GEOPHYSICAL SENSOR

Preliminary
Patent Application

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February 271, 1978

APPLICATION FOR PATENT (preliminary draft)

Geophysical Sensor

This invention relates to the utilization of a recently discovered so-called "petroelectric" phenomenon. The as yet little understood effect appears as electrical self-potential signals which are generated within certain high-K dielectrics, including rocks. These electrical potentials are found to undergo characteristic diurnal, secular and pulsive variations related to the geophysical environment.

The invention, therefore, relates to geophysical sensors, especially portable sensors adopted to field surveys, for determining certain geophysical parameters useful in prospecting.

The invention relates to sensors useful in geothermal surveys for determining (remote) temperature gradients or hot spots in subsurface rock formations.

The invention relates to sensors useful in earthquake precursor research.

The invention further relates to basic method and means for generating electricity,

It has been found that certain dielectric materials, more particularly those materials having high density (specific gravity) and high K (dielectric constant) generate an emf spontaneously. Such materials include many of the conventional dielectrics presently used in the manufacture of capacitors such as mica, glass, oiled paper, ceramic, plastic, and electrolytic film. Certain granitic and basaltic rocks likewise generate an internal self-potential which can be conducted away by suitably-placed electrodes and leads so as to be utilized. In most natural high-resistance materials the polarity remains fixed with time, but it has been found that, in some materials, the polarity occasionally reverses due to some external influence not as yet clearly identified.

In virtually all cases involving the so-called "petroelectric effect ", the emf is observed to vary substantially with time i.e., engaging in diurnal or semi-diurnal secular and pulsive variations which, it is found, cannot be attributed to internal changes in temperature pressure or other purely internal factors within the sensor itself. It has been established that these variations arise from external causes related, in the main, to the geophysical environment. Hence, one of the applications is a sensor for certain geophysical parameters which are otherwise difficult to observe.

It must be remembered that the geophysical environment giving rise to factors which affect the petroelectric sensor is remote from the sensor itself. The physical "mechanism" which connects the two is not, at this time, clearly understood, but it seems certain that it must be radiative in nature. In short, it would appear that the geophysical environment (air, rocks, water, etc.) produces a spectrum of penetrating radiation which is picked up (thru shielding) by the sensor.

With certain sensors, as described herein, the sensing of remote temperature is one important feature. The action is similar to that of a remote-reading pyrometer, except that the connection is not infra-red radiation but some other form of radiation not presently recognized This ability to sense the temperature of remote matter is termed "perithermal."

Practical applications of such a sensor must include, in combination, means to observe the voltage (or current) fluctuations. Digital readout meters and/or strip-chart recorders are indicated. These are standard off-the-shelf items which ore readily available commercially. A complete sensing/indicating system, therefore, includes the use of an indicating or measuring instrument along with a sensor.

For example, a simple system, intended to be covered by this application for patent., would be merely the combination of a suitable sensor (such as a capacitor or rock) connected to a millivoltmeter, as set forth in Figs. 1 & 2.

Such a system, especially the sensor, must be electrostatically and barometrically shielded and held at a constant temperature, but such peripheral facility, however, does not necessarily form a part of the following specifications.

SPECIFICATION:

Fig. 1 illustrates the simplest form of the invention consisting of a high capacitance capacitor, such as a 240,000 mfd (Mallory or equivalent) in combination with a high impedance millivoltmeter.

Fig. 2 is similar to Fig. 1 but illustrates a rock (or section of rock) in place of the capacitor.

Fig. 3 illustrates a slight departure from the above in that a high power, multi-megohm resistor is connected to a capacitor through a diode.

Fig. 4 illustrates a plurality of sensors (as in Figs. 1, 2 & 3) in series for the purpose of increasing voltage output.

Fig. 5 illustrates a plurality of sensors (as above) in parallel for the purpose of increasing current output.

Fig. 6 illustrates sensors as above connected to a useful resistive load as a power supply.

Referring in detail to the attached drawings, Fig. 1 represents the simplest embodiment of the invention, i.e., capacitor 1 is connected by leads 2 and 2a to a high-impedance millivoltmeter 3. This meter may be a combination pre-amplifier coupled to a suitable readout or recorder.

Fig. 2 is similar to Fig. 1 except that dielectric section 4, preferably of high density (spec .

gravity), high-K (dielectric constant) material, is substituted for the capacitor. Electrodes are plated on said dielectric section which are connected by leads 5 and 5a to high impedance millivoltmeter 6 or equivalent.

Fig. 3 shows a combination of a high power multi-megohm resistor 7 connected to diode 8 and storage capacitor 9, hence to millivoltmeter or equivalents In this configuration, pulsive voltage variations ore generated within resistor 7, which is electromagnetically and electrostatically shielded within suitable shield 11, thence rectified (if necessary) by diode 8 and conducted to storage capacitor 9 which is monitored by readout 10. Tests revealed that the behavior of certain resistors match that of capacitors and rocks as set forth in Figs. 1 and 2.

Fig. 4 shows a plurality of capacitors, la, lb, 1c, & 1d as in Fig. 1, connected by leads 2 and 2a to readout 3, for the purpose of increasing voltage output and sensitivity.

Fig. 5 is similar to Fig. 4 except that capacitors 1a, 1b, 1c & 1d are connected in parallel by leads 2 and 2a to readout 3 for the purpose of increasing current output and sensitivity.

Fig. 6 illustrates the simplest form of power supply wherein capacitor 1 generates a continuous electrical output which is conducted by leads 2 and 2a to a useful resistive load 12.

<u>CLAIMS</u>:

1. A geophysical sensor consisting in combination of capacitor and a voltmeter,

2. A geophysical sensor consisting in combination a rock-like material capable of generating steady state (current) electricity and a DC voltmeter.

3. A geophysical sensor consisting in combination a high resistance, a diode, a capacitor and a DC voltmeter,

4. A sensor in accordance with Claim 1, comprising o plurality of capacitors in series.

5. A sensor in accordance with Claim 1 comprising a plurality of capacitors in parallel.

6. An electrical power source consisting of one or more isolated capacitors in combination with a useful resistive load.

7. An electrical power source consisting of massive high-K dielectrics free from piezoelectric, pyroelectric or electrochemical electric output in combination with a useful resistive load.

8. A power source as in Claim 7 consisting of rocks or rock-like materials.

9. Means for generating (as opposed to storing) current electricity comprising a large capacitor equipped with terminals and leads.

10. Means for generating direct current electricity comprising rocks or rock-like materials free from piezoelectric, pyroelectric or electrochemical energy excitation and equipped with terminals and leads to conduct said current to a useful resistive load.

11. A geophysical sensor comprising the combination with electrical indicating means, of a plurality of sections of rock-like materials free from piezoelectric, pyroelectric or electrochemical energy excitation.

12. A sensor according to Claim 2 consisting of heavy dielectric material such as barium titanate or lead zirconate titanate.

13. Method of generating sustained-current (DC) electricity beyond that obtained from piezoelectric, charged electret, pyroelectric or electro-chemical sources, consisting in utilizing dielectric material, attaching electrodes to said material, and conducting away the charges developed on said electrodes by said material.

14. Method in accordance with Claim 13 wherein the dielectric material comprises slabs or sections of rock.

15. Method in accordance with Claim 13 wherein the dielectric material comprises the dielectric of a capacitor.

16. Method for measuring remote geophysical parameters consisting in employing dielectric materials, attaching electrodes to said materials and utilizing the self-potential signals developed by said materials to actuate measuring instruments.

17. Method in accordance with Claim 16 for detecting geothermal reservoirs.

18. Method in accordance with Claim 16 for detecting remote sources of heat.

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Witnessed this 27 day of February, 1978.

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