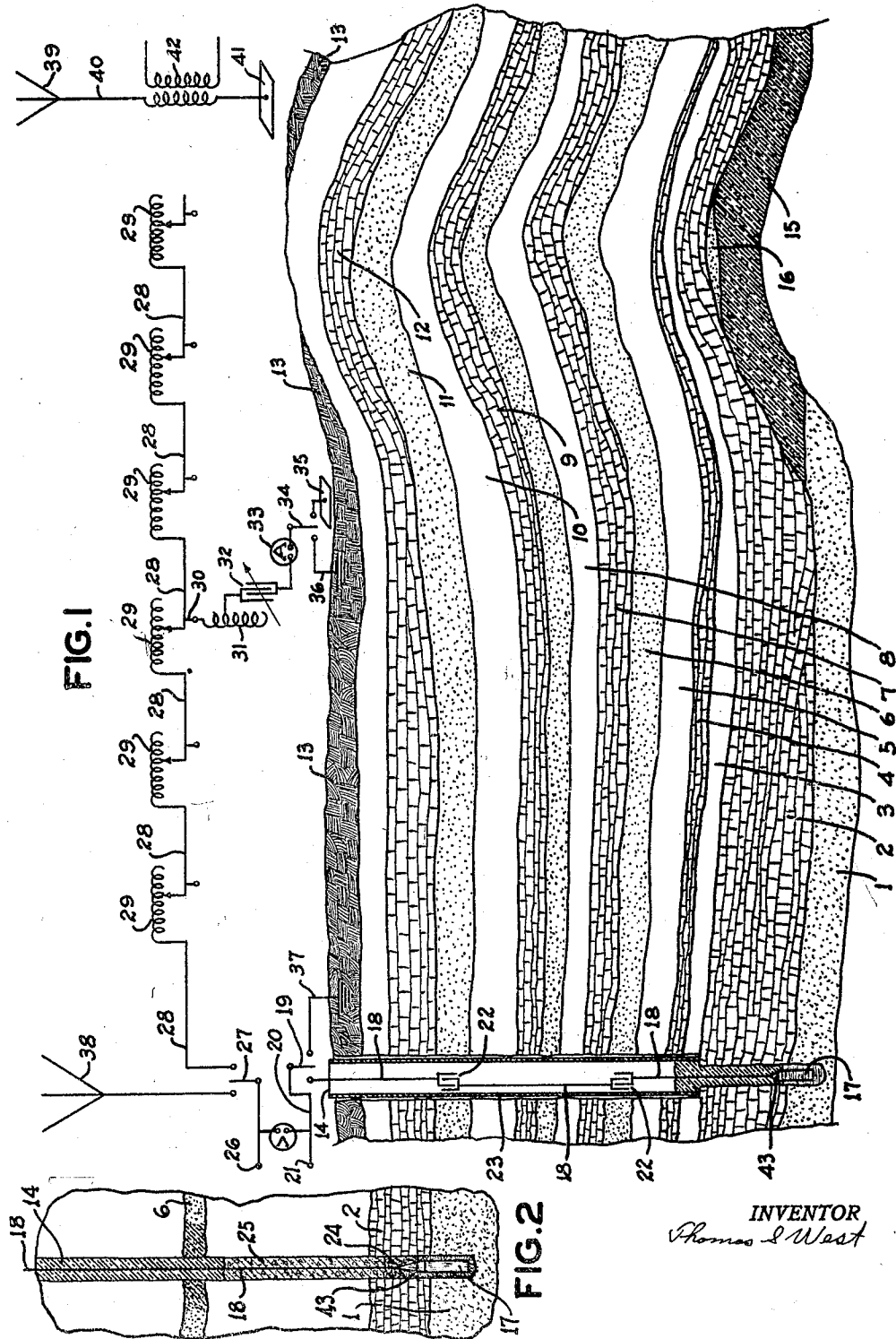


Feb. 16, 1932.

T. S. WEST

1,845,379

PROCESS OF AND APPARATUS FOR LOCATING MINERAL
DEPOSITS IN SUBSURFACE EARTH STRATA
Filed May 13, 1930



INVENTOR
Thomas S. West

Patented Feb. 16, 1932

1,845,379

UNITED STATES PATENT OFFICE

THOMAS S. WEST, OF DRUMRIGHT, OKLAHOMA

PROCESS OF AND APPARATUS FOR LOCATING MINERAL DEPOSITS IN SUBSURFACE EARTH STRATA

Application filed May 13, 1930. Serial No. 452,113.

My invention relates to the exploration of the earth's subsurface strata for deposits of ore, oil, gas and other mineral substances.

The objects of my invention are to provide
5 a device of this class which is new, novel, practical and of utility; which will permit the exploration of any stratum that it is possible to reach by a bored-hole, or any stratum lying between the stratum in which the
10 bored-hole terminates and the earth's surface; which will disclose the variance in the level of a stratum; which will operate electrically; which will detect any oil, gas, or ore deposits either in the stratum being explored, or between that stratum and the earth's surface, due to the difference in electrical properties of the bodies and the surrounding or intervening strata; which will be inexpensive in operation and installation; and which
20 will be efficient in accomplishing all the purposes for which it is intended.

At the present time, geology is depended upon to determine the likelihood of the presence of a mineral bearing stratum at a given
25 locality. This method is not infallible, and in fact is quite unreliable in a great many instances. For instance a great many non-productive wells are drilled in localities where the geological structure points to the probable presence of oil. Thus a waste of
30 much time and money is occasioned. This inefficiency of geology is also comparatively true with reference to the locating of other minerals such as iron, lead, zinc, and the like. Many times much expense is incurred in boring and digging to locate ore deposits, the presence of which are indicated by the geological structure of a vicinity, but which are not actually in existence.

40 My method is based, and depends for its function, upon the fact that different mineral bodies or different earth formations offer a different impedance or resistance to electrical current.

15 With these and other objects in view as

will more fully appear, my invention consists in the construction, novel features, and combination of parts hereinafter more fully described, pointed out in the claims hereto appended and illustrated in the accompanying
50 one-sheet drawings, of which,

Figure 1 is a vertical sectional view of imaginary earth strata with a cased bored hole therethrough, and showing my apparatus installed for use, the apparatus being
55 shown in diagram; and,

Fig. 2 is a fragmentary sectional view of the lower portion of an uncased bored hole, showing the method of packing-off the lower
60 stratum.

Like characters of reference designate like parts in all the figures.

It is understood that various changes in the form, proportion, size, shape, weight, and other details of construction, within the
65 scope of my invention may be resorted to without departing from the spirit or broad principle of my invention and without sacrificing any of the advantages thereof; and it is also understood that the drawings are to
70 be interpreted as being illustrative and not restrictive.

One practical embodiment of the invention as illustrated in the drawings follows:

In the drawings herein, I have illustrated,
75 and will describe herebelow the operation and application of my apparatus and method with reference to the exploration of subsurface earth strata for locating an oil or oil and gas deposit. It will be obvious that an
80 ore deposit might be located in a similar manner to that used in locating oil, the only difference being in the interpretation of the data obtained.

As best seen in Fig. 1 the reference numeral 1 indicates a water bearing sand stratum, 2 a lime stratum thereabove, 3 a shale stratum, 4 a lime stratum, 5 a shale stratum, 6 another water bearing sand stratum, 7 a lime stratum, 8 a shale stratum, 9 a lime stratum, 10 a shale
85 90

stratum, 11 a water bearing sand stratum, and 12 a lime stratum. The numeral 13 indicates the loam at the earth's surface and 14 indicates a bored hole or well reaching from the earth's surface to within said water bearing sand stratum 1. The numeral 15 indicates an oil deposit in said stratum 1, and 16 a gas pocket between oil pocket 15 and said lime stratum 2. It will be understood that the above described structure is purely imaginative and is shown for illustrative purposes only. In practice various strata may be encountered in various sequences.

Within the bottom of said well 14, I provide an electrode 17, connected, above the earth surface, by an insulated conductor 18 through a manually operated two-way switch 19 and a wire 20, to one terminal 21 of a desired source or supply of either alternating or direct electrical current, not shown. Said source may consist of a desired generator, of either A. C. or D. C. electro-motive force, or may consist of either a single or a series of condenser discharges, or other suitable apparatus, for providing electro-motive force. (Herein after spoken of as "E. M. F."). The opposite terminal of said supply is indicated at 26.

Said conductor 18 may if desired, be provided with a plurality of condensers 22 in order to prevent induction of E. M. F. through the well casing 23 to adjacent conductive formations, due to electro-static capacity between said conductor 18 and said casing 23. In this case only A. C. or interrupted current can be used.

In installing said electrode 17 in cased well 14, the electrode will be lowered into contact with said stratum 1, below the lower end of said casing 23, and oil or other insulating fluid of high electrical resistance will be pumped into the well under sufficient pressure to force any water standing within the casing, due to rock pressure, out into said stratum 1. This pressure may be held within said casing 23 by any usual means such as a pump or the like, during the entire exploration process.

Obviously, should it be desired to utilize an uncased well for the exploration process, it will be necessary to insulate the lower stratum 1 from any conductive stratum thereabove. This may be accomplished in a manner best illustrated in Fig. 2 in which the electrode 17 has been lowered into contact with stratum 1 through a usual drill pipe, not shown. When the electrode is in its desired position, a quantity of lead filing or shavings 24 are dropped into the pipe. The pipe is then slightly raised and the shavings are permitted to fill the well hole around said electrode 17. The pipe is then slightly lowered and raised repeatedly until the shavings have been firmly tamped or packed around said electrode. After this has been accomplished

cement 25 may be forced into contact with the top of said packed shavings. After the well has thus been plugged with the cement 25, oil may be pumped into the well around said conductor 18 at a sufficient pressure to displace any water therein and force the oil out into any water bearing sand stratum through which the well penetrates. The separating of the electrode from direct electrical connection with other low resistance strata may possibly be accomplished by other methods than those above described, and applicant does not wish to bind himself to any one method, as different conditions may necessitate different methods. It will be noted however, that the upper end of said electrode is provided with a conical portion 43 to assist in aligning the electrode during the packing of said lead shavings 24 therearound.

I have thus far described a positive means of supplying E. M. F. to a desired sub-surface stratum of low resistance. The electrical apparatus thus far described as lying between said terminal 21 and to and including said electrode 17, is one branch of the circuit. The other branch of the circuit comprises:

A two-way switch 27, a conductor 28, provided with a plurality of adjustable inductance coils 29 for bringing the current and voltage in phase at desired points, a detachable conductor 30, an adjustable inductance coil 31, an adjustable condenser 32, an ammeter 33, a two-way switch 34, and a plate 35. Any additional apparatus such as amplifiers and the like, may be supplied adjacent said ammeter 33, for measuring or gauging accurately the current which may flow through the circuit. Preferably, said plate 35 will not be placed in direct contact with the earth when A. C. is used. It will be understood that the apparatus indicated by reference numerals 30 to 35 inclusive will be preferably confined in a portable housing together with such other current gauging or controlling means as may be found desirable, and that conductor 30 will be constructed so as to be easily and quickly attached to or detached from said conductor 28 at any desired point in its extent.

From the above description it may be seen that when A. C. is used, I depend for the completion of the circuit, upon current flow from said electrode 17 to plate 35 by conduction along various conductive strata and upon the current flow from said electrode 17 to plate 35 by electrostatic capacity between the various conductive strata and the plate. Obviously the current flow will be divided among the conductive paths and the amount of current flowing in each path will be inversely proportional to the impedance of such path. A larger portion of the current which is introduced into said stratum 1, will flow by conductance along said stratum 1 to the

1,845,379

3

782

nearest possible point to said plate 35, whence a portion of it will flow upward to the plate because of electrostatic capacity. Obviously, also, any deposit of a substance of high resistance, such as oil deposit 16, in the path of the current flowing either by conductance or by electrostatic capacity from said electrode 17 to said plate 35, will register its effect on the current upon said gauging apparatus; and that any deposit of a substance of low resistance, such as a metal ore or the like, under similar circumstances, will have the reverse effect upon the current. Consequently if plate 35 were to be moved from its illustrated position to a point at the outer end of said conductor 28, the deposit of oil 16 would increase the capacitive reactance between stratum 1 and said plate 35.

It may be seen that any variance in the elevation of said stratum 1, will have its effect upon the current flow from said electrode 17 to said plate 35, and may be determined by the variance in the phase relation of the current and the voltage, the variance in resistance, and the abruptness at which such variance occurs.

In case it is desired to use D. C. or a low frequency A. C., said switch 34 may be disconnected from said plate 35 and connected to a grounded conductor 36. It will be obvious that in case D. C. or a low frequency A. C. is used in connection with said grounded conductor 36, the current flow from said electrode 17 to said conductor 36 will be affected by any or oil deposit encountered.

In preparing for the operation of the device, it may be found desirable to test the resistance of said stratum 13 and for this purpose said switch 19 may be disconnected from said conductor 18 and placed in contact with grounded conductor 37.

Another slightly different embodiment of the apparatus, but one not different in principle may be used as follows:

An antenna 38 may be provided at a point adjacent the top of said well and in a manner in which connection may be had there-to through said switch 27. A second portable antenna 39 may be provided, having electrical contact through conductor 40 with a plate 41 similar to said plate 35. In this embodiment said conductor 40 will be provided with a radio transformer 42, which in turn may be supplied with desired current gauging and controlling apparatus, as previously described herein, but which has not been shown. Obviously in using this embodiment, the principle will be the same as previously described, the only difference being that the radio wave between said antennae 38 and 39 take the place of said conductor 28 and its connecting apparatus.

Obviously a desired result may be had by causing the current to flow from said electrode 17 to said stratum 1 by electric wave

motion in a dielectric instead of the electrode being in physical contact with said stratum 1.

Obviously, the invention is susceptible of embodiment in forms other than that which is illustrated in the accompanying drawings and described herein, and applicable for uses and purposes other than as detailed, and I therefore consider as my own all such modifications and adaptations and other uses of the form of the device herein described as fairly fall within the scope of my invention.

Having thus described my invention, what is claimed and desired to be secured by Letters Patent, is:

1. Apparatus as and for the purposes described, embodying an electrode adapted to be lowered into a well by an insulated conductor and into electrical connection with a desired stratum, means for insulating said conductor and electrode from a desired portion of the well's wall, means for measuring the magnitude, phase relations, and other characteristics of electric current electrically, connected at a point distant from said well with said stratum through a different earth stratum, means connected to said measuring means for regulating the current, and means connected between said regulating means and said conductor for producing an electrical potential difference therebetween.

2. Apparatus as and for the purposes described, embodying a conical topped electrode adapted to be lowered into a well by an insulated conductor and into electrical connection with a desired stratum, means for insulating said conductor and electrode from a desired portion of the well's wall, means for measuring the magnitude, phase relations, and other characteristics of electric current electrically connected at a point distant from said well with said stratum through a different earth stratum, means connected to said measuring means for regulating the current, and means connected between said regulating means and said conductor for producing an electrical potential difference therebetween.

3. Organization as described in claim 1 in which said detecting means is in electrical connection with said different stratum through a dielectric.

4. Organization as described in claim 1 in which the connection between said regulating means and said electrical current producing means is had by a radio wave.

5. The process of exploring sub-surface earth strata for locating deposits of mineral substances, comprising, applying an electrical connection to a known sub-surface stratum, placing an electrical current detecting device in electrical connection with said stratum through a different stratum at a point distant from the point of contact with said known stratum, connecting said detecting means in series with a means for measuring

the magnitude, phase relation, and other characteristics of said current and a current regulating means, connecting a device between said regulating means and said contact for producing an electrical potential difference therebetween, and determining the presence or absence of said deposits between said stratum and said detecting device or within said stratum by the magnitude and character of the current exerted through the detecting device.

THOMAS S. WEST.

15

20

25

30

35

40

45

50

55

60

65