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METHOD OF REMOVING DRILLING TOOLS.

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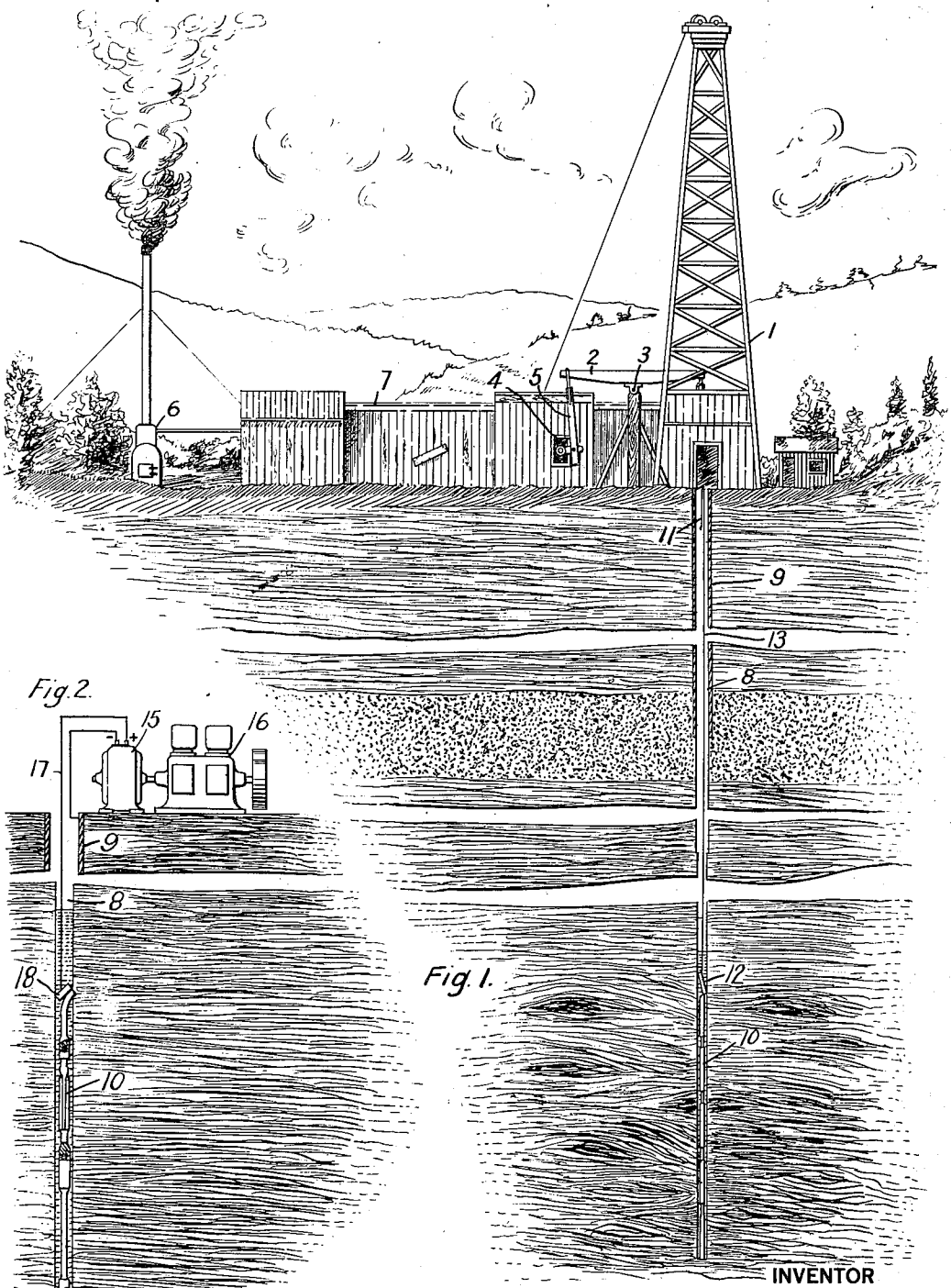


Fig. 1.

Fig. 2.

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METHOD OF REMOVING DRILLING-TOOLS.

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To all whom it may concern:

Be it known that I, WALTER O. SNELLING, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of Removing Drilling-Tools, of which the following is a specification.

My invention relates to the removal of well-drilling tools or other metallic objects embedded in the earth, and it has special reference to the removal of such metallic objects from deep drilled wells.

The object of my invention is to provide a simple and rapid electrolytic method for dislodging or destroying oxidizable metallic bodies embedded in the earth, and particularly for removing broken and jammed drilling tools, casing parts or other metallic obstructions from the deep wells that are commonly drilled for oil, gas, or water.

In the accompanying drawing, Figure 1 is a general view, partly in side elevation and partly in vertical section, of a well-drilling installation or rig, showing a string of drilling tools jammed at the bottom of the hole, and Fig. 2 is a vertical sectional view of a partly drilled well, showing a jammed and broken string of tools, and illustrating one modification of my present invention.

In the drilling of deep wells for oil, gas or water, the loss of a string of drilling tools in a not infrequent occurrence, and much attention has been paid to devising so-called "fishing" methods and apparatus for recovering such lost tools or parts of tools. However, in spite of the most improved fishing methods, tools are often lost which cannot be recovered in this manner, and which remain as a serious obstruction in the well. In such a case, it is necessary either to find means for drilling around the obstruction, a matter of much difficulty, or to abandon the well at a considerable loss.

According to my present invention, I dispose of broken tools, casing parts or other oxidizable metallic obstructions by making such an obstruction the positive electrode or anode of an electrolytic cell, in the presence of a suitable electrolyte and preferably with the assistance of strong electric currents. The effect of this treatment is to transform the metal, either wholly or in part, into loose masses of oxids. The process of electrolytic oxidation may be carried only far enough to reduce the size of the metallic object sufficiently to permit it to be dislodged and removed by ordinary fishing methods; or the metal may be completely oxidized, the resulting oxid slimes being readily removed or penetrated in renewed drilling operations.

Fig. 1 of the accompanying drawing illustrates a situation to which my present invention may be applied, and shows a well drilling rig consisting of the usual derrick 1, a walking beam 2, oscillated about a pivot 3 by means of a crank 4 and a connecting rod 5, and a boiler 6 for supplying steam to an engine which, together with the other operating mechanism, is housed by a building 7. The well 8 is exaggerated in diameter for the purpose of illustration and is shown sunk to a considerable depth, which may be several hundreds or thousands of feet, through various strata of earth. The upper section of the well is provided with the usual casing 9. At the bottom of the well is a string of drilling tools 10, composed of the usual bit, jars and sinker, the upper end of the string of tools being shown in the bent and distorted condition in which they are left after unsuccessful fishing operations and the operating cable 11 being indicated as having parted and left the tools below. It is my present object to remove lost and jammed tools, such as those shown, by partial or complete electrolysis.

Many drilled wells, especially those that are bored for oil and gas, contain saline solutions, and in such cases, no additional electrolyte is necessary for my purpose. When such solutions are not already present, I prefer to introduce into the well a quantity of common salt, together with sufficient water, if the well is dry, to submerge the metallic parts to be electrolyzed. While common salt is a convenient electrolyte for my purpose, any other electrolyte may be used that has a corrosive action upon iron under the conditions described below.

The principles of my invention may be applied in several ways, the simplest of which consists in providing a suitable electrolyte and lowering into the well, in contact with the tools, a bar 12 of copper or of some other material that is electrolytically negative with respect to iron. Such a bar, when brought into contact with the iron as

shown in Fig. 1, forms a short-circuited galvanic cell, and generates sufficient current to cause the negative ions of the electrolyte to move toward the iron electrode, where they give up their electric charges, and decompose a portion of the water present. The nascent oxygen thus evolved corrodes the iron at a substantial rate, and the corrosion process may be assisted by raising and dropping the bar 12 by means of a suspending cord or wire 13, in order to remove the adhering oxids from the iron tools and to expose fresh surfaces to the electrolytic action. This process, however, is relatively slow, and I therefore prefer to make use of electric currents of considerable magnitude, in order to hasten the oxidation of the tools.

Portable direct-current electric generators and motor-generators sets are now in common use for electric welding and for other direct-current service, and such portable generators are frequently capable of producing currents, at low voltages, of 300 or 400 amperes. Such generators are well adapted for my present purpose, and may be driven either by electric motors or by gas engines, according to the circumstances under which they are used. Fig. 2 of the accompanying drawing shows an arrangement for utilizing a generator set of this kind in the electrolysis of drilling tools according to my invention.

The generator 15, driven by a gas engine 16, is brought near the surface opening of the well 8, and its positive terminal is connected, by means of an insulated conductor 17, with a contact member 18, which is suitably of coppper, and which is lowered into the well into contact with the tools 10. The negative terminal of the generator 15 should be well grounded, suitably by connecting it to the well casing 9. Current from the generator flows through the conductor 17 and the contact member 18 to the tools 10, and then through the electrolyte to the earth. The tools 10 are thus made the positive electrode of a powerful electrolytic cell, of which the earth forms the negative electrode, and they are rapidly corroded by the ensuing oxidizing action. The iron oxids produced in contact with the iron tend to set up small galvanic couples which promote the destruction of the iron by self-corrosion. The voltage of the generator should of course be as low as possible, in order to reduce the consumption of power and also to prevent leakage of current from the conductor 17 to the well casing 9.

As indicated above, the electrolysis of the iron may be either partial or complete. Thus, it may be only necessary to remove a small outer portion of the iron to enable the tools to be dislodged and removed by ordinary fishing methods, or it may be more convenient to completely consume the tools, especially if the quantity of iron is not great and if the tools are badly jammed in the well. It may be advisable to remove the oxids from time to time, in order to maintain free access of the electrolyte to the iron.

While the use of direct current is ordinarily to be preferred in carrying out my present method, it is also possible to employ alternating current, by adding to the electrolyte a chemical agent such as a soluble carbonate which forms an insoluble compound with the iron dissolved at each alternation of the current in the electrolyzing direction. For example, sodium carbonate may be added to the electrolyte for this purpose, and under these circumstances it may be found desirable to substitute a carbon electrode for the copper contact member 18.

My invention may be variously modified without exceeding the scope of the appended claims, and it is therefore to be understood that the structural details which I have shown and described are to be construed as being illustrative only, and not as imposing limitiations upon the claims.

I claim as my invention:

1. The method of disposing of well-drilling appliances embedded in the earth that comprises electrolytically destroying the metallic character of at least a portion of the metal composing such appliances.

2. The method of disposing of well-drilling tools embedded in the earth that comprises electrolytically oxidizing such tools.

3. The method of disposing of well-drilling tools embedded in the earth that comprises making such tools the anode of an electrolytic cell and thereby transforming the metal composing the tools at least partially into a non-metallic condition.

4. The method of disposing of well-drilling tools embedded in the earth that comprises making such tools the anode of an electrolytic cell and passing electrolyzing current through the cell thus formed thereby transforming the metal composing the tools at least partially into a non-metallic condition.

5. The method of disposing of well-drilling tools embedded in the earth that comprises making such tools the anode of an electrolytic cell, passing an electrolyzing current through the cell thus formed, and removing the non-metallic ferruginous reaction products.

6. The method of disposing of well-drilling tools embedded in a well that comprises providing sufficient electrolyte in the well to submerge the tools, lowering an electric contact member into engagement with the tools, and supplying an electrolyzing current to the said contact member.

7. The method of disposing of well-drill-

ing tools embedded in the earth that comprises lowering an electric contact member into engagement with the tools, in the presence of an electrolyte, and supplying an electrolyzing current to the said contact member.

In testimony whereof, I have hereunto subscribed my name this 23rd day of August, 1915.

WALTER O. SNELLING.

Witnesses:
M. R. McKeown,
J. G. Kaiser.