Experimental Evidence of a Breach of Unity on Switched Circuit Apparatus

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Abstract- **This First part of a two-part paper deals with results from a circuit that was designed to determine whether the amount of energy dissipated in a circuit could exceed the amount of energy delivered from a battery supply. If so, then this result would prove the basis of a magnetic field model that predicts an exploitable non-conservative field condition. This model is the subject of the second paper. The distinction is drawn that the energy that is dissipated in a circuit is sourced from the induced potential difference in the circuit material itself. Correspondingly then, the proposal is that the circuit material itself may be used as a supplementary and secondary energy supply source that has not, typically, been factored into the analysis of power conversion. This raises the question as to whether Kirchhoff's Laws exceed Faraday's Laws of Induction. And if not, then there is also a potential for the conservation of potential difference at a supply that may be exploited to enhance energy efficiencies. Test results show that this is, indeed, possible and that the inductive and conductive components of circuit material may be factored in as a potential energy supply source depending on the circuit design and intention.**

***Index Terms*—Energy efficiency, heating, inductance, switching circuits, Kirchhoff's Law, magnetic fields.**

I. Introduction

Convention has determined that energy that is delivered by a supply source is either stored or dissipated in circuit components in series with that supply. Therefore, consistent with Kirchhoff's Rules, the amount of energy, either stored or dissipated in that circuit, will equal but never exceed the amount of energy first delivered from that supply. In line with Faraday's Inductive Laws, current flow from the source induces a reversed voltage or potential difference, over such inductive or conductive circuit material that can, in turn generate a reversed current flow. This is widely referred to as counter electromotive force (CEMF). This, in turn, may be applied as a secondary energy supply source when used in conjunction with a switched or interrupted power supply. But the amount of potential difference that is then induced over circuit material is, nonetheless, assumed to be restricted to the amount of energy first applied from the source. Therefore the amount of energy, either stored or dissipated through those collapsing fields, is expected to equal the amount of energy first supplied. Therefore does convention assume that Kirchhoff's equivalence principles are inviolate.

The questions relating to equivalence are relevant to the conclusions of a magnetic field model that is referenced herein, under Discussion. This broad description is included as the model predicts a potential for a breach in unity constraints under certain switched applications, which indeed, was the object of this research. But rigorous analysis is still to be applied to that model largely resting, as it does, on an early conceptual analysis. The assumption is made that the circuit material itself is, in fact, a secondary source of energy and a source of the consequent current flow that results from CEMF. This current then flows back to its own material source, subject to the availability of a path in the circuit for this flow. It is preferred, however, that the tests be evaluated on their own merits and as it relates to classical prediction rather than in line with that model.

To this end the circuit incorporates an atypically paralleled arrangement of MOSFET transistors, (Fig. 1) referred to as the Q-array, to enable this unobstructed path for CEMF. When a negative signal is applied at the gate of the MOSFET Q1, it induces a burst oscillation that persists for the duration of the applied negative signal. This results in an oscillation that is robust and generates strong current flows that reverse direction, first flowing from and then back to the source and thereby alternately discharging and recharging the battery supply.

The four tests that are included herein are intended to show various aspects of this oscillation and its effects on the measured conservation of potential difference at the supply and as it relates to the energy dissipated at the element resistor (R_{L1}). What is evident in all variations of the applied source voltage, the applied switching period and the offset adjustments is that, depending on those settings, there is a significant dissipation of energy measured at R_{L1}. This was also tested to the limits of the transistors' tolerances. Yet, at no time in any of those tests, was there any measured loss of energy at the supply. This result flies in the face of classical requirement and indicates that there may, indeed, be an alternate energy supply source in circuit material that works in conjunction with a primary supply.

The voltages across the battery and the current sensing resistor, present a precise 180-degree anti-phase relationship that generates a self-supporting oscillation. This is widely known as parasitic oscillation and, under usual circumstances, switched circuits are configured to minimize or discard this effect, as the resulting heat byproduct is not required for standard applications. This reason, coupled with the assumption of Kirchhoff's equivalence, is possibly why its more exploitable thermal properties have not also, historically, been more fully explored. Of special interest is that these waveforms can be replicated on software simulations, which indicates that classical algorithms depend on inductive rather than equivalence principles. What may now be required is a revision of classical power analysis as the computation of wattage returned to that supply results in a negative value,

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which has little, in any, relevance within classical paradigms. This, together with more thorough research into the actual properties of current is now required which may be enabled through a wide dissemination of these early results. This is the primary objective of this submission.

II. The Circuit

The experimental apparatus comprises a simple switching circuit (Fig. 1). 6 x 12 volt lead acid batteries are in series with both a heating element (R_{L1}) and the Q-array of 5 MOSFET transistors (Q1 & Q2 x 4 in parallel). A signal generator drives the transistors. A current sensing resistor (R_{SHUNT}) on the source rail of the supply determines the rate of current flow both to and from the battery supply source. Circuit components are listed in Table I.

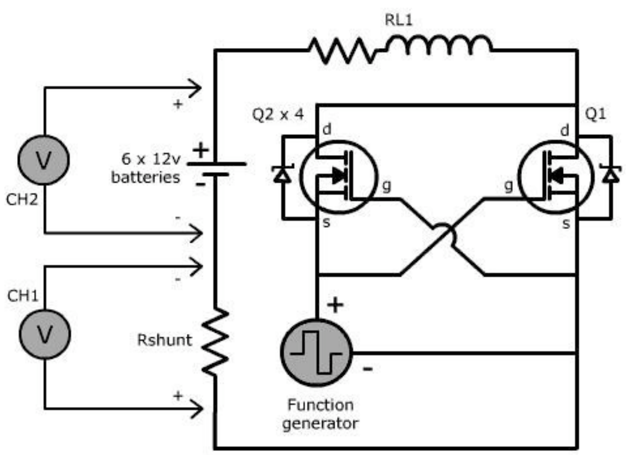

Fig. 1. Circuit schematic including position of measuring probe positions.

TABLE I
CIRCUIT COMPONENTS

Component	Description
R_{L1}	Incoloy alloy air heating rod element threaded with nichrome resistive wire. Resistance = 11.11Ω, L = 2.23µH. 200 watts. Supplied by Specific Heat CC, Cape Town, South Africa.
R_{SHUNT}	4 ceramic wire wound 1 watt resistors 1Ω each, placed in parallel. Resistance therefore = 0.25Ω. L = 110nH.
Q1-Q5	IRFPG50 with Zener body diode
Functions generator	IsoTech GFG 324
Batteries	12 V Raylite silver calcium

A. Operation

The circuit is designed to allow a secondary current flow that is induced from the collapsing fields of R_{L1} and inductive components in the material of the circuit, during the OFF period of the duty cycle and as a result of CEMF. A reverse current path is enabled by the body diode in the transistors as well as the paralleled Q-array positioning of MOSFETs (Q2) that are configured to enable their body diodes to allow a counter clockwise current flow driven by a negative charge applied to the gate of Q1. This allows a current flow generated by CEMF, that returns to the battery supply source to recharge it. Small adjustments to the offset of the functions generator enable the generation of a 'burst oscillation' mode that is triggered when the gate voltage defaults below zero. This oscillation occurs at a natural resonating frequency determined by the impedance of the circuit components. The adjustment to the offset also requires careful tuning to regulate the level of power required to be dissipated at the load.

III. Measurement

The following measuring instruments were used: Le Croy WaveJet 324 200 MHz Oscilloscope (DSO) (2GS/s 400 Vpk tolerance. Sample range maximum 500,000 samples), Tektronix MSO 3054 Mixed Signal Oscilloscope (DSO) (500 MHz 2.5 GS/s. Sample range maximum 1 million samples), FLUKE Digital Multimeter TopTronic T48 True RMS with thermocouple measuring to 400°C (rated at ±1%+4).

A. Measurement of Wattage Dissipated

Measurement of the energy dissipated at the resistor element (R_{L1}) was determined by comparison with results from a control to establish empirical measurements while avoiding the complexity of factoring in power factor corrections. A constant voltage was applied from a DC power supply source in series with R_{L1}. The voltage was then steadily increased in increments of 1 volt each from 1 volt through to 22 volts. The wattage was then determined as the squared product of the voltage over the resistance of R_{L1}, or $P=V^2 / R_{L1}$.

The temperature of the resistor was then recorded against the applied wattage and the temperature difference above ambient determined the level of wattage as represented in Fig. 2 and Table II.

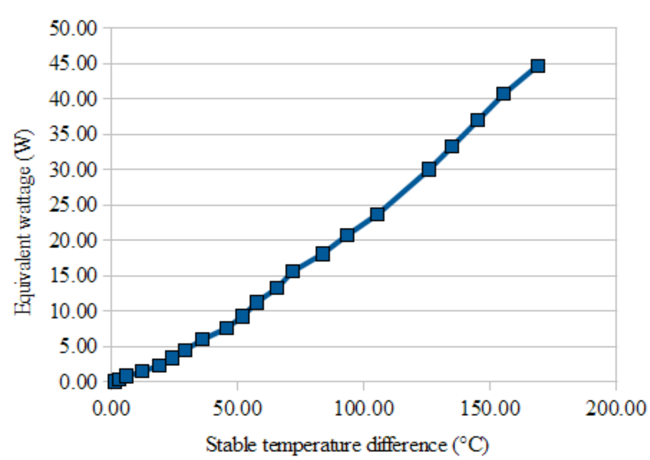

Fig. 2. Temperature related to wattage dissipated in control experiment.

B. Measurement of Wattage Delivered by the Battery

Energy is based on vi dt. The current (i) is determined by the voltage measured across R_{SHUNT} over the resistance of R_{SHUNT}, or $I=V_{SHUNT} / R_{SHUNT}$. Typically the battery supplies a direct current. Therefore, voltage that is measured above zero is considered to result in a current flow delivered by the battery. And, conversely, voltage that is measured below zero is considered to result in a current flow delivered to the battery. This is more fully qualified under Discussions, Para 1 as it relates to the measurements during the oscillation phase

TABLE II
RESULTS OF CONTROL EXPERIMENT

Time	**Voltage (V)**	**Current (A)**	**Ambient temperature (°C)**	**Temperature at load (°C)**	**Temperature difference (°C)**	**Stable temperature difference (°C)**	**Equivalent wattage (W)**
16:23:00	1	0.09	26	27.3	1.3	1.3	0.09
16:28:00	2	0.18	25.9	29.3	3.4	3.4	0.36
16:39:00	3	0.28	26.9	33	6.1	6.1	0.83
16:51:00	4	0.37	25.7	38.1	12.4	12.4	1.48
17:08:00	5	0.47	25.8	44.8	19	19	2.35
17:12:00	6	0.56	25.8	49.7	23.9	23.9	3.36
17:21:00	7	0.65	26.1	55.4	29.3	29.3	4.52
17:27:00	8	0.75	26.1	62.2	36.1	36.1	6
17:38:00	9	0.84	25.8	71.3	45.5	45.5	7.56
17:45:00	10	0.93	26.3	78.4	52.1	52.1	9.3
17:50:00	11	1.02	26.2	83.6	57.4	57.4	11.22
17:55:00	12	1.11	26.2	92	65.8	65.8	13.32
18:35:00	13	1.2	25.1	96.8	71.7	71.7	15.6
18:41:00	14	1.29	25.2	108.7	83.5	83.5	18.06
18:48:00	15	1.38	24.8	118	93.2	93.2	20.7
18:52:00	16	1.48	24.8	130.2	105.4	105.4	23.68
19:03:00	18	1.67	25.1	151	125.9	125.9	30.06
19:15:00	19	1.75	24.4	159.3	134.9	134.9	33.25
19:22:00	20	1.85	24.8	170.01	145.21	145.21	37
19:29:00	21	1.94	24.5	180.01	155.51	155.51	40.74
19:35:00	22	2.03	24.5	193.14	168.64	168.64	44.66

of each switched period.

The instantaneous wattage delivered to or by the battery is then determined as the product of the voltage across the batteries and the current being vi·dt. All voltages were determined by the display on the LeCroy oscilloscope. However, in order to confirm these values the data samples were transferred to a spreadsheet for detailed analysis. Such samples range in number from 100,000 to 500,000 per screen shot. All measurements were found to be consistent with the display. In determining the rate of current flow, an adjustment was applied to the Ohms value of the resistor to incorporate its impedance at the frequency of the oscillations. This required an adjustment of the impedance value to approximately 0.9Ω during the oscillation period. This value was incorporated into the spreadsheet analysis and the rate of amperage flow was then calculated accordingly.

IV. Test 1: To Determine the Potential Duration of the Oscillations and its Advantages

A. *Test 1 Setup*

The schematic in Fig. 1 refers with the following settings: 6 batteries x 12 volts each were applied in series. The offset of the function generator was set to its extreme negative limit resulting in an entire restriction of current flow during the ON phase of the duty cycle. The duty cycle is also set to the limit of the function generator's shortest ON time within each switching period of 2.7 minutes. The waveforms produced by this setup are shown in Fig. 3 and Fig. 4.

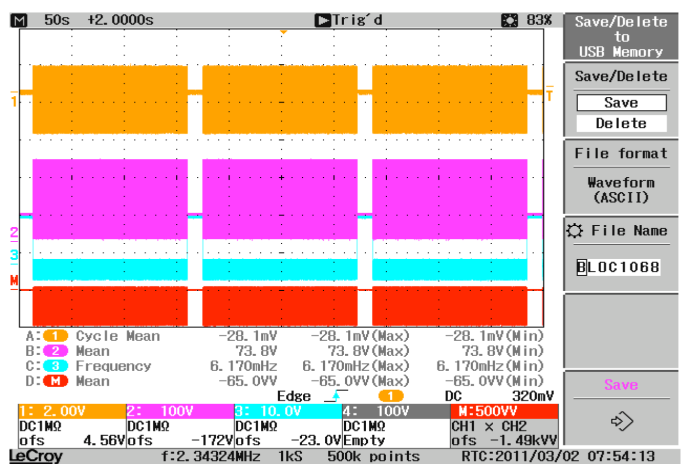

Fig. 3. Typical waveforms during Test 1. A: Channel 1 Voltage across current sensing resistor (R_{SHUNT}). B: Channel 2 Voltage across battery. C: Channel 3 Voltage across gate of MOSFET Q1. D: Channel M Math trace product of R_{SHUNT} and battery voltages.

B. *Test 1 Results*

There is no current measured to have been delivered by the battery during the ON phase of the duty cycle notwithstanding which there is a high level of oscillation during the OFF period of each switching cycle. The sum of the voltage across

R_{SHUNT} is -28.1mV in each cycle, which results from the oscillation that is generated during that period when the gate signal is negative, thereby indicating a net gain to the potential difference at the supply. There is a typically high level of battery oscillations where the voltages swing between a little above 10 volts to peak at approximately 220 volts. The math trace results in a negative product for the R_{SHUNT} and battery voltage. Duration of the oscillation is enabled to the limit of the signal generator's slowest switching speed at 2.7 minutes or 6.172mHz. Temperature over the resistor rose to ±49°C above ambient representing wattage dissipated at R_{L1} of approximately 8 watts. The product of the battery and R_{SHUNT} voltages, vi dt, was negative. At no stage in this test was any measure of energy delivered, by the battery as evident in the math trace and spreadsheet analysis. It is also evident that the oscillation will persist provided a negative signal is continually applied at the gate of the transistor MOSFET Q1.

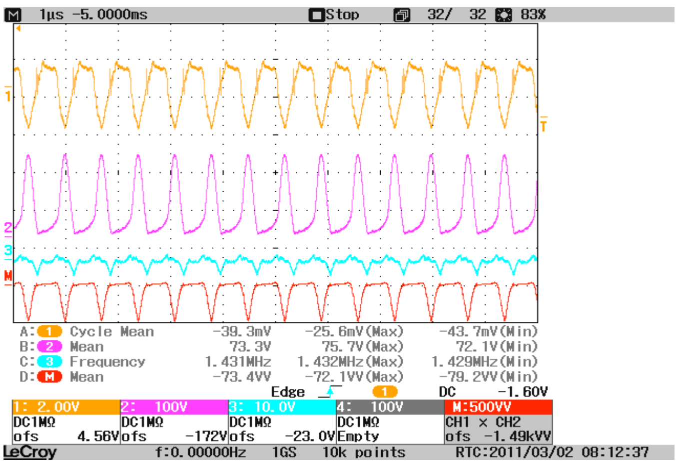

Fig. 4. Detail of the oscillation seen in Fig. 3. A: Channel 1 Voltage across current sensing resistor (R_{SHUNT}). B: Channel 2 Voltage across battery. C: Channel 3 Voltage across gate of MOSFET Q1. D: Channel M Math trace product of R_{SHUNT} and battery voltages.

This is the only example required to show the oscillation waveform detail as this frequency and phase relationship is seen to persist in all variations to the offset, the duty cycle and the and the applied voltage at the source. The evidence is that the oscillation will persist with the provision of a constantly applied negative charge at Q1. There is a precise 180-degree anti-phase relationship between R_{SHUNT} and Battery voltages that is self-reinforcing, extending as it does, for the full duration of the cycle while the signal at the gate of Q1 is negative. The significance of this is more fully described under Discussion and the evidence is that current is not, in fact, being discharged by the battery supply during this oscillation phase.

V. Test 2: To Determine the Benefit of the Anti-Phase Relationship of Voltages across the Current Sensing Resistor and the Supply

A. Test 2 Setup

The schematic in Fig. 1 refers, with the following settings: 6 batteries x 12 volts each were applied in series. The offset of the function generator was increased by 25% allowing a limited amount of current flow from the battery during the ON period of the duty cycle. The switching period was set to 684µs. The cycle mean average voltage across R_{SHUNT} is now positive. However, the math trace nonetheless computes a net negative voltage as a product of the voltages across R_{SHUNT} and the battery (see Fig. 5).

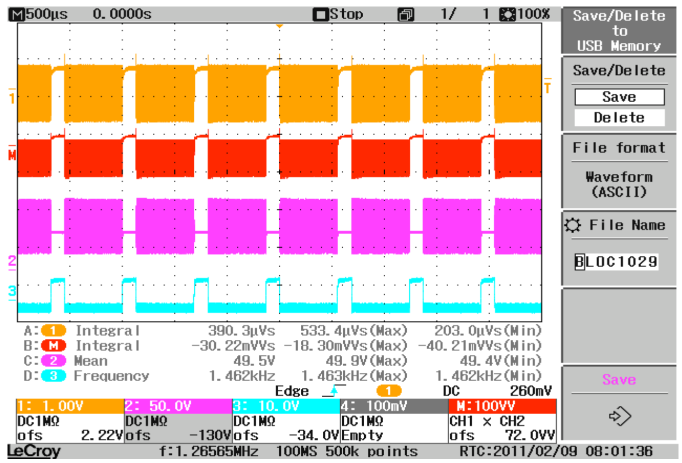

Fig. 5. Typical waveforms during Test 2. A: Channel 1 Voltage across current sensing resistor (R_{SHUNT}). B: Channel M Math trace product of R_{SHUNT} and Battery voltages. C: Channel 2 Voltage across the batteries. D: Channel Frequency of the applied switch and voltage applied at the gate.

B. Test 2 Results

Temperature over the resistor stabilized at ±120°C above ambient representing wattage dissipated at R_{L1} of about 25 watts. The product of the battery and R_{SHUNT} voltages was negative. At no stage in this test was there any energy depleted by the battery, as measured by the math trace and spreadsheet analysis. Therefore is there an evident, secondary benefit to the conservation of potential difference at the supply that is the result of the re-enforcement of the oscillations from the anti-phase relationship between the voltage across the battery source and R_{SHUNT}. This negative product is measured, notwithstanding the positive sum of the cycle mean average voltage across R_{SHUNT}.

VI. Test 3: To Determine the Practicality of the Circuit Potential by Taking Water to Boil

A. Test 3 Setup

The schematic in Fig. 1 refers with the following settings: 5 batteries x 12 volts each were applied in series. The offset of the functions generator is increased by a fraction to 0.186 volts applied across R_{SHUNT} during the ON period of the switching cycle (Fig. 6 and Fig. 7). The switching period was set to approximately 120 milliseconds.

B. Test 3 Results

The cycle mean and mean average voltage across the shunt measured a negative voltage as did the math trace being a product of the battery and R_{SHUNT} voltages. These negative values remained throughout the 1.6 hour test period. The temperature at the R_{L1} rose steadily to 248°C. It was then immersed in about 0.85 liters of water and the water temperature then steadied at approximately 82°C. The switching period was then increased and set to approximately 1.25 milliseconds as evident in Fig. 7. The temperature of the water then rose to 104°C in less than 10 minutes. The battery voltage both rose and fell marginally, throughout this entire test period and measured 62.1 volts prior to concluding that test period.

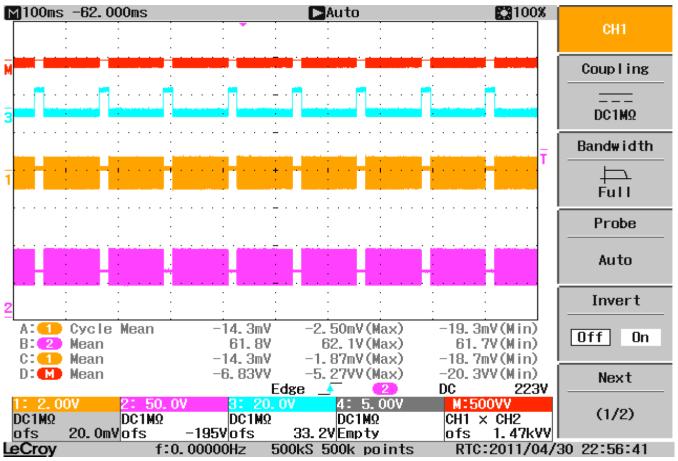

Fig. 6. Typical waveform for Test 3. A: Channel 1 Voltage across R_{SHUNT} per cycle. B: Channel 2 Voltage across the batteries. C: Channel 1 Voltage across R_{SHUNT} per screen. D: Channel M Math trace product of R_{SHUNT} and battery voltages. Channel 3 Voltage across Q1 gate.

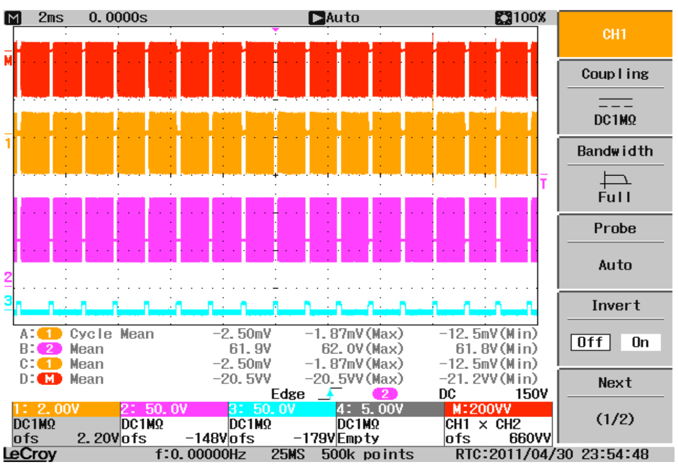

Fig. 7. Typical waveform for Test 3 (increased switching frequency). A: Channel 1 Voltage across R_{SHUNT} per cycle. B: Channel 2 Voltage across the batteries. C: Channel 1 Voltage across R_{SHUNT} per screen. D: Channel M Math trace product of R_{SHUNT} and battery voltages. Channel 3 Voltage across Q1 gate.

Steam was evident at all times when the temperature exceeded 62°C, which points to a secondary exploitable potential. At no stage in this test was any energy depleted by the batteries as measured in the math trace and spreadsheet analysis. Therefore it is evident that it is possible to bring water to boil without any depletion of potential difference from the supply. Given 4.1 joules required to heat 1 gram of water by 1°C then over the entire 1.6 hour test period about 5 904 000 joules were dissipated. The batteries' rated capacity is

VII. Test 4: To Determine Whether the Circuit Can Operate in a Booster Converter Mode

A. Test 4 Setup

The schematic in Fig. 1 refers, with the following settings: 6 batteries x 12 volts applied to this test. The offset of the function generator is again set to its extreme negative limit, resulting in an entire restriction of current flow during the ON phase of the duty cycle. The switching period was set to approximately 20µs in order to generate high voltage spikes at the transitional phase of the switching cycle (Fig. 8). The test duration was limited as the voltage tolerances of the transistors were stressed.

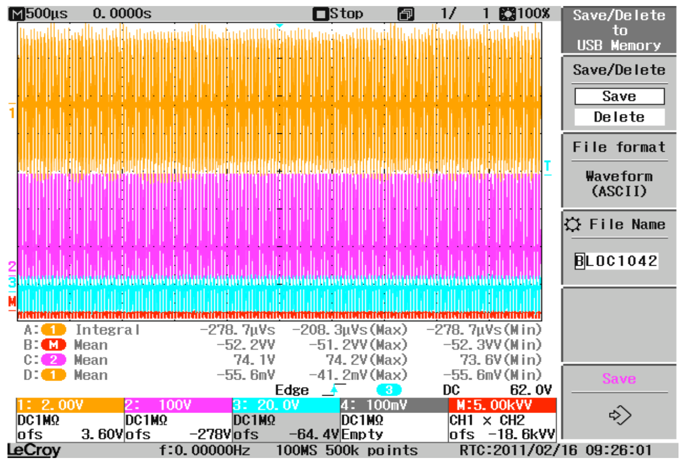

Fig. 8. Typical waveform for Test 4 showing high-voltage spikes. A: Channel 1 Integral of voltage across current sensing resistor (R_{SHUNT}). B: Channel M Math trace product of R_{SHUNT} and battery voltages. C: Channel 2 Voltage across the batteries. D: Channel Mean average of voltage across entire screenshot. Channel 3 Voltage across Q1 gate.

B. Test 4 Results

The battery voltages defaulted to slightly below zero at certain stages of this cycle. Notwithstanding the measured high current flow resulting from these spikes, the negative mean average of the voltages across the shunt, never defaulted to a positive value. The Math trace reflected this measurement showing a negative product and a retained potential difference at the supply source. The rate of temperature rise and high voltage spikes measured across R_{SHUNT}, indicated a necessity for an early termination of this test. The voltage across R_{SHUNT} measured a current flow greater than the current flow available from standard applications. This indicates that there is indeed a potential to use the system in a booster converter mode of operation subject only to the availability of more robust transistors. At no stage in this test was any energy depleted by the battery as measured in the math trace. The test was terminated before a screen sample download could be captured. At this point the temperature over the element resistor rose to 124°C.

VIII. Discussion

A. Discussion on the Phase Angles of the Oscillation Period and of the Measurements

Convention determines the discharge of current from a battery source is determined from a voltage that is greater than zero. This discharge results in an expected and measured drop in the voltage from that supply depending on the rate of current flow. And correspondingly, when a counter or negative flow of current is applied relative to that supply, then the voltage across the battery supply increases, again depending on the rate of current flow. The oscillations that are induced in these tests incorporate both a recharge and a discharge period in each cycle as determined by the voltage that is measured across R_{SHUNT}. And a feature of these oscillations is that there is, typically, an exceptionally high level of current flow during each cycle. And equally, there is a wide swing in the battery voltages that moves to extreme voltage levels both above and below its rated potentials.

The explanation for these extreme voltages measured across the battery terminals, is that the measurements incorporate the sum of two opposing potentials that are induced from CEMF in the circuit material. Effectively a negative applied voltage from the circuit material increases the voltage of the battery supply above its potential and correspondingly, the positive applied voltage from the circuit material decreases the voltage of the battery supply below its rated potential. Therefore does the potential difference resulting from that CEMF from circuit material, impose itself on the measured voltage across the battery to exceed or diminish that supply voltage above or below its actual rated potential. And precisely because of this measured excess over their rated potentials, the evidence is that the energy or potential difference responsible for this oscillation is extraneous to that battery source. In as much as this oscillation is also evident on simulations it obviates the signal generator as the source of this extra energy. Therefore the only other viable source for the extra energy is from the circuit material itself as a result of its induced potentials.

Computation of wattage is based on the product of voltage and amperage over time or vi dt. But standard protocols have assumed a single supply source to the circuit. The measure of the potential difference from these induced voltages on the circuit cannot be precisely established except as it relates to the battery supply source. However, it is correctly represented as the sum of the voltages that are now evident in the oscillations measured across the battery supply. Therefore vi dt is the correct basis for the measure of energy delivered to and from that supply, incorporating, as it does, the sum of both the applied potential difference from the circuit and from the supply.

Of interest is the fact that the path for both directional flows are available to the circuit through that oscillating cycle which is, correspondingly, prevented, in open circuit conditions and resulting from that applied switching period. In effect, there is something in the nature of that current material itself that permits a flow through the body diodes in either direction during the oscillation period, which it cannot manage under closed circuit conditions. The thesis proposes that current that is generated from the circuit retains a negative charge and remains negatively polarized. Here the distinction is drawn that the voltage potential induced on the circuit is reversed relative to the current discharge from the battery. Therefore it flows from the cathode terminal of the battery to the anode consistent with the justification of the body diode at Q2 during the recharge cycle. In reversing, this flow then presents a negative charge at the anode of that body diode consistent with that flow. Current induced from this negative cycle is therefore able to move in either direction through those diodes. Correspondingly, the current flow that is generated from the battery supply during closed circuit conditions remains positive. And, being positive, it, correspondingly, cannot, breach the polarization of those diodes, except under closed circuit conditions with the applied positive signal at the gate of Q1. This goes to the heart of the proposals of the thesis that requires a polarized property to current flow that depends on the material at the source. In effect, the proposal is that the material property of current flow is, itself, either positive or negative depending on its source and on the material at the source.

Because the sum of the energy returned to the battery is greater than the energy delivered, these test results appear to contradict the requirement of a co-efficient of performance (COP) equal to 1. The many variations of the circuit that have been tested, in fact result in COP greater than 1. And the tests that are based on this circuit (Fig. 1), that are referenced herein, in fact result in an infinite COP here defined as the measure of more energy dissipated on a circuit than the energy delivered. In effect, these test results and all the other tests not detailed herein, have progressed to the point that there is the persistent and real anomaly of a wattage value based on a negative product that has no historical precedent. Nor can this be resolved in terms of traditional protocols, as the concepts that are now applicable require an evaluation of the material and mass of the circuit components themselves, as this relates to current flow and induced potential difference. This is because the inductive and conductive properties of the circuit material have not been factored in as a potential or supplementary energy supply source but have widely been assumed to be stored from an initial discharge from the supply source.

The challenge is to redefine the concept and material properties of current flow as the evidence is that this is limited, not by the amount of potential difference transferred to the circuit material, but by that circuit material itself and the degree of restriction of that flow of current through the paths allowed for by that circuit. The thesis proposes that the current flow induced through CEMF is sourced and returns to that circuit material in exactly the same way that the current from the battery supply source returns to its material source. And depending on that directional flow then the source and the circuit material both, can be balanced that the potential difference is then reduced. However, what is managed, in the oscillations evident in these tests is that the balance of potential difference at the circuit material is at the cost of an applied imbalance of the potential difference at the supply and vice versa. Therefore are neither energy supply sources able to balance that charge that is proposed to be the overriding requirement of that current flow. This induces the perpetuating condition of that current which then is trapped in a continuous oscillation. This is measured to contribute to the retained potential difference at the supply and, depending on the force and frequency of the applied source current, this can then generate significant and exploitable heat at a circuit's workstation.

But there are no precedents yet established that can relate the level of work performed to the amount of energy first applied, as has been managed by standard measurement protocols. If the proposals in the thesis are correct, then there is a basis for this to be computed, but that thesis still needs resolution, which is addressed in the second part of this paper. In any event, the proposal is that in as much as the material of current from the source is not, in fact, dissipated anywhere on a circuit, then the amount of energy measured to be returned through CEMF does not, in fact, remain with that supply. It simply passes through the supply, thereby restoring the potential difference that was first reduced from an initial discharge of current. So it is that the potential difference at the supply may be altered but its material properties do not change. Therefore there has been no effort made to quantify the amount of energy that is returned to the supply, as this no longer has a quantifiable relevance to standard measurement protocols.

It is to be noted that the controls were established to a limit of 50 watts. Therefore temperatures recorded in excess of 170°C above ambient are not precisely related to a wattage value. But as all dissipated energy in all four tests recorded herein resulted in an infinite COP, then there is gross evidence of wattage dissipated, which is in line with the predictions of that thesis. The research of this circuit was funded entirely by the authors and such funding is constrained. The hope is that these results will merit further research and investigation through a far wider academic forum that these protocols can be better established.

IX. Conclusion

The results that are shown in this report are consistent with all previous reported test results related to this circuitry. These tests, circuit variations and even replications have been widely reported. The difference here is in the generation of a continuous and self-sustained oscillating condition over an extended period following the application of a negative signal at the gate of Q1. This appears to enhance the circuit performance to what is now measured as an infinite co-efficient of performance (COP). Infinite COP is defined as the condition where more energy is measured to have been returned to the energy supply source than was first delivered. While this value has indeed been carefully evaluated it flies in the face of classical prediction and it is therefore preferred that the results are more widely replicated and verified. This can be through replication either of the experimental apparatus or through simulation software.

Some mention must be made of those aspects of the tests that have not been thoroughly explored. The first relates to the batteries rated capacity. The batteries used in these experiments have been used on a regular basis for over 10 months. They have been dissipating an average wattage conservatively assessed at 20 watts for five hours of each working day, during that period, continually subjected as they were, to both light and heavy use. Notwithstanding this extensive use, they have never shown any evidence of any loss of voltage at all. Nor have they been recharged except for two batteries that caught fire. However there has not been a close analysis of the electrolytic condition of the batteries, before, during or even after their use. This requires a fuller study by our chemistry experts. Results therefore were confined to classical measurement protocols with the distinction that the energy dissipated at the resistor element was established empirically and as it related to the heat dissipated on that resistor.

Also to be noted is that there is a measure of inductance on the current-sensing resistor that begs some margin for error in the measurements. However, the measure of efficiency in the transfer of energy here is that extreme that a wide margin can be applied without materially altering these beneficial results.

It is, in any event, clearly evident that the circuit benefits from the inductances that are measured over the circuit components, including the wiring. As this is both inexpensive and easy to incorporate into circuit designs then the indications are that this aspect of the technology is easily established. What is needed is fuller research into the critical amounts to enable the burst oscillation mode and, indeed, into the requirements that enable this negative triggering of the oscillation, in the first instance. The potential for the circuit to be used in a booster converter mode also begs the requirement for more robust transistors than is available in the market.

There was no attempt made in these tests to precisely quantify the energy delivered by the battery as this relates to the measured rise of temperature over the resistor element. This was based on the fact that in all tests and, notwithstanding variations to the frequency and offset adjustments, the results show a zero discharge of energy from the battery supply. Therefore, any measured rise in temperature over ambient on the resistor element is seen as being anomalous.

It is also to be noted that the simulation of these waveforms are possible and the measurements also reflect the advantage of that oscillation. As the software for simulations are based on classical protocols then one may assume that classical measurement allows for these results. Certainly they confront Kirchhoff's Laws albeit that they are in line with Faraday's Inductive Laws.

Also of interest is that in subsequent tests, some measure of success has been achieved in applying the driving signal to the switch without the use of a functions generator. The evidence is that the same benefits are apparent but the stability of the signal is still to be improved. What this does show is that questions related to grounding issues are obviated. Also, there were those who suggested that the extra energy is actually coming from the signal supply. These concerns are also thereby discounted.

The thesis that predicted these results points to the possibility that an energy supply source, not factored into classical analysis, is hidden in the inductive and conductive material of the circuit components. This would still be in line with Einstein's mass/energy equivalence as the quantity of binding fields would be consistent with the size of the bound structure and quantity of its material properties. And the thesis proposes that these inductive and conductive materials are able to induce their own energy as a result of applied potential differences. Effectively the magnetic field model proposes that there is a potential in induced negative voltages that has not, heretofore, been fully exploited. But the evaluation of that thesis is secondary to this submission, which relies on the assessment of these anomalous test results.

The intention of this paper is to bring these anomalies to the academic forum so that experts can research these effects more thoroughly. There are many questions here that need answers and it is considered that this is best established across a broad range of research to establish the checks and balances required for the progress of this and any new technology. The fact that these results can be simulated should enable an easy overview of these claims and also enable a wide range of participants to evaluate this evidence. This would be a desirable consequence, the more so as there may here exist some potential solutions to the global energy crisis that is growing ever more critical in the face of diminishing or pollutant energy sources coupled with our burgeoning global need for increased supplies. It must be remembered that this work has been open sourced and is not therefore patentable. It is hoped that further research in this field will follow suit in the interests of promoting a thorough understanding of this and the field study that preceded these experiments. Also we have not found reviewed publication of prior work into these effects, constituting, as it does, a marked departure from standard concepts related to the transfer of electric energy. This, therefore, constitutes a seminal study and it is therefore understood that this limits the citations.

X. References

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