United States Patent [19]

Shaffer

[11] **3,734,181**

[45] **May 22, 1973**

[54] CORROSION REDUCING APPARATUS FOR A PRODUCING OIL WELL OR THE LIKE

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[22] Filed: **Mar. 25, 1971**

[21] Appl. No.: **127,921**

[52] **U.S. Cl.** .....**166/244 C,** 166/65 R
[51] **Int. Cl.** **E216 43/00**
[58] **Field of Search** .....166/65, 244 C

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[57] **ABSTRACT**

The corrosion reducing apparatus for a producing oil well has the positive terminals of three substantially discharged batteries connected respectively to the pump rod, the casing head, and the casing of the oil well; and has the negative terminals of the batteries connected to a rod driven into the ground. The pump rod is provided with a split zinc jacket around the short tube between pup joints, and a latch-on bow spring around the jacket to secure the jacket to the rod for insertion into a tube in the well whereupon the bow spring engages the tube to electrically connect the rod to the tube.

9 Claims, 4 Drawing Figures

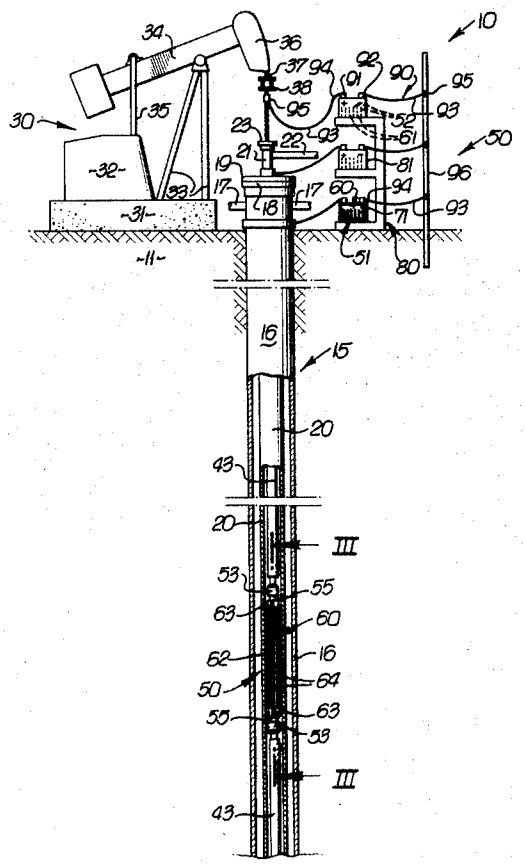


FIG. 1.

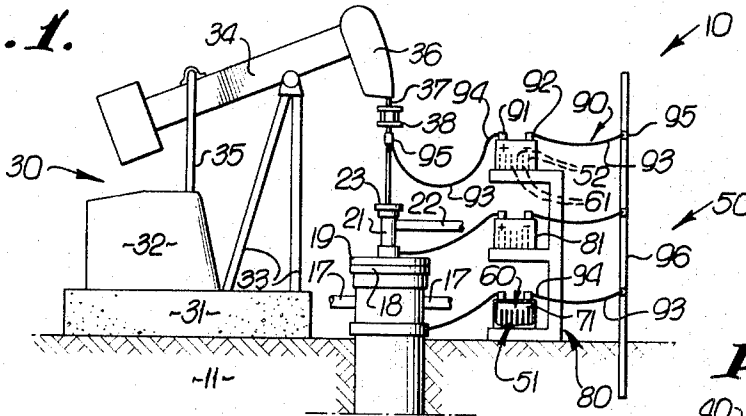
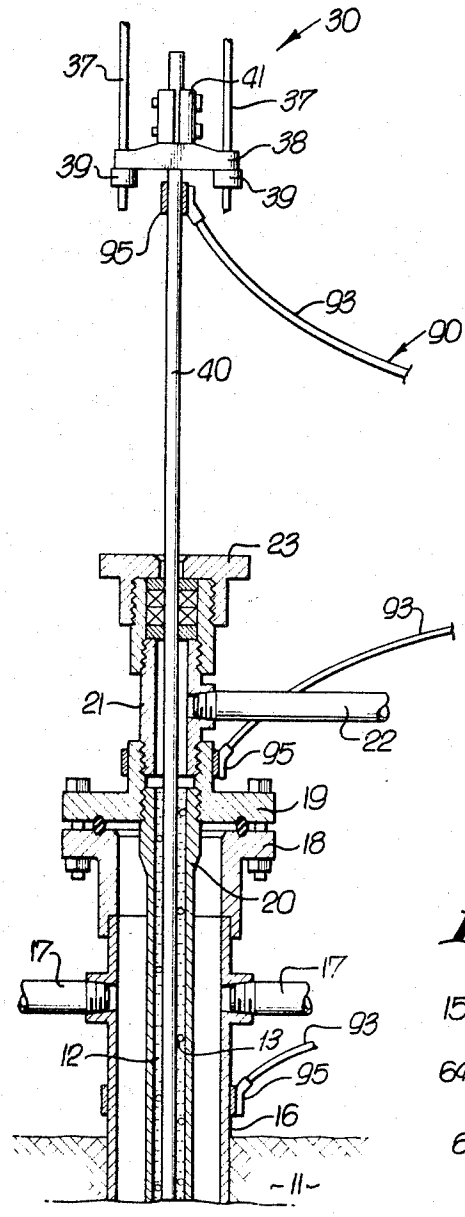


FIG. 2.



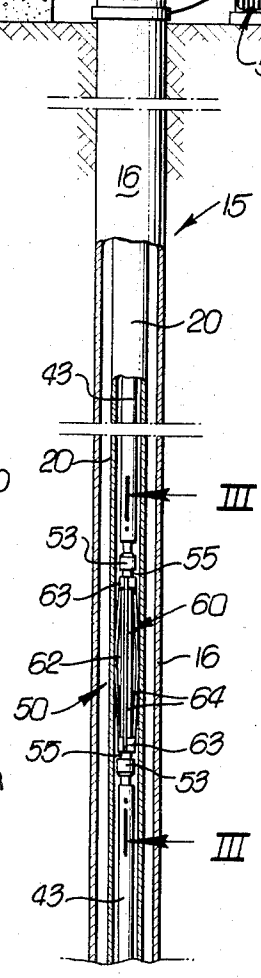


FIG. 3.

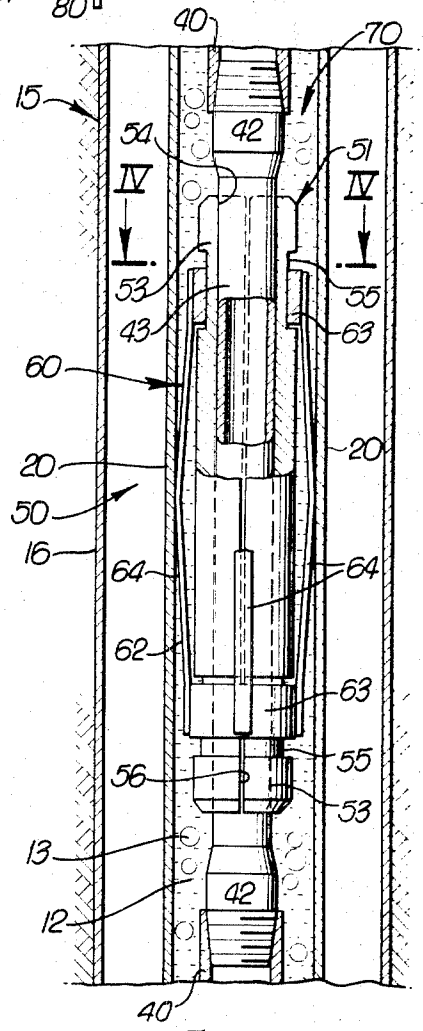
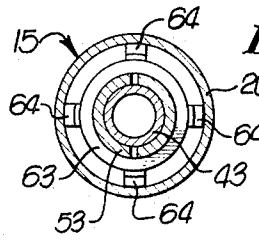


FIG. 4.



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CORROSION REDUCING APPARATUS FOR A PRODUCING OIL WELL OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to wells, and more particularly to a corrosion reducing apparatus and method for wells.

All wells have corrosion problems because they have corrodable metal parts and a corroding agent, usually ground water, to attack the metal parts. The corrosion problem is particularly acute in a producing oil well, because such wells not only have metal parts exposed to ground water, but also because such wells have a pump rod which reciprocates relative to the tubing of the casing, producing static electricity which initiates and aids the corrosion process.

The corrosion that causes most problems in a producing oil well is corrosion on the pump rod itself. The pump rod, as it reciprocates in the casing tube to operate the pump, is surrounded by an oil and water mixture which aided by static electricity attacks the surface of the rod. After a period of time, this corrosion sufficiently weakens the rod, so that it must be replaced. Even before the corrosion requires replacement of the rod, the corrosion gouges the surface of the rod to in turn chew the sealing surfaces of the oil well packing around the rod. After a sufficient length of time, the packing also must be replaced. Of course, while the rod and packing are being replaced, the well is not producing, and thus the corrosion causes not only the cost of the replacement parts, but also the cost of down time of the well. These two costs make the corrosion of the pump rod a very expensive problem.

Likewise, corrosion attacks the tube into which the rod extends. This corrosion will eventually eat through the tube and allow some of the oil pumped therein to escape into the casing. When the corrosion openings become large, too much of the oil being pumped escapes into the casing and the tube must be either repaired or replaced. Either course of action is expensive. Additionally many other parts of the oil well are subject to corrosion, and so must be replaced periodically adding to the expense caused by corrosion.

I have found that the corrosion occurring in a producing oil well can be reduced by the corrosion reducing apparatus, which is disclosed in this patent application. This corrosion reducing apparatus therefore substantially reduces the cost of pumping oil by reducing the down time and parts replacement due to corrosion.

SUMMARY OF THE INVENTION

Therefore it is the principal object of this invention to provide a novel corrosion apparatus and method for use in a producing oil well or the like.

Other and additional objects of this invention are to provide such an apparatus which can operate internally and/or externally of the well, to provide such an apparatus which is inexpensive to make and which utilizes an existing product as the primary component part, to provide such an apparatus which is easily installed on the oil well and which does not obstruct with the pumping operations of the oil well, and to provide such an apparatus which is effective to reduce corrosion and thereby decrease the expense of producing oil in an operating oil well.

Generally, the corrosion reducing apparatus according to this invention for reducing the corrosion of a producing oil well includes, at least a pair of elements, the first of which is of a material having a high oxidation potential, and the second of which is of a material having a lower oxidation potential, an electrolytic solution, means mounting the elements in the electrolytic solution, means electrically connecting the first element to the oil well, and means electrically connecting the second element to ground to provide a path to ground for the eddy currents caused by the motion of the associated oil well pumping mechanism. A generally discharged battery having positive and negative terminals may provide the elements, the electrolytic solution and the mounting means with the positive terminal being electrically connected to the oil well, and the negative terminal being connected to ground. A split zinc jacket may be provided about the rod of the pumping mechanism in electrical contact therewith with an aluminum spring surrounding the jacket to secure the jacket to the rod while the arms of the spring extend to electrically contact the tube of the casing.

Generally stated, the method of reducing corrosion in a producing oil well according to this invention includes the steps of: providing a pair of elements in an electrolytic solution, the first of the elements being made of material having a higher oxidation potential than the material of the second of said elements; electrically connecting the first element to the oil well and electrically connecting the second element to ground, The step of providing a pair of elements in electrolytic solution may include the step of providing a generally discharged battery and the step of electrically connecting the first element may include the step connecting a wire between the oil well and the positive battery terminal, and the step of electrically connecting the second element may include the step of electrically connecting the second element may include the stp of connecting the wire between the negative terminal and ground. The step of providing a pair of elements may include the steps of locating a split jacket of a material of high oxidation potential around the moving rod of the pumping mechanism and locating a spring of a material of low oxidation potential around the jacket to secure the jacket to the rod, inserting the rod with the jacket and spring thereon into the tube, whereupon the spring arms electrically engage the tube to provide a path to ground

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of a producing oil well having a corrosion preventing apparatus, according to this invention, installed thereon.

FIG. 2 is an enlarged side elevational view of a portion of FIG. 1.

FIG. 3 is an enlarged cross-sectional view taken along the plane III—III of FIG. 1, and

FIG. 4 is a cross-sectional view taken along the plane IV—IV of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the figures, and particularly to FIG. 1, an operating oil well is generally denoted by the numeral 10. The illustrative operating oil well 10 is located on the surface of ground 11 for pumping oil 12 from an oil well 10 deep underground. Many times, the underground oil pool 12 is located on the surface of a ground water pool 13, and always the ground 11 over

the oil pool 12 contains ground water 13 so that a producing oil well 10 pumps a mixture of oil 12 and water 13, which remain heterogeneous though mixed. The heterogeneous character of the mixture aids the corrosive action of the ground water 13 to corrode the oil well apparatus 10. The apparatus of the producing oil well 10 is composed of two main types, a casing assembly 15 and a pumping assembly 30.

The casing assembly 15 of the producing oil well 10 is typical and includes a generally vertical casing 16 sunk into the well hole in the ground 11. The casing 16 is provided with two horizontal casing pipes 17 to provide pressure relief, if needed. The upper end of the casing 16 is closed by a "Christmas tree," typically a casing head 18 having a tube hanger flange 19 thereover. Tubing 20 depends from the flange 19 and a T-joint 21 rises from the flange 19. The laterally opening juncture of the T-joint has a production line 22 therein for conducting the oil raised by the pumping apparatus 30 into storage tanks and the upwardly opening juncture of the T-joint 21 has a stuffing box 23 mounted thereon.

The pumping assembly 30 of the producing oil well 10 typically includes a concrete base 31 on which an engine or motor 32 is mounted. The base 31 also mounts supporting structure 33. for a walking beam 34. One end of the walking beam 34 has a driving arm 35 extending therefrom to the engine or motor 32 and the other end of the walking beam has a head 36. The head 36 has one end of a pair of cables 37 secured thereto with the other end of the cables 37 extending downward to receive a sucker rod elevator 38 which is secured thereto by clamps 39. The sucker rod elevator 38 has a pumping rod 40 extending through a central hole, with a rod clamp 41 securing the pumping rod 40 to the sucker rod elevator 38. The pumping rod 40 is made up of a series of individual rods, joined together by pup joints 42 and short takes 43 between the pup joints 42.

The pumping rod 40 of the oil well pumping assembly 30 extends through the stuffing box 23 and into the tubing 20 of the casing assembly 15 until reaching the oil pool at the bottom of the well where a pump (not shown) is attached thereto. The pump is located in the oil, and lifts an oil and water mixture up the tubing 20 in response to vertical reciprocal motion of the rod 40, caused by the walking beam 34 driven by the motor 32. As the rod 40 reciprocates vertically in the tubing 20, static electricity is produced on the surfaces of the tubing 20 and the rod 40 which causes eddy currents. These eddy currents, aid the mixture of oil and water to corrode the surfaces of both the rod 40 and the tubing 20 until one or both need to be replaced.

The corrosion reducing apparatus 50, according to this invention is for reducing the above-described corrosion in the producing oil well 10. Generally, the apparatus 50 includes a high oxidation potential element 51, a low oxidation potential element 60, an electrolytic solution 70, mounting means 80 for mounting the elements 51 and 60 in the electrolytic solution 70, and electrical connecting means 90 for electrically connecting the elements 51 and 60 to the oil well apparatus 15 and 30 and the ground 11 respectively. The corrosion reducing apparatus 50 thereby provides a path to ground for the static electricity and eddy currents produced by the motion of the oil well pumping apparatus 30.

Basically, the corrosion reducing apparatus 50 according to this invention is shown in two illustrative forms. The external form is illustrated in FIGS. 1 and 2, and an internal form is illustrated in FIGS. 1, 3 and 4.

Referring now to FIG. 1, the external form of the corrosion reducing apparatus 50 includes the provision of substantially discharged batteries. In such a battery, the high oxidation potential element 51 is a plurality of zinc plates 52, and the low oxidation potential element 60 is a like plurality of lead plates 61. The electrolytic solution 70 is battery acid 71 and mounting means 80 is the battery case 81. The battery case 81 mounts the zinc plates 52 in interdigitating relationship with the lead plates 61 in the battery acid 71, as is well known.

The electrical connecting means 90 of the external form of the corrosion reducing apparatus 50 includes a positive terminal 91 of the battery which is connected to the zinc plates 52, and a negative terminal 92 of the battery which is connected to the lead plates 61. The electrical connecting means 90 also includes a wire 93 having a battery terminal end 94, and a clip end 95. As seen in FIGS. 1 and 2, a wire 93 extends from the positive terminal 91 of three batteries in a battery rack respectively to the rod 40, to the tubing hanger flange 19, and to the tubing 20 to electrically connect the positive terminal 91 to the batteries to the producing oil well 10. Another wire 93 extends from the negative terminal 92 to a rod 96 driven into the ground 11, to complete the external form of the corrosion reducing apparatus 50. Any eddy currents produced by relative motion between the rod 40 and the tubing 20 are conducted through the battery and into the ground where they are dissipated.

The internal form of the corrosion reducing apparatus 50 is best seen in FIGS. 3 and 4. The internal form of the corrosion reducing apparatus 50 illustratively includes a zinc jacket 53 as the high oxidation potential element 51. The zinc jacket 53 is generally cylindrical with a cylindrical bore 54, and upper and lower external annular grooves 55. The jacket 53 is split at 56 into the two halves enabling the jacket 53 to be mounted around the short take 43 without separating the pup joints 42.

The low oxidation potential element 60 of the internal form of corrosion reducing apparatus 50 is a spring 62 having upper and lower rings 63 between which bowed arms 64 extend. The rings 63 are split and so sized as to snap into the angular grooves 55 of the jacket 53 to secure the two halves of the jacket 53 around the short take 43 between the pup joints 42, and additionally to secure the spring 62 thereto.

After the spring 62 and the jacket 53 are secured to the rod 40, it is inserted into the tubing 20. The bowed arm 54 of the spring 62 engage the sides of the tubing 20 for electrical contact therewith. The jacket 53 is in electrical contact with the rod 40 to provide an electrical path between the tubing 20 and the rod 40 to ground. During pumping, the mixture of oil and ground water being lifted up the tubing 20 acts as the electrolytic solution between the spring 62 and the jacket 53 to pass the static electricity and eddy currents to ground where they are dissipated, as before.

It should be noted that the element 50 could be secured to the rod 40 and the element 60 could be secured to the tubing 20, with spring arms extending between the elements 50 and 60 to provide the electrical

contact therebetween, but such assembly would be harder to accomplish than the illustrated assembly.

Thus, the corrosion reducing apparatus **50**, according to this invention, provides a path to ground for the eddy currents and static electricity produced by the reciprocal motion of a producing oil well to reduce the corrosion on the oil well apparatus, especially on the pumping rod **40** and on the tubing **20.**

I claim:

1. A corrosion reducing apparatus for reducing the corrosion of a producing oil well or the like, having well casing, tubing and rod member extending into the ground and exposed to ground water therein, due to eddy currents caused by the motion of the associated oil well pumping apparatus, comprising

at least a pair of elements, the first of which is of a material having a high oxidation potential and the second of which is of a material having a lower oxidation potential,

an electrolytic solution,

means for mounting the elements in the electrolytic solution,

means for electrically connecting the first element to at least one of the oil well casing, tubing and rod members, and

means electrically connecting the second element to ground.

2. The apparatus as in claim **1** wherein a generally discharged battery, having positive and negative terminals, provides the elements, the electrolytic solution, and the mounting means, the positive terminal of the battery being electrically connected to one of the oil well casing, tubing and rod members and the negative terminal being grounded.

3. The apparatus as in claim **1** wherein the first element is provided as a jacket about and in both physical and electrical contact with one of said casing tubing and rod members.

4. A corrosion reducing apparatus for reducing the corrosion of a producing oil well or the like, extending into the ground and exposed to ground water therein, due to eddy currents caused by the motion of the associated oil well pumping apparatus, wherein the oil well includes a tube extending into the ground and exposed to ground water, and the pumping apparatus of the oil well includes a pumping rod centrally located in the tubing and reciprocating therein to pump the oil, comprising

at least a pair of elements, the first of which is of a material having a high oxidation potential and the second of which is of a material having a lower oxidation potential, wherein the first element is a jacket surrounding the rod in electrical contact therewith; wherein the second element surrounds the jacket in electrical contact with the tubing;

an electrolytic solution provided by the ground water in the oil in the tubing,

means mounting the elements in the electrolytic solution,

means electrically connecting the first element to a portion of the oil well, and

means electrically connecting the second element to ground.

5. The apparatus as in claim **4** wherein the jacket is split to mount around the rod, and wherein the second element is a spring which mounts around the split jacket to secure the jacket to the rod, said spring extending outwardly into engagement with the tubing.

6. A method of reducing corrosion of an operating oil well having well casing tubing and rod members extending into the ground and being exposed to ground water therein, comprising the steps of:

providing a pair of elements in an electrolytic solution, the first of said elements being made of a material having a higher oxidation potential than the material of the second of said elements;

electrically connecting the first of said elements to at least one of the oil well casing, tubing and rod members; and

electrically connecting the second of said elements to ground.

7. The method of claim **6** wherein the step of providing a pair of elements in an electrolytic solution includes the step of providing a generally discharged battery including a positive and a negative terminal, and wherein the step of electrically connecting the first element includes the step of connecting at least one wire between the oil well casing, tubing or rod member and the positive terminal of the battery and the step of electrically connecting the second element includes the step of connecting a wire between the negative terminal and the ground.

8. A method of reducing corrosion of an operating oil well extending into the ground and being exposed to ground water therein, due to eddy currents caused by the motion of the oil well pumping apparatus, comprising the steps of:

providing a pair of elements in an electrolytic solution, the first of said elements being made of a material having a higher oxidation potential than the material of the second of said elements;

electrically connecting the first of said elements to the oil well; and

electrically connecting the second of said elements to ground, wherein the step of providing a pair of elements includes the step of locating a jacket of the high oxidation potential material about a reciprocating rod from the pumping apparatus, and locating a spring of the low oxidation potential material in electrical contact with a tubing.

9. The method of claim **9** wherein the step of locating the jacket about a reciprocating rod includes the step of spliting the jacket into two halves, and placing these halves around the rod, and wherein the step of locating the spring includes the steps of mounting the spring about the halves of the jacket to secure the jacket to the rod and inserting the rod, with the jacket and spring thereon, into the tube whereupon the spring engages the tube in electrical contact therewith while the jacket is in electrical contact with the rod, said electrolytic solution being the ground water in the tubing.

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