Andrija PUHARICH

Water Decomposition by AC Electrolysis

A. Puharich: "Cutting The Gordian Knot of the Great Energy Bind"

USP # 4,394,230 ~ Method & Apparatus for Splitting Water Molecules

Dr Andrija Puharich reportedly drove his motor home for hundreds of thousands of miles around North America in the 1970s using only water as fuel. At a mountain pass in Mexico, he collected snow for water. Here is the only article he wrote on the subject, plus his patent:

Cutting The Gordian Knot of the Great Energy Bind
by Andrija Puharich

(1) *Introduction* ~

It is hardly necessary to weigh the value of the World Energy bank account for any sophisticated person, these days. It is grim. The oil reserves will dwindle away in a score of years or so, and the coal reserves will be gone in some twelve score years. (Ref. 1)

This is not to say that the outlook is hopeless. There is an abundance of alternative energy sources, but the economics of development and exploitation present an enormous short term strain on the world political and banking resources.

Visionary scientists tell us that the ideal fuel in the future will be as cheap as water, that it will be non toxic both in its short term, and in its long term, effects, that it will be renewable in that it can be used over and over again, that it will be safe to handle, and present minimal storage and transportation problems and costs. And finally that it will be universally available anywhere on earth.

What is this magical fuel, and why is it not being used? The fuel is water. It can be used in its fresh water form. It can be used in its salt water form. It can be used in its brackish form. It can be used in its snow and ice form. When such water is decomposed by electrolytic fission into hydrogen and oxygen gases, it becomes a high energy fuel with three times the energy output which is available from an equivalent weight of high grade gasoline.

(Ref. 1) The interested reader should refer to the special issue of *National Geographic*, "Energy", February 1981.

Then why is water not being used as a fuel? The answer is simple. It costs too much with existing technology to convert water into gases hydrogen and oxygen. The basic cycle of using water for fuel is described in the following two equations, familiar to every high school student of Chemistry:

H_2O Electrolysis + 249.68 Btu Delta G ==> H_2 + $(1/2)O_2$ per mole of water (1 mole = 18 gms.). (1)

This means that it requires 249.688 Btu of energy (from electricity) to break water by electrocal fission into the gases hydrogen and oxygen.

H_2 and $(1/2)O_2$ === catalyst ===> H_2O - Delta H 302.375 Btu per mole of water. (2)

This means that 302.375 Btu of energy (heat or electricity) will be released when the gases, hydrogen and oxygen, combine. The end product (the exhaust) from this reaction is water. Note that more energy (under ideal conditions) is released from combining the gases than is used to free them from water. It is know that under ideal conditions it is possible to get some 20% more energy out of reaction (2) above, then it takes to produce the gases of reaction (1) above. Therefore, if reaction (1) could be carried out at 100% efficiency, the release of energy from reaction (2) in an optimally efficient engine (such as a low temperature fuel cell), there would be a net energy profit which would make the use of water as a fuel an economically feasible source of energy .

The cost of producing hydrogen is directly related to the cost of producing electricity. Hydrogen as produced today is generally a byproduct of off-peak-hour electrical production in either nuclear or hydroelectric plants. The electricity thus produced is the cheapest way of making hydrogen. We can compare the cost of production of electricity and the cost of producing hydrogen. The following table is adapted from Penner (Ref. 2) whose data source is based on Federal Power Commission, and American Gas Association Figures of 1970 and on a 1973 price evaluation (just before OPEC oil price escalation.)

Table 1: *Relative Prices in Dollars per 10^6 Btu* . See Appendix 1 for definition of British Thermal units (a) @ 9.1 mils/kWh

Cost Component ~ Electricity ~ Electrolytically-Produced H
Production ~ 2.67 (b) ~ 2.95 to 3.23 (b)
Transmission ~ 0.61 ~ 0.52 (c)
Distribution ~ 1.61 ~ 0.34
Total Cost ~ $4.89 ~ $3.81 to $4.09

If we compare only the unit cost of production of electricity vs Hydrogen from the above table:

10^6 Btu H_2 / 10^6 Btu El = \$3.23 / \$2.67, or 20.9% higher cost, H_2

(Ref. 2) Penner, S.S. & L. Iceman: *Non Nuclear Technologies*, Vol II, Addison-Wesley Publishing Company, 1977, Chap. 11, and Table 11.1-2 (Page 132).

It must also be noted that the price of natural gas is much cheaper than either electricity or hydrogen, but because of the price fluctuations due to recent deregulation of gas. It is not possible to present a realistic figure.

In the opinion of Penner (op. cit.), if the hydrogen production cost component of its total cost could be reduced three fold, it would become a viable alternate energy source. In order to achieve such a three-fold reduction in production costs, several major breakthroughs would have to occur.

(1) ENDERGONIC REACTION ~ (1) supra. A technological breakthrough that permits 100% conversion efficiency of water by electrolysis fission into the two gases, Hydrogen as fuel and Oxygen as oxidant.

(2) HYDROGEN PRODUCTION, in situ. A technological breakthrough that eliminates the need and cost of hydrogen liquefaction and storage, transmission, and distribution, by producing the fuel in situ, when and where needed.

(3) EXERGONIC REACTION ~ (2) supra. A technological breakthrough which yields a 100% efficient energy release from the combination of hydrogen and oxygen into water in an engine that can utilize the heat, steam, or electricity thus produced.

(4) ENGINE EFFICIENCY. By a combination of the breakthroughs outlined above, (1), (2), and (3) utilized in a highly efficient engine to do work, it is possible to achieve a 15% to 20% surplus of energy return over energy input, theoretically.

It is of interest to record that a new invention is now being developed to realise the above outlined goal of cheap, clean renewable and high grade energy.

A Thermodynamic Device has been invented which produces hydrogen as fuel, and oxygen as oxidant, from ordinary or from sea water, eliminating the cost and hazard of liquefaction, storage, transmission, and distribution. The saving of this aspect of the invention alone reduces the total cost of hydrogen by about 25%.

This Thermodynamic Device is based on a new discovery --- the efficient electrolytic fission of water into hydrogen gas and oxygen gas by the use of low frequency alternating currents as opposed to the conventual use of direct current, or ultra-high frequency current today. Such gas production from water by electrolytic fission approaches 100% efficiency under laboratory conditions and measurements. No laws of physics are violated in this process.

This Thermodynamic Device has already been tested at ambient pressures and temperatures from sea level to an altitude of 10,000 feet above sea level without any loss of its peak efficiency. The device produces two types of gas bubbles; one type of bubble contains hydrogen gas; the other type contains oxygen gas. The two gases are thereafter easily separable by passive membrane filters to yield pure hydrogen gas, and pure oxygen gas.

The separate gases are now ready to be combined in a chemical fusion with a small activation energy such as that from a catalyst or an electrical spark, and yield energy in the form of heat, or steam, or electricity --- as needed .When the energy is released by the chemical fusion of hydrogen and oxygen, the exhaust product is clean water. The water exhaust can be released into nature and then renewed in its energy content by natural processes of evaporation, solar irradiation in cloud form, an subsequent precipitation as rain on land or sea, and then collected again as a fuel source. Or, the exhaust water can have its energy content pumped up by artificial processes such as through solar energy acting through photocells. Hence, the exhaust product is both clean and renewable. The fuel hydrogen, and the oxidant oxygen, can be used in any form of heat engine as an energy source if economy is not an important factor. But the practical considerations of maximum efficiency dictate that a low temperature fuel cell with its direct chemical fusion conversion from gases to electricity offers the greatest economy and efficiency from small power plants (less than 5 kilowatts).

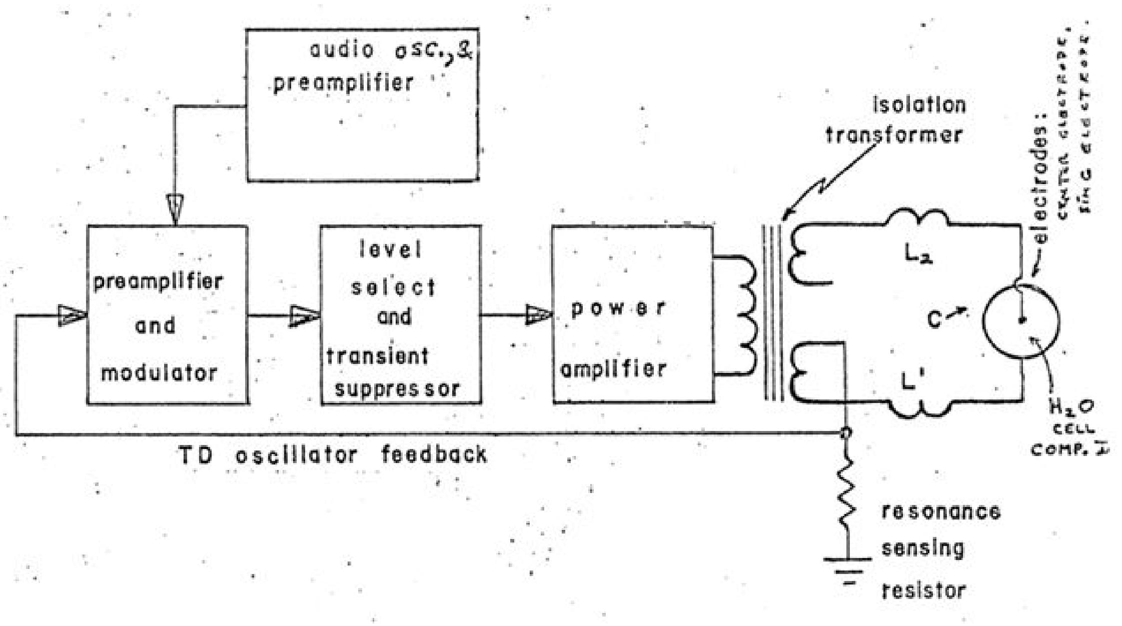
For large power plants, steam and gas turbines are the ideal heat engines for economy and efficiency. With the proper engineering effort, automobiles could be converted rather easily to use water as the main fuel source.

(2) *A Elementry Introduction to the Design & Operation of the Thermodynamic Device to Electrolyse Water with AC ~*

The Thermodynamic Device (TD) is made up of three principal components: An electrical function generator, Component I, that energizes a water cell, the TD, Component II and Component III , a weak electrolyte.

COMPONENT I: The Electrical Function Generator ~ See Fig 1.

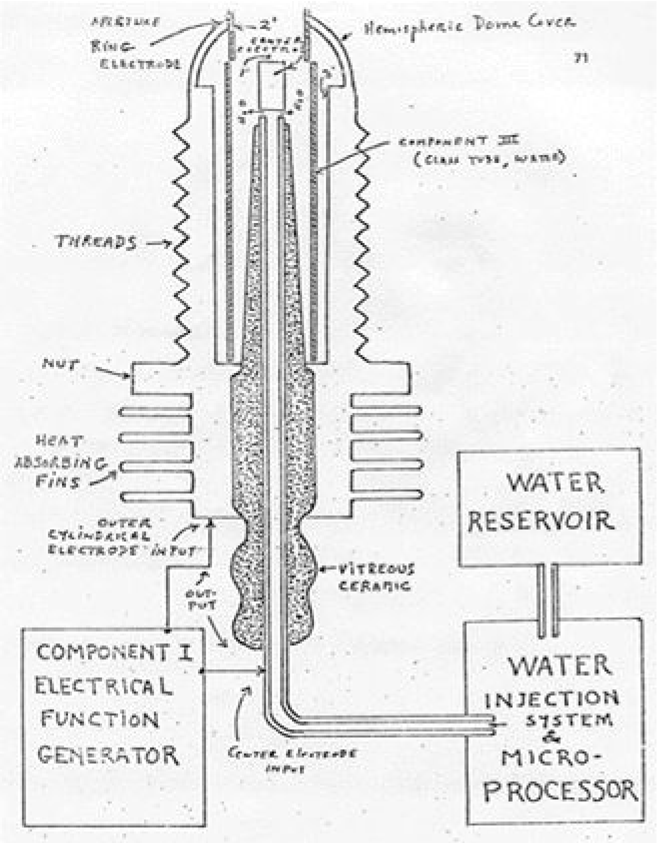
Figure 1: Signal Generator Component Block ~



This electronic device has a complex alternating current output consisting of an audio frequency (range 20 to 200 Hz) amplitude modulation of a carrier wave (range: 200 to 100,000 Hz). The output is connected by two wires to Component II at the center electrode, and at the ring electrode. See Fig1. The impedance of this output signal is continuously being matched to the load which is the water solution in Component II.

COMPONENT II: The Thermodynamic Device (TD). See Figure 2.

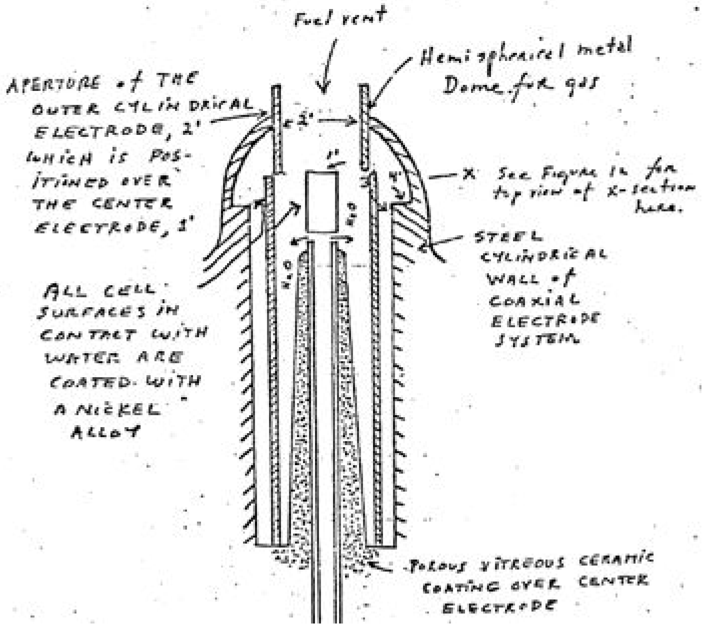
Figure 2: Thermodynamic Device (TD) ~



The TD is fabricated of metals and ceramic in the geometric form of a coaxial cylinder made up of a centered hollow tubular electrode which is surrounded by a larger tubular steel cylinder. These two electrodes comprise the coaxial electrode system energised by Component I. The space between the two electrodes is, properly speaking, Component III which contains the water solution to be electrolysed. The center hollow tubular electrode carries water into the cell, and is further separated from the outer cylindrical electrode by a porous ceramic vitreous material. The space between the two electrodes contains two lengths of tubular Pyrex glass, shown in Figures 2 and 3. The metal electrode surface in contact with the water solution are coated with a nickel alloy.

COMPONENT III: the weak electrolyte water solution. Fig.3

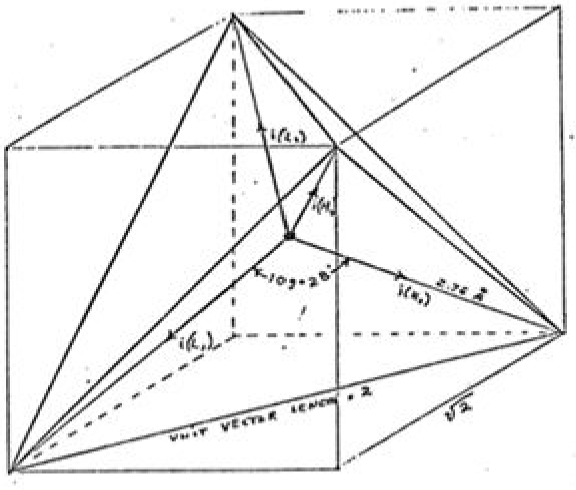
Figure 3: The Water Cell Section of Component II ~



This consists of the water solution, the two glass tubes, and the geometry of the containing wall of Component II. It is the true load for Component I, and its electrode of Component II.

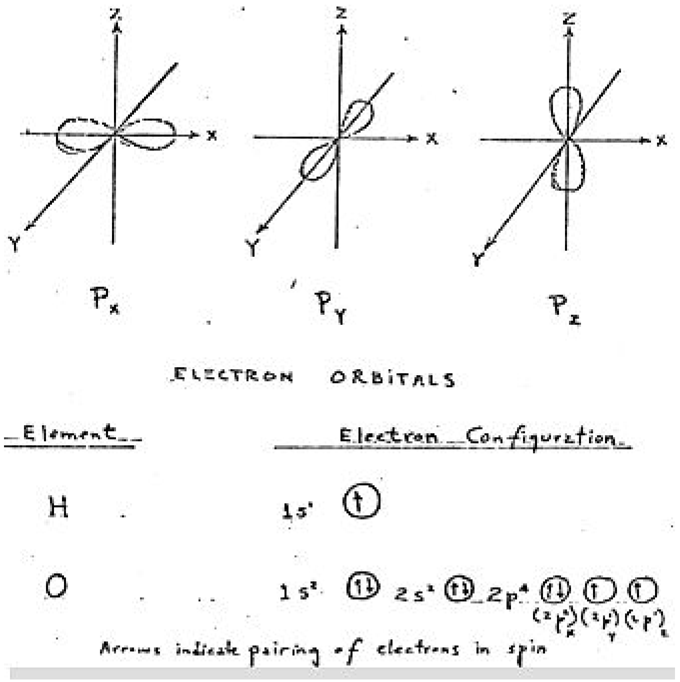
The Component III water solution is more properly speaking, ideally a 0.1540 M Sodium Chloride solution, and such is a weak electrolyte. In figure 4 we show the hypothetical tetrahedral structure of water molecule, probably in the form in which the complex electromagnetic waves of Component I to see it. The center of mass of this tetrahedral form is the oxygen atom. The geometric arrangement of the p electrons of oxygen probably determine the vectors i (L_1) and i (L_2) and i (H_1) and i (H_2) which in turn probably determine the tetrahedral architecture of the water molecule. The *p* electron configuration of oxygen is shown in Figure 5. Reference to Figure 4 shows that the diagonal of the right side of the cube has at its corner terminations the positive charge hydrogen (H+) atoms; and that the left side of the cube diagonal has at its corners the lone pair electrons, (e^-). It is to be further noted that this diagonal pair has an orthonormal relationship.

Figure 4: The Water Molecule in Tetrahedral Form ~



Hydrogen bonding occurs only along the four vectors pointing to the four vertices of a regular tetrahedron, and in the above drawing we show the four unit vectors along these directions originating from the oxygen atoms at the center. *i*(H_1) and *i*(H_2) are the vectors of the hydrogen bonds formed by the molecule *i* as a donor molecule. These are assigned to the lone pair electrons. Molecules *i* are the neighboring oxygen atoms at each vertex of the tetrahedron.

Figure 5: Electron Orbitals ~



(3) *Electrothermodynamics ~*

We will now portray the complex electromagnetic wave as the tetrahedral water molecule sees it. The first effect felt by the water molecule is in the protons of the vectors, i (H_1) and i (H_2). These protons feel the 3 second cycling of the amplitude of the carrier frequency and its associated side bands as generated by Component I. This sets up a rotation moment of the proton magnetic moment which one can clearly see on the XY plot of an oscilloscope, as an hysteresis loop figure. However, it is noted that this hysteresis loop does not appear in the liquid water sample until all the parameters of the three components have been adjusted to the configuration which is the novel basis of this device. The hysteresis loop gives us a vivid portrayal of the nuclear magnetic relaxation cycle of the proton in water.

The next effect felt by the water molecule is the Component I carrier resonant frequency, F_o. At the peak efficiency for electrolysis the value of F_o is 600 Hz +/- 5 Hz.

This resonance however is achieved through control of two other factors. The first is the molal concentration of salt in the water. This is controlled by measuring the conductivity of the water through the built in current meter of Component I. There is maintained an idea ratio of current to voltage I/E = 0.01870 which is an index to the optimum salt concentration of 0.1540 Molal.

The second factor which helps to hold the resonant which helps to hold the resonant frequency at 600 Hz is the gap distance of Y, between the centre electrode, and the ring electrode of Component II.

This gap distance will vary depending on the size scale of Component II, but again the current flow, I, is used to set it to the optimal distance when the voltage reads between 2.30 (rms) volts, at resonance F_o, and at molal concentration, 0.1540. The molal concentration of the water is thus seen to represent the electric term of the water molecule and hence its conductivity.

The amplitude modulation of the carrier gives rise to side bands in the power spectrum of the carrier frequency distribution. It is these side bands which give rise to an acoustic vibration of the liquid water, and it is believed to the tetrahedral water molecule. The importance of the phonon effect --- the acoustic vibration of water in electrolysis --- was discovered in a roundabout way. Research work with Component I had earlier established that it could be used for the electro-stimulation of hearing in humans. When the output of Component I is comprised of flat circular metal plates applied to the head of normal hearing humans, it was found that they could hear pure tones and speech. Simultaneously, acoustic vibration could also be heard by an outside observer with a stethoscope placed near one of the electrodes on the skin. It was observed that the absolute threshold of hearing could be obtained at 0.16 mW (rms), and by calculation that there was an amplitude of displacement of the eardrum of the order of 10^{-11} and a corresponding amplitude of the cochlear basilar membrane of 10^{-13} meter. Corollary to this finding. I was able to achieve the absolute reversible threshold of electrolysis at a power level of 0.16 mW (rms). By carrying out new calculations I was able to show that the water was being vibrated with a displacement of the order of 1 Angstrom (= 10^{-10} meters). This displacement is of the order of the diameter of the hydrogen atom.

Thus it is possible that the acoustic phonons generated by audio side bands of the carrier are able to vibrate particle structures within the unit water tetrahedron.

We now turn to the measurement problem with respect to efficiency of electrolysis. There are four means that can be used to measure the reactant product of water electrolysis . For simple volume measurements one can use a precision nitrometer such as the Pregl type. For both volume and quantitative analysis one can use the gas chromatography with thermal conductivity detector. For a continuous flow analysis of both volume and gas species the mass spectrometer is very useful. For pure thermodynamic measurements the calorimeter is useful. In our measurements, all four methods were examined, and it was found that the mass spectrometer gave the most flexibility and the greatest precision. In the next section we will describe our measurement using the mass spectrometer.

Protocol

(4) *Methodology for the Evaluation of the Efficiency of Water Decomposition by Means of Alternating Current Electrolysis ~*

Introduction ~

All systems used today for the electrolysis of water into hydrogen as fuel, and oxygen as oxidant apply direct current to a strong electrolyte solution. These systems range in efficiency from 50% to 71%. The calculation of energy efficiency in electrolysis is defined as follows:

"The energy efficiency is the ration of the energy released from the electrolysis products formed (when they are subsequently used) to the energy required to effect electrolysis." (Ref. 1)

The energy released by the exergonic process under standard conditions

$H_2(g) + (1/2)\ O_2(g) ===> H_2O = 3\ 02.375$ Btu

which is 68.315 Kcal/mol. or, 286,021 Joules/mol, and is numerically equal to the enthalphy charge (Delta H) for the indicated process. On the other hand the minimum energy (or useful work input) required at constant temperature and pressure for electrolysis equals the Gibbs free energy change (Delta G). (Ref 2)

(Ref. 1) S.S. Penner and L. Iceman: *Energy*. Volume II , Non Nuclear Energy Technologies. Adison Wesley Publishing Company, Inc.Reading Massachusetts, 1977 (Rev. Ed.) chapter 11.

(Ref. 2) S.S. Penner: *Thermodynamics*, Chapter 11, Addison-Wesley Publishing Co. Reading, Massachusetts, 1968.

Penner shows (op.cit.) that there is a basic relation derivable from the first and second laws of thermodynamics for isothermal changes which shows that

Delta G = Delta H - T Delta S (2)

where Delta S represents the entropy change for the chemical reaction and T is the absolute temperature.

The Gibbs free energy change (Delta G) is also related to the voltage (e) required to implement electrolysis by Faraday's equation,

e = (Delta G / 23.06 n) volts (3)

where Delta G is in Kcal/mol, and n is the number of electrons (or equivalents) per mole of water electrolysed and has the numerical value 2 in the equation (endergonic process),

$H_2O ===> H_2\ (g) + (1/2)O_2\ (g) + 56.620$ kcal or + 249.68 Btu (4)

Therefore, according to equation (2) at atmospheric pressure, and 300 degrees K , Delta H = 68.315 kcal/mol or H_2O, and Delta G = 56.620 kcal / mol of H_2O = 236,954 J/mol H_20 for the electrolysis of liquid water.

In view of these thermodynamic parameters for the electrolysis of water into gases, hydrogen and oxygen, we can establish by Eq.(2) numeric values where, Delta G = 236.954 J/mol H_2O

under standard conditions. Thus

n = Delta G (J/mol) / Delta Ge (J/mol) = <1 (5)

where Delta G_e is the electrical energy input to H_2O (1) in Joules, and Delta G is the Gibbs free energy of H_2O. The conversion between the two quantities is one Watt second (Ws) = one Joule.

Or, in terms of gas volume, as hydrogen, produced and measured,

n = Measured H_2 (cc) / Ideal H_2 (cc) = <1 (6)

In accordance with these general principles we present the methodology followed in evaluating the electrolytic of alternating current on H_2O in producing the gases, hydrogen and oxygen. No attempt has been made to utilize these gases according to the process of Eq.(1). It is to be noted that the process

H_2 (g) + (1/2)O_2 (g) ===> H_2O (g) (7)

yields only 57.796 kcal /mol. Eq.(7) shows that per mole of gases water formed at 300° K, the heat released is reduced from the 68.315 kcal/mol at Eq. (1) by the molar heat of evaporation of water at 300° K (10.5 kcal) and the overall heat release is 57.796 kcal/mol if H_2O (g) is formed at 300° K. (Ref. 1)

In the following sections we describe the new method of electrolysis by means of alternating current, and the exact method and means used to measure the endergonic process of Eq.(4) and the governing Eq.(2) and Eq.(5).

(Ref. 1) Op.cit., Ref. (1) page 3. page 299ff.

(5) *Thermodynanic Measurement ~*

In order to properly couple Component II to a mass spectrometer one requires a special housing around Component II that it will capture the gases produced and permit these to to be drawn under low vacuum into the mass spectometer. Therefore a stainless steel and glass chamber was built to contain Component II, and provision made to couple it directly through a CO_2 watertrap to the mass spectrometer with the appropriate stainless steel tubing. This chamber is designated as Component IV. Both the mass spectrometer and Component IV were purged with helium and evacuated for a two hour period before any gas samples were drawn. In this way contamination was minimized. The definitive measurement were done at Gollob Analytical Services in Berkeley Heights, New Jersey

We now describe the use of Component I and how its energy <u>output</u> to Component II is measured. The energy output of Component I is an amplitude modulated alternating current looking into a highly non-linear load, i.e., the water solution. Component I is so designed that at peak load it is in resonance across the system --- Components I, II, and III --- and the vector diagrams show that the capacitive reactance, and the inductance reactance are almost exactly 180° out of phase, so that the net power output is reactive (the dissipative power is very small). This design ensures minimum power lossses across the entire output system. In the experiments to be described, the entire emphasis is placed on achieving the maximum gas yield (credit) in exchange for the minimum applied electrical energy.

The most precise way to measure the applied energy from Component I to Component II and Component III is to measure the power, P, in watts, W. Ideally this should be done with a precision wattmeter. But since we were interested in following the voltage and current separately, it was decided not to use the watt meter. Separate meters were used to continuously monitor the current and the volts.

This is done by precision measurement of the volts across Component III as root mean square (rms) volts; and the current flowing in the system as rms amperes. Precisely calibrated instruments were used to take these two measurements. A typical set of experiments using water in the form of 0.9% saline solution 0.1540 molar to obtain high efficiency hydrolysis gave the following results:

rms Current = I = 25mA to 38 mA (0.025 A to 0.038 A.)

rms Volts = E = 4 Volts to 2.6 Volts

The resultant ration between current and voltage is dependent on many factors such as the gap distance between the center and ring electrodes, dielectric properties of the water, conductivity properties of the water, equilibrium states, isothermal conditions, materials used, and even the pressure of clathrates. The above current and voltage values reflect the net effect of various combinations of such parameters. When one takes the product of rms current, and rms volts, one has a measure of the power, P in watts.

P = I x E = 25 mA x 4.0 volts =100 mW (0.1 W)

and P = I x E =38 mA x 2.6 volts = 98.8 mW (0.0988 W)

At these power levels (with load), the resonant frequency of the system is 600 Hz (plus or minus 5 Hz) as measured on a precision frequency counter. The wave form was monitored for harmonic content on an oscilloscope, and the nuclear magnetic relaxation cycle was monitored on an XY plotting oscilloscope in order to maintain the proper hysteresis loop figure. All experiments were run so that the power in watts, applied through Components I, II, and III ranged between 98.8 mW to 100 mW.

Since by the International System of Units 1971 (ST), one Watt-second (Ws) is exactly equal to one Joule (J), our measurements of efficiency used these two yardsticks (1 Ws = 1J) from the debit side of the measurement.

The energy output of the system is, of course, the two gases, Hydrogen (H_2) and Oxygen, $(1/2)O_2$, and this credit side was measured in two laboratories, on two kinds of calibrated instruments, namely gas chromatography machine, and mass spectrometer machine.

The volume of gases H_2 and $(1/2)O_2$ was measured as produced under standard conditions of temperature and pressure in unit time, i.e., in cubic centimeters per minute (cc/min), as well as the possibility contaminating gases,such as air oxygen, nitrogen and argon, carbon monoxide, carbon dioxide, water vapor, etc.

The electrical and gas measurements were reduced to the common denominator of Joules of energy so that the efficiency accounting could all be handled in one currency. We now present the averaged results from many experiments. The standard error between different samples, machines, and locations is at +/- 10%, and we only use the mean for all the following calculations.

II. *Thermodynamic Efficiency for the Endergonic Decomposition of Liquid Water (Salininized) to Gases Under Standard Atmosphere (754 to 750 m.m. Hg) and Standard Isothermal Conditions @ 25° C = 77° F = 298.16° K, According to the Following Reaction*:

H_20 (1) _> H_2(g) + $(1/2)O_2$(1) + Delta G = 56.620 Kcal /mole (10)

As already described, Delta G is the Gibbs function. We convert Kcal to our common currency of Joules by the formula, One Calorie = 4.1868 Joules

Delta G = 56.620 Kcal x 4.1868 J = 236,954/J/mol of H_2O where1 mole = 18 gr. (11)

Delta G_e = the electrical energy required to yield an equivalent amount of energy from H_2O in the form of gases H_2 and $(1/2)O_2$.

To simplify our calculation we wish to find out how much energy is required to produce the 1.0 cc of H_2O as the gases H_2 and $(1/2)O_2$. There are (under standard conditions) 22,400 cc = V of gas in one mole of H_2O. Therefore

Delta G / V = 236,954 J / 22,400 cc = 10.5783 J/cc. (12)

We now calculate how much electrical energy is required to liberate 1.0 cc of the H_2O gases (where H_2 = 0.666 parts, and $(1/2)O_2$ = 0.333 parts by volume) from liquid water. Since P = 1 Ws= 1 Joule , and V = 1.0 cc of gas = 10.5783 Joules, then

PV = 1 Js x 10.5783 J = 10.5783 Js, or, = 10.5783 Ws (13)

Since our experiments were run at 100 mW (0.1 W) applied to the water sample in Component II, III, for 30 minutes, we wish to calculate the ideal (100% efficient) gas production at this total applied power level. This is,

0.1 Ws x 60 sec x 30 min = 180,00 Joules (for 30 min.). The total gas production at ideal 100% efficiency is 180 J/10.5783 J/cc = 17.01 cc H_2O (g)

We further wish to calculate how much hydrogen is present in the 17.01 cc H_2O (g).

17.01 cc H_2O (g) x 0.666 H_2 (g) = 11.329 cc H_2(g) (14)

17.01 cc H_2O (g) x 0.333 (1/2)O_2 (g) = 5.681 cc (1/2) O_2 (g)

Against this ideal standard of efficiency of expected gas production, we must measure the actual amount of gas produced under: (1) Standard conditions as defined above, and (2) 0.1 Ws power applied over 30 minutes. In our experiments, the mean amount of H_2 and (1/2)O_2 produced, as measured on precision calibrated GC, and MS machines in two different laboratories, where SE is +/- 10%, is,

Measured Mean = 10.80 cc H_2 (g)
Measured Mean = 5.40 cc (1/2) cc (1/2)O_2 (g)
Total Mean = 16.20 cc H_2O (g)

The ratio, n, between the ideal yield, and measured yield,

Measured H_2 (g) / Ideal H_2 (g) = 10.80 cc / 11.33 cc = 91.30%

(6) *Alternative Methodology for Calculating Efficiency Based on the Faraday Law of Electrochemistry ~*

This method is based on the number of electrons that must be removed, or added to decompose, or form one mole of, a substance of valence one. In water H_2O, one mole has the following weight:

H = 1.008 gr /mol
H = 1.008 gr /mol
O = 15.999 gr/mol
Thus, 1 mol H_2O = 18.015 gr/mol

For a unvalent substance one gram mole contains 6.022×10^{-23} electrons = N = Avogadro's Number. If the substance is divalent, trivalent, etc., N is multiplied by the number of the valence. Water is generally considered to be of valence two.

At standard temperature and pressure (STP) one mole of a substance contains 22.414 cc, where Standard temperature is 273.15° K = 0° C = T . Standard Pressure is one atmosphere = 760 mm Hg = P.

One Faraday (1*F*) is 96,485 Coulombs per mole (univalent).

One Coulomb (C) is defined as:

$1 \text{ N} / 1 F = 6.122 \times 10^{23}$ Electrons / 96,485 C = one C

The flow of one C/second = one Ampere.
One C x one volt = one Joule second (Js).
One Ampere per second @ one volt = one Watt = one Joule.

In alternating current, when amps (I) and Volts (E) are expressed in root mean squares (rms), their product is Power.

P = IE watts.

With these basic definitions we can now calculate efficiency of electrolysis of water by the method of Faraday is electrochemistry.

The two-electron model of water requires 2 moles of electrons for electrolysis (2 x 6.022 x 10^{23}), or two Faraday quantities (2 x 96,485 = 192,970 Coulombs).

The amount of gas produced will be:

H_2 = 22,414 cc /mol at STP
(1/2)O_2 = 11,207 cc / mol at STP
Gases = 33.621 cc / mol H_2O (g)

The number of coulombs required to produce one cc of gases by electrolysis of water:

193,970 C / 33621 C = 5.739567 C per cc gases.

Then, 5,739 C /cc /sec = 5.739 amp/sec/cc. How many cc of total gases will be produced by 1 A/sec?

0.1742291709 cc.

How many cc of total gases will be produced by 1 A/min ?

10.45375 cc/min

What does this represent as the gases H_2 and O_2 ?

(1/2)O_2 = 3.136438721 cc/Amp/min.
H_2 = 6.2728 cc/Amp /min.

We can now develop a Table for values of current used in some of our experiments,and disregarding the voltage as is done conventionally.

I. Calculations for 100 mA per minute:
Total Gases = 1.04537 cc/min
H_2 = 0.6968 cc/min
(1/2)O_2 = 0.3484 cc/min
30 min. H_2 = 20.9054 cc/ 30 minutes

II. Calculations for 38 mA per minute:
Total Gases = 0.3972 cc/ 30 minutes
H_2 = 0.2645 cc/min
(1/2)O_2 = 0.1323 cc/min
30 min. H_2 = 7.9369 cc/min

III. Calculations for 25mA per minute:
30 min. H_2 = 5.2263 cc/ minute

(7) *Conclusion ~*

Figure 6 and 7 [not available] show two of the many energy production systems that may be configured to include renewable sources and the present electrolysis technique. Figure 6 shows a proposed photovoltaic powered system using a fuel cell as the primary battery. Assuming optimum operating conditions using 0.25 watt seconds of energy from the photovoltaic array would enable 0.15 watt seconds to be load.

Figure 7 depicts several renewable sources operating in conjuncction with the electrolysis device to provide motive power for an automobile.

US Patent # 4,394,230

Method & Apparatus for Splitting Water Molecules

Henry K. Puharich

(July 19, 1983)

Abstract ~

Disclosed herein is a new and improved thermodynamic device to produce hydrogen gas and oxygen gas from ordinary water molecules or from seawater at normal temperatures and pressure. Also disclosed is a new and improved method for electrically treating water molecules to decompose them into hydrogen gas and oxygen gas at efficiency levels ranging between approximately 80-100%. The evolved hydrogen gas may be used as a fuel; and the evolved oxygen gas may be used as an oxidant.

Inventors: Puharich; Henry K. (Rte. 1, Box 97, Delaplane, VA 22025)
Appl. No.: 272277 ~ Filed: June 10, 1981

Current U.S. Class: 205/341; 204/229.5; 204/260; 204/263; 204/266; 205/628
Intern'l Class: C25B 001/04; C25B 001/10; C25B 009/04
Field of Search: 204/129,228,260,263,266

References Cited [Referenced By] ~ U.S. Patent Documents:
3,563,246 Feb., 1971 ~ Puharich 331/47.
3,726,762 Apr., 1973 ~ Puharich 128/422.
4,107,008 Aug., 1978 ~ Horvath 204/129.

Primary Examiner: Andrews; R. L. ~ Attorney, Agent or Firm: Mandeville and Schweitzer

Description ~

BACKGROUND OF THE INVENTION

The scientific community has long realized that water is an enormous natural energy resource, indeed an inexhaustible source, since there are over 300 million cubic miles of water on the earth's surface, all of it a potential source of hydrogen for use as fuel. In fact, more than 100 years ago Jules Verne prophesied that water eventually would be employed as a fuel and that the hydrogen and oxygen which constitute it would furnish an inexhaustible source of heat and light.

Water has been split into its constituent elements of hydrogen and oxygen by electrolytic methods, which have been extremely inefficient, by thermochemical extraction processes called thermochemical water-splitting, which have likewise been inefficient and have also been inordinately expensive, and by other processes including some employing solar energy. In addition, artificial chloroplasts imitating the natural process of photosynthesis have been used to separate hydrogen from water utilizing complicated membranes and sophisticated artificial catalysts. However, these artificial chloroplasts have yet to produce hydrogen at an efficient and economical rate.

These and other proposed water splitting techniques are all part of a massive effort by the scientific community to find a plentiful, clean, and inexpensive source of fuel. While none of the methods have yet proved to be commercially feasible, they all share in common the known acceptability of hydrogen gas as a clean fuel, one that can be transmitted easily and economically over long distances and one which when burned forms water.

SUMMARY OF THE PRESENT INVENTION

In classical quantum physical chemistry, the water molecule has two basic bond angles, one angle being 104°, and the other angle being 109°28'.

The present invention involves a method by which a water molecule can be energized by electrical means so as to shift the bond angle from the 104°.degree. configuration to the 109°.degree.28' tetrahedral geometrical configuration.

An electrical function generator (Component 1) is used to produce complex electrical wave form frequencies which are applied to, and match the complex resonant frequencies of the tetrahedral geometrical form of water.

It is this complex electrical wave form applied to water which is contained in a special thermodynamic device (Component II) which shatters the water molecule by resonance into its component molecules --- hydrogen and oxygen.

The hydrogen, in gas form, may then be used as fuel; and oxygen, in gas form is used as oxidant. For example, the thermodynamic device of the present invention may be used as a hydrogen fuel source for any existing heat engine --- such as, internal combustion engines of all types, turbines, fuel cell, space heaters, water heaters, heat exchange systems, and other such devices. It can also be used for the desalinization of sea water, and other water purification purposes. It can also be applied to the development of new closed cycle heat engines where water goes in as fuel, and water comes out as a clean exhaust.

For a more complete understanding of the present invention and for a greater appreciation of its attendant advantages, reference should be made to the following detailed description taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram illustrating the electrical function generator, Component I, employed in the practice of the present invention;

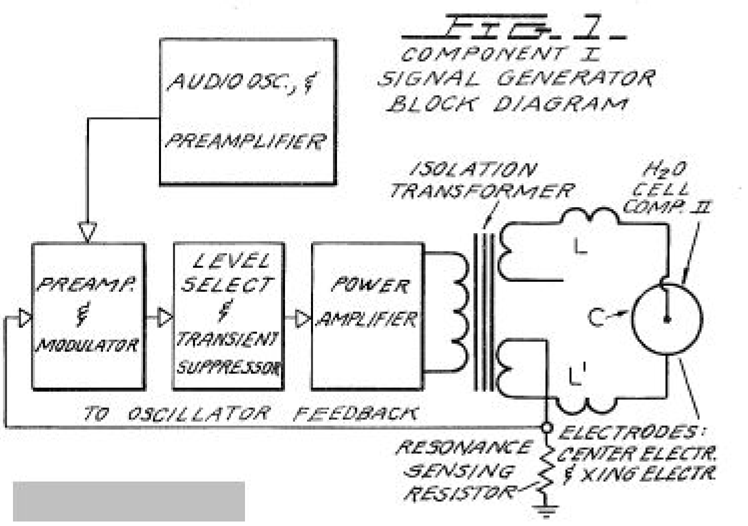


FIG. 1
COMPONENT I
SIGNAL GENERATOR
BLOCK DIAGRAM

FIG. 2 is a schematic illustration of the apparatus of the present invention, including a cross sectional representation of the thermodynamic device, Component II;

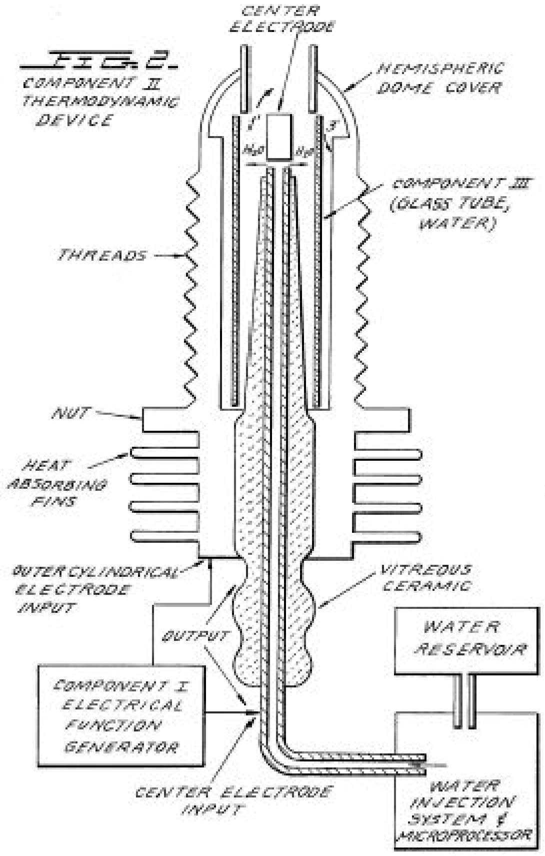


FIG. 2
COMPONENT II
THERMODYNAMIC DEVICE

FIG. 3 is a cross-sectional view of Component III of the present invention, the water cell section of Component II;

FIG. 3
COMPONENT III.
THE WATER CELL SECTION
OF COMPONENT II

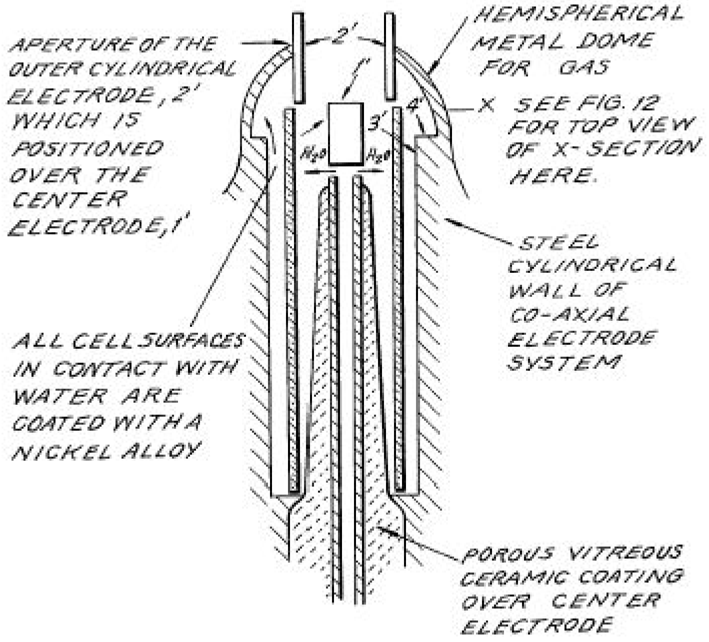


FIG. 4 is an illustration of the hydrogen covalent bond;

FIG. 4.

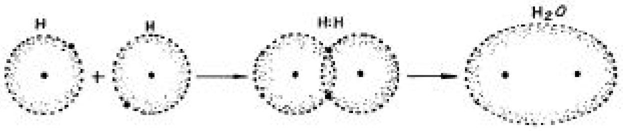


FIG. 4A is an illustration of the hydrogen bond angle;

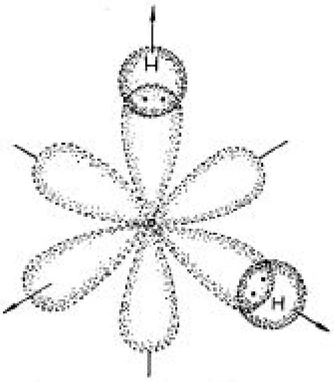
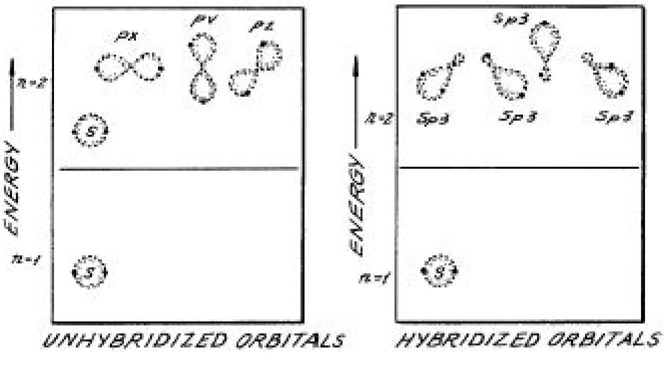


FIG. 4A.

UNHYBRIDIZED ORBITAL INTERACTION IN WATER BOND ANGLE IS 104° RATHER THAN 90° AS PREDICTED

FIG. 4B is an illustration of hybridized and un-hybridized orbitals;

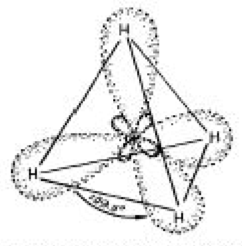


UNHYBRIDIZED ORBITALS HYBRIDIZED ORBITALS

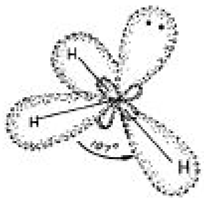
FIG. 4B.

FORMATION OF sp3 HYBRID ORBITALS

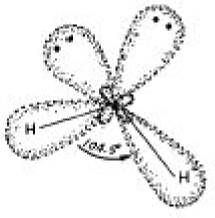
FIG. 4C is an illustration of the geometry of methane ammonia and water molecules;



HYBRIDIZED METHANE MOLECULE CH_4



HYBRIDIZED AMMONIA MOLECULE NH_3

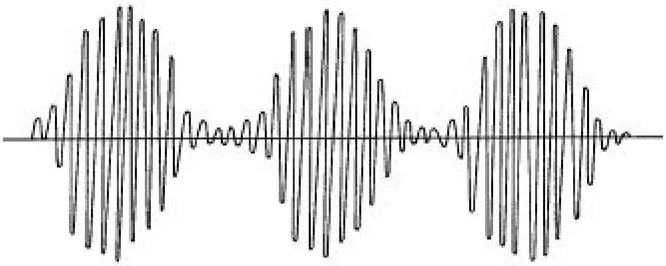


HYBRIDIZED WATER MOLECULE H_2O

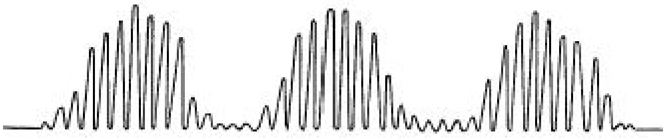
FIG. 4C.
GEOMETRY OF METHANE,
AMMONIA, AND WATER MOLECULES

FIG. 5 is an illustration of an amplitude modulated carrier wave;

[redacted] FIG. 5. [redacted]



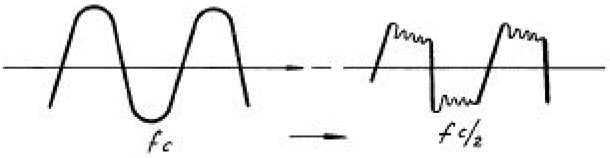
AMPLITUDE MODULATED 90° CARRIER SINE WAVE



HALF-WAVE VECTIFICATION OF ABOVE SIGNAL

FIG. 6 is an illustration of a ripple square wave;
FIG. 6 A is an illustration of unipolar pulses;

FIG. 6.



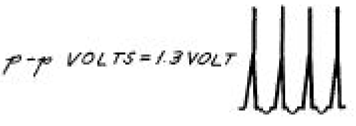


FIG. 6A.

FIG. 7 is a diagram showing ion distribution at the negative electrode;

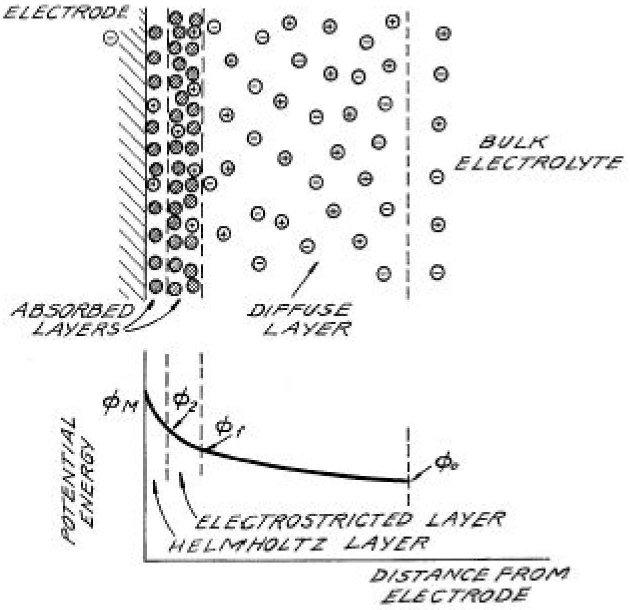


FIG. 7.

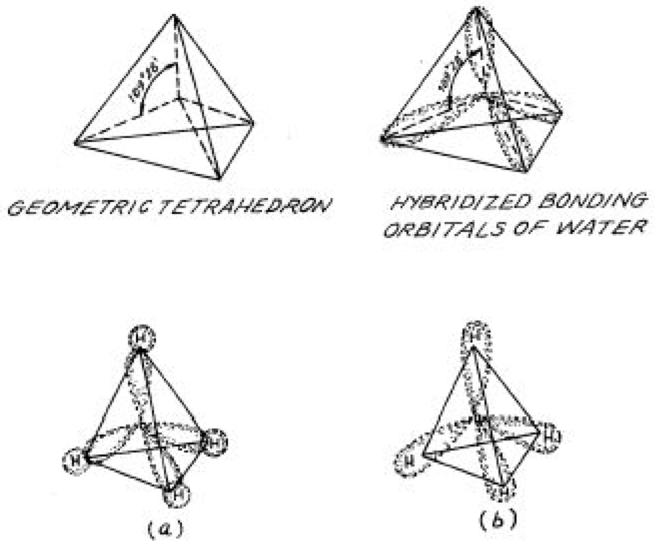
DIAGRAM OF THE DOUBLE LAYER CLOSE TO A NEGATIVE ELECTRODE. THE POTENTIAL ENERGY OF POSITIVE IONS IN THIS REGION WHEN NO CURRENT IS FLOWING IS SHOWN IN THE LOWER DIAGRAM. $\phi_M - \phi_2$ IS THE ELECTRON TRANSFER POTENTIAL: $\phi_2 - \phi_1$ IS RELATED TO THE ACTIVATION OVERPOTENTIAL: AND $\phi_1 - \phi_0$ IS RELATED TO THE DIFFUSION OVERPOTENTIAL.

KEY
● SOLVENT MOLECULE = H_2O
⊕ POSITIVE ION = H^+
⊖ NEGATIVE ION = O^-

FIG. 8 is an illustration of tetrahedral bonding orbitals;

FIG. 8

EQUIVALENT TETRAHEDRAL BONDING ORBITALS OF WATER



METHANE OVERLAP OF SPHERICAL 1s ORBITAL OF HYDROGEN WITH sp3 BONDING ORBITALS OF CARBON (a) RESULTS IN EQUIVALENT SIGMA BONDS, THE MOLECULAR ORBITALS OF (b).

FIG. 9 is an illustration of water molecules;

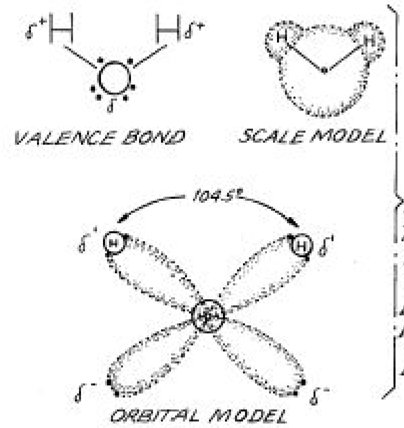


FIG. 9

THE WATER MOLECULE. THE WATER DIPOLE RESULTS FROM UNEVEN CHARGE DISTRIBUTION.

FIG. 10 is an illustration of productive and non-productive collisions of hydrogen with iodine;

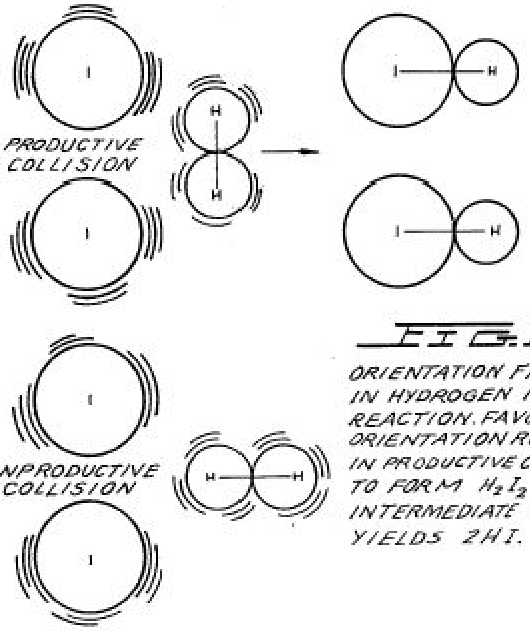


FIG. 10

ORIENTATION FACTOR IN HYDROGEN IODIDE REACTION. FAVORABLE ORIENTATION RESULTS IN PRODUCTIVE COLLISION TO FORM H_2I_2 INTERMEDIATE WHICH YIELDS 2HI.

FIG. 11 is a wave form found to be the prime characteristic for optimum efficiency;

FIG. 11

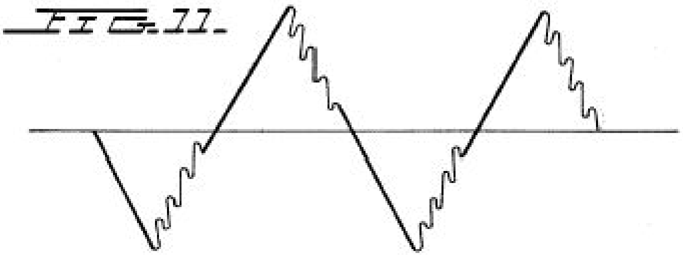


FIG. 12 is an illustration of pearl chain formation;

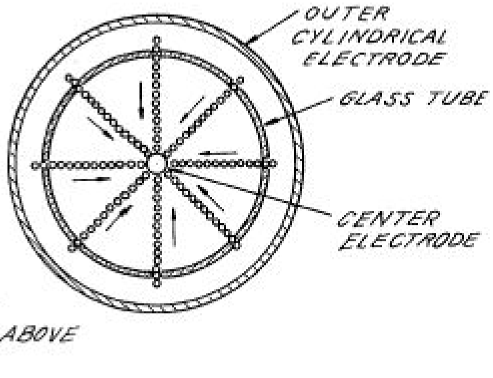


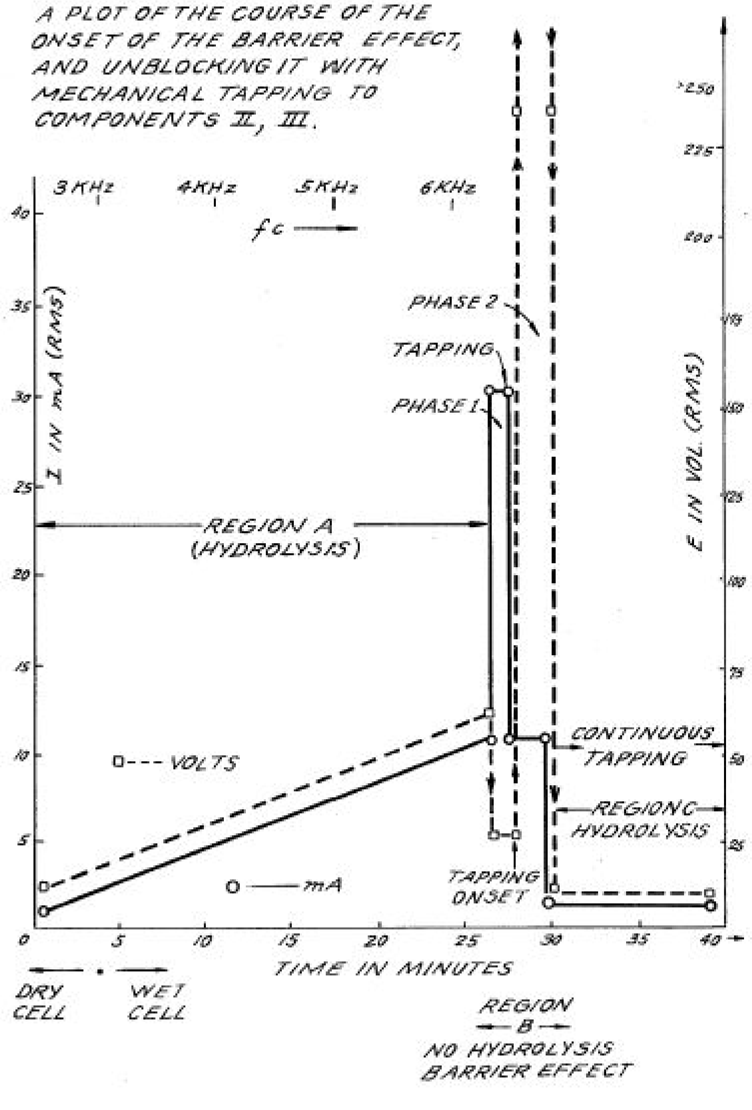
FIG. 12

PEARL CHAIN FORMATION OF HYDROGEN GAS BUBBLES IN COMPONENT III AS SEEN FROM ABOVE

FIG. 13 is a plot of the course of the onset of the barrier effect and the unblocking of the barrier effect; and

FIG. 13

A PLOT OF THE COURSE OF THE ONSET OF THE BARRIER EFFECT, AND UNBLOCKING IT WITH MECHANICAL TAPPING TO COMPONENTS II, III.



FIGS. 14A, B, and C are energy diagrams for exergonic reactions.

FIG. 14A.

(a) AN EXERGONIC REACTION. PRODUCTS HAVE A LOWER POTENTIAL ENERGY THAN REACTANTS, THEREFORE, ENERGY IS RELEASED.

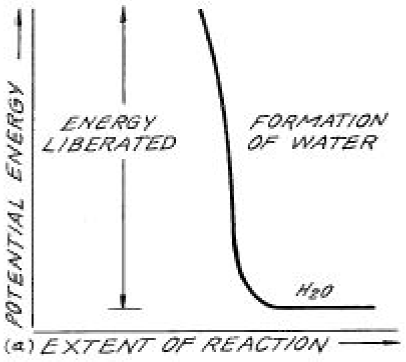


FIG. 14B.

(b) AN ENDERGONIC REACTION PRODUCTS HAVE A HIGHER POTENTIAL ENERGY THAN REACTANTS, CAUSING ENERGY TO BE CONSUMED.

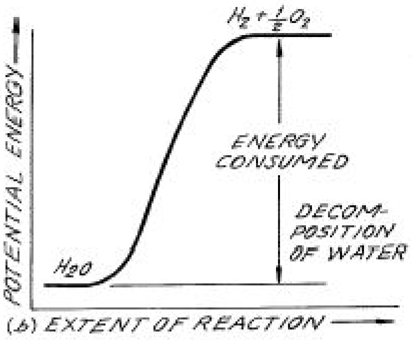
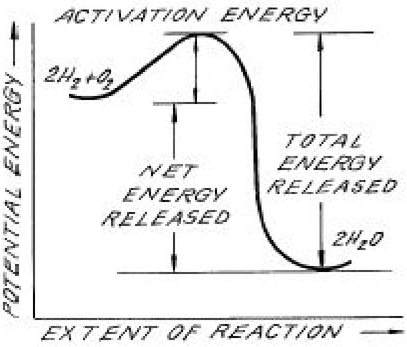


FIG. 14C.

ENERGY DIAGRAM FOR EXERGONIC REACTION. ACTIVATION ENERGY IS BARRIER TO BE OVERCOME FOR REACTION TO PROCEED, & IS SUPPLIED AS A "SPARK" TO THE GASES TO GET IGNITION.



DETAILED DESCRIPTION OF INVENTION

Section 1 --- Apparatus of Invention

The apparatus of the invention consists of three components, the electrical function generator, the thermodynamic device, and the water cell.

COMPONENT I. The Electrical Funtion Generator ~

This device has an output consisting of an audio frequency (range 20 to 200 Hz) amplitude modulation of a carrier wave (range 200 Hz to 100,000 Hz). The impedance of this output signal is continuously being matched to the load which is the second component, the thermodynamic device.

The electrical function generator represents a novel application of circuitry disclosed in my earlier U.S. Pat. Nos. 3,629,521; 3,563,246; and 3,726,762, which are incorporated by reference herein. See FIG. 1 for the block diagram of Component I.

COMPONENT II. The Thermodynamic Device ~

The thermodynamic device is fabricated of metals and ceramic in the geometric form of coaxial cylinder made up of a centered hollow tubular electrode which is surrounded by a larger tubular steel cylinder, said two electrodes comprising the coaxial electrode system which forms the load of the output of the electrical function generator, Component I. Said center hollow tubular electrode carries water, and is separated from the outer cylindrical electrode by a porous ceramic vitreous material. Between the outer surface of the insulating ceramic vitreous material, and the inner surface of the outer cylindrical electrode exists a space to contain the water to be electrolysed. This water cell space comprises the third component (Component III) of the invention. It contains two lengths of tubular pyrex glass, shown in FIGS. 2 and 3. The metal electrode surfaces of the two electrodes which are in contact with the water are coated with a nickel alloy.

The coaxial electrode system is specifically designed in materials and geometry to energize the water molecule to the end that it might be electrolysed. The center electrode is a hollow tube and also serves as a conductor of water to the Component III cell. The center tubular electrode is coated with a nickel alloy, and surrounded with a porous vitreous ceramic and a glass tube with the exception of the tip that faces the second electrode. The outer cylindrical electrode is made of a heat conducting steel alloy with fins on the outside, and coated on the inside with a nickel alloy. The center electrode, and the cylindrical electrode are electrically connected by an arching dome extension of the outer electrode which brings the two electrodes at one point to a critical gap distance which is determined by the known quenching distance for hydrogen. See FIG. 2 for an illustration of Component II.

COMPONENT III. The Water Cell

The water cell is a part of the upper end of Component II, and has been described. An enlarged schematic illustration of the cell is presented in FIG. 3. The Component III consists of the water and glass tubes contained in the geometrical form of the walls of cell in Component II, the thermodynamic device. The elements of a practical device for the practice of the invention will include:

(A) Water reservoir; and salt reservoir; and/or salt

(B) Water injection system with microprocessor or other controls which sense and regulate (in accordance with the parameters set forth hereinafter):

a. carrier frequency
b. current
c. voltage
d. RC relaxation time constant of water in the cell
e. nuclear magnetic relaxation constant of water
f. temperature of hydrogen combustion
g. carrier wave form
h. RPM of an internal combustion engine (if used)
i. ignition control system
j. temperature of region to be heated;

(C) An electrical ignition system to ignite the evolved hydrogen gas fuel.

The important aspects of Component III are the tubular vitreous material, the geometry of the containing walls of the cell, and the geometrical forms of the water molecules that are contained in the cell. A further important aspect of the invention is the manipulation of the tetrahedral geometry of the water molecule by the novel methods and means which will be more fully described in the succeeding sections of this specification.

The different parts of a molecule are bound together by electrons. One of the electron configurations which can exist is the covalent bond which is achieved by the sharing of electrons. A molecule of hydrogen gas, H_2 is the smallest representative unit of covalent bonding, as can be seen in FIG. 4. The molecule of hydrogen gas is formed by the overlap and pairing of 1s orbital electrons. A new molecular orbit is formed in which the shared electron pair orbits both nuclei as shown in FIG. 4. The attraction of the nuclei for the shared electrons holds the atoms together in a covalent bond.

Covalent bonds have direction. The electronic orbitals of an uncombined atom can change shape and direction when that atom becomes part of a molecule. In a molecule in which two or more covalent bonds are present the molecular geometry is dictated by the bond angles about the central atom. The outermost lone pair (non-bonding) electrons profoundly affect the molecular geometry.

The geometry of water illustrates this concept. In the ground state, oxygen has the outer shell configuration

$1s^2\ 2s^2\ 2p^2{}_x\ 2p^1{}_y\ 2p^1{}_z$

In water the 1s electrons from two hydrogens bond with the $2p_y$ and $2p_z$ electrons of oxygen. Since p orbitals lie at right angles to each other (see FIG. 4A), a bond angle of 90° might be expected. However, the bond angle is found experimentally to be approximately 104°. Theoretically this is explained by the effect of lone pair electrons on hybridized orbitals.

Combined or hybrid orbitals are formed when the excitement of 2s electrons results in their promotion from the ground state to a state energetically equivalent to the 2p orbitals. The new hybrids are termed sp^3 from the combination of one s and three p orbitals (See FIG. 4B). Hybrid sp^3 orbitals are directed in space from the center of a regular tetrahedron toward the four corners. If the orbitals are equivalent the bond angle will be 109°28' (See Fig. 15) consistent with the geometry of a tetrahedron. In the case of water two of the orbitals are occupied by non-bonding electrons (See FIG. 4C). There is greater repulsion of these lone pair electrons which orbit only one nucleus, compared to the repulsion of electrons in bonding orbitals which orbit two nuclei. This tends to increase the angle between non-bonding orbitals so that it is greater than 109°, which pushes the bonding orbitals together, reducing the bond angle to 104°. In the case of ammonia, NH_3 where there is only one lone pair, the repulsion is not so great and the bond angle is 107°. Carbon forms typical tetrahedral forms and components the simplest being the gas methane, CH_4 (See FIGS. 4C and 8). The repulsion of lone pair electrons affects charge distribution and contributes to the polarity of a covalent bond. (See FIG. 16)

As demonstrated in succeeding sections of this patent specification, a significant and novel aspect of this invention is the manipulation, by electronic methods and means, of the energy level of the water molecule, and the transformation of the water molecule into, and out of, the geometrical form of the tetrahedron. This is made possible only by certain subtle dynamic interactions among the Components I, II, and III of the present invention.

Section 2 --- Electrodynamics (Pure Water) ~

The electrodynamics of Components I, II, and III described individually and in interaction during the progress of purewater reaction rate in time. The reactions of saline water will be described in Section 3. It is to be noted that the output of Component I automatically follows the seven stages (hereinafter Stages A-F) of the reaction rate by varying its parameters of resonant carrier frequency, wave form, current voltage and impedance. All the seven states of the reaction herein described are not necessary for the practical operation of the system, but are included in order to explicate the dynamics and novel aspects of the invention. The seven stages are applicable only to the electrolysis of pure water.

STAGE A

Dry Charging of Component II by Component I ~

To make the new system operational, the Component I output electrodes are connected to component II, but no water is placed in the cell of Component III. When Component I output is across the load of Component II we observe the following electrical parameters are observed:

Range of current (I) output with (dry) load:

0 to 25 mA (milliamperes) rms.

Range of voltage (E) output with (dry) load:

0 to 250 Volts (AC) rms.

There is no distortion of the amplitude modulated (AM), or of the sine wave carrier whose center frequency, f_c'

Ranges between 59,748 Hz to 66, 221 Hz

with f_c average = 62, 985 Hz

The carrier frequency varies with the power output in that f_c goes down with an increase in amperes (current). The AM wave form is shown in FIG. 5. It is to be noted here that the electrical function generator, Component I, has an automatic amplitude modulation volume control which cycles the degree of AM from 0% to 100%, and then down from 100% to 0% .congruent. every 3.0 seconds. This cycle rate of 3.0 seconds corresponds to the nuclear spin relaxation time, tau/sec, of the water in Component III. The meaning of this effect will be discussed in greater detail in a later section.

In summary, the principal effects to be noted during Stage A -dry charging of Component II are as follows:

a. Tests the integrity of Component I circuitry.

b. Tests the integrity of the coaxial electrodes, and the vitreous ceramic materials of Component II and Component III.

c. Electrostatic cleaning of electrode and ceramic surfaces.

STAGE B

Initial operation of Component I, Component II, and with Component III containing pure water. There is no significant electrolysis of water during Stage B. However, in Stage B the sine wave output of Component I is shaped to a rippled square wave by the changing RC constant of the water as it is treated;

There is an `Open Circuit` reversible threshold effect that occurs in Component III due to water polarization effects that lead to half wave rectification and the appearance of positive unipolar pulses; and

There are electrode polarization effects in Component II which are a prelude to true electrolysis of water as evidenced by oxygen and hydrogen gas bubble formation.

Appearance of Rippled Square Waves ~

Phase 1: At the end of the Stage A dry charging, the output of Component I is lowered to a typical value of:

I = 1mA. E = 24VAC. f_c .congruent.66,234 Hz.

Phase 2: Then water is added to the Component III water cell drop by drop until the top of the center electrode, 1', in FIG. 3 is covered, and when this water just makes contact with the inner surface of the top outer electrode at 2'. As this coupling of the two electrodes by water happens, the following series of events occur:

Phase 3: The f_c drops from 66,234 Hz, to a range from 1272 Hz to 1848 Hz. The current and voltage both drop, and begin to pulse in entrainment with the water nuclear spin relaxation constant, tau =3.0 sec. The presence of the nuclear spin relaxation oscillation is proven by a characteristic hysteresis loop on the X-Y axes of an oscillscope.

I = 0 to 0.2mA surging at .tau. cycle

E = 4.3 to 4.8VAC surging at .tau. cycle

The sine wave carrier converts to a rippled square wave pulse which reflects the RC time constant of water, and it is observed that the square wave contains higher order harmonics. See FIG. 6:

With the appearance of the rippled square wave, the threshold of hydrolysis may be detected (just barely) as a vapor precipitation on a cover glass slip placed over the Component III cell and viewed under a low power microscope.

The `Open Circuit` Reversible Threshold Effect ~

Phase 4: A secondary effect of the change in the RC constant of water on the wave form shows up as a full half wave rectification of the carrier wave indicating a high level of polarization of the water molecule in tetrahedral form at the outer electrode.

With the already noted appearance of the rippled square wave, and the signs of faint vapor precipitation which indicate the earliest stage of electrolysis, it is possible to test for the presence of a reversible hydrolysis threshold. This test is carried out by creating an open circuit between Components I and II, i.e., no current flows. This is done by lowering the water level between the two electrodes in the region --- 1' and 2' shown in FIG. 3; or by interrupting the circuit between Component I and II, while the Component I signal generator is on and oscillating.

Immediately, with the creation of an `open circuit` condition, the following effects occur:

(a) The carrier frequency, f_c, shifts from Phase 4 valve 1272 Hz to 1848 Hz to 6128 Hz.

(b) The current and voltage drop to zero on the meters which record I and E, but the oscilloscope continues to show the presence of the peak-to-peak (p-p) voltage, and the waveform shows a remarkable effect. The rippled square wave has disappeared, and in its place there appear unipolar (positive) pulses as follows in FIG. 6A.

The unipolar pulse frequency stabilizes to ca. 5000 Hz. The unipolar pulses undergo a 0 to 1.3 volt pulsing amplitude modulation with .tau. at 3.0 seconds.

Thus, there exists a pure open circuit reversible threshold for water electrolysis in which the water molecules are capacitor charging and discharging at their characteristic low frequency RC time constant of 0.0002 seconds. It is to be noted that pure water has a very high dielectric constant which makes such an effect possible. The pulsing amplitude modulation of the voltage is determined by the Hydrogen Nuclear Spin Relaxation constant, where .tau..congruent.3.0 seconds. It is to be noted that the positive pulse spikes are followed by a negative after-potential. These pulse wave forms are identical to the classic nerve action potential spikes found in the nervous system of all living species that have a nervous system. The fact that these unipolar pulses were observed arising in water under the conditions of reversible threshold hydrolysis has a profound significance. These findings illuminate and confirm the Warren McCulloch Theory of water "crystal" dynamics as being the foundation of neural dynamics; and the converse theory of Linus

Pauling which holds that water clathrate formation is the mechanism of neural anesthesia.

Phase 5: The effects associated with reversible threshold electrolysis are noted only in passim since they reflect events which are occurring on the electrode surfaces of Component II, the Thermodynamic Device.

A principal effect that occurs in Stage B, Phase 3, in Component II, the thermodynamic device, is that the two electrodes undergo stages of polarization. It has been observed in extensive experiments with different kinds of fluids in the cell of Component II , i.e., distilled water, sea water, tap water, Ringers solution, dilute suspensions of animal and human blood cells, that the inner surface of the outer ring electrode at 3' in FIG. 3 (the electrode that is in contact with the fluid) becomes negatively charged. Referring to FIG. 7, this corresponds to the left hand columnar area marked, Electrode .crclbar..

Electrode Polarization Effects at the Interface Between Components II and III ~

Concurrently with the driver pulsing of Component I at the .tau. constant cycle which leads to electrode polarization effects in Component II, there is an action on Component III which energizes and entrains the water molecule to a higher energy level which shifts the bond angle from 104° to the tetrahedral form with angle 109°28' as shown in FIGS. 8 and 15. This electronic pumping action is most important, and represents a significant part of the novel method of this invention for several reasons. First, the shift to the tetrahedral form of water increases the structural stability of the water molecule, thereby making it more susceptible to breakage at the correct resonant frequency, or frequencies. Second, increasing the polarization of the water molecule makes the lone pair electrons, S- connected with the oxygen molecule more electronegative; and the weakly positive hydrogen atoms, S+ more positive. See FIG. 9 and FIG. 22.

As the outer electrode becomes more electronegative, the center electrode concomitantly becomes more electropositive as will be shown. As the polarity of the water molecule tetrahedron increases, a repulsive force occurs between the two S+ apices of the water tetrahedron and the negatively charged electrode surface within the region of the Helmholtz layer, as shown in FIG. 7. This effect "orients" the water molecule in the field, and is the well-known "orientation factor" of electrochemistry which serves to catalyse the rate of oxygen dissociation from the water molecule, and thereby causes the reaction rate to proceed at the lowest energy levels. See FIG. 10 for an example of how the orientation factor works.

Near the end of Stage B, the conditions are established for the beginning of the next stage, the stage of high efficiency electrolysis of water.

STAGE C

Generation of the complex wave form frequencies from Component I to match the complex wave form resonant frequencies of the energized and highly polarized water molecule in tetrahedral form with angles, 109°28' are carried out in Stage C.

In the operation of the invention active bubble electrolysis of water is initiated following Stage B, phase 3 by setting (automatically) the output of Component I to:

I = 1mA., E = 22VAC-rms,

causing the rippled square wave pulses to disappear with the appearance of a rippled sawtooth wave. The basic frequency of the carrier now becomes, f_c = 3980 Hz.

The wave form now automatically shifts to a form found to be the prime characteristic necessary for optimum efficiency in the electrolysis of water and illustrated in FIG. 11. In the wave form of FIG. 11, the fundamental carrier frequency, f_c = 3980 Hz., and a harmonic modulation of the carrier is as follows:

1st Order Harmonic Modulation (OHM) = 7960 Hz.

2nd Order Harmonic Modulation (II OHM) = 15,920 Hz.

3rd Order Harmonic Modulation (III OHM) = 31,840 Hz.

4th Order Harmonic Modulation (IV OHM) = 63,690 Hz.

What is believed to be happening in this IV OHM effect is that each of the four apices of the tetrahedron water molecule is resonant to one of the four harmonics observed. It is believed that the combination of negative repulsive forces at the outer electrode with the resonant frequencies just described work together to shatter the water molecule into its component hydrogen and oxygen atoms (as gases). This deduction is based on the following observations of the process through a low power microscope. The hydrogen bubbles were seen to originate at the electrode rim, 4', of FIG. 3. The bubbles then moved in a very orderly `pearl chain` formation centripetally (like the spokes of a wheel) toward the center electrode, 1' of FIG. 3. FIG. 12 shows a top view of this effect.

Thereafter, upon lowering the output of Component I, the threshold for electrolysis of water as evidenced by vapor deposition of water droplets on a glass cover plate over the cell of Component III, is:

$$\left.\begin{array}{l} I = \text{mA.} \\ E = 10 \text{ volts} \end{array}\right\} = 10\ mw.$$

with all other conditions and waveforms as described under Stage C, supra. Occasionally, this threshold can be lowered to:

$$\left.\begin{array}{l} I - \text{mA.} \\ E = 2.6 \text{ volts} \end{array}\right\} = 2.6\ mw.$$

This Stage C vapor hydrolysis threshold effect cannot be directly observed as taking place in the fluid because no bubbles are formed --- only invisible gas molecules which become visible when they strike a glass plate and combine into water molecules and form droplets which appear as vapor.

STAGE D

Production of hydrogen and oxygen gas at an efficient rate of water electrolysis is slowed in Stage D when a barrier potential is formed, which barrier blocks electrolysis, irrespective of the amount of power applied to Components II and III.

A typical experiment will illustrate the problems of barrier potential formation. Components I, II, and III are set to operate with the following parameters:

$$\left.\begin{array}{l} I = 1 \text{ mA.} \\ E = 11.2 \text{ volts} \end{array}\right\} \begin{array}{l} = 11.2 \; mw. \text{ (at the start)} \\ \text{(rising to } 100 \; mw.) \end{array}$$

This input to Component III yields, by electrolysis of water, approximately 0.1 cm^3 of hydrogen gas per minute at one atmosphere and 289° K. It is observed that as a function of time the f_c crept up from 2978 Hz to 6474 Hz over 27 minutes. The current and the voltage also rose with time. At the 27th minute a barrier effect blocked the electrolysis of water, and one can best appreciate the cycle of events by reference to FIG. 13.

STAGE E

The Anatomy of the Barrier Effect

Region A: Shows active and efficient hydrolysis

Region B: The barrier region effect can be initiated with taps of the finger, or it can spontaneously occur as a function of time.

Phase a: The current rose from 1 mA to 30 mA. The voltage fell from 22 volts to 2.5 V.

Phase b: If component II is tapped mechanically during Phase a supra --- it can be reversed as follows: The current dropped from 30 Ma to 10 Ma. The voltage shot up from 5 volts to over 250 volts (off scale).

Throughout Phase a and Phase b, all hydrolysis has ceased. It was observed under the microscope that the inner surface of the outer electrode was thickly covered with hydrogen gas bubbles. It was reasoned that the hydrogen gas bubbles had become trapped in the electrostricted layer, because the water molecule tetrahedrons had flipped so that the S+ hydrogen apices had entered the Helmholtz layer and were absorbed to the electronegative charge of the electrode. This left the S- lone pair apices facing the electrostricted layer. This process bound the newly forming H.sup.+ ions which blocked the reaction

$H^+ + H^+ + 2e \Longrightarrow H_2$ (gas)

STAGE F

Region C: It was found that the barrier effect could be unblocked by some relatively simple procedures:

(a) Reversing the output electrodes from Component I to Component II, and/or:

(b) Mechanically tapping the Component III cell at a frequency T/2 = 1.5 seconds per tap.

These effects are shown in FIG. 12 and induce the drop in barrier potential from:

$$\left.\begin{array}{l} E = /250 \text{ volts to } 4 \text{ volts} \\ I = 10 \text{ mA to } 1 \text{ mA} \end{array}\right\} \doteq 4\ mw. \text{ (final state)}$$

Upon unblocking of the barrier effect, electrolysis of water resumed with renewed bubble formation of hydrogen gas.

The barrier potential problem has been solved for practical application by lowering the high dielectric constant of pure water, by adding salts (NaCl, KOH, etc.) to the pure water thereby increasing its conductivity characteristics. For optimum efficiency the salt concentration need not exceed that of sea water (0.9% salinity) in Section 3, "Thermodynamics of the Invention", it is to be understood that all water solutions described are not "pure" water as in Section B, but refer only to salinized water.

Section 3 --- The Thermodynamics of the Invention (Saline Water) ~

Introduction (water, hereinafter refers to salinized water) ~

The thermodynamic considerations in the normal operations of Components I, II, and III in producing hydrogen as fuel, and oxygen as oxidant during the electrolysis of water, and the combustion of the hydrogen fuel to do work in various heat engines is discussed in this section.

In chemical reactions the participating atoms form new bonds resulting in compounds with different electronic configurations. Chemical reactions which release energy are said to be exergonic and result in products whose chemical bonds have a lower energy content than the reactants. The energy released most frequently appears as heat. Energy, like matter, can neither be created nor destroyed according to conservation law. The energy released in a chemical reaction plus the lower energy state of the products is equal to the original energy content of the reactants. The burning of hydrogen occurs rather violently to produce water as follows:

$2H_2 + O_2$ ===> $2H_2O$ - .DELTA.H 68.315 Kcal/mol (this is the enthalpy, or heat of combustion at constant pressure)

(18 gms) = 1 mol)

The chemical bonds of the water molecules have a lower energy content than the hydrogen and oxygen gases which serve at the reactants. Low energy molecules are characterized by their ability. High energy molecules are inherently unstable. These relations are summarized in the two graphs of FIG. 14. It is to be noted that FIG. 14 (b) shows the endergonic reaction aspect of the invention when water is decomposed by electrolysis into hydrogen and oxygen. FIG. 14 (a) shows the reaction when the hydrogen and oxygen gases combine, liberate energy, and re-form into water. Note that there is a difference in the potential energy of the two reactions. FIG. 14 (c) shows that there are two components to this potential energy. The net energy released, or the energy that yields net work is labelled in the diagram as Net Energy released, and is more properly called the free energy change denoted by the Gibbs function, -.DELTA.G. The energy which must be supplied for a reaction to achieve (burning) spontaneity is called the activation energy. The sum of the two is the total energy released. A first thermodynamic subtlety of the thermodynamic device of the invention is noted in Angus McDougall's *Fuel Cells*, Energy Alternative Series, The MacMillan Press Ltd., London, 1976, page 15 it is stated:

"The Gibbs function is defined in terms of the enthalpy H, and the entropy S of the system:

G = H-T S (where .tau. is the thermodynamic temperature)

A particularly important result is that for an electrochemical cell working reversibly at constant temperature and pressure, the electrical work done is the net work and hence,

.DELTA.G = $-w_e$

For this to be a reversible process, it is necessary for the cell to be on `open circuit`, that is, no current flows and the potential difference across the electrodes is the EMF, E. Thus,

.DELTA.G = -zFE

(where F is the Faraday constant --- the product of the Avogadro Constant + N_A = 6.022045×10^{23} mole^{-1}, and the charge on the electron, e = $1.602\,189 \times 10^{-19}$ C --- both in SI units; and z is the number of electrons transported.) when the cell reaction proceeds from left to right."

It is to be noted that the activation energy is directly related to the controlling reaction rate process, and thus is related to the Gibbs free energy changes.

The other thermodynamic subtlety is described by S. S. Penner in his work: Penner, S. S. and L. Icerman, *Energy*, Vol, II, Non-Nuclear Energy Technologies. Addison-Wesley Publishing Company, Inc. Revised Edition, 1977. Reading, Mass. Page 140 ff.

"It should be possible to improve the efficiency achieved in practical electrolysis to about 100% because, under optimal operating conditions, the theoretically-attainable energy conversion by electrolysis is about 120% of the electrical energy input. The physical basis for this last statement will now be considered.

"A useful definition for energy efficiency in electrolysis is the following: the energy efficiency is the ratio of the energy released from the electrolysis products formed (when they are subsequently used) to the energy required to effect electrolysis. The energy released by the process

H_2 (gas) + (1/2)O_2 (gas) ===> H_2O (liquid)

under standard conditions (standard conditions in this example are: (1) atmospheric pressure = 760 mm Hg and (2) temperature = 298.16° K. = 25° C. = 77° F.) is 68.315 Kcal and is numerically equal to the enthalph change (.DELTA.H) for the indicated process. On the other hand, the minimum energy (or useful work input) required at constant temperature and pressure for electrolysis equals the Gibbs free energy change (.DELTA.G). There is a basic relation derivable from the first and second laws of thermodynamics for isothermal changes, which shows that

.DELTA.G = .DELTA.H - T.DELTA.S

where .DELTA.S represents the entropy change for the chemical reaction. The Gibbs free energy change (.DELTA.G) is also related to the voltage (E) required to implement electrolysis by Faraday's equation, viz.

E = (.DELTA.G/23.06n) volts

where .DELTA.G is in Kcal/mol and n is the number of electrons (or equivalents) per mol of water electrolyzed and has the numerical value 2.

"At atmospheric pressure and 300° K., .DELTA.H = 68.315 Kcal/mol of H_2O (i) and .DELTA.G = 56.62 Kcal/mole of H_2O (i) for the electrolysis of liquid water. Hence, the energy efficiency of electrolysis at 300° K. is about 120%."

$$\frac{\Delta G}{\Delta G} = 120\%$$

"(When) H_2 (gas) and O_2 (gas) are generated by electrolysis, the electrolysis cell must absorb heat from the surroundings, in order to remain at constant temperature. It is this ability to produce gaseous electrolysis products with heat absorption from the surroundings that is ultimately responsible for energy-conversion efficiencies during electrolysis greater than unity."

Using the criteria of these two authorities, it is possible to make a rough calculation of the efficiency of the present invention.

Section 4 --- Thermodynamic Efficiency of the Invention ~

Efficiency is deduced on the grounds of scientific accounting principles which are based on accurate measurements of total energy input to a system (debit), and accurate measurements of total energy (or work) obtained out of the system (credit). In principle, this is followed by drawing up a balance sheet of energy debits and credits, and expressing them as an efficiency ration, .eta..

$$\eta = \frac{\text{Credit}}{\text{Debit}} = \frac{\text{Energy Out}}{\text{Energy In}} = < 1$$

The energy output of Component I is an alternating current looking into a highly non-linear load, i.e., the water solution. This alternating current generator (Component I) is so designed that at peak load it is in resonance (Components I, II, III), and the vector diagrams show that the capacitive reactance, and the inductive reactance are almost exactly 180° out of phase, so that the net power output is reactive, and the dissipative power is very small. This design insures minimum power losses across the entire output system. In the experiments which are now to be described the entire emphasis was placed on achieving the maximum gas yield (credit) in exchange for the minimum applied energy (debit).

The most precise way to measure the applied energy to Components II and III is to measure the Power, P, in Watts, W. This was done by precision measurements of the volts across Component II as root mean square (rms) volts; and the current flowing in the system as rms amperes. Precisely calibrated instruments were used to take these two measurements. A typical set of experiments (using water in the form of 0.9% saline solution = 0.1540 molar concentration) to obtain high efficiency hydrolysis gave the following results:

rms Current = I = 25 mA to 38 mA (0.025 A to 0.038 A)

rms Volts = E = 4 Volts to 2.6 Volts

The resultant ratio between current and voltage is dependent on many factors, such as the gap distance between the center and ring electrodes, dielectric properties of the water, conductivity properties of the water, equilibrium states, isothermal conditions, materials used, and even the presence of clathrates. The above current and voltage values reflect the net effect of various combinations of such parameters. The product of rms current, and rms volts is a measure of the power, P in watts:

P = I x E = 25 mA.times.4.0 volts = 100 mW (0.1 W)

P = I x E = 38 mA.times.2.6 volts = 98.8 mW (0.0988 W)

At these power levels (with load), the resonant frequency of the system is 600 Hz (.+-.5 Hz) as measured on a precision frequency counter. The wave form was monitored for harmonic content on an oscilloscope, and the nuclear magnetic relaxation cycle was monitored on an X-Y plotting oscilloscope in order to maintain the proper hysteresis loop figure. All experiments were run so that the power in Watts, applied through Components I, II, and III ranged between 98.8 mW to 100 mW.

Since, by the International System of Units --- 1971 (SI), One-Watt-second (Ws) is exactly equal to One Joule (J), the measurements of efficiency used these two yardsticks (1 Ws=1 J) for the debit side of the measurement.

The energy output of the system is, of course, the two gases, hydrogen (H_2) and oxygen ($1/2O_2$), and this credit side was measured in two laboratories, on two kinds of calibrated instruments, namely, a Gas Chromatography Machine, and, a Mass Spectrometer Machine.

The volume of gases, H_2 and $(1/2)O_2$, was measured as produced under standard conditions of temperature and pressure in unit time, i.e., in cubic centimeters per minute (cc/min), as well as the possibly contaminating gases, such as air oxygen, nitrogen and argon; carbon monoxide, carbon dioxide, water vapor, etc.

The electrical, and gas, measurements were reduced to the common denominator of Joules of energy so that the efficiency accounting could all be handled in common units. The averaged results from many experiments follow. The Standard Error between different samples, machines, and locations is .+-.10%, and only the mean was used for all the following calculations.

Section 5 --- Endergonic Decomposition of Liquid Water ~

Thermodynamic efficiency for the endergonic decomposition of liquid water (salinized) to gases under standard atmosphere (754 to 750 m.m. Hg), and standard isothermal conditions @ 25° C. = 77° F. = 298.16° K., according to the following reaction:

$H_2O(1)$ ===> H_2 (g) + $(1/2)O_2$ (g) + .DELTA.G 56.620 KCal/mole

As already described, .DELTA.G is the Gibbs function (FIG. 14b). A conversion of Kcal to the common units, Joules, by the formula, One Calorie = 4.1868 Joules was made.

.DELTA.G = 56.620 Kcal x 4.1868 J = 236,954 J/mol of H_2O (1) where, 1 mole is 18 gms.

.DELTA.G = the free energy required to yield an equivalent amount of energy from H.sub.2 O in the form of the gases, H_2 and $(1/2)O_2$.

To simplify the calculations, the energy required to produce 1.0 cc of H_2O as the gases, H_2 and $(1/2)O_2$ was determined. There are (under standard conditions) 22,400 cc = V, of gas in one mole of H_2O. Therefore,

$$\frac{\Delta G}{V} = \frac{236.954\ J}{22{,}400\ cc}\ 10.5783\ J/cc$$

The electrical energy required to liberate 1.0 cc of the H_2O gases (where H_2 = 0.666 parts, and $(1/2)O_2$ = 0.333 parts, by volume) from liquid water is then determined. Since P = 1 Ws = 1 Joule, and V=1.0 cc of gas = 10.5783 Joules, then,

$$\begin{aligned} PV \ldots 1\ J \times 10.5783\ J \ldots\ & 10.5783\ J \\ = & \ 10.5783\ Ws \end{aligned}$$

Since the experiments were run at 100 mW (0.1 W) applied to the water sample in Component II, III, for 30 minutes, the ideal (100% efficient) gas production at this total applied power level was calculated.

0.1 Ws x 60 sec x 30 min = 180.00 Joules (for 30 min)

The total gas production at Ideal 100% efficiency is,

180.00 J / 10.5783 J/cc = 17.01 cc H_2O (g)

The amount of hydrogen present in the 17.01 cc H_2O (g) was then calculated.

17.01 cc H_2O (gas) x 0.666 H_2 (g) = 11.329 cc H_2 (g)

17.01 cc H_2O (g) x 0.333 $(1/2)O_2$ (g) = 5.681 cc $(1/2)O_2$ (g)

Against this ideal standard of efficiency of expected gas production, the actual amount of gas produced was measured under: (1) standard conditions as defined above (2) 0.1 Ws power applied over 30 minutes. In the experiments, the mean amount of H_2 and $(1/2)O_2$ produced, as measured on precision calibrated GC, and MS machines in two different laboratories, where the S.E. is +-10%, was,

Measured Mean = 10.80 cc H_2 (g)
Measured Mean = 5.40 cc $(1/2)\ O_2$ (g)
Total Mean = 16.20 cc H_2O(g)

The ratio, .eta., between the ideal yield, and measured yield,

$$\eta = \frac{\text{Measured } H_2(g)}{\text{Ideal } H_2(g)} = \frac{10.80 \text{ cc}}{11.33 \text{ cc}} = 91.30\%$$

Section 6 --- Energy Release ~

The total energy release (as heat, or electricity) from an exergonic reaction of the gases, H_2 and O_2, is given by,

$$H_2(g) + (\tfrac{1}{2})O_2(g) \longrightarrow H_2O\ (\ell) -- \Delta H\ 68.315\ \text{Kcal/mol} =$$
$$(--\Delta H\ 286{,}021\ \text{Joules})/\text{mol}$$

It is possible (Penner, Op. Cit., p. 128) to get a total heat release, or total conversion to electricity in a fuel cell, in the above reaction when the reactants are initially near room temperature (298.16° K.), and the reactant product (H_2O) is finally returned to room temperature. With this authoritative opinion in mind, it is desirable to determine the amount of energy released (ideal) from the exergonic experiment. The total energy of 1.0 cc of H_2O (1), as above is:

$$1.0 \text{ cc } \Delta H = \frac{286{,}021 \text{ J/mol}}{22{,}400 \text{ cc/mol}} = 12.7687 \text{ J/cc } H_2O\ (l)$$

for H_2 = 12.7687 x 0.666 = 8.509 J/0.66 cc H_2 for O_2 = 12.7687 x 0.333 = 4.259 J/0.33 cc $(1/2)O_2$

The energy produced from the gases produced in the experiments in an exergonic reaction was,

16.20 cc H_2O (g) x 12.7687 J/cc H_2O = 206,8544 J.

The overall energy transaction can be written as,

$$\frac{\text{EXERGONIC}}{\text{ENDERGONIC}} = \eta = \frac{-\Delta H}{+\Delta G} = \frac{206.8544\ \text{J}}{180{,}000\ \text{J}} = 1.14919 = 114.92\%$$

In practical bookkeeping terms the balance of debits and credits, n = (-.DELTA.H) - (+.DELTA.G), so, n = 206.8544 J - 180.0 = + 26.8544 J (surplus).

Since, in the invention, the gas is produced where and when needed, there is no additional cost accounting for liquifaction, storage, or transportation of the hydrogen fuel, and the oxygen oxidant. Therefore, the practical efficiency, is

$$\eta_P = \frac{26.8544\ \text{J}}{180.0000\ \text{J}} = 14.919\%\ \text{(as net return on the original energy investment)}$$

In practical applications, the energy output (exergonic) of the Component II System can be parsed between the electrical energy required to power the Component I System, as an isothermal closed loop; while the surplus of approximately 15% can be shunted to an engine (heat, electrical, battery, etc.) that has a work load. Although this energy cost accounting represents an ideal model, it is believed that there is enough return (app. 15%) on the capital energy investment to yield a net energy profit that can be used to do useful work.

Conclusion ~

From the foregoing disclosure it will be appreciated that the achievement of efficient water splitting through the application of complex electrical waveforms to energized water molecules, i.e. tetrahedral molecules having bonding angles of 109°28', in the special apparatus described and illustrated, will provide ample and economical production of hydrogen gas and oxygen gas from readily available sources of water. It is to be understood, that the specific forms of the invention disclosed and discussed herein are intended to be representative and by way of illustrative example only, since various changes may be made therein without departing from the clear and specific teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the method and apparatus of the present invention.

'INFOLIO'

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TITLE:

JOVITSCHITSCH

J4-JOV Milorad: TRANSMUTATION OF CARBON TO OXYGEN -- Ethylene & acetylene were reacted with phosphorus or copper oxide, condensed and analyzed. Elemental carbon had been transformed to Oxygen! The experiment was repeated with various reagents and similar results. Here are 2 papers -- IN GERMAN -- reporting the remarkable simple experimental details.. This process has enormous implications for industry, agriculture, geochemistry, etc..

: CHEMICAL ABSTRACTS, A

May 20, 1908. Volume 2, #10, pp 1410.

~~gave the cholesterol test. Experiments with ricinoleic acid instead of oleic acid led to similar results. Fractionation of the material showed all fractions to be optically active.~~ H. C. JACKSON.

Monatsh. f. Chemie Vol. 29 pp 1-14 (1908)

The Condensation Products of Ethylene and Acetylene Formed through the Agency of the Silent Electric Discharge. MILORAD Z. JOVITSCHITSCH. Bergau-Akademie in Belgrad. *Monatsh.*, 29, 5–14.—Berthelot has shown that a silent electric discharge acting upon saturated or unsaturated hydrocarbons will split off hydrogen in varying quantities from the molecule and, instead of polymerization products, condensation products will result. The author reports the work upon ethylene and acetylene under these conditions. The pure dry gases were introduced into a synthetizer, an ozonizer with manometer attachment. In the case of ethylene the condensation product is soluble in EtOH and Et_2O and gives a high molecular weight of 420. This corresponds to a formula approaching $C_{30}H_{54}$. The action of bromine and nitric acid upon this product led to its classification with cyclic compounds. The acetylene condensation product is extremely insoluble and hence no molecular weight determination could be directly obtained. The compound is similar in chemical properties to the preceding one, and is undoubtedly of ring structure. The deficiency in percentage of carbon in these compounds is worthy of note. An explanation for the same is given by the author in the following abstract (*Monatsh.*, 29, 1–4).

WILLIAM J. HALE.

The Mysterious Deficiency of Carbon in the Condensation Products from Ethylene and Acetylene. MILORAD Z. JOVITSCHITSCH. Bergau-Akademie in Belgrad. *Monatsh.*, 29, 1–4.—Pure dry ethylene and acetylene were in turn brought under the influence of silent electric discharge, and the condensation product in each case analyzed. The purest chemical reagents were employed in the combustions. From several determinations the percentage of carbon and hydrogen taken together fell below the theoretical 100%; in the case of the ethylene product a 7% and in that of the acetylene product a 22% deficiency was noted. This loss in the amount of hydrogen and carbon required by the formulae of hydrocarbons has been accounted for by Berthelot in the possibility of oxygen absorption from the atmosphere. The author has excluded this possibility by working with dry gases and preserving the products in hermetically sealed tubes immediately upon their formation. It is stated also that condensed ethylene loses no carbon on exposure to the air and that condensed acetylene is hardly affected by many weeks' standing. The analysis of the products from sealed tubes and those exposed for some time to the air were in agreement with each other. The possible intake of oxygen during the removal from the tubes is practically *nil*, owing to the rather insoluble nature of the compounds and the absence of any change in their appearance. These facts present us with a scientific riddle, a chemical anomaly, which the author believes can be explained only through experimental errors or through the transformation of elements. As great care and precision were taken in all of the determinations, the author is more convinced of the latter possibility, especially since these condensation products, notably that of acetylene, possess strong radioactive properties. These products, therefore, may be considered, not as simple hydrocarbons, but as compounds of these with known or unknown elements here brought into existence through the action of the silent electric discharge upon gaseous ethylene or acetylene.

WILLIAM J. HALE.

CO_2

Der rätselhafte Mangel an Kohlenstoff bei den Kondensationsprodukten von Äthylen und Acetylen

von

Milorad Z. Jovitschitsch.

Aus dem Laboratorium der Bergbau-Akademie in Belgrad.

(Vorgelegt in der Sitzung am 10. Oktober 1907.)

Der zu wiederholtem Male bedeutend geringer gefundene Kohlenstoffgehalt bei diesen Produkten drängte mich, hierüber Aufklärung zu erhalten. Vor allem beobachtete ich die größte Sorgfalt bei der Darstellung. Das Äthylen sowohl als auch das Acetylen wurden vollkommen trocken in den Synthetisator eingeführt, dessen Inhalt kaum über 50 bis 60 *cm*^{3} betrug. Das kondensierte Äthylen wurde auf Schwefelgehalt geprüft, das kondensierte Acetylen auf Phosphor, beidemal mit negativem Erfolge.

Dann schritt ich mit allen zu Gebote stehenden Vorsichtsmitteln zur Verbrennung. Die Verbrennungen wurden zuerst mit Kupferoxyd ausgeführt, indem die Substanzen innig mit diesem zusammengemischt waren; das Kupferoxyd ist von Kahlbaum bezogen. Dann führte ich die Verbrennung im Sauerstoffstrom und schließlich mit Bleichromat aus, welches ebenfalls von Kahlbaum herrührte. In allen diesen Fällen waren die Resultate dieselben.

Hier die Grenzwerte jener zwei Analysen des kondensierten Äthylens, zwischen denen die Werte aller anderen Wasserstoff- und Kohlenstoffzahlen einer und derselben Portion variierten:[1]

---

[1] Ich erwarte, daß je nach der Stromstärke und Einwirkungsdauer verschiedene Werte für Kohlenstoff gefunden werden.

I. 0·1147 g Substanz ergaben 0·1425 g H_2O und 0·3384 g CO_2 oder 13·22% H und 80·44% C.
II. 0·1746 g Substanz ergaben 0·2062 g H_2O und 0·5108 g CO_2 oder 13·13% H und 79·84% C.

Bei der ersten Analyse wurde die Substanz einige Tage zuvor der atmosphärischen Luft ausgesetzt; die Summe von Kohlenstoff und Wasserstoff ist um 6% geringer von 100. Bei der zweiten Analyse, deren Substanz frisch dem hermetisch zugemachten Gefäße direkt entnommen wurde, ist diese Summe um 7% geringer von 100.

Hier die Resultate von drei Analysen kondensierten Acetylens, von welchen je eine mit Kupferoxyd allein, im Sauerstoffstrom und mit Bleichromat ausgeführt wurde.

I. 0·130 g Substanz ergaben 0·0818 g H_2O und 0·3432 g CO_2 oder 6·98% H und 71·96% C. Die Substanz wurde direkt nach der Darstellung mit Alkohol ausgekocht, sodann im Exsikkator getrocknet.
II. Absichtlich doppeltes Gewicht abgewogen.
0·260 g Substanz ergaben 0·1628 g H_2O und 0·684 g CO_2 oder 6·94% H und 71·96% C.
III. 0·1498 g Substanz ergaben 0·0919 g H_2O und 0·3905 g CO_2 oder 6·87% H und 71·23% C. Die Substanz ist längere Zeit vor der Verbrennung der atmosphärischen Luft ausgesetzt worden, wobei sie an Gewicht nicht zugenommen hat. Einige Milligramm Wasser nimmt sie wohl dabei auf, verliert es aber im Exsikkator wieder.

Die Summe von Kohlenstoff und Wasserstoff ist hier um 22%, zweiundzwanzig Prozente, geringer als 100. So oft die Verbrennung unter welchen Bedingungen immer ausgeführt wurde, bekam man nie mehr Kohlenstoff.

Das sind Tatsachen, welche vorläufig keine Erklärung finden. An die Berthelot'sche Angabe, daß diese Kondensationsprodukte begierig Sauerstoff aufnehmen, ist gar nicht zu denken. Kondensiertes Äthylen wird beim Stehen an der Luft zwar dickflüssiger, verliert dabei aber von seinem Kohlenstoffgehalte kaum etwas. Kondensiertes Acetylen aber ändert sich auch bei wochenlangem Stehen an der Luft nicht im geringsten äußerlich. Ob Berthelot zu jener Angabe durch eventuell konstatierte Verluste an Kohlenstoff mittels einer Elementaranalyse, worüber er keine Mitteilung macht, gebracht worden ist oder durch irgend eine andere Beobachtung, weiß ich nicht. Die Angabe ist für meine Präparate, die in hermetisch geschlossenen Gefäßen aufbewahrt wurden, da ich dieser Berthelot'schen Angabe Rechnung trug, ausgeschlossen, wenn sie auch sonst zuträfe. Übrigens, wie gesagt, zeichnen sich die Analysen des an der Luft ausgesetzten von dem im hermetisch geschlossenen Gefäß aufbewahrten Präparate durch nichts aus. Es könnte nur noch eine Möglichkeit vorhanden sein, nämlich die, daß der Sauerstoff während des Herausnehmens der Substanz aus dem Apparate hinzukam. Dies scheint mir ausgeschlossen; erstens deshalb, weil kein Unterschied, keine Veränderung dabei zu beobachten ist, und zweitens, weil ein so widerstandsfähiger und nirgends auflöslicher Körper eine so große Empfindlichkeit schwerlich besitzen könnte.

CuOxide

Ich glaube vielmehr, daß wir durch diese experimentellen Tatsachen vor ein großes wissenschaftliches Rätsel gebracht worden sind. Als Schützenberger[1] vor 25 Jahren bei den Elementaranalysen kaukasischen Petroleums häufig 101 bis 101·5% Kohlen- und Wasserstoff statt 100 erhalten hatte, glaubte er den Grund dafür »in der Unsicherheit der Grundlage unseres wissenschaftlichen Gebäudes finden zu können«, indem er noch hinzufügte, daß es diese Fähigkeit durch Belichtung verliere, im Dunkeln aber behalte. Damals bezeichnete man diese Angabe als eine chemische Anomalie.

Meine experimentellen Beweise aber sind keine Anomalien. Denn wenn bei einer chemischen Reaktion, in diesem Falle einer Synthese aus einem bekannten Kohlenwasserstoffe, wieder nur ein Kohlenwasserstoff resultiert, dessen Summe von Bestandteilen aber um 7, beziehungsweise 22% von dem normalen Werte von 100 differiert, so können da nur zwei Möglichkeiten vorhanden sein. Entweder hat man mit einem analytischen Fehler oder mit einer Transformation von Elementen zu tun. Etwas Drittes ist völlig ausgeschlossen.

Mag die Ansicht über die Transformation von Elementen bei der Einwirkung dunkler elektrischer Entladung auf Äthylen und Acetylen noch so unglaublich erscheinen, sie ist der tatsächlichen Sachlage gemäß die einzig gestattete. Ich bin von ihr um so mehr überzeugt, als beide Kondensationsprodukte,

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[1] Ber. der deutschen chem. Ges., *15*, 988 (1882).

besonders das des Acetylens, stark radioaktive Eigenschaften besitzen. Somit wären diese Kondensationsprodukte keine einfachen Kohlenwasserstoffe, sondern Verbindungen mit noch einem entweder bekannten oder unbekannten Elemente, zu dessen Bildung die Einwirkung dunkler elektrischer Entladung auf gasförmiges Äthylen und Acetylen den Anlaß gegeben hatte. Der obige Mangel bis 100 muß also diesem dritten Elemente zukommen.

Trifft diese Vermutung zu, so sind selbstverständlich die experimentellen Resultate der vorhergehenden Abhandlung anders zu deuten. Aber nicht nur sie, sondern das ganze chemische Gebäude wird dann in neuem Lichte erscheinen.

Zum Schlusse soll noch erwähnt werden, daß die in der zitierten ersten Arbeit ausgesprochene Vermutung über erfolgreiche Einwirkung des stark wechselnden sogenannten Tesla-schen Stromes auf chemische Reaktionen in dem Synthetisator sich nicht bewahrheitete. Als ich in ein einige Zentimeter breites, beiderseits offenes, mit Korken gut verstopftes Glas, durch welches zwei parallele Drähte gingen, diesen Strom dem darin befindlichen Acetylen zuführte, spaltete sich Wasserstoff unter Ablagerung von Kohle an den Drähten ab. Es scheint somit diese Tesla'sche Elektrizität der Funkenelektrizität, betreffend die chemischen Reaktionen, gleichzukommen.

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Rax Research

Über die Kondensationsprodukte von Äthylen und Acetylen mittels der dunklen elektrischen Entladung

von

Milorad Z. Jovitschitsch.

(Vorgelegt in der Sitzung am 10. Oktober 1907.)

Vor etwa 45 Jahren studierte Berthelot die Einwirkung dunkler elektrischer Entladung auf die chemischen Reaktionen in seinem Ozonizator und erhielt das Ozon, das Schwefelheptaoxyd und noch einige andere Körper. Vor zehn Jahren[1] führten Lozanitsch und ich eine Reihe von Synthesen in demselben, durch einen Manometeransatz modifizierten Apparat aus, den wir Elektrisator nannten, für den ich aber infolge der synthetischen Prozesse, die in ihm verlaufen, den Namen Synthetisator vorschlage. Unter anderem wurde die Einwirkung dunkler elektrischer Entladung auch auf die ungesättigten Kohlenwasserstoffe geprüft, für welche wir wegen der physikalischen Eigenschaften der erhaltenen Produkte Polymerisation zu Verbindungen von hohem Molekulargewicht annahmen. Vor uns schon studierte Thenard im Jahre 1874 diese Elektrizität, aber nur auf Acetylen, und fand ebenfalls, daß es sich dabei zu einem von der Zusammensetzung des Acetylens äußerst beständigen Produkt polymerisiert.[2]

Gleich nach unserer Publikation ergriff Berthelot von neuem die Arbeit auf diesem Gebiet[3] und bewies, daß bei der Einwirkung dunkler elektrischer Entladungen sowohl auf gesättigte als auch ungesättigte Kohlenwasserstoffe sich Wasser-

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[1] Ber. der Deutschen chem. Ges., *30*, 135 (1897).

[2] Ber. der Deutschen chem. Ges., *7*, 190 (1874).

[3] Comptes Rendus (1898), I, 561.

stoff in verschiedenen Quantitäten abspalte, somit keine Polymerisations-, sondern Kondensationsprodukte sich bilden. Der zu diesem Zwecke durch je 24 Stunden dauernde Strom war von der Stärke 2 Ampère und 12 Volt.

Ich bediente mich diesmal eines noch kräftigeren Stromes, als für die ersten derartigen Versuche angegeben wurde, und zwar über 3 Ampère und gegen 100 Volt. In dem Synthetisator ließ ich durch 3 Tage und 2 Nächte fast ununterbrochen diesen Strom auf das trockene Äthylen, dargestellt aus Alkohol und Schwefelsäure, einwirken. Das Äthylen gelangte aus einem Gasometer in den Synthetisator in dem Maße, in welchem es in diesem verbraucht wurde. Es entstanden 3·6 *g* von dem schon früher beschriebenen, dickflüssigen gelbrötlichen, über 200° siedenden Produkte. Auf dieselbe Weise (Versuchsdauer 30 Stunden) stellte ich gegen 4 *g* vom festen Kondensationsprodukte des Acetylens dar. Das Acetylen wurde aus Calciumcarbid gewonnen und vollständig trocken der Einwirkung dunkler elektrischer Entladung ausgesetzt.

Untersuchungen über kondensiertes Äthylen.

Es interessierte mich, zunächst die Größe des Molekulargewichtes dieser beiden Körper zu ermitteln. Das aus Acetylen erhaltene, beim Erhitzen stark zu verpuffende Produkt ist aber so gut wie unlöslich, dagegen das aus Äthylen in Äther und Alkohol leicht löslich. Durch die Freundlichkeit des Herrn Prof. **Siegfried** aus Leipzig wurde das Molekulargewicht mittels der Siedepunktserhöhung bestimmt und auf 419·7 gefunden.

Gewicht des Alkohols	19·70.
Gewicht der Substanz	0·4668.
Temperaturerhöhung	0·065.

Die Formel $C_{30}H_{60}$, deren Molekulargewicht 420 beträgt, ist ausgeschlossen, weil, wie schon erwähnt, bei der Reaktion keine Polymerisation stattfindet. Auf Grund seiner analytischen Daten, daß aus 100 Volumen Äthylen 25·15 Volumen Wasserstoff und 1·35 Volumen Äthan entstehen, hat **Berthelot** das Atomverhältnis des Kohlenstoffes zu Wasserstoff in dem Kondensationsprodukte zu $C_2 : H_{3 \cdot 4}$ berechnet und zuerst die Formel $(C_{10}H_{16})_n$, später die Formeln $(C_8H_{14})_n$ oder $(C_{10}H_{18})_n$ aufgestellt.[1]

Durch Elementaranalysen zu entscheiden, welche einfachste Formel dem Kondensationsprodukt zukommt, stieß auf unerwartete Schwierigkeiten. Die für den Kohlenstoff sowohl bei der Äthylenverbindung als auch bei der Acetylenverbindung gefundenen Zahlen bringen mich zu der Ansicht, daß eine bisher unbekannte Fehlerquelle vorliegt.

Es läßt sich aber auf Grund der Berthelot'schen Zahlen und der ermittelten Wasserstoffwerten dann doch eine Be- [illegible].

Dem ermittelten Molekulargewicht von rund 420 passen die Formeln $C_{30}H_{50}$, $C_{32}H_{56}$ und $C_{30}H_{54}$, von den Molekulargewichten 410, 440 und 414 besonders die erste und dritte. Die Wasserstoffwerte mehrerer Verbrennungen variierten zwischen 13% und 14% und sind im Mittel 13·45%.

Die Formel $C_{30}H_{50}$ fordert nur 12·20% H, die Formel $C_{32}H_{56}$ 12·73%. Sie sind also auszuschließen. Es bleibt somit als wahrscheinlichste Formel $C_{30}H_{54}$, welche 13·04% Wasserstoff erfordert. Zur Entscheidung, ob man es mit einem den alyphatischen oder zyklischen Verbindungen gehörigen Körper zu tun hatte, studierte ich die Einwirkung von Brom.

Die ätherische Lösung wurde mit Brom im Überschuß versetzt. Es schied sich nichts aus. Nach Verdunstung des Äthers blieb eine braune, zähe Masse zurück, die sich in warmem Alkohol nicht auflöst, sondern nur schmilzt und beim Erkalten asphaltähnlich wird. Um darin Brom zu bestimmen, erhitzte ich es in zugeschmolzenem Rohre mit konzentrierter Salpetersäure in Gegenwart von Silbernitrat bis 100°. Es entstand reichlich eine gelblich-weiße Substanz, die sich aber nicht als Silberbromid, sondern als eine bromfreie Verbindung erwies, welche auf Zusatz von wenigen Kubikzentimetern Salpetersäure in Lösung ging. Das durch Brom entstandene braune Produkt, dessen Gewicht aus 0·32 *g* kondensierten Äthylens nur etwas über 0·213 *g* betrug, ist deshalb wahr-

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[1] Comptes Rendus (1898), 570.

scheinlich ein Oxydationsprodukt, und das durch Einwirkung von Salpetersäure auf dasselbe erhaltene gelblich-weiße Silbersalz, in welchem Stickstoff nachzuweisen ist, ein Nitrifikationsprodukt.

Wäre die Bindung der Kohlenstoffatome in dem Kondensationsprodukte eine geradlinige, so müßte die Bromaddition relativ leicht vor sich gehen. Dann und wann sah ich zwar aus 0·3 bis 0·35 *g* angewandter Substanz einige Milligramme eines Brom enthaltenden, gelblich aussehenden Körpers ausfallen; nach seiner geringen Menge ist er wohl aber als ein Produkt einer sekundären Reaktion zu betrachten. Dieses Ausbleiben einer Bromaddition läßt auf eine zyklische Bindung der Kohlenstoffatome im Molekul des Kondensationsproduktes schließen.

Dafür spricht auch das Verhalten der konzentrierten Salpetersäure gegenüber. Von dieser wird es sofort braun, wie wenn man diese zu Anilin oder Benzol hinzufügt. Es entsteht ein dem bei der Bromeinwirkung erhaltenen ähnlicher Körper. Auch beim längeren Stehen tritt keine weitere Veränderung ein; es trennt sich nur die Säure von der an deren Oberfläche schwimmenden braunöligen Flüssigkeit. Erst durch Erwärmen auf dem Wasserbade auf 50 bis 60° tritt stürmische Reaktion ein, welche man durch Wegnehmen des Gefäßes vom Wasserbade mäßigen kann. Das Glasrohr, in welchem am besten die Reaktion auszuführen ist, füllt sich mit einer schaumigen Masse und die Flüssigkeit wird gelblich klar. Nach Zusatz von Wasser erstarrt die schaumige Masse zu einem plastischen, voluminösen, gelb gefärbten Körper, welcher, mehrere Male mit viel Wasser, schließlich mit Alkohol ausgewaschen, fast unslöslich und im Exsikkator bis zum konstanten Gewicht getrocknet wird. Dabei wird er hart, von rötlichem Aussehen. Aus 0·53 *g* des Kondensationsproduktes, die mit 5 bis 6 *cm*³ konzentrierter Salpetersäure behandelt wurden, entstanden 0·552 *g* von diesem letzteren und aus der sauren Flüssigkeit samt Waschwasser und Alkohol, beim Eindampfen bis zur Trockene, blieben noch 0·065 *g* zurück, im ganzen also 0·617 *g*.

Beim Kochen mit Alkohol löste sich bis auf 0·123 *g* alles, die auch beim wiederholten Behandeln mit diesem unlöslich

blieben. Aus dem noch warmen Filtrat schied sich zuerst ein fester, gelblicher Körper im Gewichte von 0·057 *g* aus und nach [illegible] Abkühlung des Alkohols eine sirupartige Flüssigkeit, die Hauptmasse des durch die Einwirkung von konzentrierter Salpetersäure erhaltenen Produktes ab, welches nach Verdunstenlassen des Alkohols im Exsikkator zu einem festen, roten, lackähnlichen, anfangs klebrigen, später aber vollständig luftbeständigen Körper erstarrte.

In Alkohol löslicher Teil.

[illegible] *g* Substanz ergaben [illegible] *g* H_2O und 0·3040 *g* CO_2.

[illegible] Volumen *N* bei 756 *mm*, *t* = 23° oder [illegible]

Nach diesen Zahlen berechnet sich einfaches Atomverhältnis [illegible]

In 100 Teilen:

	Berechnet für	Gefunden
C	59·55	59·01
H	7·81	8·14
N	9·93	10·46

In heißem Alkohol unlöslicher Teil.

0·110 *g* Substanz ergaben 0·0741 *g* H_2O und 0·2288 *g* CO_2.

In 100 Teilen:

	Berechnet für $C_6H_9NO_2$	Gefunden
C	56·68	56·23
H	7·09	7·491

Die beiden Oxydations- oder vielmehr Nitrifikationsprodukte unterscheiden sich voneinander um eine CH_2-Gruppe, sind somit homologe Verbindungen.

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[1] Infolge Mangels an der Substanz konnte eine Stickstoffbestimmung nicht vorgenommen werden. Da das Atomgewicht des Stickstoffs beinahe dem des Sauerstoffs entspricht, so läßt sich, vorausgesetzt, daß der Rest bis 100, 100—(7·49+56·23) = 36·28% dem Sauerstoff zukomme, folgendes Atomverhältnis herleiten: $C_6H_9O_2$, und daraus die Zahl der Stickstoffatome berechnen, nämlich $C_6H_9NO_2$.

Um die Konstitution des Kondensationsproduktes zu lösen sowie auch jene seiner Derivate, bedarf man ihrer größerer Mengen. Diesmal genügt festzustellen:

1. daß das reine Äthylen bei der Einwirkung dunkler elektrischer Entladung sich nicht polymerisiert, sondern kondensiert, und

2. daß diese Kondensation der Klasse zyklischer Verbindungen gehört.

Untersuchungen über kondensiertes Acetylen.

Schon Thenard[1] hat gefunden, daß es unlöslich in allen bekannten Lösungsmitteln ist. Sein Molekulargewicht konnte deshalb mittels keiner der bekannten Methoden bestimmt werden; ich war gezwungen, mich einer Analogiemethode zu bedienen.

Bei der Elementaranalyse fand ich noch größere Anomalien als beim Kondensationsprodukt des Äthylens. Man kann aber in folgender Weise sich doch eine bestimmte Ansicht bilden.

Berthelot hat nach der kleinen Menge des bei der Einwirkung dunkler elektrischer Entladung auf Allylen abgespalteten Wasserstoffs für das entstandene Kondensationsprodukt die Formel $(C_{15}H_{19})_2$ oder $C_{30}H_{38}$ berechnet.[1] Er hat weiter gefunden, daß die Menge des abgespalteten Wasserstoffs bei der Einwirkung dunkler elektrischer Entladung auf Acetylen ebenso gering ist, woraus sich für das Kondensationsprodukt des Acetylens auf die Formel $C_{30}H_{28}$ oder $C_{30}H_{26}$ schließen läßt. Die Annahme des Eintritts von 30 Kohlenstoffatomen beim kondensierten Allylen und Acetylen stimmte somit mit den gefundenen 30 Atomen beim kondensierten Äthylen überein sowie mit der Tatsache, daß auch die in der Natur vorkommenden höchsten Kohlenwasserstoffe bis 30 Atome in ihren Molekülen enthalten. Die Elementaranalysen ergaben übereinstimmende Werte für Wasserstoff, welche zwischen 6·5 bis 7·00% variierten. Die Formel $C_{30}H_{28}$ erfordert 7·22% und die $C_{30}H_{26}$ nur 6·74%, somit ist diese letztere wahrscheinlich die richtigere. Der Kohlenstoffgehalt war aber immer ein bedeutend geringerer, als sich für diese Formeln berechnete. Ich legte anfangs auf diese merkwürdige Tatsache nicht so besonderes Gewicht, da doch aus einer reinen Kohlenwasserstoffverbindung wieder nur eine Kohlenwasserstoffverbindung entstehen kann.

Ich prüfte das Verhalten gegen Brom. Das hornartige Kondensationsprodukt verhält sich äußerst widerstandsfähig. Wenn man das vom inneren Rohre des Synthetisators abgekratzte Produkt mit Alkohol auswäscht, worin nur ein kleiner Teil gelöst wird, und mit Brom direkt versetzt, so tritt fast keine Veränderung ein. Pulvert man aber zu feinem Mehle und setzt dann Brom zu, so tritt momentan erhebliche Wärmeentwicklung ein. Mehrere Versuche stellten fest, daß dabei nur zwei Bromatome addiert werden, und zwar nach dem den zwei Atomen entsprechenden Zuwachs an Gewicht der angewandten Substanz sowie auch nach dem Bromgehalt.

I. 0·1456 *g* Substanz, behandelt mit überschüssigem Brom bei gewöhnlicher Temperatur und Druck, ergaben 0·1987 *g* statt 0·206 *g* Bromverbindung.

II. 0·1262 *g* Substanz bei denselben Bedingungen ergaben 0·1699 *g* statt 0·176 *g*.

III. 0·213 *g* Substanz ergaben 0·1426 *g* AgBr oder 28·87% Br statt 29·19% für $C_{30}H_{26}Br_2$.

0·226 *g* Substanz ergaben 0·0968 *g* H_2O und 0·3858 *g* CO_2 oder 4·76% H und 46·39% C.

Wird das in wenig Äther oder Alkohol suspendierte Kondensationsprodukt in einem 3 bis 4 *dm* langen offenen Rohr mit Brom auf 100° auf dem Wasserbade erhitzt, hinterbleibt nach Verdunstung des Lösungsmittels und nach mehrmaligem Auskochen mit Alkohol ein Produkt, dessen Bromgehalt so ziemlich drei Bromatomen entspricht. Wahrscheinlich liegt ein Gemisch von wenig Dibrom- und viel Tribromderivat vor. Bei der Einwirkung war Auftreten von Bromwasserstoff bemerkbar.

0·38 *g* Substanz ergaben auf diese Weise 0·609 *g* Bromderivat. Davon ergaben 0·350 *g*, im zugeschmolzenen Rohr erhitzt, 0·307 *g* AgBr oder 37·44% Br. Die Formel $C_{30}H_{25}Br_3$ fordert 38·33%.

In einem zugeschmolzenen Rohre, in welchem kondensiertes Acetylen auf 100° mit einem Bromüberschuß 2 Stunden

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[1] Comptes Rendus (1898), 573.

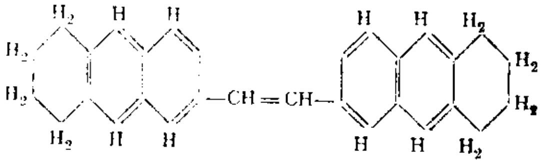
lang erhitzt wurde, beobachtete ich beim Öffnen des Rohres starken Druck von reichlich gebildetem Bromwasserstoff. Der Zuwachs an dem angewandten Kondensationsprodukt entsprach dem Eintritt von vier Bromatomen. Eine Brombestimmung des so erhaltenen Bromderivates bestätigte dies.

0·230 *g* Substanz ergaben 0·2545 *g* AgBr oder 45·31% Br statt 45·33% für $C_{30}H_{24}Br_4$.

0·1696 *g* Substanz ergaben 0·0452 *g* H_2O und 0·1735 *g* CO_2 oder 2·97% H und 28·05% C.

Das Bi- und Tribromderivat, behandelt im zugeschmolzenen Rohre mit Brom, geht in das Tetrabromderivat über.

Was die Tatsache anbelangt, daß die Addition von nur zwei Bromatomen sowie auch die Substitution von nur zwei weiteren Bromatomen stattfindet, so könnte das für folgende Konstitution sprechen:



obwohl durch sie das Ausbleiben weiterer Substitution nicht erklärt wird. Vielleicht daß bei über 100° gesteigerter Temperatur noch weitere Substitution erfolgt.

Die Bromderivate ähneln äußerlich im allgemeinen der Mustersubstanz, mit dem Unterschiede aber, daß sie beim Erhitzen nicht verpuffen.

Wie Thenard hervorhob, widersteht das kondensierte Acetylen der Einwirkung rauchender Salpetersäure. Wie ich beobachtet habe, wird sie aber in gepulvertem Zustande selbst von gewöhnlicher konzentrierter Salpetersäure verändert, von rauchender sogar sehr heftig angegriffen, selbst bei gewöhnlicher Temperatur. Mit einem Dezigramm (0·1 *g*) gelang mir die Reaktion auch mit rauchender Salpetersäure trefflich. Als ich 0·7 *g* verarbeiten wollte, war die Einwirkung so stürmisch, daß das Rohr erglühte und von reichlichen Mengen eines Rauches erfüllt wurde, dessen Geruch deutlich an den

aromatischer Verbindungen erinnerte.[1] Die von der abgeschiedenen Kohle abfiltrierte saure Flüssigkeit, ohne weiteres bis zur Trockene abgedampft, hinterließ einen lackähnlichen, äußerst zerfließlichen, braunen, in Wasser sehr leicht löslichen Körper; er war stickstoffhaltig. Mehrere Male in Wasser gelöst, abfiltriert und bis zur Trockene eingedampft, dann im Exsikkator bis zum konstanten Gewicht getrocknet, gelangte er zur Analyse.

0·2870 *g* Substanz ergaben 0·1212 *g* H_2O und 0·495 *g* CO_2 oder 4·69% H und 46·09% C. Für Stickstoffbestimmung hatte ich leider keine Substanz mehr.

Weiter verarbeitete ich 0·387 *g* fein zermahlenen Produktes mit gewöhnlicher konzentrierter Salpetersäure. Bei gewöhnlicher Temperatur tritt keine Veränderung auch bei längerem Stehen ein. Beim Erwärmen auf dem Wasserbade, am besten in einem Rohre, das in ein geräumiges, auf 80 bis 90° erhitztes Wasser enthaltendes Becherglas taucht, tritt die Reaktion bald ein. Nach etwa 20 Minuten löst sich das Produkt unter Stickstoffoxydentwicklung vollkommen klar auf; kocht man das Wasser im Becherglas noch eine Zeit lang auf, so scheidet sich durch Zusatz von Wasser zu der Reaktionsflüssigkeit gewöhnlich nichts aus oder aber es entsteht in geringer Menge ein gelber, feiner Niederschlag.

Die abfiltrierte saure Flüssigkeit, bis zur Trockene eingedampft, hinterließ einen gelben, in Wasser und Alkohol äußerst leicht löslichen, stickstoffhaltigen Körper in einer Menge von 0·449 *g*. Ohne weitere Reinigung gelangte er zur Analyse.

I. 0·2050 *g* Substanz ergaben 0·052 *g* H_2O und 0·2964 *g* CO_2 oder 2·87% H und 39·56% C.

II. 0·1278 *g* Substanz ergaben 5·6 Volumen N bei 740 *mm* und *t* = 22° oder 4·85% N.

Nach Auflösen dieser Substanz in Wasser und Eindampfen hinterbleibt sie mit dunklerer Farbe, doch mit denselben mißlichen Eigenschaften.

0·115 *g* Substanz ergaben 0·1637 *g* CO_2 oder 40·16% C. Die Wasserstoffbestimmung mißglückte.

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[1] Berthelot wies beim Erhitzen dieses Körpers für sich das Styrol unter anderem nach.

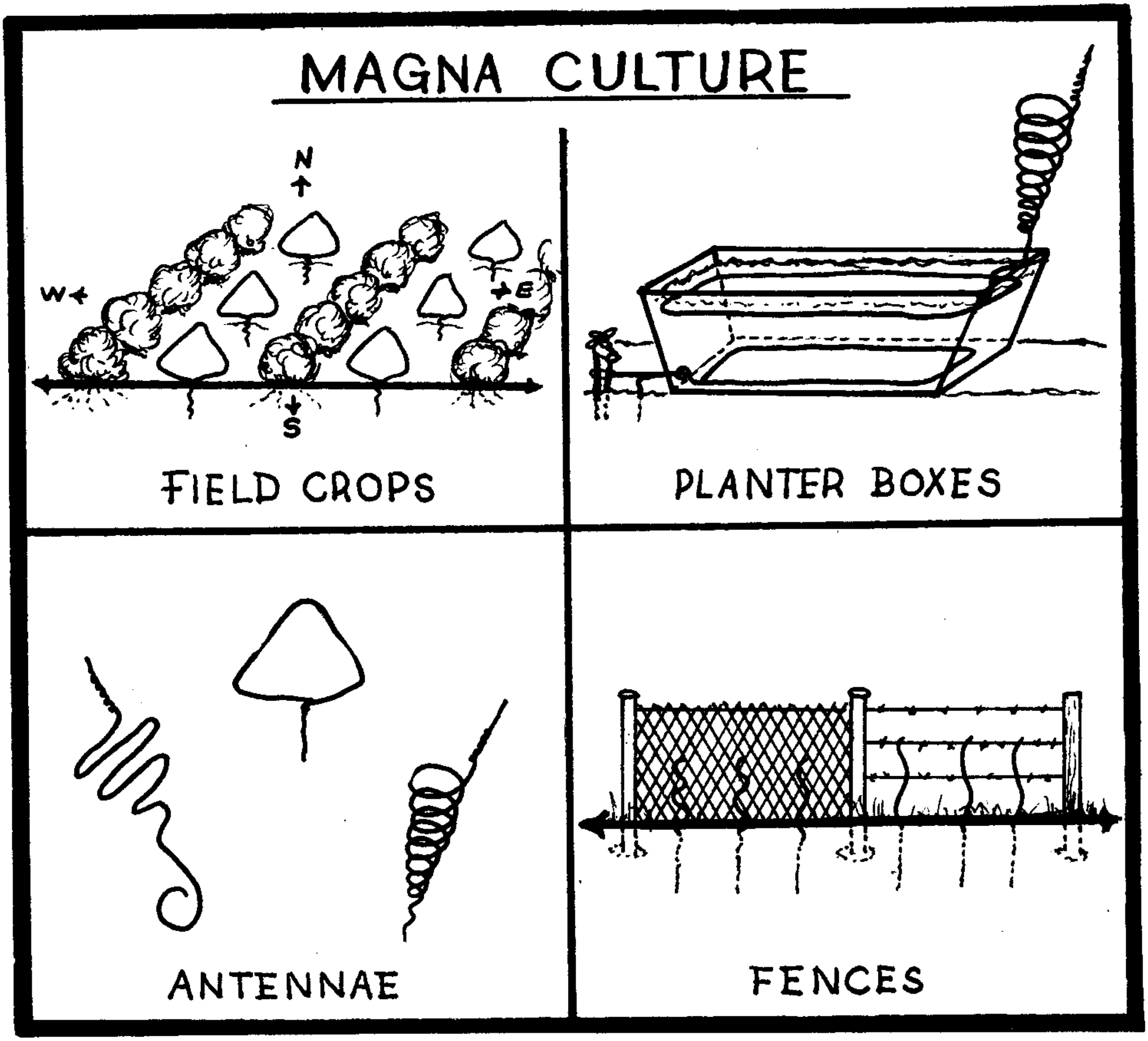
Aus diesen Zahlen berechnet sich die Formel $C_{30}H_{25}N_3O_{30}$, welche für C = 39·69%, für H = 2·75% und für N = 4·63% fordert.

Auffallend ist der so hohe Sauerstoffgehalt und der sehr geringe Kohlenstoffgehalt.

Nachdem ich auch bei der Muttersubstanz, dem kondensierten Acetylen, sowie auch bei dessen Bromderivaten, Di- und Tetrabromid, ebenfalls ein Manko an Kohlenstoff beobachtet habe, glaube ich nicht, daß analytische Fehler vorliegen, sondern daß diese Differenzen auf einer bisher nicht beobachteten Tatsache beruhen. Über diese äußere ich mich in der folgenden Mitteilung.

NEW AGE SCIENCE JOURNAL

June 1976



World Federation Of Science And Engineering

MAGNA CULTURE

This issue is dedicated to agriculture in hopes that the combined information will be of help to the farmers of the future, of which we feel will be everyone.

With the increase in our population throughout the world and a decrease in the farming, it will become necessary for approximatly 40% of the people to grow their own vegetables, that is if they want to survive.

From the beginning of time on earth, man has had the privilage of working with plants and the discription of the first so called garden that was placed here came with the instructions of how to keep it in good shape and let it produce 100% for the benefit of mankind.

Yes, we are talking about the GARDEN OF EDEN. All of the exposed surface of the earth was covered with plants and the Eden that it existed in was the atmosphere; the air, moisture, and frequency that these plants grew into and in the middle of all of this was a special kind of tree that was different than the rest of the plants, and it was called the TREE OF THE KNOWLEDGE OF LIFE. Why was it called this and why was it different?

We feel that it was a system that helped disperse the many thousands of micro frequencies that are in motion throughout the atmosphere, thus giving each plant a close relation with the count of frequency it needed. This is referred to as the R.F. count in most professions that are working along these lines today. It is a known fact today that each plant has its own R.F. factor, even though they might yeild the same kind of fruit they have a different count. This we refer to as each plant with its own knowledge.

Let us review some of the facts that have been recorded for the past 70 or so years from the research in this direction.

RADIOFREQUENCY CATALYST FOR INSECT CONTROL

One of the greatest boons to our society would be insect control by nonchemical or semichemical methods lacking polluting side effects. It is episodic pollution that captures public attention. The recent deaths of thousands of sheep in the vicinity of a military testing ground are an example. However, within the context of the problem, perhaps more important are long-range cumulative effects produced by chlorinated organic pesticides such as aldrin, DDT, dieldrin, methoxychlor, and others. The dangerous philosophy prevails that if one cannot see, feel, smell, or taste a pollutant, it does not exist. Nuclear hazards, for example, were frequently overlooked until obvious cases of radiation sickness were reported. Here it took inventors to provide advanced instrumentation that replaced the old spinthariscope in this critical field.

Fossil records indicate that insects are the oldest inhabitants on earth. Ninty percent of all animals are insects. Silk, cochineal, honey, and lac are insect products. A few hundred of the 500,000 species known are harmful. Selective insect control in agriculture and peripheral fields is important to effective plant growth and yeild. Although the intrinsic nature of insects is not fully understood, it appears that electronics could emerge as a controlling agent.

Insects are susceptible to ultrasonic waves and electromagnetic fields. If dense energy trains are directed at a specimen, internal heating effects tend to occur, and the animal might boil and explode. However, if gains are evaluated against costs, the fact emerges that the use of electronic methods alone is too expensive for practical applications.

By contrast, chemicals are cheap. This invites us to consider combinations of low-cost electronics with inexpensive chemicals, possibly in a catalytic sense. Enzymes, for example, act as catalysts in water, since many life sustaining compounds react only in solutions. Thus, electronic pulse trains might be directed at insect populations that have eaten catalyst-type chemicals responsive to relatively weak eletromagnetic stimulation. Here, the catalyst would give rise to abnormal endergonic states resulting in death. A normal endergonic event is the combination of carbon dioxide and water to form sugar within a living system.

A basic approach is shown in Fig. 1-1. The endergonic-type organic catalyst is applied to crops in the form of a spray. Aften the catalyst is taken up by insects 12 or more hours later, radiofrequency energy triggers it into action inside the body of the insect. Lethality will result from metabolistic anomalies in populations thus radiated. The ideal spray would function as a catalyst only in small animal life forms. It would have no effect on plants per se, nor would it be harmful if not irradiated by R.F.

The following references provide a basic introduction:

A. Hollaender, ed., Radiation Biology, Vols. I, II, III, (New York; McGraw-Hill Book Company, 1956).
G. G. Simpson, Life: An Introduction to Biology (New York: Harcourt, Brace and Co., 1957).

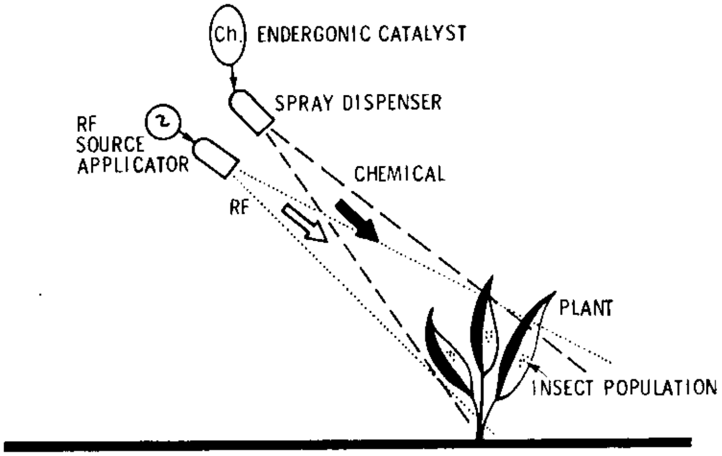


Fig. 1-1.
Radio-frequency catalyst for insect suppression.

PLANT ELECTROCULTURE

In conjunction with environmental pollution attention is directed to the nitrate pollution of agricultural fertilizers. New nethods, preferable electrical, are desired to stimulate plant growth and yeild.

Historically, attempts to increase the growth of plants date back to the 18th century. Dr. Mambray of Edinburgh, Scotland, apparently was the first to conduct experiments in 1746. Major experiments were conducted by Dr. S. Lemstroem in Finland in 1903. Exellent results were obtained.

Dr. Lemstroem, a professor of physics at Helsingfors, came to the belief that very rapid growth of vegetation in polar regions during the short arctic summer was to be ascribed to special electrical conditions of the atmosphere in these high latitudes. He duplicated these assumed conditions by increasing the atmospheric current, which normally passes from the air to the plant, by the use of atenna-type wires placed above the crop. An electrostatic Wimshurst machine was used for his purpose. Results were given in Dr. Lemstroem's book, Electricity and Agriculture and Horticulture, (London, 1904).

Lemstroem's work and results gave rise to experiments on an international scale, as is reflected in the following literature:

F. Basty, Nouvaux Essais d'Electroculture (Paris: C. Amat, 1910).

V. H. Blackman, et al, "The Effect of an Electric Current of Very Low Intensity on the Rate of Growth of the Coleoptile of Barley," Proc. Roy. Soc. B., 95, 214-28, 1923.

K. Stern, Elektrophysiologie der Pflanzen (Heidelberg-Berlin: J. Springer, 1924).

The various methods are known under the combining term "electroculture," Fig. 1-2 shows a typical electroculture system. The DC exciting voltages are determined by the height of the feeding antenna, but

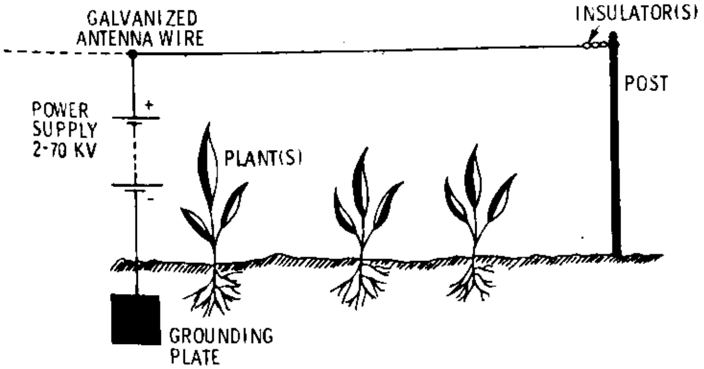


Fig. 1-2 Electroculture System.

usually are between 2000 and 70,000 volts. The following observations have been made:

1. The true percentage of yield increase for a good field is 45 percent maximum.
2. The better a field has been plowed, the greater is the yield obtained through electroculture. If the soil is too lean, no pronounced increase in yield can be observed.
3. Some plants do not respond to treatment unless watered. If they are watered, the yield can be extremely high. Peas, carrots, and cabbage are typical.
4. Electroculture treatment is detrimental to many, probably all, plants if conducted on warm, sunny days.
5. Overhead antenna wires should be arranged high enough to permit convenient plowing.

In the vicinity of the plant, current densities radiated by overhead discharge systems range approximately from 10-12 A/cm2. Natural electrical current densities peak out between 10-16 to 10-15 A/cm2. Although these current densities might appear to be extremely low, note that electroculture provides current that are about 1000 to 10,000 times higher than those given by nature. Electrometers may be used in the field to establish proper current levels. Higher drive voltages are needed to compensate for increased antenna height.

The domain of electroculture is wide open for new inventions because experiments are not complete. Specific needs for improvements reside in the area of in-field high-voltage generation and application.

It is of interest to realize that plant electroculture, in spite of its excellent promise, was relegated to dormancy by the advent of inexpensive nitrate fertilizers. Here we have a typical case in which a once-fabulous invention in chemistry commenced to dig its own grave (and perhaps ours, too!)

PSYCHOGALVANIC EFFECTS IN LIVING PLANTS

Although living plants normally are not regarded as more than edibles or raw material for construction purposes, new inventions and experiments are needed to determine their sentient properties.

Early in 1966, polygraph expert Cleve Backster of New York created the background for an entirely new science by accidental discovery. Employing the same kind of polygraph (lie detector) that is used to test emotional stimulation in human subjects, Backster found that plant specimens register fear, apprehension, pleasure, and relief. Futher, by using simple electronic methods, it was found that plants react not only to overt threats to their state of well-being, but even more stunningly, to the intentions and feelings of other living creatures, animal as well as human, with which they are closely associated.

It could be shown, for example, that simple house plants, such as the Dracaena Massangeana or philodendron, register apprehension when a dog goes past them, react violently when live shrimp are dumped into boiling water and apparently receive signals from dying cells in the drying bolld of an accidentally cut finger. Plants even appear to respond to distress signals over a considerable distance.

The immense importance of what is now referred to as the "Backster effect" need not be underlined. The phenomenon offers entirely new possibilities to inventors and research scientists, typically in areas of communications heretofore closed to us.

The overall aspects of the "Backster effect" were profiled in the following publications:

C. Backster, "Evidence of a Primary Perception in Plant life," International Journal of Parapsychology, Vol. 10:4, Winter 1968, pp. 329-48.

Anon., "ESP: More Science, Less Mysticism," Medical World News, Vol. 10:12, March 21, 1969, pp. 20-21.

L. G. Lawrence, "Electronics and Parapsychology," Electronics World, April 1970, pp. 27-29.

L. G. Lawrence, "Electronics and the Lining Plant," Electronic World, October 1969, pp. 25-28.

The effect continues to be verified both here and abroad. Its action cannot be blocked by Faraday screens, screen cages, lead-lined containers, or other shielding structures positioned between the plant and external test objects. Therefore, the phenomenon cannot be added to the inventory of electromagnetic domains established by classical physics.

How does the effect come about? Unfortunately, there are no concise answers at this time. The field is too new. However, the effect has a psychogalvanic character and can be varified by instrumentation batteries. A typical test system is composed of a variable Wheatstone bridge, a dc amplifier, a Faraday cage for the plant specimen, and graphic recorder for collecting data in a permanent manner.

In operation, the cage-contained plant is connected by a simple, leaf-attached clamp electrode to the Wheatstone bridge, and the readout system is energized. Then, by mentally projecting physical harm against the plant, response curves may be elicited. However, if the treat is not followed up by physical action (like burning, for example), the plant tends to adjust to these "idle threats" and ceases to respond. Response profiles are not uniform, changing from one specimen to the next. No responses and/or delayed reactions occur in many cases, all of which are imperfectly understood.

As a guide to inventors, the following equipment systems, approaches, and scientific considerations are offered as practical aids:

1. To avoid industrial and domestic electrical interference, electronics-oriented experiments with plants should be conducted in shielded enclosures such as metallic greenhouses. If, however, such a structure is too costly, an inexpensive wooden design may be used. Here, interference can be attenuated by attaching metallic screen wire to the walls, bottom, and ceiling of the greenhouse. Note that light must be permi-

tted to enter, since it is vital to photosynthesis. If a given Faraday-type enclosure is totally opaque, artificial illumination must be provided. If lamps of the fluorescent type are implyed, light must enter through a meshed metal screen securely grounded to a water pipe. For information on lamps designed explicitly for living plants, contact:

Commercial Engineering Department
Lighting Division
Sylvania Electric Products Inc.
Salem, Massachusetts

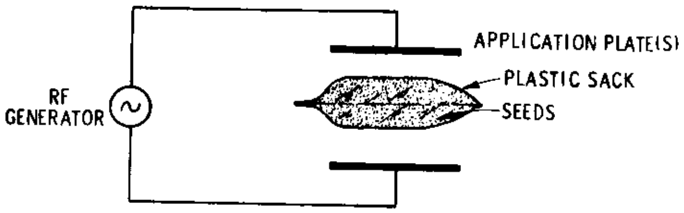
Request bulletins 0-262 ("Gro-Lux" fluorescent lamp), 0-285 and 0-286. The visible light spectrum required by plants for successful chlorophyll synthesis is between 4000 and 4800 angstroms, effective values peaking out at about 4500 angstroms.

2. For field operation involving testing of plants, psychogalvanic equipment must be housed in rugged, shielded containers. This requirement is especially stringent in those cases in which susceptibility tests are performed adjacent to power lines, populated areas, or automotive service stations generating voltage transients. Electrically, plants may be regarded as organic semiconductors and, regardless of size, have orthodox antenna functions.

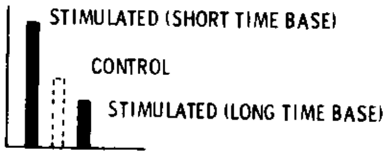
3. For dependable experimental results, new virgin plants may be used. Fresh cultures may be started conveiniently from packaged growth kits such as "Punch"n Grow" provided by Northrup, King & Co., Minneapolis, Minnesota. The kit contains seeds and soil material in a plastic container. Its cover may be punched with a blunt tool, and water may be added for seed activation.

4. In conjunction with item 3, seeds may be stimulated and raised into the seedling stage under the influence of weak radiofrequency fields. Apparatus for this purpose should operate below a wavelength of 10 meters. For information on RF stimulation of seeds, perusal of the following reports is suggested.

P. A. Ark, "Application of High-Frequency Electrostatic Fields in Agriculture," Quarterly Review of Biology 1940, 15:172-191.



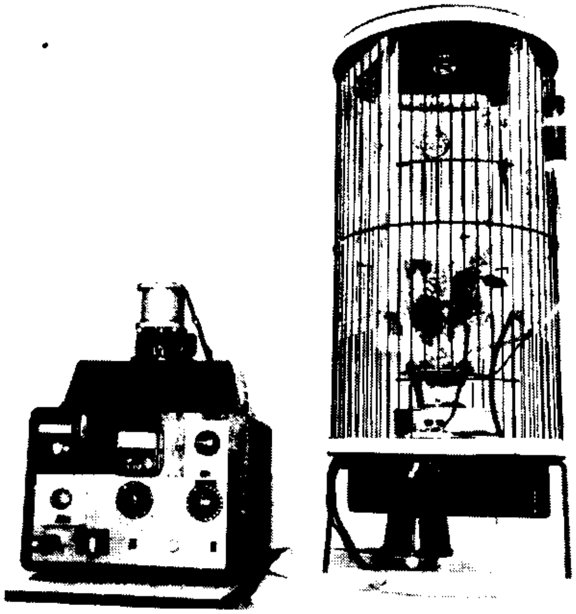
(A) Basic method.



(B) Yield patterns.

Fig. 1-3.
Stimulation of seeds by RF methods.

In the high-power stimulation phase, RF energy is applied for fractions of a second. According to the scheme shown in Fig. 1-3, seeds are contained in a plastic sack or bowl and placed between application plates connected to the RF generator tank circuit. This process is most critical and should not be attempted without background studies.



Courtesy Electro-Physics Co.

Fig. 1-4
Composite RF stimulator for seeds and seedlings.

In the low-power stimulation phase, RF currents in the micro-ampere or milli-ampere range are applied to a planted seed specimen. Apparatus is shown in Fig. 1-4. The blower-cooled RF generator to the left feeds energy into an interval switch at the bottom of the quasi-Faraday cage. A nutrient feeder for seedlings, seen at the upper right of the illustration, furnishes weak auxin-type solutions or other growth hormones.

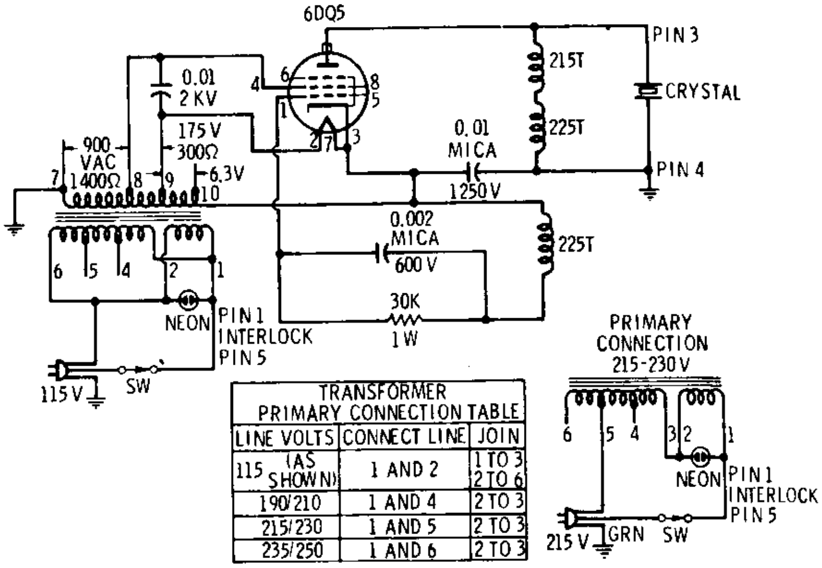
Because of its radio-frequency character, equipment of this type must always be operated within an electromagnetically shielded facility such as those outlined in item 1.

As an experimental adjunct to RF methods, seeds also can be stimulated successfully by ultrasonic processes. A research paper on the ultrasonic treatment of corn seeds is available from:

U. S. Department of Agriculture
Washington, D.C. 20250

A piezoelectric-type ultrasonic generator is shown in Fig. 1-5. Operating at frequency of 165 kHz, the instrument requires no rectifier and drives the crystal at a power of 17 watts.

In the ultrasonic mode, seeds to be treated are placed in a sieve-type metal container and placed in a water bath agitated by ultrasonic waves. Frequencies up to 900 kHz have been used. According to reports, ultrasonics are yeild-stimulating; i.e., seeds treated by this method germinate better than controls and render more produce. However, within the context of the current problem, the method is suggested primarily in order to grow virgin plants fast for experimental purposes. As in the case of RF methods, no information is available on the RF or ultrasonically stimulated plant properties differ in the expression of psychogalvanic phenomena in connection with the "Backster Effect."



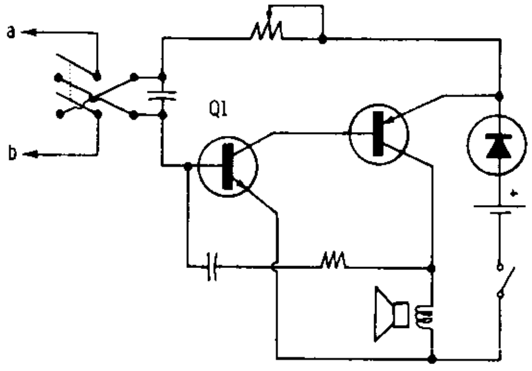
TRANSFORMER PRIMARY CONNECTION TABLE

LINE VOLTS	CONNECT LINE	JOIN
115 (AS SHOWN)	1 AND 2	1 TO 3 2 TO 6
190/210	1 AND 4	2 TO 3
215/230	1 AND 5	2 TO 3
235/250	1 AND 6	2 TO 3

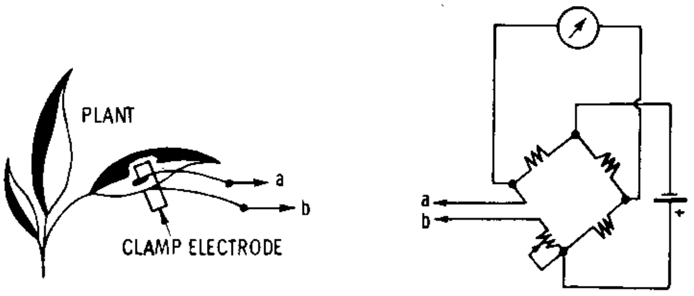
(B) Schematic.

Courtesy L & R Manufacturing Co.

Fig. 1-5.
"Minisonic" ultrasonic system.



(A) Current-controlled oscillator.



(B) Use of clamp electrode.

(C) Wheatstone-bridge detector.

Fig. 1-6.
Basic acoustical plant response detector.

5. To commercialize an invention in this area, given equipment should be small and functional. Being a "discovery tool" for others (including students, engineers, gardeners, hobbyists, etc.), new psychogalvanic cirsuitry should be developed to display plant reactions with the least possible expense.

Fig. 1-6 shows one approach. A current-controlled oscillator (Fig. 1-6A) forces a weak excitation current through a plant leaf via a clamp electrode (Fig. 1-6B). Variations in the conductance properties of the plant, which may be regarded as an organic semiconductor, will "steer" current-sensitive oscillator stage Q1. Thus, overall action is similar to that of Fig. 1-6C a Wheatstone-type detector principle.

Arranged on a tripod, the plant response detector might feature an elevated clamp electrode mounted on an extension inserted into the instrument proper. Thus, plant structures can be reached and observed as desired. During operation it is imperative that the electrode fixture does not move. Movements or bending of leaves inserted into the clamp electrode produce undesirable strain-gauge effects and impair the quality of psychogalvanic data.

In conjunction with this and related equipment, the inventor should realize that plant reactions, if any, cannot be predicted in advance. Fire (injury by acts of burning) is the most powerful stimulant a plant can experience. It was the mental projection of this very threat that led Mr. Backster to the discovery of the effect named after him. By contrast, the act of cutting can bring somewhat delayed reactions. Electrical plant behavior triggered by direct application of force produces well-known responses, typically as investigated in a specimen like the Mimosa Pudica. Data and directions for experiments may be found in the following reference:

> J. Bures, et al, Electrophysiological Methods in Biological Research (New York: Academic Press Inc,. 1967).

The function of organic semiconductors, if considered alone, is discussed in good depth in:

> F. Gutmann, Organic Semiconductors (New York: John Wiley & Sons, Inc. 1963).

The behavior of living systems exposed to stimulus and excitation is given in the book:

> G. Ungar, Excitation (Springfield, Ill.: Charles C. Thomas, Publisher, 1963).

An excellent description of electron transport systems in plants has been given by Walter D. Donner, Jr. of the University of Pennsylvania. His contribution may be found in:

> W. A. Jensen and L. G. Kavaljian (ed), Plant Biology Today: Advances and Chal-

lenges (2nd ed., Belmont, Calif.: Wadsworth Publishing Company, Inc., 1967).

All things considered, the psychogalvanic effect in plants is one of the very best vehicles for dramatic new discoveries and instumants available to inventors today. The effects of these phenomena on science and industry no doubt will be considerable and of immense value to society at large. To that end, it is hoped that definitions of the various aspects involved point ways from which to start.

GROW IT YOURSELF

The enthusiasm for home gardening that sprang up in America three or four years ago amid fast-rising food prices has taken firm root.

For the first time since World War II, more than half of all U.S. households, 51 percent, plan to have a vegetable garden in 1976. That's the finding of the Gallup Poll.

Again this spring, business is booming in seeds and fertilizer, with supplies of both reported plantiful. Tools, such as mechanical soil tilers, are readily available, sometimes at bargain prices.

All signs indicate, too, that there will be plenty of lids for canning jars this season. A survey by the Department of Agriculture finds that the industry expect to double its production in 1976.

FAVORITE VEGETABLES

In many parts of the country, tomatoes appear to be the most popular vegetable, followed by leaf lettuce and squash of all varieties.

William Foos, president of Ferry-Morse Seed Company in Mountain View, Calif., reports that early shipments of all kinds of seeds are up "a little over last year, when we had record sales."

At the Northrup King Company, in Minneapolis, Vice President Howard Schuler says inquiries about gardening are running 5 percent higher than last year. He estimated that home gardening will expand by about 2 percent this year.

A shift from days gone by is noted by Mr. Schuler, who says that those gardening now are not primarily the impoverished people trying to save money, but middle class suburbanites who want a hobby.

W. Stanley Stuart, Jr., vice president of Ball Corporation, at Muncie, Ind., estimates that there will be about 35 million home vegetable gardens during 1976, up from 32.5 million last year.

Moreover, Mr. Stuart says, about 41 percent of all American households will do some home canning in 1976, up from 37 percent a year ago.

To meet this expected increase, Ball officials have geared manufacturing operation to produce 65 percent more replacement caps and liks than were shipped out last year. The company's plants will continue to operate three shifts a day, seven days a week, as they have since January, 1975.

Supplies of gardening equipment are reported plentiful, with some at lower prices this year.

A. A. Malizia, president of McDonough Power Equipment, Inc. at McDonough, Ga. explains:

"There are plenty of soil tillers. The industry overproduced by 30 to 35 percent last year, so there are a good many carry-overs on the market. You can make some good buys.

FRESH DIRECTIONS

Among the latest trends in back-yard gardening cropping up this spring:

Built-up gardens are gaining advocates. Railroad ties or bricks are often used as a low wall to raise the soil level by a foot or two. Advantage: It's easier to work, the drainage is usually improved, and it easier to build the soil to the desired richness in such a confined area.

Drip irrigation, in which moisture is slowly metered out to plants by means of a drip hose system, is becoming more popular.

Soil testing is becoming a standard procedure for most new home gardens, often through county or State agricultural offices for a small fee of $3 or so. However, says Huey Whitehurst of Texas A & M's Dallas experimental station: "These are not really necessary, particularly after a couple of years, when you've gotten your soil built up with organic matter and fertilizer."

Moisture meters, used initially for indoor plants, are being installed in some outdoor gardens to measure the amount of moisture in the ground and indicate when watering is needed.

Container gardening is catching on with apartment dwellers. Instead of flowers, these gardeners are raising vegetables in hanging baskets, in containers on stairways, on trellises and in window boxes.

Gardening in a bucket is among the more original concepts. Milton Smith Burgess, Sr., a retired meat packer in Little Rock, Ark., last year planted 22 different vegetables in 90 containers, ranging from 5-gallon paint buckets to big garbage cons.

Mr. Burgess's technique is simple. He filled the buckets with leaves, threw in some lime and fertilizer, and topped it all off with about two inches of peat moss. "It's really easy," he explains. "All you have to do is add about a quart of water each evening and then just sit back and watch things grow. With peat moss, there are no weeds. Also, I don't have to spray for insects."

From 12 buckets of plants, he produced about 1,600 tomatoes last year. Another 16 buckets with five stalks of corn in each yielded enough to last all summer. His wife canned 50 quarts of cucumber pickles. This spring he is increasing his garden to 110 buckets.

The WORLD FEDERATION OF SCIENCE & ENGINEERING has, as one of its major projects for the past two years, been doing quite an extensive bit of experimenting with what we have named MAGNA CULTURE.

The head of the project is Dr. Norman Kellogg and due to his dedication to the project we have had some very outstanding results from the various arrangements for plant environment, and we have proven to ourselves and to a few other interested parties, that each plant is a living creature with its own type of intelligence and that the greatest restriction to life is its inability to move around and seek out the type of suroundings that would help it have a better environment to exist in.

There are three things that are very important to all types of plants: First is nutrition, make sure the soil has all the normal nutrients that are needed. Second is moisture, now when you are watering your plants make sure that you do not over do it, or that you do not under do it, make frequent checks to see if the moisture is up to about an inch from the top of the seed bed, if it is dry deeper than one inch it should be watered.

The third is frequency, if a plant does not receive enough R.F. count from the ground and the atmosphere, (and it takes both), then it will not mature properly it will only yeild around 30% of its potential. That is why most farmers only expect about 30% to 40% of the potential of each plant, quite a waste, don't you agree.

Our research has proven that by putting Antennaes up at certain locations, we can enhance the enviornment enough to allow the plant maximum R.F. count to draw from thus giving us close to 100% yeild from all types of bearing plants.

Have you ever wondered why plants grow larger and faster along a wire fence. The fence is acting as an antenna. The fence will enhance the frequency up to four or five feet on each side of it and if you dig down below the surface of the soil on each side of the fence you will also find that the moisture count in the soil is greater for about the same distance. Yet about 15 or 20 feet from the fence you will have to go down five or six times as deep to find the same kind of moisture.

Another observation that gives you some idea of what higher concentration of frequency can have on the hydro count is to set a car next to the metal poles that hold the high tension wires that run across country, and park another car about two blocks away. When you come back in the morning the car under the high tension wires next to the pole will have moisture on the windows, which the one two blocks away will not.

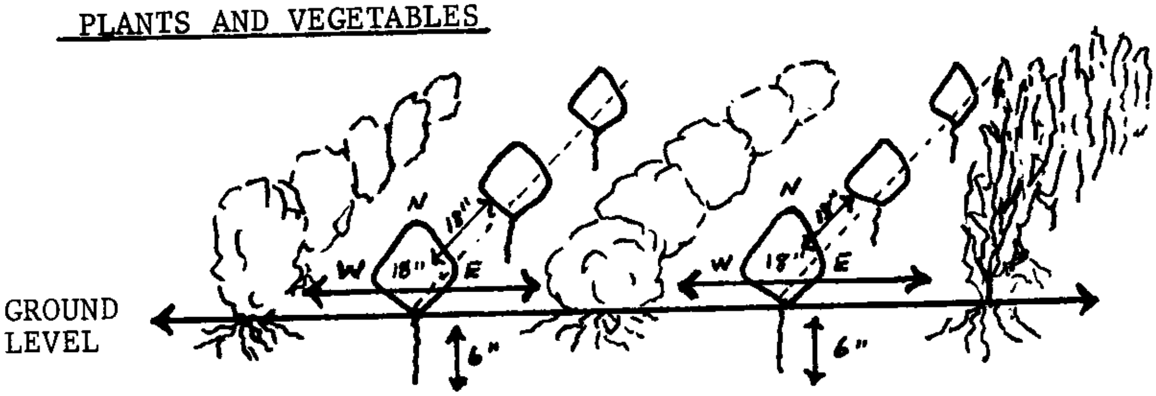
This should give you some idea of what frequencies can do. The atmosphere is loaded with millions of frequencies and they are being used daily. The funny thing is, that we are totally unaware of how much traffic is going on all around us. Another thing that is amazing, is that we are only using about 2% of this traffic.

With MAGNA CULTURE, we can use a small amount of these frequencies, we do not need them all, as long as we can attract some of them it will give the plants a much stronger flow to draw from and since each plant is a knowledge in its own, it will only use what it needs.

Some of the drawings and pictures on the next few pages will give you some idea as to how you can get better results from your plants, of course, it does not mean that this is the total answer. If you can experiment with your own arrangements and get better results, please do so and let us know what your results are.

The MAGNA CULTURE antennae recharge the minerals in the soil used by the plants or trees, using the frequency of the EARTH'S ETHER FIELD.

PLANTS AND VEGETABLES



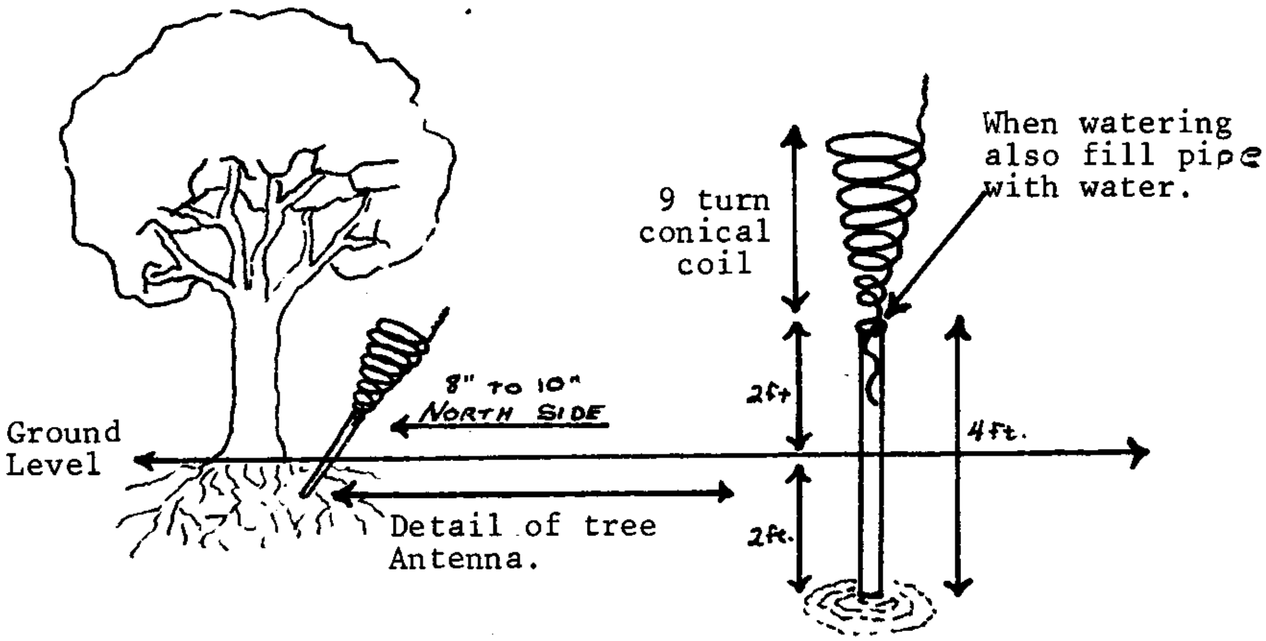
Prepare ground as for normal planting, fertilizing evenly.

Regular metal coat hangers may be used or any other type of metal wire. All paint or coating should be removed.

Reshape coat hangers for antennae, as above.

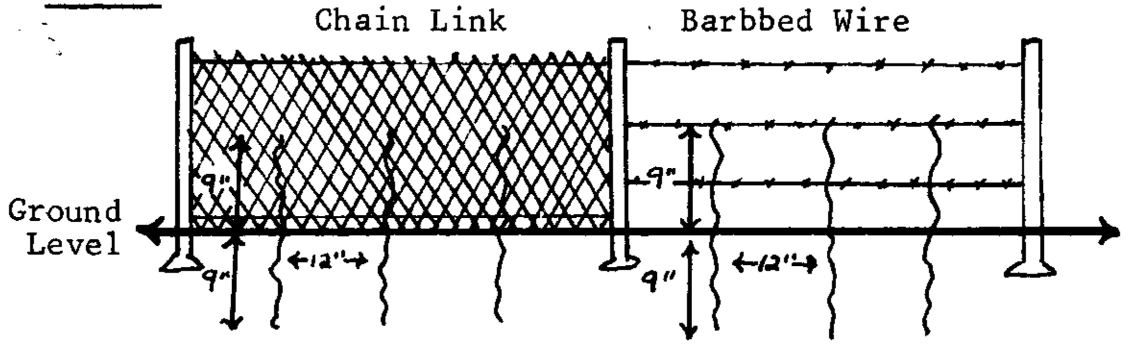
Insectisides should not be needed as much, as destructive insects do not like the frequency put out by the coils. Constructive insects, such as Bees and Earth Worms are not bothered. In fact, Earth Worms thrive under MAGNA CULTURE conditions, as our experiments have proven.

FRUIT TREES



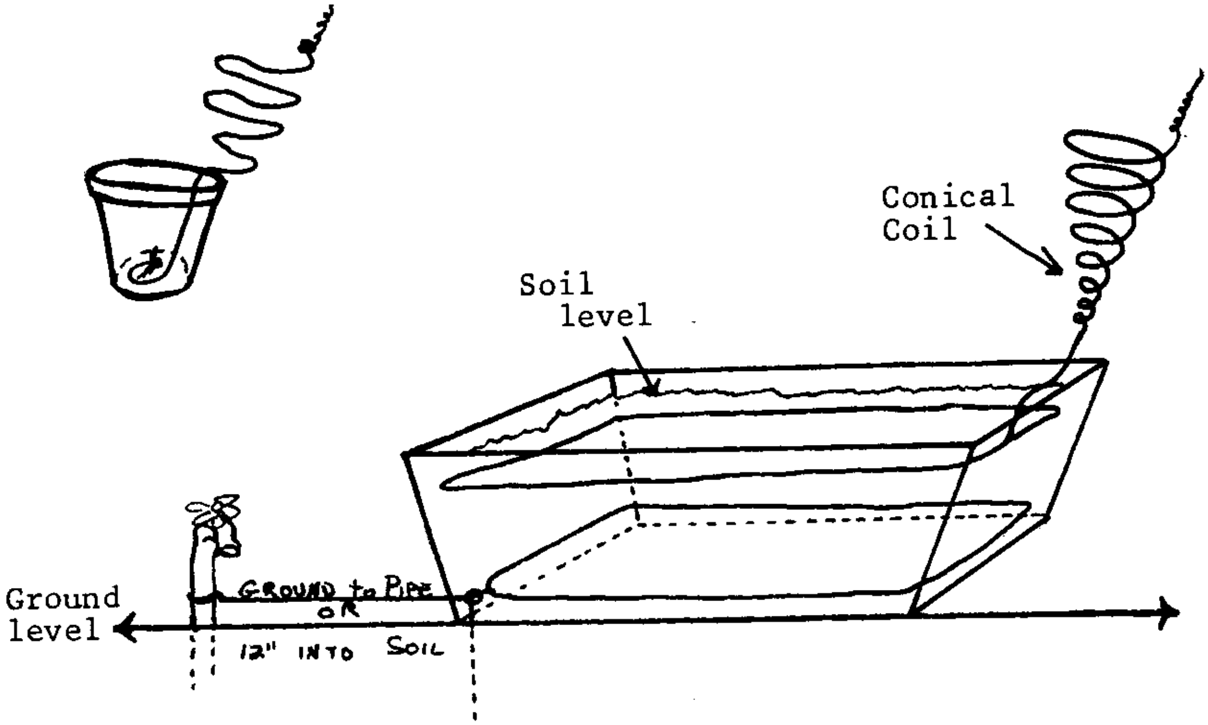
Always be careful not to allow the antenna wires to touch the leaves of the plants or burning could result.

FENCES

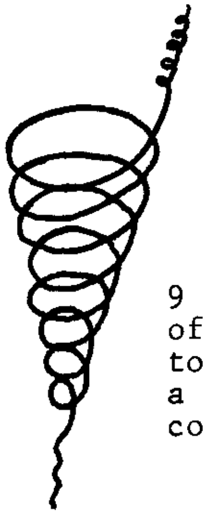


FENCES BECOME ANTENNA

POTTED PLANTS OR PLANTER BOXES



Planter box may be any size convienent for area available. Trellises can be attached for climbing plants - Peas, beans, tomatoes, etc. They may also be used indoors with Grow Lights.



9 turns
of wire
to form
a conical
coil.

Coils should be cleaned twice yearly. To do this imerse in a pail of hot water in which ½ box of soda has been disolved.

North of the Equator the coils should be COUNTER CLOCKWISE.
South of the Equator CLOCKWISE.

We do not recommend that you use commercial fertilizers, they are loaded with artificial junk. Plants are living cells of their own and it is not natural from a common sense direction for us to feed our plants something that we know is unhealthy.

If you will look at the labels on any of your commercial artificial plant fertilizers you will see that they give you a danger precaution that it is dangerous to your health, but we don't seem to realize that even after we feed it to our plants and then we eat the fruit of that plant, that it may still be dangerous to our health.

Take these three items and run them through your mind. NITROGEN, PHOSPHORUS, and POTASSIUM. That is the main ingredients of artificial fertilizers, would you sit down to a table with a plate full of these so called life giving items?

For the past 30 to 40 years, our agriculture systems have grown to depend on the commercial fertilizers to the point that 98% of our farming is artificial. Now let us take some figures from another direction and see if we can still add 2 + 2 and come up with 4.

During this same period of time we find that there has been a tremendous increase in three of the most disabiliting diseases that are known to man. Number one is Heart Conditions, number two is Arthritis Conditions, and the third is the most baffling of all - CANCER. I am not a medical doctor, but I do feel that once medical research finds a way to counteract the effects of what the chemical reactions of these artificial poisons are to the human body, they just might come up with an antidote.

Through our research we have proven to our own satisfaction that by getting back to basics and using natural organic fertilizers we have much healthier plants and feel healthier ourselves.

There is more waste that comes out of the kitchens of most homes than it would take to farm half the land the country has. To name some of the items that could be reused: old breas, coffee or tea, vegetable waste, citrus peels, old shopping bags or newspapers, yes old newspapers, just shred it up and mix it into the soil with all the rest of the left overs.

With a good system of recycling your normal organic waste and using the MAGNA CULTURE system of enhancing the frequency count around your garden, you can get back on the right track to good health.

One of our Service Members just brought us a book that is an outstanding piece of research. We recomment you read it, not only is it a good book on plant life but it is very good on basically what life is all about. Read it:

Title: "THE SECRET LIFE of PLANTS".
By: Peter Tompkins & Christopher Bird.
Pub.: AVON.

Found in most Bookstores.

We also recommend, "ORGANIC GARDENING & FARMING", a monthly magazine found usually at the local Newstands or Drugstores.

We have talked quite a bit about what the frequencies that we exist in can do for plants. So be prepared, because in our next issue we will cover what frequencies can do for the human body.

The next issue will be in September 1976. If this is the first issue of the NEW AGE SCIENCE JOURNAL that you have read, then you may be interested in the first, it was published in March '76.

The NEW AGE SCIENCE JOURNAL is a quarterly publication of the WORLD FEDERATION OF SCIENCE & ENGINEERING, THE COST IS $3.00 an issue or $9.00 for a one year subscription.

We publich a Newsletter that goes to our Service Members each quarter in addition to the JOURNAL. There is no charge for the Newsletter. To become a Service Member there is a life fee of $2.00.

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REX RESEARCH
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JEAN
NV 89019
USA

NR. M23-MUE

TITLE:

MUELLER

Magnet Motor

M23-MUE MUELLER, Wilhelm: Current & background info about a controversial unipolar high-freq. motor-alternator (utilizing 165 NdFeB magnets & 30 coils with FET heat sinks, linear ramp generator, encoder wheel, and impulse motor) that allegedly produces "free energy": 44 KW in one test in 1987.. However, others disclaim this, while otehr claim that the disclaimers are spreading intelligence-agency disinformation.. Decide for yourself, & build one if necessary: here are several pages of engineering diagrams, plus a 1982 test report that indicates only 28% efficiency for an early prototype!?.. 30 pp..

Free Energy From Revolutio

The stories on these pages were authored by Tom Valentine, a California-based free-lance journalist and frequent contributor to The SPOTLIGHT.

Side view of the simple Muller motor-generator (left photo). The second rotary device is an old prototype made with older materials, which was displayed for contrast. In the right photo, Clinton Miller of the National Health Federation (left), ponders the interior of the Muller device while Muller, center background, checks some figures with an unidentified engineer.

EXCLUSIVE TO THE SPOTLIGHT

"Move over, Joe Newman"—there's a new star on the magnetic motor horizon.

Wilhelm Muller from Pendicton, British Columbia has constructed a prototype magnetic motor-generator that produces more electricity than is required to run the equipment.

The underlying concept is called "over-unity" by Muller.

While such a motor has long been called "impossible perpetual motion" by Establishment physicists, the use of new materials makes the equipment not only possible but cost effective.

Muller has theorized about over-unity for several years, but it wasn't until he obtained very powerful neodymium-iron-boron magnets—the most powerful permanent magnets yet manufactured for industry—that he produced a machine capable of generating much more electricity than it takes to run the drive-shaft motor.

Inventor Joe Newman of Mississippi has been involved in a protracted fight against the U.S. Patent Office, which continues to deny him a patent for a similar machine. The basic difference between Muller's generator and Newman's energy machine is that Newman's machine produces a great deal of radio frequency (RF) energy rather than practical alternating or direct electrical current.

The RF energy must then be converted to usable electricity, and there are considerable losses of energy involved in the process, making Newman's device inefficient by comparison to Muller's.

PUMP ELECTRICITY

Traditionally electric current is produced by "pumping" it out of a magnetic field. A coil or conductor wire is either passed through a magnetic field, or has a magnetic field passed by it, causing electricity to race out of the field and down the coil windings and into wiring systems.

It is analogous to pumping water from a well. The more electricity one wants, the harder the pump must work.

Because work is required to pump electricity out of the magnetic field, and because of heat losses due to resistance, it has been "impossible" to generate more electricity than the amount of energy used to operate the pump.

Ever since Michael Faraday pumped the first electric current out of a magnetic field 156 years ago, science has "known" that it will always take more kinetic energy input than the amount of electricity output by any generator.

However, had Faraday, Thomas Edison or Nikola Tesla, the greatest electrical geniuses in history, been able to work with some of today's materials, the concept of over-unity might have become part of tradition and magnets, rather than oil, might then have become the dominant energy source of the 20th century.

Muller's concept is brilliant in its simplicity. First he ignored what the textbooks have to say about magnetism. The textbooks stress that magnets "do no real work."

Muller and many others, such as Les Adam of AZ Industries, who manufactured the magnets for Muller's prototype, have proved over and over that magnets can do a tremendous amount of work.

DEVICE DETAILS

Muller's device consists of 165 neodymium-iron-boron permanent magnets arranged on a flywheel of "micarter," a non-magnetic plastic material. The magnets are 2 by 2 by 0.5 inches in size and protrude from both sides of the flywheel.

The magnets produce a flux field of 4,700 oersteds per side, or a combined rating of 9,400 oersteds. By comparison, the Earth's magnetic field is 0.7 oersteds, on average.

One problem is that moving such powerful magnets past iron coils would require a tremendous amount of power due to the attractive forces of the magnets.

Muller's coils are cored with a substance called "metglass," which accepts electric current readily without hysteresis losses, or heat losses caused by resistance to electricity.

Even with the unique coils, the flywheel does not spin easily, but it can be moved by hand despite the 16 potent magnets aligned to pass 30 coils—15 coils mounted opposite the magnets on each side of the flywheel.

Initial tests in February, monitored by a competent engineer, noted that an electric motor using a total of 4,400 watts of power drove the flywheel at 2,000 rpm.

HIGH OUTPUT

Each coil of the prototype is differently wound as part of Muller's ongoing research, so each coil's electrical output measured differently. The lowest coil output measured 784 watts per hour; the highest output was metered at 1,776 watts per hour.

The variations in the coils allowed Muller to determine the optimum windings required to build the machine to run itself once started. Conceivably with 30 coils producing more than 1,700 watts (1.7 kilowatts), it will take only four coils to drive the motor, leaving 26 times 1.7 kilowatts available for output energy—a "free" energy production of 44.2 kilowatts.

One machine could easily provide all the electricity requirements of eight three-bedroom homes. In production, the Muller generator should cost less than $1,000.

"The magnetic field doesn't wear out over thousands of years," Adam noted, so the only maintenance would be on the bearings of the flywheel shaft.

The generator is so economically feasible it poses a tremendous threat to the *status q o* of the world's most powerful monopoly: the electric power monopoly.

Muller plans to demonstrate a working model of the self-propelled prototype at the "Meeting of the Minds" sponsored by "Magnets" magazine and AZ Industries this October 8-10 in Temecula, California. ●

Muller Wasn't Alone in Field

EXCLUSIVE TO THE SPOTLIGHT

While the Muller magnetic motor is perhaps the most promising of all the "over-unity" motor-generator concepts being circulated in the underground of alternative energy today, there are numerous others.

Joe Newman's energy device, which also is claimed to use permanent magnets to generate more energy than required to run the equipment, has gained considerable fame because of the U.S. Patent Office refusal to grant him a patent.

The problem is not one of semantics, or patent protection or government inefficiency—the problem for all of the many such ideas coming forward for the past several decades, many with patents granted, is a problem of power—not electric power, but financial and political and economic monopoly power.

Last year the book "Power Struggle," by Richard Rudolf and Scott Ridley, was published by Harper and Row. It has not received a great deal of media attention, but it tells the story of the last 100 years of struggle between those who would monopolize electric power and those who must use it.

The nuclear power game—the monopoly's most lucrative scam in 100 years of electrical generation schemes—is the priority of the financial and economic powermongers.

Any over-unity invention that proves feasible and cost effective would surely wreak havoc with the monopoly.

To get a glimpse of the kind of power talked about, here are a few paragraphs from "Power Struggle":

"Today the electric industry is a patchwork of contiguous monopolies.

"It consists of 2,194 municipal and public utility district systems, which range in size from the city of Los Angeles to the hamlet of Readsboro, Vermont, 870 rural cooperatives strung throughout 46 states, Puerto Rico and the Virgin Islands, 210 private companies that supply power in most major cities, and six federal agencies that provide power to public and private systems from federal dams.

"These power systems are strung together by more than 600,000 miles of overhead transmission lines and some 4 million miles of distribution wires, carrying electricity from 10,499 power plants.

"Unlike most major industrialized nations, where electricity is provided as a service by public agencies, the private companies are the dominating force in

For Those Who Say: 'Impossible'

EXCLUSIVE TO THE SPOTLIGHT

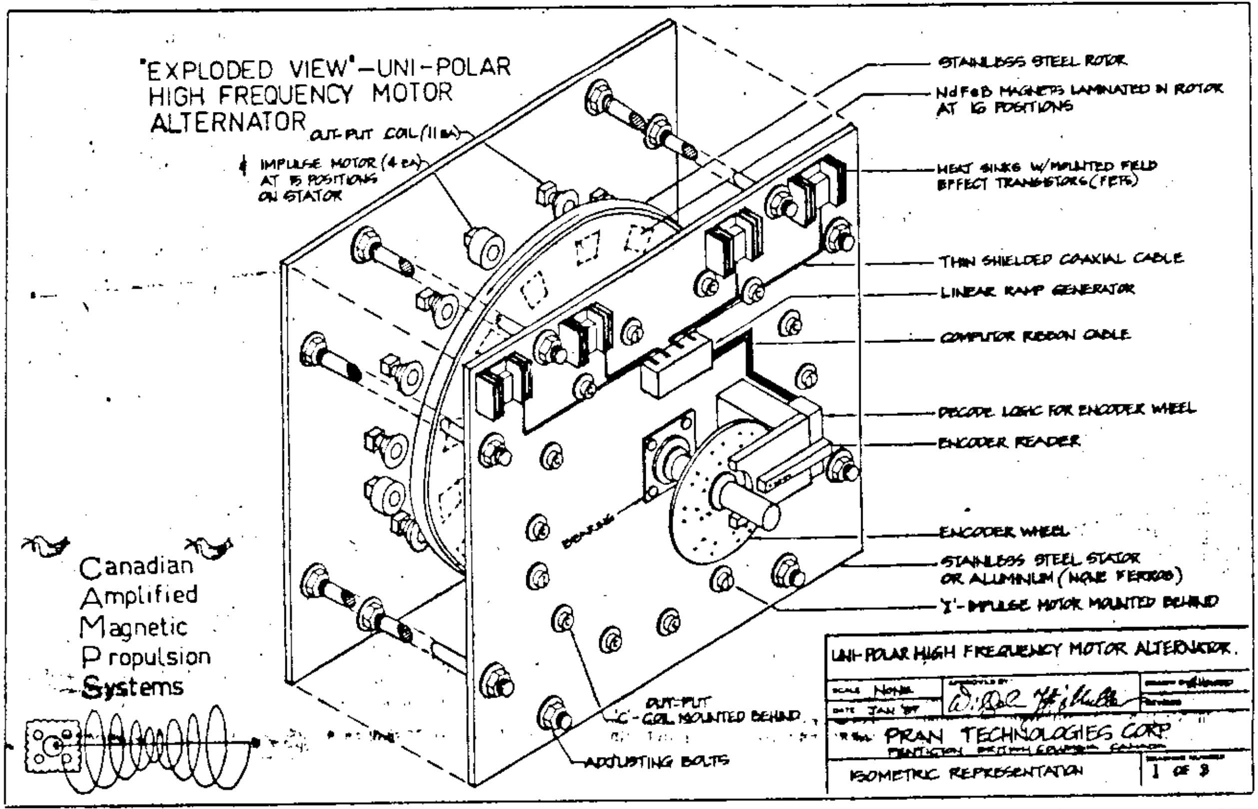
The following, taken from the Encyclopaedia Britannica (1985), is for those who argue "perpetual motion—impossible" when the subject of magnetic motors and "over-unity" comes up.

Under the subheading of "work required to move a magnetic pole" the noted reference says:

> **When a magnetic pole is moved, work must be done against any force acting on it if it is moved in the direction opposite the force, and conversely, work will be done (or can be extracted) by the magnetic pole when it moves in the force direction.**
>
> **Thus, no work is done in moving a magnetic pole around a closed path in a magnetic field. It follows that the work done in moving the pole . . . from a point A to a point B is independent of the route followed. Otherwise [the pole] could be returned to A by another route on which more work is extracted than was expended in the initial movement to A.**
>
> ***The net effect would be that work could be extracted by movement around the complete path without any other change in the system, giving the possibility of a perpetual motion machine that is contrary to the laws of mechanics.*** **[Emphasis added.]**

Wilhelm Muller's invention has "no work required to move a pole from a pole"—in other words, he has the "net effect" mentioned by the encyclopedia. ●

ary Super Magnet Invention



f Inquiry

the United States, supplying 78 percent of the nation's electricity and controlling the transmission grids, and influencing much of the government's power policies.

"Within the transmission grids, the small municipal and rural electric systems are overshadowed by the private companies and the federal power agencies are surrounded by them. State regulatory commissions, which were established in an attempt to control the private companies in the early 1900s, are highly influenced by their political clout."

After more description of the power companies' clout, there is this telling entry:

"The biggest secret is Wall Street's involvement in this empire. Producing and transmitting electricity is the most capital-intensive industry in the world, and the power companies have long been known as the dividend machines of Wall Street.

"The private power companies traditionally issue half of all the new common industrial stock every year and absorb a third of all corporate financing. As much as 40 percent of a consumer's bill goes to pay for financing charges. Thus, a large number of major bankers and brokers such as Chase Manhattan and Merrill Lynch are affected by decisions concerning power companies.

WILHELM MULLER
. . . Inventor tells his story.

"Half of the income of major investment bankers is estimated to come from financing private power companies." ●

It Won't Be Monopolized

EXCLUSIVE TO THE SPOTLIGHT

Wilhelm Muller has been interested in magnetism ever since he was a youth in Germany. However, he became obsessed with the potential power inherent in permanent magnetism about 20 years ago when a ball bearing he had placed in a moderately large flux field between two permanent magnets shot across a room and through a wall.

As new and more powerful magnet materials were developed, beginning with the rare earth materials such as the samarium-cobalt generation, Muller experimented with ways to get more power out with less work involved.

Finally, after modest success in several areas (he holds numerous Canadian patents on magnetic devices), Muller was able to construct a generator unit with spectacular "over-unity" power output, in his words, thanks to the newest generation of magnet materials.

Neodymium is a lanthanide metal, in the same family as samarium. In 1983 both General Motors and Sumitomo Metals of Japan announced the discovery of a potent magnetic alloy of neodymium, iron and boron.

This new material has the potential of producing fields double the strength of the strongest samarium-cobalt fields.

"In the 1830s," Muller told The SPOTLIGHT in an exclusive interview, "Michael Faraday set the standards that we still go by today. But permanent magnets of up to 60,000 oersteds are now possible, and magnets of 20,000 oersteds are on the shelf.

"The attractive and repulsive forces of these new magnets open the door for changes in the potential of the unipolar motor generators.

"Used in the old motor design, the static positioning becomes a force, which requires enormous torque to move. This is where my system of using the best-suited new materials shows the advantage.

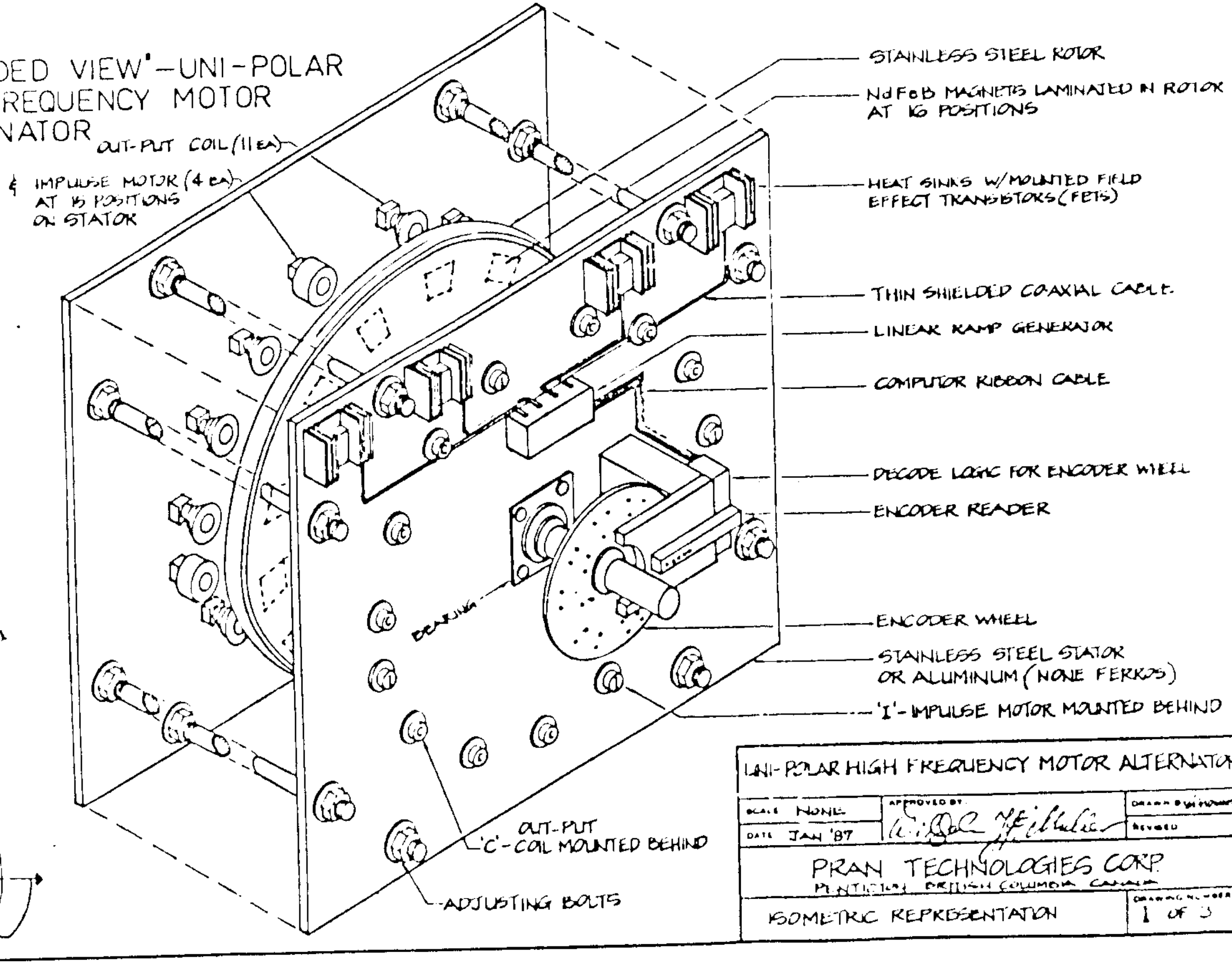
"By using an odd and even number of rotor-stator poles, and because of the special characteristics of these new materials, the magnetic attraction within the 360 degrees will balance magnetically to a zero torque on the rotor shaft.

"The rotor will move at the slightest impulse, and continue to move with no static positioning. The possibilities are mind boggling."

Muller provided The SPOTLIGHT with a set of drawings and has promised to do everything in his power to keep his research from being covered up or "monopolized" out of the hands of the people.

— Dob 11/6/2011

'EXPLODED VIEW'—UNI-POLAR HIGH FREQUENCY MOTOR ALTERNATOR



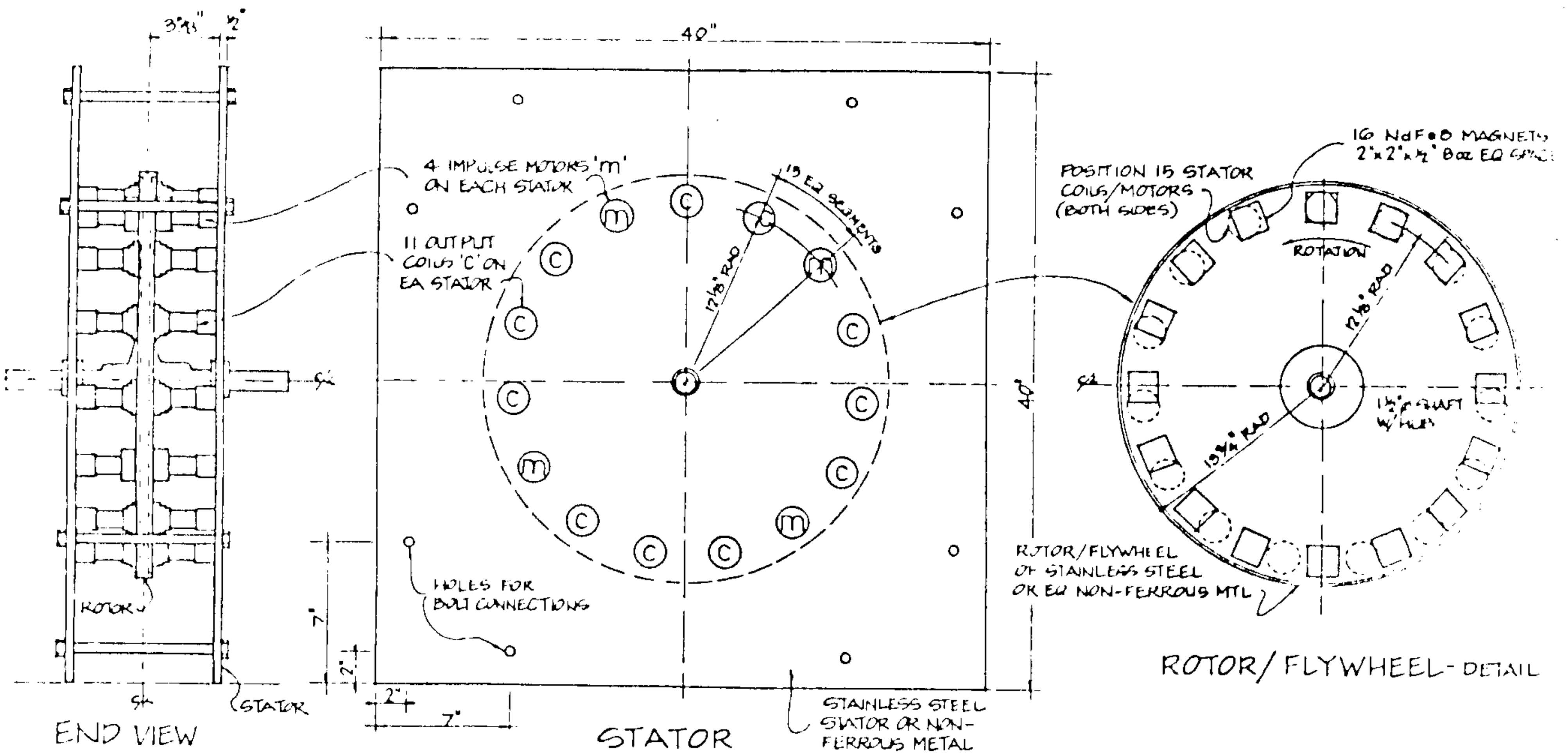
Canadian
Amplified
Magnetic
Propulsion
Systems

UNI-POLAR HIGH FREQUENCY MOTOR ALTERNATOR.

SCALE NONE
DATE JAN '87
APPROVED BY:
DRAWN BY
REVISED

PRAN TECHNOLOGIES CORP.
PENTICTON BRITISH COLUMBIA CANADA

ISOMETRIC REPRESENTATION
DRAWING NUMBER 1 OF 3



HIGH FREQUENCY UNI-POLAR MOTOR ALTERN

SCALE NONE
DATE 28 JAN '81
APPROVED BY W. Sam Y. Muller
DRAWN BY
REVISED

FRAN TECHNOLOGIES CORP. PENTICTON B.C.

FRONT & SIDE ELEV & ROTOR ELEV
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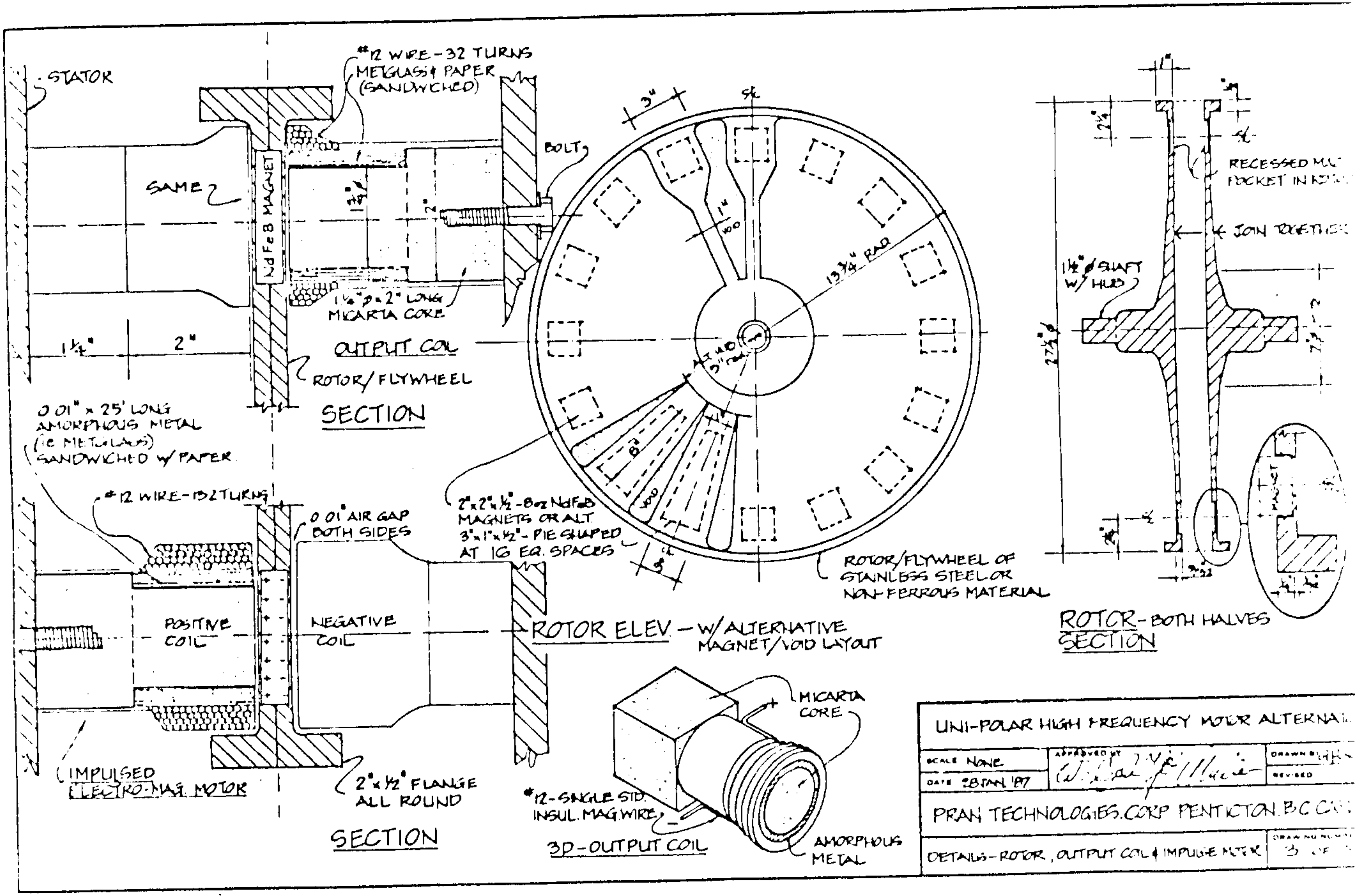

UNI-POLAR HIGH FREQUENCY MOTOR ALTERNA

SCALE None
DATE 28 JAN '97
APPROVED BY W. ... J. ...
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DETAILS-ROTOR, OUTPUT COIL & IMPULSE MTR
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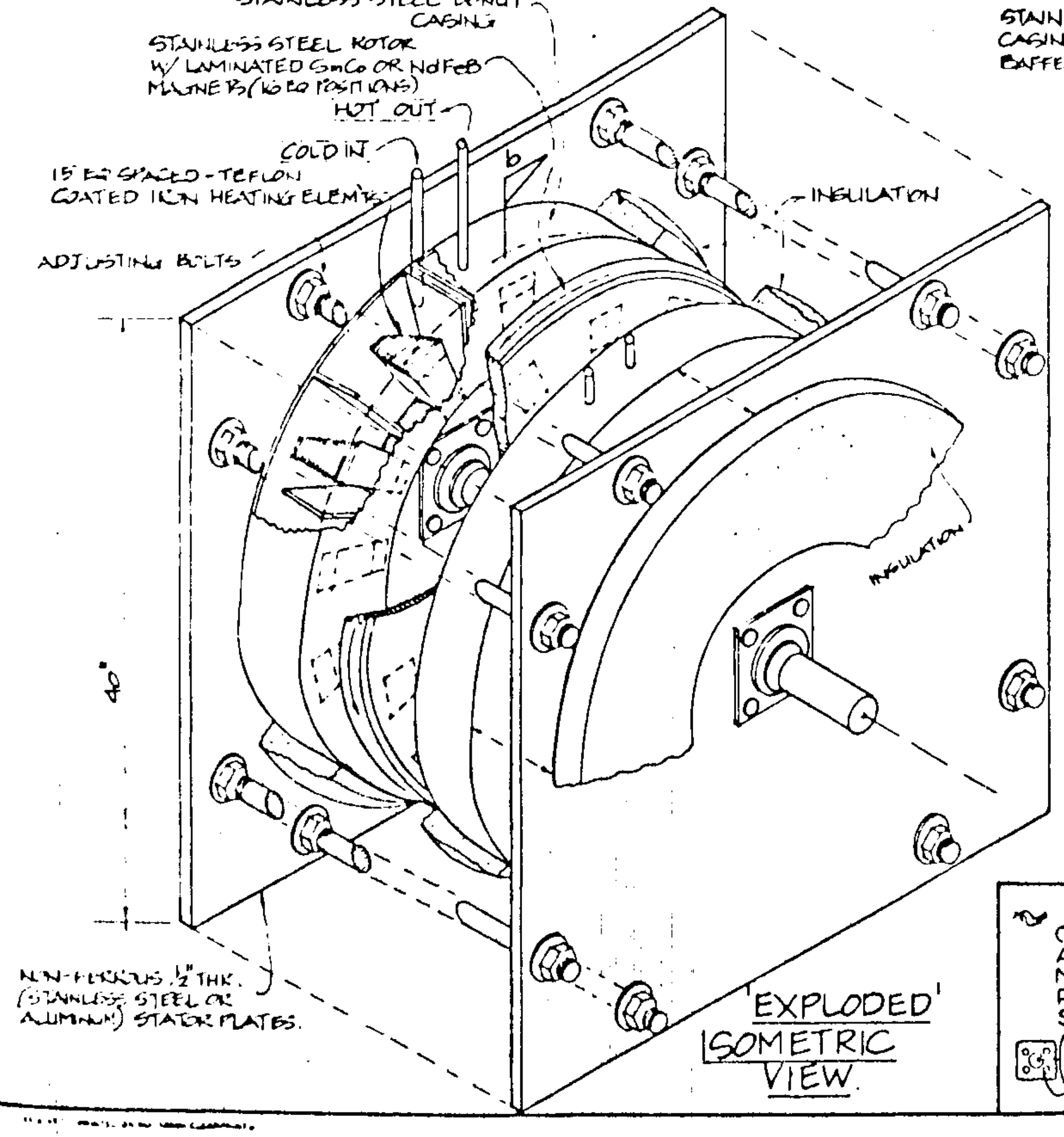
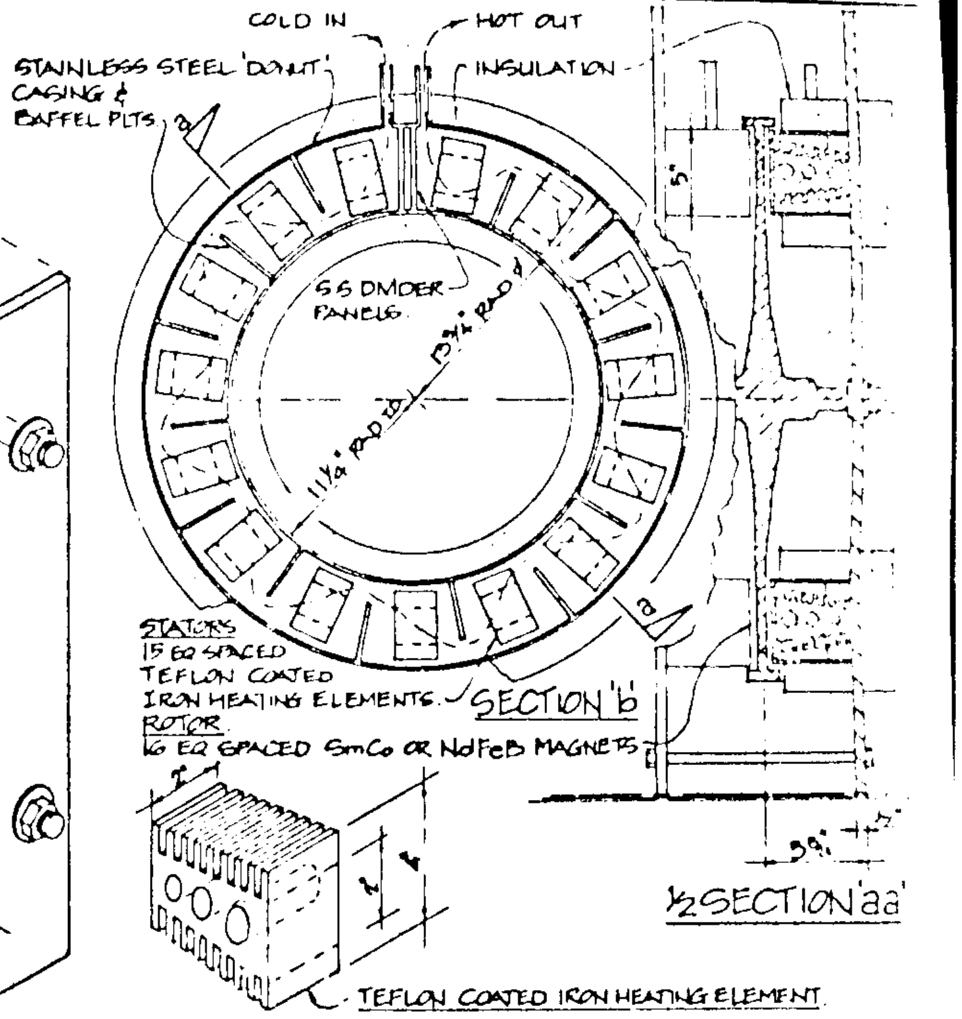


'EXPLODED' ISOMETRIC VIEW.



Canadian
Amplified
Magnetic
Propulsion
Systems

PERMANENT MAGNET INDUCTION HEATING & COOLING ST		
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DATE 28 JAN '87		REVISED
PRAN TECHNOLOGIES CORP. PENTICTON BRITISH COLUMBIA CANADA		
EXPLODED ISOMETRIC & SECTIONS		DRAWING NUMBER 1 OF 1

DETERMINATION OF EFFICIENCY OF CANADIAN AMPLIFIED MAGNETIC PROPULSION SYSTEM (CAMPS) GENERATOR

DETERMINATION OF EFFICIENCY OF CANADIAN AMPLIFIED MAGNETIC PROPULSION SYSTEMS (CAMPS) GENERATOR

Dec. 22 '82

Introduction

The purpose of these tests was to determine the efficiency of a generator invented and developed by Mr. Bill Muller and Mr. Mark Brander. It was hoped, by the inventors, the machine would have an efficiency greater than or equal to 100%, and was claimed, with proper development, that it would. The tests were carried out by Mr. Jim Hoover and Mr. Garnet Scaman on behalf of NOVA, AN ALBERTA CORPORATION at the residence of the inventors in Penticton, B.C. on November 29 and 30, 1982.

Description of Generator

The generator consists of an aluminum rotor with $\overset{16}{15}$ poles spaced equally apart and a stator with $\overset{15}{16}$ poles also spaced equally apart. Rare-earth cobalt permanent magnets are used for the stator poles. The stator poles and windings are encased in an epoxy-type material. The generator is housed in an open aluminum frame.

For this series of tests, the generator was driven by a 3 HP Baldor single-phase motor.

J.M. Hoover P.Eng

G J Scaman P Eng

NOVA,
an Alberta
Corporation

tp/d-11

Theory of Operation

As mentioned in the description, there are 16 equally spaced pairs of stator poles each of which has field windings and permanent cobalt magnets. The rotor has 15 equally spaced laminated iron paddles on the periphery. As the rotor turns, the rotor paddles progressively pass the pairs of stator poles and change the magnetic field intensities. These changes in magnetic field intensities induce voltages in the associated field windings. The difference in rotor-stator pole numbers results in 50% of the paddle being attracted in the direction of rotation and 50% in the opposite direction. The net consequences are as follows:

(a) The 'ideal' hypothetical generator with no load and no eddy or hysteresis losses will require zero net torque and zero horsepower to operate.

(b) If a load is applied to the pole windings, the resulting currents will be such that magnetic attraction will be reduced when a paddle is approaching a pole set and increased when leaving a pole set. In this way mechanical work is transferred proportionately to electrical work. This phenomenon obeys Faraday's law and Lenz's law of electromagnetic induction.

(c) Losses in the form of eddy losses or hysteresis will affect magnetic field strength in a similar fashion to that of (b).

Test Procedure

The objective of the tests was to calculate the efficiency of the generator. To do this, power out as well as power into the generator had to be derived.

The motor and generator configuration used during the test is shown in the appendix. Note due to faulty coils on the generator stator, coils #8 and #9 were paralleled. A purely resistive heating element was used for load across the generator coils. All coils in the stator are electrically independent from each other. Therefore, a continuous heating element could be used across all coils as shown, without affecting the individual coil measurements.

Voltage and current for each coil was measured. Since the load is purely resistive, power factor will be unity and power can be obtained by multiplying voltage and current.

Voltage and current measurements were also taken on the input to the motor. The series resistor, across which V_1 is taken, is a small resistor in the order of 1 ohm, and is normally shorted out. However, when the input measurements were being taken, the short circuit across that resistor was removed. The reason for this is calculations can be performed using V_T, V_1 and V_2 to give an approximate verification of power factor. Power factor on the input to the motor is critical in the analysis.

Measurements were taken using a TIF Digital Power Probe clip-on ammeter and a Sanwa Volt-Ohm meter. These measurements were verified using similar equipment supplied by the inventors. Frequency was measured using a Data Precision Frequency Meter and waveform was observed using a Philips Dual-trace oscilloscope.

Complete sets of measurements were taken for three different loads as well as the open circuit and short circuit conditions. The motor was also disconnected from the generator and input measurements taken while the motor was running free.

Summary of Results

Because of a lack of confidence in the input current measurements, due to inaccuracies of the ammeter on one particular range, the power factor and efficiency curves versus load were obtained from the motor manufacturer. The input current on the no-load test was adjusted to correlate with the data given to us by the motor manufacturer. Input currents for all the other tests were adjusted accordingly. The degree of adjustments was confirmed by comparing the calculated power factors and the one supplied by the motor manufacturer.

Raw data obtained is included in the appendix. A summary of the tests is as follows:

Test #	Power In (Watts)	Power Out (Watts)
1	1235	247
2	1354	262
3	1089	177
4	833	(open circuit)
5	1114	(short circuit)
6	352	0

If the power into the motor during a no-load condition (Test #6) is subtracted from power into the motor during the other conditions, power into and out of the generator can be compared. The generator efficiency can then be calculated as follows:

$$\text{Generator Efficiency} = \frac{(\text{Power into Motor}) - (\text{Power into Unloaded Motor})}{(\text{Power out of Generator})}$$

Generator efficiencies for the load test are:

Test #	Generator Efficiency
1	.28
2	.26
3	.24

Waveform of the generator output was examined during Test #4. The output was a sine wave with little distortion and a frequency of 480 Hz.

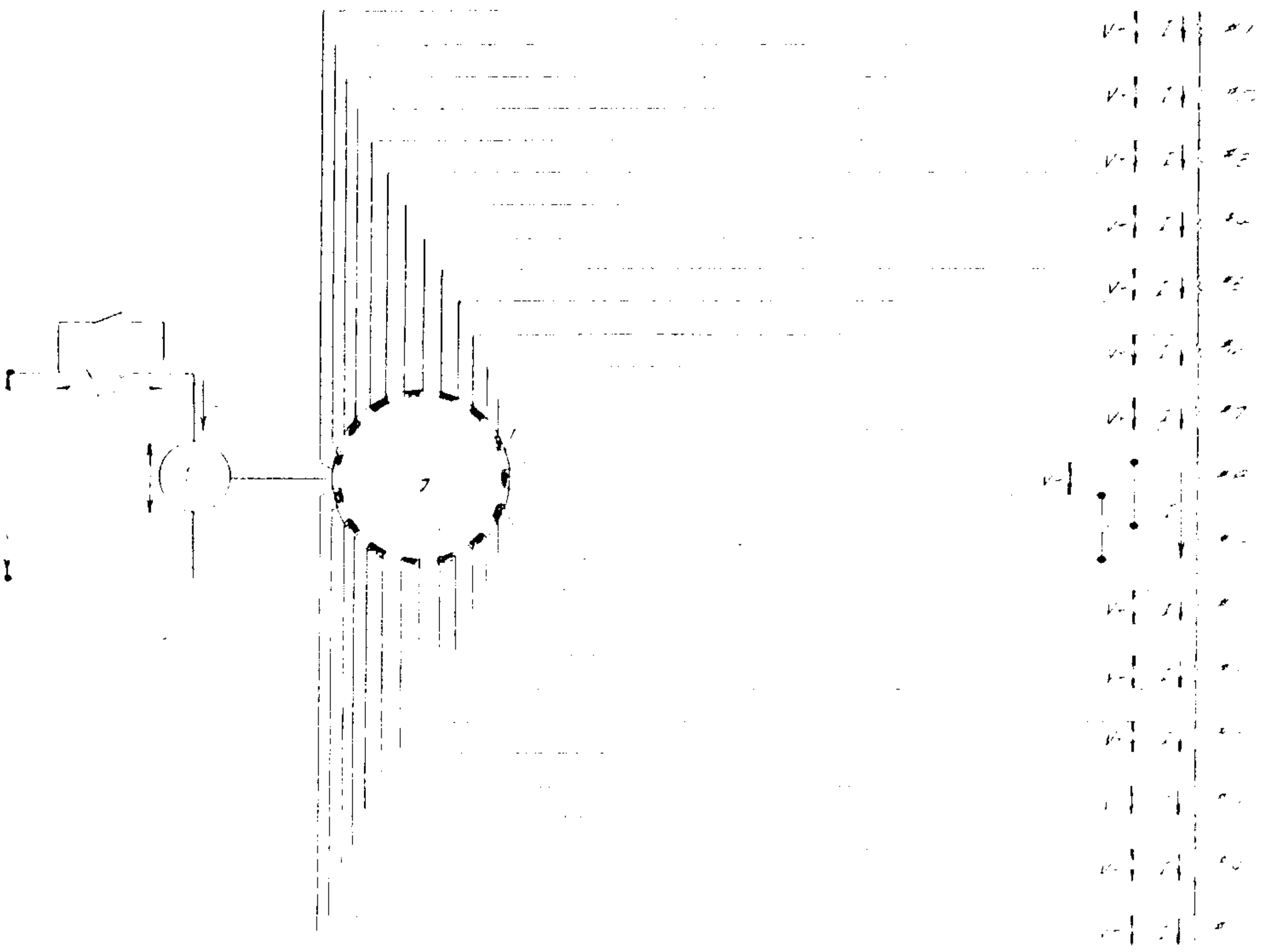
Conclusions

Based on the test results, the generator does not have an efficiency greater than 100% and, indeed, does not approach 100%. It is believed significant losses due to eddy currents in the rotor and stator and overall frictional losses account for the low efficiency. It should be understood test conditions were less than ideal, however, it is felt this analysis gives a fair estimate of the generator's efficiency.

Recommendations

We believe a further reduction of the amount of metal in the machine and a increased use of laminations would significantly reduce eddy and hysteresis losses. Frictional losses will be lowered by utilizing greater control during the machine construction stage in order to reduce tolerances.

It is our belief, with the proper development, this machine could be a relatively high efficiency generator and be of a very simple construction. Note we do not believe efficiency will ever be greater than or equal to 100%. The attractiveness of the machine is in its simple construction. Because of its high frequency generation, it would probably be more useful if the output were rectified and employed as DC power. One application that comes to mind, because of the machine's simple construction, low starting torque and apparent independence on speed, is remote wind generation.



ENGINEERING RECORD

REVISIONS

NOVA
AN ALBERTA
CORPORATION

DATE 82-11-30

TEST NO. 1

CONFIGURATION:

HEATING ELEMENT USED AS LOAD

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
SEE NOTE BELOW	232	3.2	230	.55	12.0		1.8			1.0	4.0		480Hz
					9.76*	1235	2.2				7.0		
							3.2				8.0		
							2.2				7.0		
							3.2				10.0		
							2.0				6.6		
							3.2				9.0		
							2.0				5.0		
							2.0				5.0		
							3.0				7.5		
							3.0				7.0		
							2.6				6.0		
							2.8				6.0		
							2.6				5.0		

COMMENTS

*CORRECTED WITH MOTOR MANUFACTURER'S DATA

A HEATING ELEMENT WAS USED AS LOAD ACROSS ALL PHASES. AS THIS LOAD IS PURELY RESISTIVE, POWER FACTOR ON THE OUTPUT WILL BE 1.0 AND WAS NOT MEASURED. THE LOAD WAS USED AS A MEANS OF MEASURI OUTPUT POWER ONLY, THEREFORE LOAD MAGNITUDE WAS NOT RELEVANT AND NOT MEASURED.

REVISIONS

DRAWN BY	NOVA AN ALBERTA CORPORATION	TITLE
APPROVED BY		
DATE APPROVED		NUMBER

DATE 82-11-30

TEST NO. 2

CONFIGURATION :

LOAD INCREASED FROM TEST #1

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
	234	3.27	232	.58	12.3		3.2			1.0	4.0		480Hz
					10.06*	1354	2.6				5.6		
							4.6				7.5		
							3.1				5.3		
							4.6				8.0		
							2.8				5.1		
							3.2				8.0		
							2.0				4.5		
							1.6				5.2		
							3.1				7.0		
							3.0				6.5		
							3.8				5.4		
							2.8				5.5		
							2.4				5.2		

COMMENTS * CORRECTED WITH MOTOR MANUFACTURER'S DATA

REVISIONS

DRAWN BY	NOVA AN ALBERTA CORPORATION	TITLE
APPROVED BY		
DATE		NUMBER

DATE 82-11-30

TEST NO. 3

CONFIGURATION :

LOAD DECREASED FROM TEST # 1

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
	232	3.11	230	.49	11.9		.8			1.0	4.1		48Hz
							1.4				5.7		
					9.66*	.089	2.1				8.5		
							1.7				5.8		
							2.4				9.5		
							2.0				5.4		
							3.4				8.0		
							2.0				4.5		
							1.9				4.7		
							2.4				8.0		
							2.0				7.0		
							1.5				5.7		
							1.6				6.2		
							1.4				5.5		

COMMENTS * CORRECTED WITH MOTOR MANUFACTURER'S DATA

REVISIONS

DRAWN BY

APPROVED BY

DATE APPROVED

NOVA
AN ALBERTA
CORPORATION

TITLE

NUMBER

DATE 82-11-30

TEST NO. 4

CONFIGURATION :

OPEN CIRCUIT

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
	233	3.07	232	.39	11.45		8.8			1.0	0		480 Hz
					9.21*	833	10.0						
							10.5						
							8.4						
							10.4						
							7.5						
							10.5						
							8.7						
							11.0						
							9.8						
							7.8						
							8.9						
							8.0						
							9.8						

COMMENTS

* CORRECTED WITH MOTOR MANUFACTURER'S DATA

WAVEFORM WAS EXAMINED ON THE OSCILLOSCOPE DURING THIS TEST.

REVISIONS

DRAWN BY

APPROVED BY

DATE APPROVED

NOVA
AN ALBERTA
CORPORATION

TITLE

NUMBER

DATE 82-11-30

TEST NO. 5

CONFIGURATION :

SHORT CIRCUIT

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
	235	3.14	233	.50	11.8		0			1.0	4.2		480Hz
					9.56*	1114					4.0		
											8.0		
											8.0		
											11.0		
											7.0		
											5.0		
											10.0		
											8.0		
											8.0		
											6.0		
											7.0		
											8.0		
											6.0		

COMMENTS

* CORRECTED WITH MOTOR MANUFACTURER'S DATA

REVISIONS

DRAWN BY

APPROVED BY

DATE APPROVED

NOVA
AN ALBERTA
CORPORATION

TITLE

NUMBER

DATE 82-11-30

TEST NO. 6

CONFIGURATION :

NO LOAD ON MOTOR

LOAD	INPUT						OUTPUT						
	V_T	V_1	V_2	P.F.	I	P_T	V_T	V_1	V_2	P.F.	I	P_T	f
	240	2.90	239	.17	10.9 8.66*								

COMMENTS

* CORRECTED WITH MOTOR MANUFACTURER'S DATA

REVISIONS

DRAWN BY

APPROVED BY

DATE

NOVA
AN ALBERTA
CORPORATION

TITLE

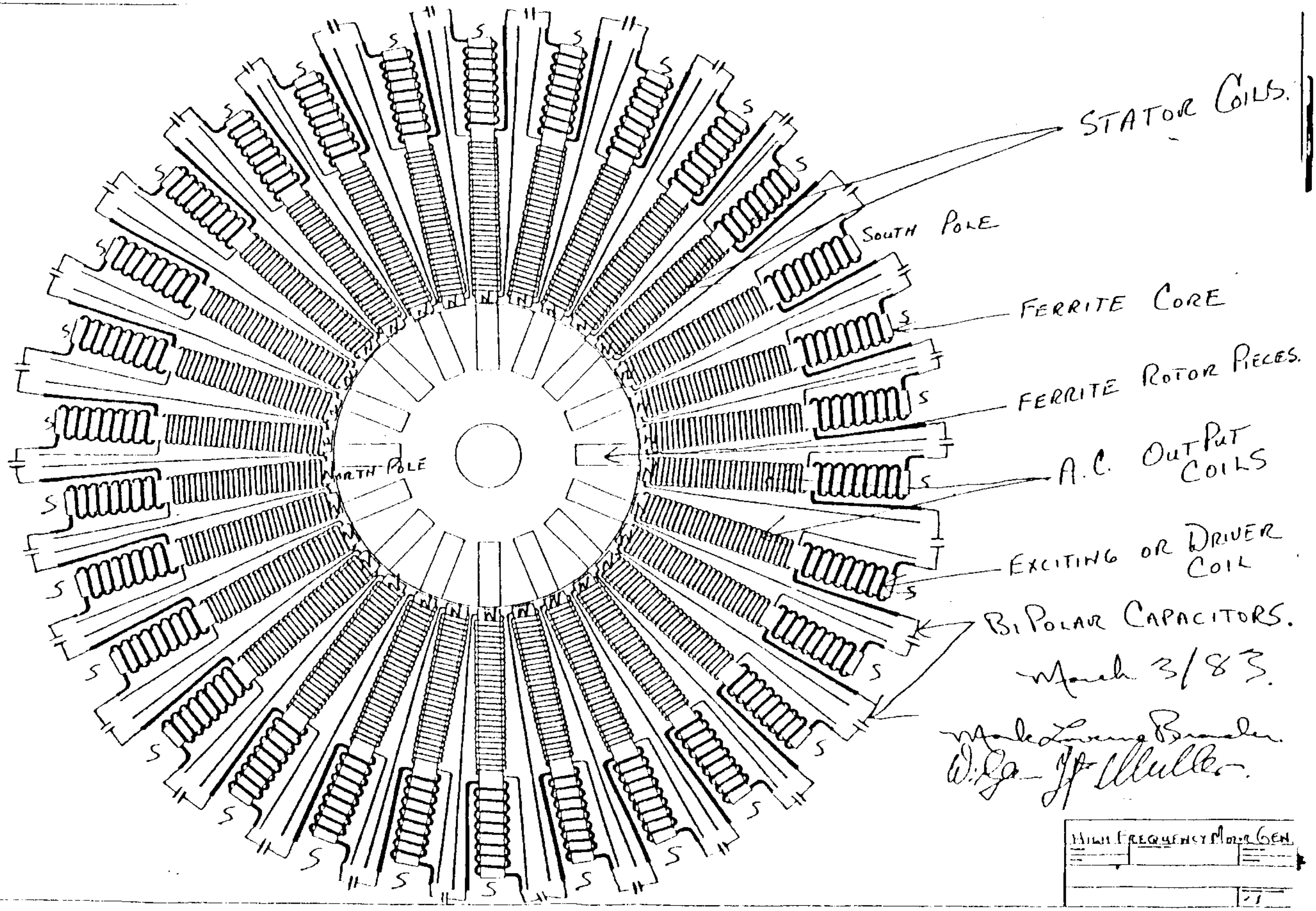
NUMBER

March 1, 1983

The disadvantage of an opposing field called the Back E.M.F. can be eliminated by not moving a magnet past a coil or a coil past a magnet as is described in U.S. Patent #   granted to John Ecklin. The Ecklin design however does not have a very substantial output as it is limited to a minimal amount of Rotor Poles and Stator Coils because of the static pressure of the pole pieces wanting to attract to their respective magnets. We have been able to eliminate this pressure by increasing to an odd number a plurality of Stator Magnets positioned around an even number of Rotor Poles and thus creating a staggerment of Stator Magnets and neutralizing magnetic pressure so that the rotor may turn freely with minimal effort. This is mentioned in caveat # 32,351 issued September 15, 1982.

Minimal hysterisis losses in the Rotor Poles is achieved by utilizing the same polarity of all Stator magnets, so that a complete magnetic change from North to South Poles does not occur thus eliminating half of a normal hysterisis loop that would occur should the Stator Magnets be polarized in an alternating north and south fashion.

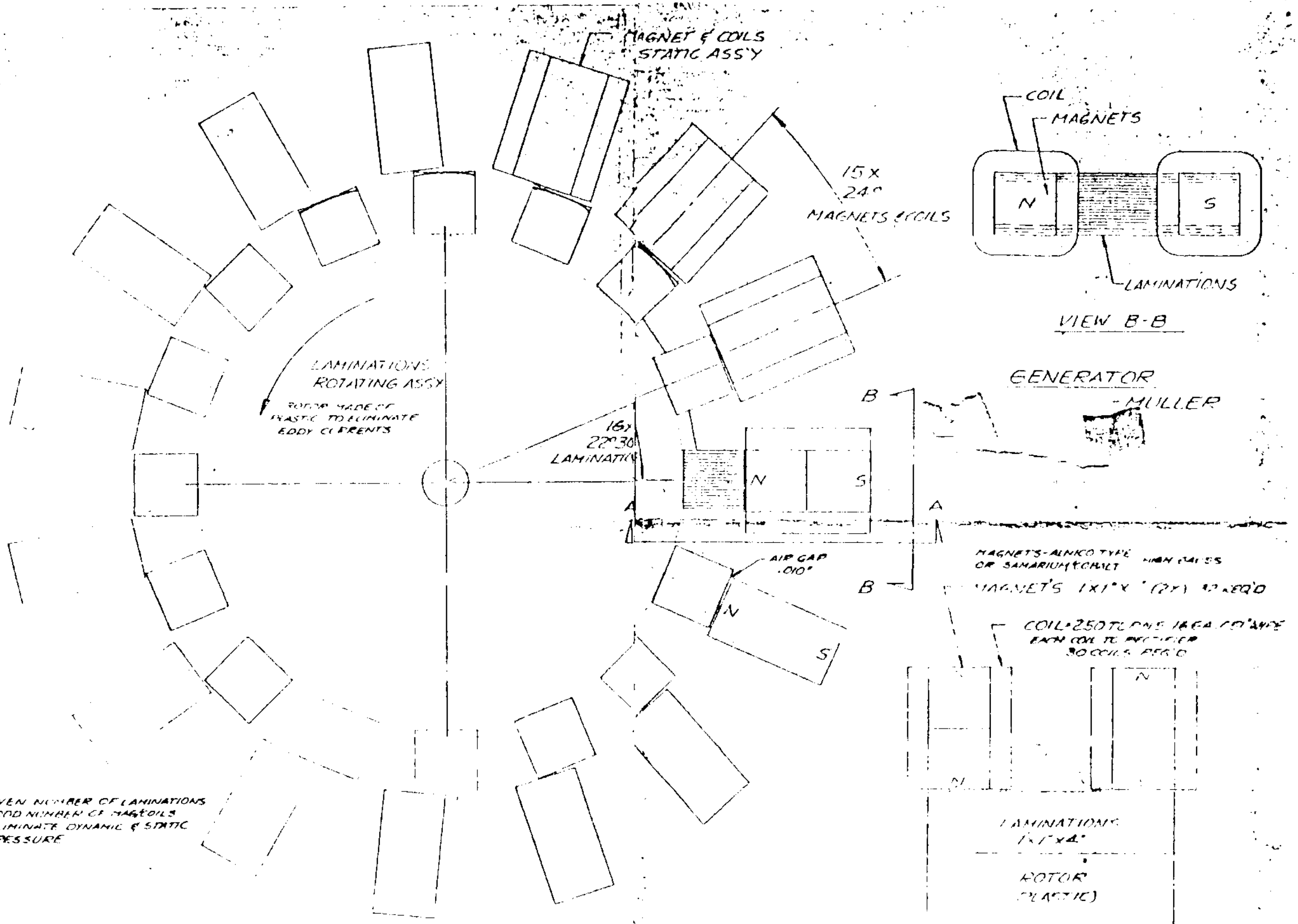
The unique design of the generator when constructed with electro magnets to the rear and beside each Stator Output Coil and connected in series with each other by means of bi-polar capacitors will also provide its own motive force. This occurs when the Stator Magnets are grouped close enough to each other at the rotors edge so that when a Rotor Pole has caused current to flow in an Exciting or Driving Coil on the rear of the Stator Magnet it can be transferred to the adjacent Driver Coil through a capacitor and thus causing a movement of the rotor. The rotor has to be initially rotated and the Exciting Coils momentarily energized to permit internal motive force to begin. The rotor can initially be brought to speed by utilizing Micro Processors and Micro Switches suitably programmed to use the Output Coils to act as motor windings and then turn them back into Output Coils. The Driver Coils can be momentarily energized by discharging an appropriate D. C. capacitor into the Eciting Coils, by means of Diodes connected in series between all Drivers.



March 3/83.

[illegible] Muller.

HIGH FREQUENCY MOTOR GEN.


MAGNET & COILS STATIC ASS'Y
15 X 24°
MAGNETS & COILS
COIL
MAGNETS
N
S
LAMINATIONS
VIEW B-B
GENERATOR
- MULLER
LAMINATIONS ROTATING ASS'Y
ROTOR MADE OF PLASTIC TO ELIMINATE EDDY CURRENTS
16X 22°30'
LAMINATIONS
B
B
A
A
N
S
AIR GAP .010"
N
S
MAGNETS-ALNICO TYPE OR SAMARIUM & COBALT HIGH GAUSS
MAGNET'S 1X1"X "(?X) 32 REQ'D
COIL-250 TURNS 16GA. COPPER
EACH COIL TO RECTIFIER
30 COILS REQ'D
N
N
LAMINATIONS 1X1"X4"
ROTOR (PLASTIC)
EVEN NUMBER OF LAMINATIONS & ODD NUMBER OF MAG&COILS ELIMINATE DYNAMIC & STATIC PRESSURE

PLEASE NOTICE;

No recommendation was given by NOVA on the coil's size and number of turns.

Our generator has guess wound 200-250 turns of #16 wire which is not an optimum coil. The best coil output was read at 15 volts, 10 amps which is 150 watt power. That means if we calculate the proper coil winding and size it should increase the output substantially. Wire size and coil turns and coil numbers and cores can produce any output desired.

We beleive that conventional generator coil windings that make a flux change through a 8,000 B(gauss) magnet, could be turns of any size wire on a one inch cobalt magnetic core that is the standard norm.

It would create the optimum amperage and voltage output if we adheared to the conventional generator coil's output!

No reference to Newton's Law was made on Kinetic Energy stored in a fly wheel rotor. (Mass in motion tends to stay in motion)

04/22/83

GENERAL EXPLANATION

Permanent and/or electro magnetically imbalanced infinite laminated even iron segments around a rotor, stationary uneven magnets and coils.

SIMPLE OR MULTIPLE DOUBLE RETURNING HELIX IN ALL RELUCTANCE MOTORS AND/OR GENERATORS

Magnetic elimination around a shaft is explained for all non reluctant motor generators which is achieved by employing an even number of rotor segments and an uneven number of stationary permanent and/or electro magnets and coils. Therefore, magnetically eliminating all static and dynamic pressure on all reluctant motor generators, in a forward and returning helix properly spaced around, and/or along, shafts or spindles of cobalt, and/or electro magnets, and/or air bearings in a turbine rotary fashion.

Odd and even, indefinitely returning gives you a zero torque input, and this is achieved by unequalizing magnetic pressures, called magnetic motor and magnetic generator.

04/22/73

REFER TO:

Fischer Electronics Co., Engineering Report

Drawings One and Two

Encl., Letter, Resume, and Drawings

THE ROTOR EXPLAINED

The rotor has even segments of fine laminations of brass and iron alternately and/or other magnetic materials, would dampen the eddie currents and hysterisis. These segments are imbedded in a non-magnetic or non-conductive material.

The rotor can be in any direction indefinitely, along an axel, vertical or horizontal, or any combination thereof.

Rotor core material should be EQUAL in mass to the material of stator coils in a returning helix.

The purpose of the rotor is to pump magnetic flux changes through coils.

04/22/93

Kenetic Energy is stored in the fly wheel rotor assembly at any size. Circumfrences responds proportionately to mass and speed. (Apply Newton's Laws of Physics) Motor force - no more torque input necessary.

04/22/93

THE GENERATOR COILS AND HOW THEY ARE POSITIONED

Wire should be wound in the proper direction, turns and size equal to coils of conventional generators around a core material of cobalt rare earth magnets charged to the amount of 8-10,000 B(gauss) or Hci 16-18,000 Oe, or of an electro magnetic nature at any volume B(gauss).

Using an odd number of A.C. coils, wound on magnetic cores, they are then placed around an even numbered iron and brass segmented rotor. In the parisphere of a rotor; gyroscopic, cylindrical, linear, eliptical, horizontal, vertical, spherical, cone shaped, diamond shaped, or ringed and/or any combination thereof.

04/22/83

REFER TO:

An Elementary Book on Electricity and Magnetism and Their Applications.
Norwood Press / J.S. Cushing & Co. - Berwick & Smith / Norwood Mass., U.S.A.
The MacMillan Company; London: MacMillan & Co., Ltd. / Copyright 1902
Page 139 / 1st Paragraph / Chapter 10 / Faraday's & Lenz's Law

NOVA's Determination of Efficiency of Canadian Amplified Magnetic Propulsion Systems (CAMPS) Generator.
Page 2 - Theory of Operation / Paragraph B.

Physics Parts I & II / Authors, David Halliday & Robert Resnick
John Wiley & Sons, Inc. - New York - London - Sydney / copyright 1960, 1962, 1966.
Page 874 / Chapter 35 / Faraday's Law / 3rd Paragraph

TO EXPLAIN ANY FLUX CHANGE

(FARADAY & LENZ'S LAW)

Making a flux change in ANY manner in a magnetic field, that is, not moving a magnet or a coil. We make our flux change by moving segmented iron or ferrite material, and set up corresponding magnetic field in a coil that is energized by a flux change, does not seem to explain the back E.M.F., when we are in the same direction with the output coils. As the permanent magnet which is stationary and when our flux change comes through the coil and we short circuit it, it will only make the magnet stronger!, but not opposing. These two sentences of Faraday and Henry on page 139 are in paradox with each other because the back E.M.F. only occurs when we move a magnet or a coil, or the coil is wound in the wrong direction on a magnet.

Please investigate this law in relation to uncoventional generators and motors.

BACK E.M.F. IN COILS

Back E.M.F. is explained away by NOT moving a magnet through a coil or a coil through a magnetic field. Therefore we make a flux change by rotating laminated iron and brass segments and/or other magnetic materials, only past a coil on a magnet, stationary on the outside of the rotor. The electrical current produced in the coil while the flux change has taken place with a moving rotor, is in the same direction as the original permanent magnetic flux direction which it is on. Therefore, they are NOT opposing, as in a conventional dynamic generator. (DIRECTIONAL Electron Motor Force)

To any change, which refers to making electricity by flux change any way you want, does not apply to the word any, only to the statement of moving a magnet through, or past a coil. Contradicting itself.

04/22/83

THE ELECTRO MAGNETIC MOTOR
COILS EXPLAINED

4-22-83

Two coils on each core (one A.C. - one D.C.) self energized controlled by micro processors and/or others, capacitor discharge which in turn will give us magnetizm on the core, which in turn will give us pulsed magnetic rotation of the rotor.

Test- results of the
Muller- generator in Canada
Aug./Sept. 87

Rec'd [illegible]

NEWS RELEASE

For the past eight months Active Marketing Ltd. has supported the development of a magnetic generator by Mr. Wilhelm Muller of the country Canada.

Prior to Active Marketing's involvement many prominent scientists from around the world had viewed Muller's technology and expressed tremendous optimism that over unity could be achieved if the project was properly funded.

To this aim Active Marketing provided funding and professional personnel required to determine the feasibility of the technology. Funding for the project exceeded one million dollars.

The machine was constructed in accordance to Mr. Muller's wishes with state of the art componentry. Extensive testing was conducted by Mr. Charles Clark (Chief Scientific Officer) and his staff. A general outline of the results is provided below:

..... Two Muller homopolar generators employing the odd/even principle were tested during the month of August, 1987. The first configuration consisted of 16 Neodinium-Iron-Boron magnets and 30 copper wire electrical coils (15 per side) for the generation of electrical output power. The second configuration was a smaller wheel using 8 Samarium -Cobalt magnets and 7 aluminum heat exchanger coils for inductively heating water or similar fluids.

Both AC and DC drive motors were used to provide the input power needed to maintain a rotor speed of 2000 to 3000 RPM. A DC output rectifier capable of 18 KW was designed, fabricated and tested on the generator configuration. Additionally a solid state DC pulse motor was constructed using four driver coils and the 16 rotor magnets to power the electrical generator.

The test equipment used to verify performance consisted of a Hitachi dual trace 60 MHz oscilloscope, a Fluke RMS volt meter, and an Amprobe-1000 AC/DC hall effect ampere meter.

Over thirty tests were concluded with the electric generator. The output coils were matched electrically in pairs prior to testing to maximize power output and minimize pulse transient losses. Both DC rectified and AC output power measurements were conducted using varied non-inductive test loads. Input power was corrected for power factor while using AC drive motors. The results of the tests revealed a maximum output to input power ratio of 0.56 for both AC and DC rectified measurements. Testing with the solid state pulse motor was not successful due to extensive transient spikes produced by the collapsing magnetic field in the driver coils. Presently the solid state system is being replaced by a more conventional brush and commutator system.

Fifteen tests were completed with the induction heating configuration. Transient as well as steady state tests were conducted. Results indicated that the design runs near unity during the transient test. However, the accuracy of the data is suspect since startup motor work could not be integrated to accurately determine input power. Steady state tests indicated output to input ratios ranging from 0.56 to 0.66, slightly higher than the generator testing. The induction machine was also run with an even amount of poles and magnets. Starting torque was significantly increased with the extra pole indicating an advantage with the odd/even principle during startup. However, once running the output/input power ratio was the same.

In conclusion the present system as configured does not operate over-unity and the odd/even principal does not prove to be beneficial during continuous operation. ....

Based on the above results, Active Marketing has suspended funding for the project until further scientific evidence indicates the technology can be developed successfully.

Active Marketing Ltd. would like to express their sincere appreciation to the many scientists and the hundreds of individuals who expressed support for the project. The above individuals were from every major area of the world.

In closing, I would like to express my gratitude to the many businessmen and governments from around the world who were prepared to standby to develop the technology if proven successful. The majority of these businessmen and governments became involved based on the credibility of the individuals behind Active Marketing and their past business experiences. Thank you for your open mindedness, confidence and support.

Best Regards,

Rick Tomita.
Associate/Active Marketing Ltd.

Energy Conference Reports

Scientists Express Amazement at Muller Demonstration

"You're violating the Laws of Conservation of Energy," a scientist from Maryland exclaimed to Bill Muller of Penticton, B.C., Canada. He was among a group of participants, at the Society for Scientific Exploration (SSE) meeting in August, gathered around a small experimental apparatus. It was sitting on the sidewalk outside a building on the Stanford University campus, where the SSE meeting was held.

The small-scale experiment had been devised by Muller to test what is happening in his larger machine. The experimental apparatus contained two of the specially-wound "driver" coils (which go into Muller's magnet motor) stacked face-to-face, two electrolytic capacitors and a full wave bridge for DC (direct current), all on a strip of Plexiglas.

The researchers had brought testing equipment — a multimometer and current probe — and showed onlookers what happened when the cord on the apparatus was plugged into an electrical outlet outside the building.

The equipment showed 2.9 amperes of the 115-volt current going into the little demonstration apparatus. Multiplied, that means the input was 333 5 watts AC. But the output was measured at 2.5 amps and 153 volts — 382.5 watts DC — which caused head-scratching and amazement among SSE members and guests.

Muller and his engineer Gerald Diel came up with the experiment in order to prove that the materials they use do "boost" — or in other words amplify — the power flowing through them. Usually the power comes from the process of moving super-powerful magnets past the special coils, the researchers explain. The experiment was to try using AC (alternating current) on a lineup of components, instead of having the magnets passing by the coils.

Eliminates Core Losses

The materials include amorphous metal cores inside the coils. Muller was one of the first independent researchers to work with amorphous metals, otherwise known as metallic glasses. The alloy was developed to cut down on heat losses in transformers for utility companies. In Muller's machine, the benefit is that the amorphous-metal core doesn't oppose the next oncoming magnet.

Muller invented the brushless magnet motor and generator in which a flywheel rotates super strong magnets, spaced along its periphery, past coils containing amorphous metal cores. The machine contains an odd-number/even-number configuration of poles/magnets so that the wheel is never stuck in one position. Over the years Muller refined his concept into a sophisticated device that has no static (stopped) position and therefore turns easily despite the powerful holding force of the new magnets. A further refinement has been the addition of an electromagnet which periodically kicks a flywheel magnet forward just after it passes the electromagnet. This split-second timing is done by electronic switching: a microprocessor controls the process of flashing current into the coil which then briefly becomes an activated electromagnet, of a polarity to repel the flywheel magnet and this keeps the wheel rolling.

Displayed Magnet Motor

When Bill and Ilona Muller and Muller Technologies engineer Gerald Diel were invited to the SSE meeting, they in turn asked associates in California, Ray Camaano and James Warthan, to bring a sample of the Muller motor/generator.

Driving a van from their homes in San Jose to Stanford, Camaano and Warthan hauled the 80-pound version which they had built. The van was parked near the SSE meeting place, and there Muller and associates demonstrated their hardware to scores of SSE participants, in small groups.

Regarding whether his machine can be both a motor and a generator at the same time, Muller says, "ultra-fast switching ability — nanosecond timing" is a key to its being both. It can "generate when a magnet approaches a coil, and "motor" as the magnet passes the coils. A computer controls when the device is operating as a motor turning its shaft, and when it is generating electricity. The generated electricity is stored momentarily in capacitors to be used when the machine switches to being a motor.

Muller said his own machine has tested at between eight to one and five to one "over unity" (more power out than goes into a device).
What about the machine demonstrated to SSE participants? Is it "over unity"? Camaano replied that the Muller model reproduced in San Jose by himself and Warthan "hasn't been tested under load. But Bill's (machine) has."

San Jose Innovators Design New Machine

Could a "free energy" car be approaching over the horizon? At the Society for Scientific Exploration meeting, raum & zeit interviewed two Californians who said they believe they could, in less than a year, build a Muller magnet motor to power a vehicle.

Ray Camaano and James Warthan of San Jose have already built a version of the motor/generator, in cooperation with its inventor, Bill Muller of Penticton, B.C., Canada. When Muller was invited to the SSE meeting, he asked his two San Jose associates to bring their machine to Stanford. Otherwise, Muller would have had to transport his own demonstration model through the bureaucracy of the international border.

Camaano, a 27 year old machinist/mechanic, and Warthan, a 45 year old computer programmer, say they would be only about six months away from running a car with the magnet motor "if we had the funds." They figure they need $20,000 to carry out their plan of powering a standard VW Rabbit pickup with a device that any auto mechanic could install into a vehicle in a day or two.

"We could have two batteries — one that the magnet motor-generator charges and one that it runs off of." Timing would be controlled by a microprocessor control circuit. "Braking the car to a dead stop would be no problem," Camaano says. "The coils would act as brakes." A "cogging effect" would slow down the car. As in the incurrent machine, the microprocessor would switch the motor/generator to the generator mode, inducing a braking effect known as "regenerative braking" on the car.

Microprocessor Control Circuit

The switching is controlled by a microprocessor control circuit which receives data from an optical encoder as to the magnet/coil pair relationships, then activates mosfet (metal oxide silicon field effect transistor) switches to energize the electromagnets.

Regarding the Muller magnet motor, which uses powerful neodymium-iron-boron permanent magnets, Camaano says, "We're harnessing vortexes." He also commented on matching capacitance and inductance, and tuned circuits: "Tesla did almost everything with resonant circuits. When you make a magnetic field resonate, the power of the field goes way up."

So far the San Jose duo has spent thousands of dollars on researching and building the machine. On their wish-list is a $5,000 dynameter for testing. Realistically, however, their next purchase was to be the new mosfets which can handle 1,000 volts at 50 amps. The powerful magnets, inducing current as they turn past the coils, are responsible for spikes of current which previously burned out components before the new mosfets were available and protection devices used.

Their microprocessor control circuit was designed and developed by Jack Masterman for Light Engineering (Camaano and Warthan's company), and the prototype control unit was developed by the same company.

The microprocessor can be interfaced with a personal computer, Camaano explains. "Through the personal computer we can control all functions of the motor/generator while it is running. Therefore, duty cycle, timing advance, motor/generator mode are all adjustable while the machine is running — a feat that is impossible for conventional commutators!"

"The status of all functions can be continuously monitored by the personal computer, and once the optimum operating parameters are established, this data can be permanently programmed into the microprocessor for production models."

The two researchers say that powering a car would be fairly straight-forward. The existing clutch, flywheel and transmission can be used. "An adapter plat would need to be made to mount the motor to the transmission, and the shaft of the motor would need to be machined to accept the existing flywheel. Motor speed can also be controlled by microprocessor."

"Then we would have a free energy electric car!"

On Oct. 15, 1990, the innovators from San Jose gave **raum&zeit** a further update on activities of Light Engineering: "We have a new motor/generator under construction that utilizes all the principles we know of, and should produce free energy ratios far in excess of that which is known at this time. We are using twin counter-rotating discs, with the motor section down toward the center of the discs and the generating section out on the periphery.

"What is required to generate power is a fluctuating magnetic field. The conventional way to generate electricity is by moving magnets past coils. The problem with this is that the more power you take out of the generator, the more torque is required to turn the shaft, due to Lenz's law. What happens is, the coil repels the magnet coming in, and holds onto it going away (in a

Energy Conference Reports

Researchers Share Information

Muller has cooperated long distance by sharing information with the two San Jose men as they built their model of his motor. Both the Canadians and the Californians are experimenting to find the best balance between voltage and amperage for doing work, Camaano said. He and Warthan have built coils in which they aim for higher voltage and lower amperage. "Maybe 100 volts at ten amps."

In the Muller motor/generator model they took to Stanford, the San Jose researchers were using fewer magnets — eight magnets turning past seven coils — in their flywheel than Muller. As they learned from Muller, Camaano and Warthan were using neodymium-iron-boron (NdFeB) magnets, of a size two inches square and one inch thick, which Camaano said are 37 megagauss in strength. This means, said Muller, that each magnet has a holding force of 2,000 times its own weight.

Over the years of his research, Muller has informed thousands of people that a permanent magnet is a perpetual energy source, carrying "enormous ampoere pressures within itself." Unlike a battery, the new breed of super-powerful permanent magnet doesn't lose strength over decades, or with use.

Muller Educates

As for the Law of Conservation of Energy, Muller joins leading-edge physicists in describing the universe as an open system. A more-output-than-input device would break the Law if operating within a closed system.
In addition to new materials such as permanent magnets and amorphous metals making it possible for Muller to do what formerly was not possible, new advancements in electronics also make new machines feasible. High current can be switched in whatever direction desired, Muller explains, "so we are now able to construct permanent magnet motors, large or small, that are also generators at the same time."

"We can now direct back motive forces — that are normally against the magnet — back into the same direction as the motor. Without the use of brushes."

Muller began his career as an electromechanic for the giant Siemens electrical company of West Germany, with training in high-frequency work. Later challenges included bringing power to mines in northern Canada, and then starting his own appliance repair business in British Columbia. His experimentation with magnets goes back to 1966.

Increasing Recognition

August of 1990 was a step forward in public recognition of Muller Technologies. Muller is still receiving letters and phone calls from people who saw his demonstrations at Stanford and, on August 11 and 12, at the Solar Energy Expo and Rally (SEER) in Willits, California. Muller made two of those letters available to **raum&zeit**.

For example, one scientist with a Ph.D., director of a center for leading-edge research, wrote Muller: "... I was impressed with your demonstrations at the SSE meeting this August."

An engineer from Berkeley writes to Muller: "... about your fantastic machine. The simplicity of hardware coupled with complexity of control makes your dynamo approach the design of nature."

Ilona Muller reports that at the Solar Energy Exposition, they showed the Muller motor-generator to many solar car innovators (including those with the Stanford University car, which, incidentally, won first prize). At the SEER gathering "we also met with Dr. Kincheloe again." Dr. Robert Kincheloe is a Stanford University researcher who has in the past demonstrated willingness to examine selected unorthodox energy-generating hardware.

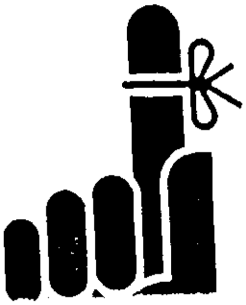
Energy Conference Reports

conventional design)."

"Our new machine does not do this. We keep the magnets and coils stationary in relationship to each other, and move Metglas (amorphous metal) pole pieces in between, thus causing a fluctuating magnetic field which in turn produces power. But very little torque is required to generate power with this design.

"The motoring section is unique also. We have an arrangement of permanent magnets that produce a slight motoring effect, and we only use very little current to enhance the motoring of the discs."

"It is computer-controlled and the circuits are now in development and should be completed within two months."



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Energy Conference Reports

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For example, one scientist with a Ph.D., director of a center for leading-edge research, wrote Muller: "... I was impressed with your demonstrations at the SSE meeting this August."

An engineer from Berkeley writes to Muller: "... about your fantastic machine. The simplicity of hardware coupled with complexity of control makes your dynamo approach the design of nature."

Ilona Muller reports that at the Solar Energy Exposition, they showed the Muller motor-generator to many solar car innovators (including those with the Stanford University car, which, incidentally, won first prize). At the SEER gathering "we also met with Dr. Kincheloe again." Dr. Robert Kincheloe is a Stanford University researcher who has in the past demonstrated willingness to examine selected unorthodox energy-generating hardware.