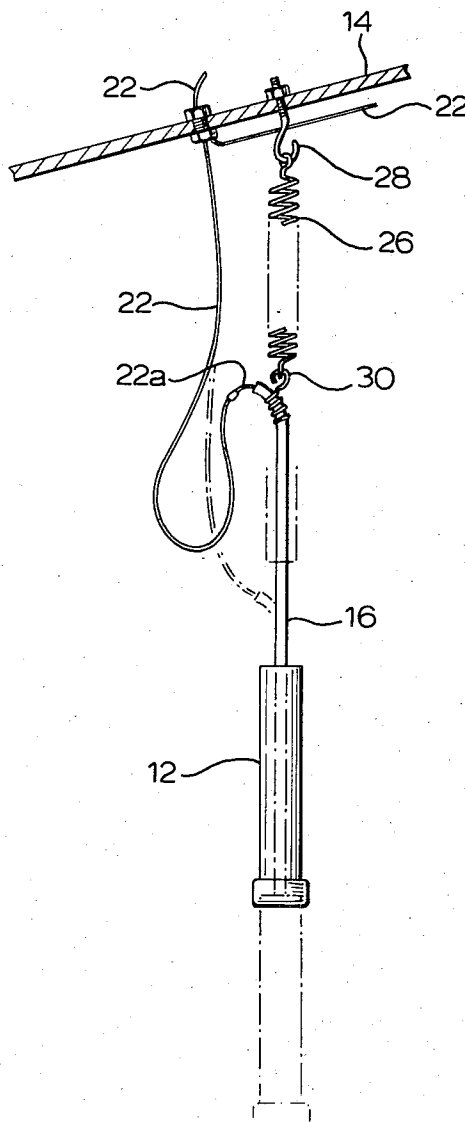
[56] **References Cited**
UNITED STATES PATENTS

3,196,101 7/1965 Hosford 204/196

[57] **ABSTRACT**

This invention relates to the cathodic protection of water storage tanks. In particular, this invention relates to a suspension means for suspending anodes within water storage tanks which is resiliently adjustable in length to permit movement of the anode with respect to the mounting from which it is suspended.

5 Claims, 4 Drawing Figures



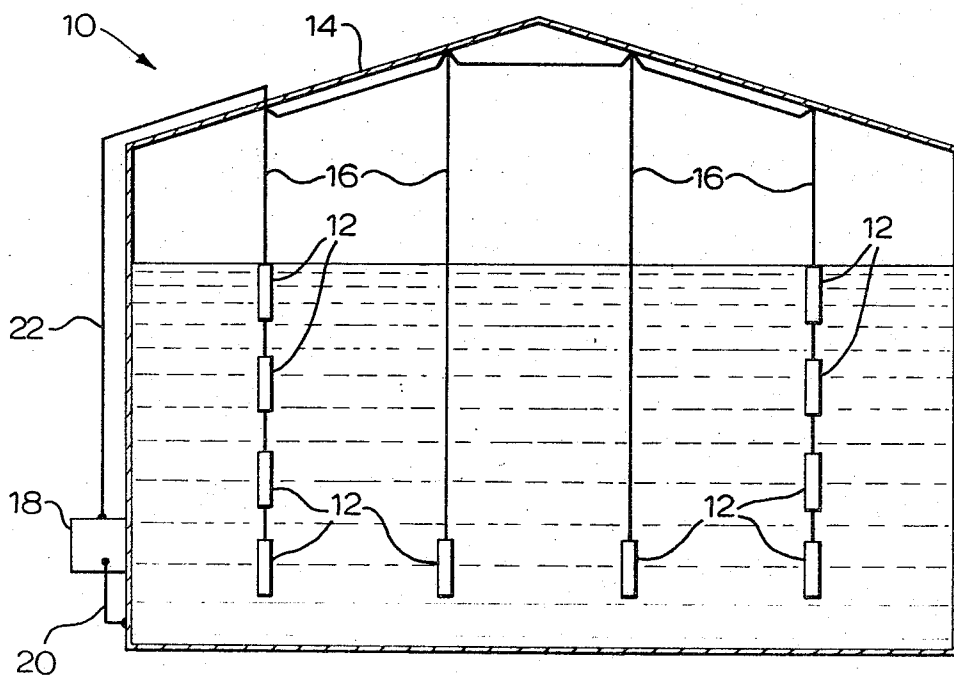


FIG. 1

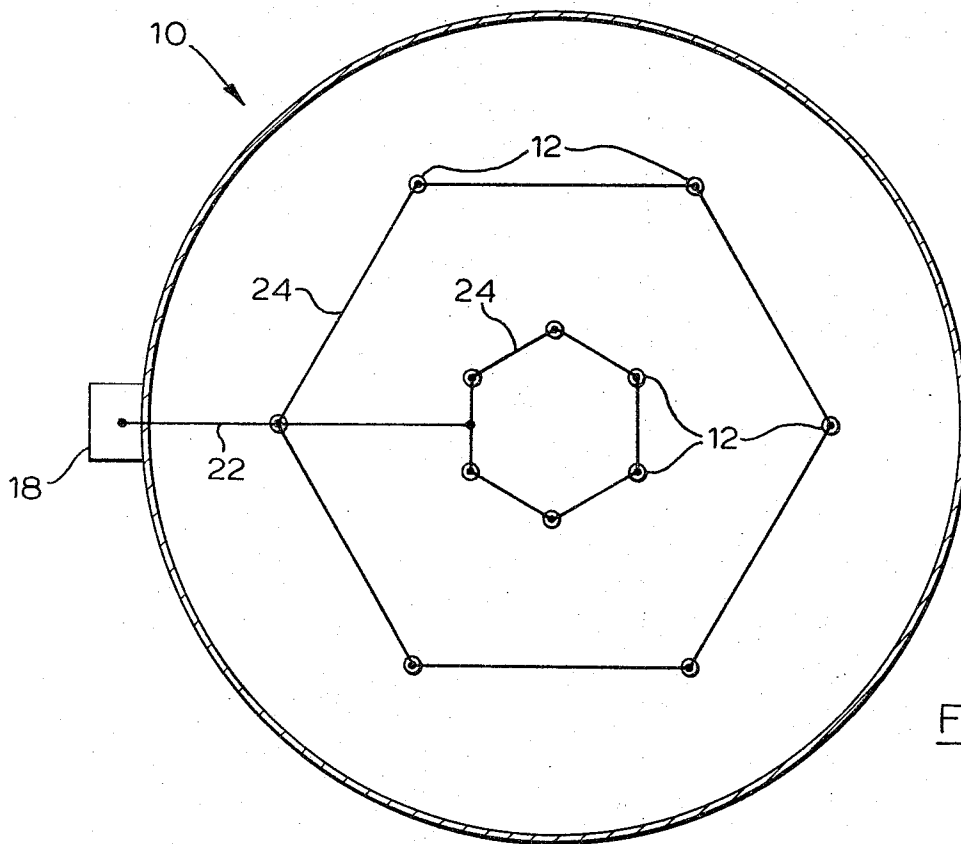


FIG. 2

FIG. 4

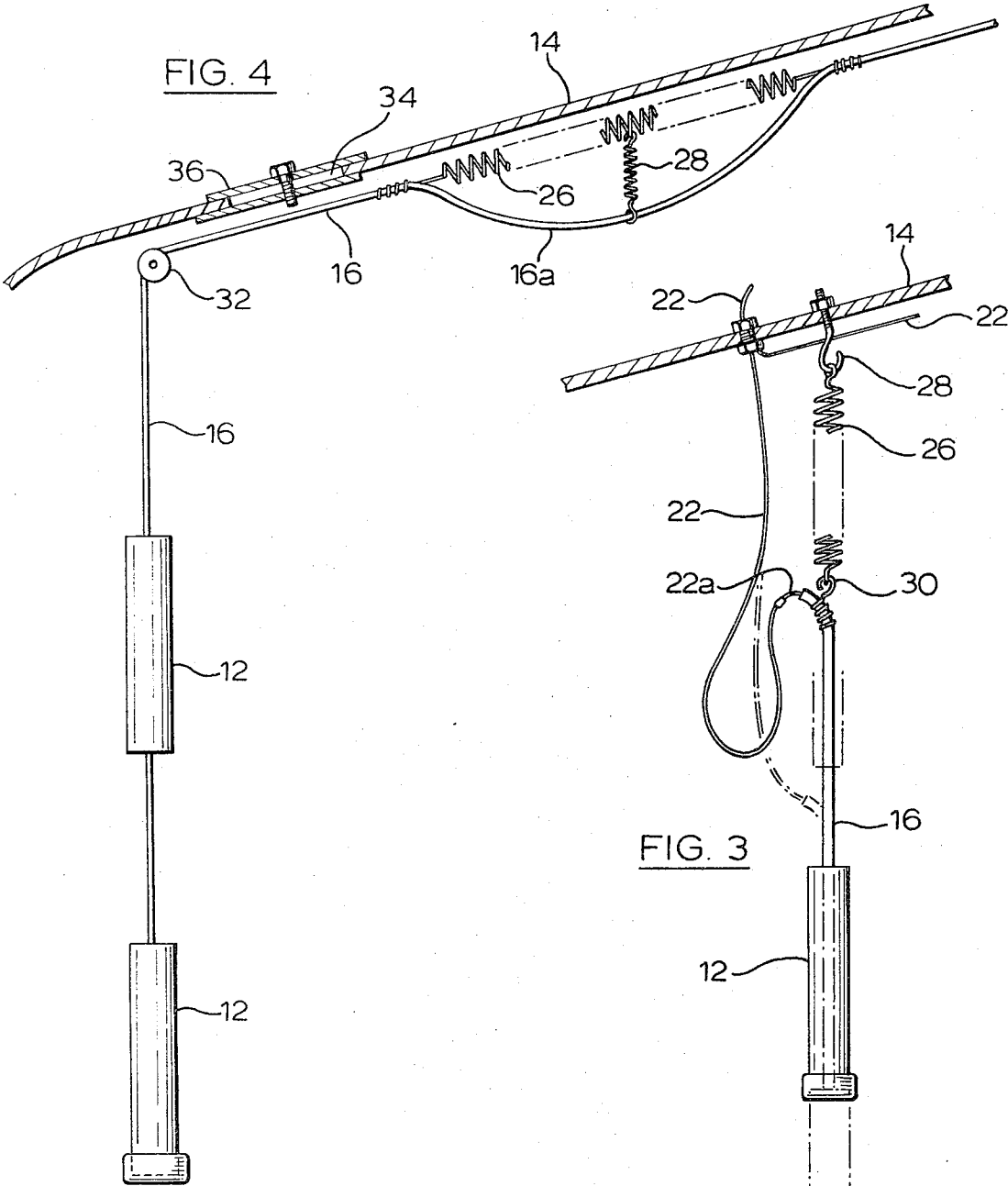
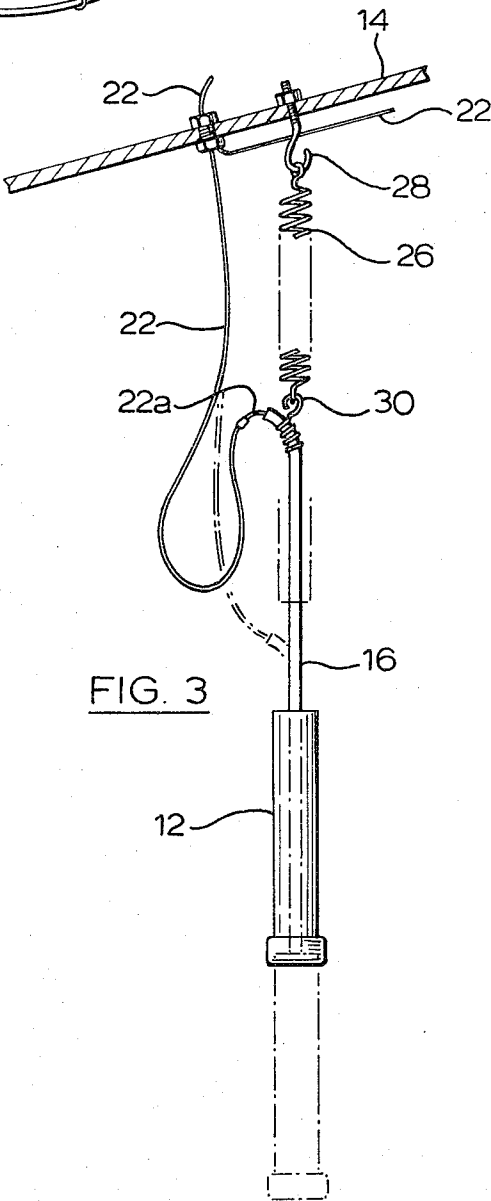


FIG. 3



WATER TANK ANODE SUSPENSION

PRIOR ART

The interior of steel water storage tanks is subject to corrosive damage by the water dependant on the composition of the water and the temperature of the steel surface in contact with the water. Above the water level corrosion is general, resulting in gradual reduction in the metal thickness. Below the water level, corrosion is by pitting, resulting in eventual perforation of the tank shell and leakage. The latter form of attack is more critical, particularly in the case of elevated tanks. Protection can be afforded by applying a protective coating to the interior surfaces. It is difficult to obtain a defect-free coating and the technique of cathodic protection is frequently employed to prevent corrosion at coating defects. The combination of coating and cathodic protection can provide complete protection against corrosion. Coatings may be omitted completely on immersed surfaces and cathodic protection alone used to prevent corrosion. cathodic protection involves the discharge of DC current to the surfaces to be protected from an "anode" suspended in the water at some distance from the metal surface. An array of anodes is needed to give good current distribution and generally these are suspended from the tank roof.

Regular inspections of the tank interior are necessary to ensure that the coating is in good condition and that the cathodic protection system is giving adequate protection. Excessive cathodic protection voltage can cause damage to the coating. The application of protective coatings presents many problems due to the difficult working conditions and a shortage of experienced and competent applicators.

In cold climates tanks are subject to internal ice formation which has made complete cathodic protection impossible to date and makes more frequent internal inspections necessary. When the metal temperature drops below the freezing point, a ring of ice forms around the periphery of the tank and may extend completely across the tank to a depth of several feet. If water is drawn out or pumped into the tank, the ice formation can break loose from the tank surface and move up and down as the water level fluctuates. This results in abrasion of the coating over the range of water level fluctuation. If a cathodic protection anode is suspended from the tank roof, it can freeze into the ice and will be pulled down if the water level drops. This can and has damaged tank roofs when the breaking strength of the anode wire was greater than the structural strength of the tank roof.

It has been common practice to remove the anodes prior to freeze-up and replace them when the internal ice formation has melted. This semi-annual work represents a substantial expense. Appreciable corrosion may take place during the period when the cathodic protection system is inoperative. The tank surface may be relatively warm due to radiant energy absorption. Radiant absorption is near maximum intensity on the area of tank surface subject to ice abrasion during the late winter and early spring. Thus, even when an adequate protective coating has been applied and a cathodic protection system is operated for as great a proportion of the year as possible, appreciable corrosion can occur, representing a reduction in the expected life of the tank.

Various techniques of suspending the anodes from rafts etc. have been tried in the past but none have been universally successful to the extent that most tank owners in Canada and many in the U.S.A. rely completely on protective coatings for corrosion control. This results in considerable expenditures for coating application and repair. Economic analysis have shown that the most economical solution to the problem is to apply a protective coating to unimmersed surfaces and to rely on cathodic protection to protect immersed surfaces. To date this solution has not been possible in colder climates because ice formation prevents year-round protection of immersed surfaces by cathodic protection. Since some corrosion occurs, periodic inspections are necessary, requiring that the tank be emptied and cleaned at considerable expense.

SUMMARY

The present invention overcomes the difficulties of the prior art described above by providing an extensible suspension system for the anode which permits movement of the anode away from its point of suspension within the tank so as to permit the anode to move under the influence of ice formations within the tank.

According to an embodiment of the present invention, there is provided in a water storage tank having cathodic protection means for inhibiting corrosion which includes anode means disposed within the tank the improvement of anode suspension in the tank one end rigidly secured to the tank and anode means secured at the other end thereof, and tension spring means disposed intermediate the ends of said suspension means to permit movement of said anode with respect to said rigidly secured end of said suspension means.

PREFERRED EMBODIMENT

The invention will be more clearly understood after reference to the following detailed specification read in conjunction with the drawings wherein:

FIG. 1 is a diagrammatic side view of a water storage tank illustrating the means in which a plurality of anodes are suspended;

FIG. 2 is a diagrammatic plan view of the tank of FIG. 1 further illustrating the anode distribution;

FIG. 3 is a partially sectioned side view illustrating an anode suspension means according to an embodiment of the present invention;

FIG. 4 is a side view similar to FIG. 3 illustrating an anode suspension means according to a further embodiment of the present invention.

With reference to the drawings, the reference numeral 10 refers generally to a water storage tank of a type which employs a cathodic protection system according to an embodiment of the present invention. The tank 11 has a plurality of anodes 12 suspended from the roof 14 by means of anode cable 16.

As shown in FIG. 2 of the drawings, the anodes are arranged in two substantially concentric rings. Each anode cable in the outer ring supports a plurality of anodes arranged one above the other in a position closely adjacent the side wall of the tank. The anodes in the inner ring are attached at the bottom of the cable so as to be disposed closely adjacent the bottom wall of the tank. The negative terminal of the rectifier 18 is connected to the tank by means of a lead 20. Lead 22 is

connected to the positive terminal of the rectifier and extends into the tank to be connected to each of the anodes 12.

A suspension system according to an embodiment of the present invention is illustrated in FIG. 3 of the drawings, to which reference is now made. The suspension system includes a tension coil spring 26 which has one end mounted on a hook member 28 which is rigidly secured with respect to the roof 14 of the tank 10. The other end of the spring 26 is connected to an eyelet 30 which is formed in a cable which is secured to the anode cable 16. The anode lead wire 22 is spliced to the lead 22a which extends coaxially with the cable 16. The length of the anode cable 22 which extends into the tank is substantially greater than the extended length of the coil spring 26 so that when the coil spring 26 is fully extended, the lead wire 22 will not be fully extended.

A suitable suspension hook 28 may be made from galvanized steel or bronze. The spring 26 is preferably made from stainless steel so as to resist corrosion in use. The stainless steel spring must be sufficiently resilient to permit the anode to move both vertically and horizontally in response to ice movement and it must have a sufficient range of extension to accommodate the range of water level likely to occur within the tank in use. In many tanks, the extension will be as much as ten feet or more. The spring should also be selected so that it will break or its connection with the roof structure will break under a load which is less than that required to overload the roof of the tank so as to cause structural damage or deformation to the roof of the tank.

A further embodiment of the present invention is illustrated in FIG. 4 of the drawings to which reference is now made. In this embodiment, the anodes 12 are suspended by means of a cable 16 which extends over a pulley 32. Thereafter the cable 16 extends towards a central location at which a plurality of cables open outwardly from the tank for connection to the rectifier. In this embodiment, the coil spring 26 has both of its ends connected to the cable 16. The portion 16a of the cable 16 which extends between the ends of the spring 26 again has a length which is substantially greater than the extended length of the spring 26 so that when the spring 26 is fully extended, the portion 16a of the cable 16 is not fully extended. A small secondary spring 28 serves to support the slack portion 16a of the cable in a spaced relationship with respect to the spring 26 so that even when the spring is fully extended, the slack portion 16a will be held in a spaced relationship with respect to the spring.

The embodiment illustrated in FIG. 4 is particularly useful when the clearance between the roof of the tank and the water level is limited as this arrangement maintains the spring above the water level and permits a substantial extension of the suspension.

Access to the interior of the tank for the purpose of servicing the suspension system may be provided by means of a passage 34 which is normally closed by a removable manhole cover assembly 36.

In use under the influence of moving ice within the tank, the suspension systems of the present invention permit the anodes to move both vertically and horizontally within the tank by means of the flexing and/or extension of the coil springs which are an integral part of the suspension system.

Normally in a tank measuring from 50 to 100 feet in diameter and of about 25 feet in depth, the maximum spring extension required is about 10 feet.

The use of a tension spring of a type illustrated herein is of considerable importance. It has been found that suspension systems incorporating a spring driven rotatable reel do not operate efficiently as they "ice-up" under the very conditions in which the proper operation of the suspension system is essential. It will be seen that even if ice forms on the exterior of the extension spring of the present invention, the ice will be dislodged very easily when the spring extends in response to movement of the anodes.

The springs 26 are preferably pre-tensioned so that extension of the spring resulting from initial loading is minimized thereby ensuring that the major portion of the spring extension is available for use in the protective function of the suspension system.

It will be apparent from the foregoing that the present invention provides a simple and efficient form of suspension means suitable for supporting anodes within a water storage tank in a manner such that movement of the anodes under the influence of ice within the tank will not result in damage to the anode suspension system or the tank.

Various modifications of the present invention will be apparent to those skilled in the art without departing from the scope of the invention. For example, the suspension system may be employed in a cathodic protection system employing any number of various arrangements of anodes including a system in which only one centrally located anode is employed.

What I claim as my invention is:

1. In an outdoor water storage tank having cathodic protection means for inhibiting corrosion which includes anode means disposed in the tank, the improvement of anode suspension means having one end rigidly secured to the tank and anode means secured at the other end thereof, and metal coil tension spring means secure to said anode suspension means and disposed intermediate the ends thereof to permit movement of said anode means with respect to said rigidly secured end of said suspension means.

2. In an outdoor water storage tank having a cathodic protection means including anode means suspended within the tank, the improvement of suspension means comprising

a. anode cable means having one end secured to said anode and the other end rigidly secured to said tank.

b. metal coil tension spring means having one end secured with respect to said anode cable at a first point on the length of said anode cable and the other end of said spring means being secured with respect to said cable at a second point on the length of said anode cable which is spaced from the first point along the length of said cable a distance which is substantially greater than the length of said tension spring means whereby said suspension means is adjustable within the range of extension of said spring means to permit movement of said anode means with respect to said tank without overloading said anode cable means.

3. A water storage tank as claimed in claim 2 wherein said metal tension spring means is entirely disposed above the normal high water level in the tank such that

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the action of the spring is unaffected by the formation of ice in the tank.

4. A water storage tank as claimed in claim 2 having an upper wall extending generally transversely thereof, said metal tension spring means being mounted in said tank to extend closely adjacent to and substantially parallel to said upper wall so as to be entirely disposed above the high water level in the tank.

5. In an outdoor water storage tank having a cathodic protection means including anode means suspended within said tank, the improvement of suspension means for suspending said anode means within said tank comprising

- a. metal coil tension spring means having a first end and a second end, said first end of said tension spring means being secured with respect to said

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tank,

- b. anode cable means having one end secured to said anode means and the other end opening outwardly of said tank adjacent said first end of said tension spring means,

- c. said second end of said tension spring means being secured to said anode cable means at a point intermediate the ends of said anode cable means, said anode cable means having a length between said point and said other end thereof which is greater than the length of said spring means whereby said spring means may be extended to permit movement of said anode means within said tank without overloading said anode cable means.

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