# PROSPECTING FOR OIL BY RESONANT TELLURIC INDUCTION

( the petrovoltaic method )

# PROSPECTING FOR OIL BY RESONANT TELLURIC INDUCTION

( the petrovoltaic method )

Telluric electric currents encircling the Earth are regarded as being useful in prospecting for oil and many minerals. Various methods have been developed through the years to detect and identify materials deep in the Earth through which naturally-occurring telluric currents pass. It is believed that fields of oil and mineral deposits of all kinds, by virtue of their different electrical conductivities affect the belt of these earth-bound currents, producing departures which are detectable.

For example, a deposit of iron or other conductive mineral will tend to compress the path of the current, so that it passes largely through the deposit, whereas oil (being an insulator) tends to expand the current around the deposit, producing a "bulge" in the current belt. The change in intensity , caused by the bulge, inductively (and remotely) affects the petrovoltaic sensors in the survey truck making possible an oil "signal". In brief, the presence of oil causes alterations in the deep telluric currents which are carried inductively to the surface and affect the resonant sensors.

Other methods of electric prospecting (in use today) require electrodes in contact with the earth. Such electrodes must be buried or driven into the ground, and this is a time-consuming, expensive disadvantage. The petrovoltaic method does not need or use electrodes. The sensors are about the size of Geiger counters, may be held in the hand, and are readily portable. The method is patentable.

Primary Energy Technology, Ltd.
Electrical Prospecting Division
Los Angeles, Calif.

September 10, 1985

PRIMARY ENERGY TECHNOLOGY, LTD.

PHOENIX GEOPHYSICS, INC.

( a joint venture )

A completely new all-electric method of oil exploration is to be introduced to the oil industry. Preparations are being made to form a joint-venture between a high technology (physics research) organization and an established oil exploration company to carry forward the investigation

The new method makes use of the belt of telluric electric currents which occur in nature and which encircle the crust of the Earth. Such currents are believed to be caused by high-energy components of the Solar wind, trapped by the Earth's magnetic field. They traverse the continents at a depth believed to be approximately that of oil deposits. It is predicted that the presence of oil, due to its lower electrical conductivity, distorts the electric field of the belt and causes resonant inductive effects in the surrounding rocks extending to the surface. Hence, susceptible rocks in the vicinity can sense the presence of oil by inductive resonance even though they may be insulated from the underlying telluric current belt.

The new method makes use of a technology which has come to be known as "petrovoltaic induction". It is the generation of subliminal currents in rocks (and certain other heavy high-K dielectric) even though the rocks may be fully encased (portable) and completely insulated from the Earth. This work has been carried forward by a number of universities, using monitoring stations across the U.S., over a period of about 10 years. Only recently, has the petrovoltaic phenomenon been considered to be associated with the "parent" telluric currents and the possibilities of its use in the exploration of oil.

## IS IT VALID ?

The question is asked - "What evidence do we have that petrovoltaic sensors can detect the presence of oil ? This, of course, is the question any investor would ask who might be considering investing time or money in the Joint Venture.

The answer is, as yet, no solid empirical evidence one way or the other. No tests have ever been conducted which would positively establish a connection. If such a connection were definitely established today, there would be no need for further research and the results, then assured, would be worth millions. Unfortunately, this is not the case. It would be wonderful if it were. To be able to eliminate all of the uncertainties of exploration would, to say the least, be a boon to the oil industry.

As with the seismic exploration which is in dominate use today, and with sonic and chemical methods , the chances are good (maybe 50-50) but not perfect. That is why no single method can be depended upon. Only confirmation by all available methods is acceptable to the industry, and then only with caution.

All have limitations. The seismic method , the favorite so far, is useless in certain geological structures. The sonic method is limited in range. Chemical methods are far from certain. It is admitted that the seismic, sonic and other methods with their present inaccuracies are being used not because they are "proved", but because there is nothing better.

The electrical method is gaining favor over the others because of the comparatively recent discovery of the fortunate part played by telluric currents, which are believed to pass through the oil deposits. It follows , because of the high electrical resistance of oil, that the belt of currents would be expanded and intensity diminished It is reasoned that anything which can measure the intensity of the current, either directly or by resonant induction, can apriori "detect" oil.

## COMMON BACKGROUND:

The monitoring at nationwide petrovoltaic stations, which has been going on for the last several years, has consistently revealed solar related (diurnal and pulsive) variations, traceable to the Solar Wind. These sudden and distinctive signals are found also in nearby rocks inductively coupled to the underlying telluric currents. One could say that -"things equal to the same things - are equal to each other", and that there is now little doubt that the petrovoltaic phenomenon , through resonant induction, directly reveals the intensity of the basic telluric currents.

## GEOTHERMAL:

Even at the start, a sub-section of "PETROPHOENIX" will be engaged in the search for new geothermal reservoirs and the outlining of known fields, such Geyser and in the Coachella Valley. The sensing of hotwater, so-called peri-thermal (remote heat) effect in the petrovoltaic phenomenon has long been known in the laboratory, but no field studies have ever been made. It is known that such studies are very much in demand. In Australia, and in the arid countries , immediate contracts could be forthcoming. According to known laboratory (tapes) records, peri-thermal technology is already advanced over that for oil, and this suggests immediate financial return, with oil prospecting coming later.

## MINERAL PROSPECTING:

This is in a class by itself. The variety o f minerals and the variety of effects upon sensors, undoubtedly make the prospecting for specific minerals complicated and difficult. Unless by some good fortune, resonance peaks exist and stand out as, let us say, with gold or silver, the use of petrovoltaic method may be some time in coming. It is worhh keeping in mind, however.

## OFFSHORE ELECTRIC EXPLORATION:

The need to have electrodes (cadmium rods driven into the earth) precludes the use of the present methods of a electric prospecting for offshore fields. The magneto-telluric method MT presently developed by Phoenix Geophysics, Inc., must have 8 electrodes imbedded in the earth to pick up the vestigial telluric currents. Another method in use today requires 32 electrodes. Hence, where electrodes are needed, offshore exploration is impossible.

## RESONANT INDUCTION NOT SO LIMITED

The situation is quite different where the new resonant induction is used. No electrodes are needed whether tne survey is run over land or water. One might even run profiles from a motor boat !

The new method, it must be recognized is in a class by itself. There is nothing like it in the science of geophysical exploration today. Instead of having to make electrical contact with the telluric currents directly, the new method makes use of so-called "resonant induction, where the deep telluric currents resonate with endogenous (internal currents) within the ambient rocks, and transfer energy to them by induction. These ambient rocks , acting as receptors or sensors, need not be insitu, but can be small in size insulated from the earth and completely portable. They may be easily carried about in a truck from one site to another and there can be any number of sensors in different channels (like radio stations) to confirm a common background reading. As a further advantage, the truck need not stop to take readings on station, and considerable time can be saved in running profiles in the field.

## OIL PROSPECTING:

Here, after all, we may have the greater profit potential. Anyone engaged in oil exploration will admit, even using all existing methods - seismic, chemical, biochemical sonic or whatever, the actual finding of oil is not a sure bet. The chances are greater, of course, when more than one prospecting method is used, especially if all are used and give confirming results, but, even so, it is never sure. A dry hole costs a lot of money, and that is why, if a dry hole can be avoided, the cost of initial surveys is not important. It seems certain that when it becomes known that the new electric method shows promise, the oil-drilling companies will be "beating onthe door". Just the open chance of a new and successful method will be enough. Here, of course, is where quick success depends upon the way the new method is introduced, advertised (if you will), And this is where the experience of Phoenix Geophysics, inc., is so important. Properly announced, with emphasis on the "new technology" success should not be long in coming.

# PRIMARY ENERGY TECHNOLOGY - - PHOENIX GEOPHYSICS

( a joint venture )

This coordinated effort will serve a double purpose. It will:

1) On the one hand, provide a permanent monitoring station for the various channels of the petrovoltaic spectrum (at least in Denver) and ultimately assist in explaining theoretically what is happening. This is what we hoped could have been done in Texas, but were disappointed.

2) On the other hand, the Joint Venture would take immediate steps to develop the money-making potential of the petrovoltaic phenomenon, doing this without first knowing much, if anything, about what it is. We are reminded that Edison did not concern himself to find out what electricity was before he made use of it.

The Joint Venture, therefore, proposes to use what we presently know about the phenomenon to "postulate" a rational connection between existing earth currents and the presence of oil. The postulate will "assume" that a connection exists. As a matter of fact, no one can know, one way or the other, until adequate tests have been conducted over a period of time.

PET cannot do this alone. It must have field facilities and assistance of an established exploration team actually engaged in oil prospecting. Portable petrovoltaic sensors suitable for field use must be designed and built and the results compared with those of other electric prospecting methods in use today. Surveys must be made across known oil fields to obtain quantitative profiles. Only established oil prospecting teams having operational privileges with the major oil companies have such "free" access.

There are, of course, many companies, both here and abroad, with established reputations in electric prospecting. Phoenix Geophysics of Denver is one of those companies and is a recognized leader. A working association with Phoenix would appear to be invaluable if arrangements can be made. Preliminary telephone contact has already taken place with the President of the company, and a plan of friendly collaboration seems possible.

In other words, a joint effort would accomplish a working relationship whereby a base laboratory and field facilities would be made available to PET. Such facilities, it is assumed, would be in Denver or wherever Pheonix performs its laboratory work. The operation of the joint effort would be entirely the responsibility of Phoenix, with PET retaining only minimal functions as necessary.

Laboratory equipment and all sensors, presently in storage on Catalina Island, would be supplied, free of charge, to Phoenix, to assist in getting started. PET would not be called upon to assist in any experimental, production or field costs. Its function would be that of a holding company, for the benefit of the Partners who may wish eventually to acquire land leases in anticipation of future drilling.

Patents would be applied for by the Foundation as required by Phoenix during development, and Phoenix would be granted exclusive licenses covering their use. The Foundation would pay all patent expenses including filing of application and the payment of foreign annuities.

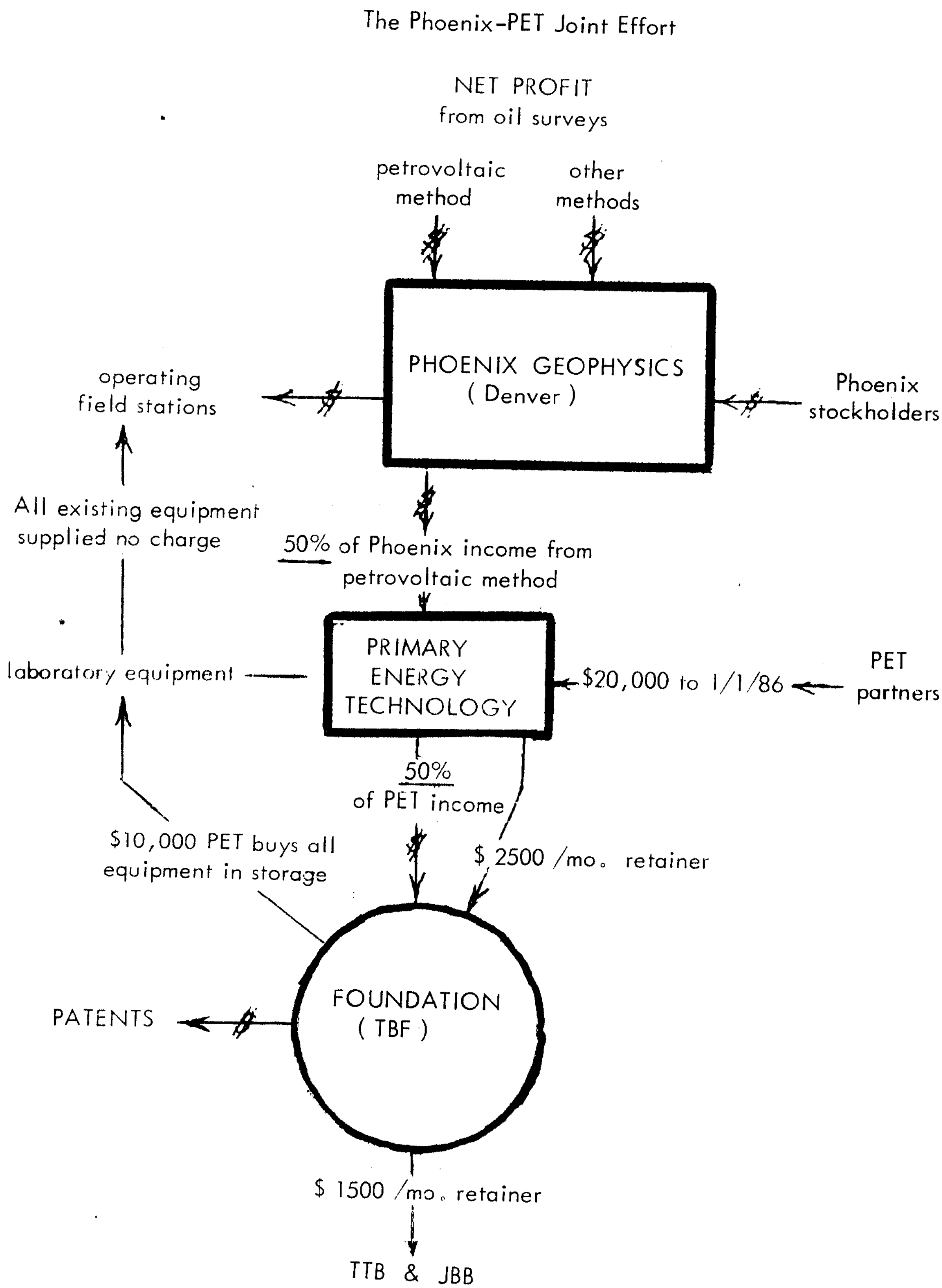
The Joint-Venture would be maintained on a 50-50 profit basis with PET. As shown on the attached flow chart. Phoenix receives all revenue from services to the oil industry concerning exploration. After legitimate expenses in the field are paid, Phoenix pays PET 50% of the net income. This is in return for the exclusive patent license. PET, in turn, pays 50% of its income to the Foundation for consulting services, which are continually provided to Phoenix.

PET's partners (investors) are at no continuing expense beyond the initial $10,000 to buy the laboratory equipment which it provides gratis to Phoenix to get started. The partners do supply the Foundation $2500/mo. -Sept., Oct., Nov., and Dec., 1985, during the time the program is getting underway. It is assumed that beginning in January, 1986, PET has adequate income from Phoenix to take care of these $2500/mo. retainers to the Foundation. TTB and JBB are paid $1500/mo. from the Foundation for their personal consulting and secretarial services.

In summary then, this sets forth the initial steps of the 50-50 Joint Venture. It provides -

1) an established facility for the development and exploration of the petrovoltaic method.
2) a market for the product,
3) a working laboratory,
4) a "home" for all equipment now in dead storage,
5) technical data leading to a better understanding of the petrovoltaic phenomenon, including adequate theory, and
6) the publication of technical papers by both Phoenix and the Foundation.

# FINANCIAL FLOW SHEET



PRELIMINARY
PATENT APPLICATION

# " GEOPHYSICAL SENSOR "

T. Townsend Brown

Sunnyvale, California
February 27, 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 adapted 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 sub-surface rock formations.

The invention relates to sensors useful in earthquake percursor 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 an 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 are 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 plurablity 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 equivalent. In this configuration, pulsive voltage variations are 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 reveal 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, 1a, 1b, 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.

CLAIMS:

1. A geophysical sensor consisting in combination a 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 a 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 electrochemical 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.

Thomas Townsend Brown

Thomas Townsend Brown
Applicant

Witnessed this 27 day of February, 1978.

Charles W. Miller

Joseph A. [illegible]

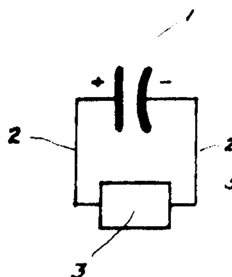



Fig. 1

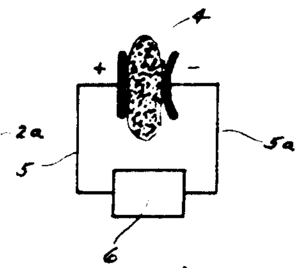



Fig. 2

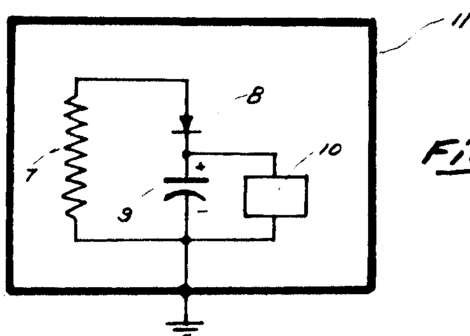



Fig. 3

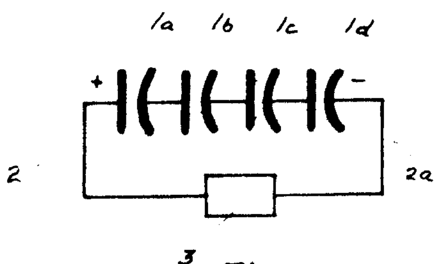



Fig. 4

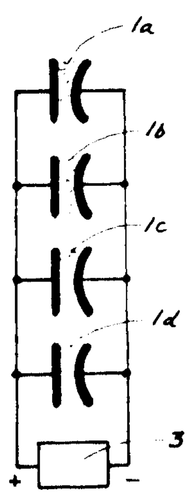



Fig. 5

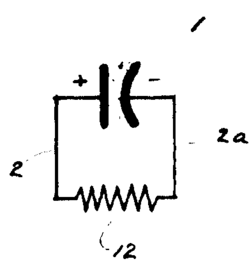



Fig. 6