Proposed variation to Faraday's Lines of Force to include a magnetic dipole in its structure

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Abstract-**A heat by product of an oscillation has an exploitable potential as this relates to the efficient use of energy, which is the subject of the first part of this two-part paper. This second part looks at the implications of that oscillation as it confronts certain assumptions related to current flow. An oscillation is induced on a circuit that then enables a reversing current flow that exceeds the circuit restrictions to this flow. This is explained using an extension to Faraday's model of Lines of Force to include a dual charge in the material property of current flow. These explanations form a small part of a non-standard magnetic field model that predicted and required these results. The analysis concludes that energy can be sourced from the inductive and conductive circuit material.**

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

I Introduction

A circuit (Fig 1) is designed to reliably induce an oscillation that is enabled for the duration that a negative signal is applied to the gate of the MOSFET Q1. The level of that oscillation can be varied through adjustments to the duty cycle and to the applied signal at the gate of the transistors. The waveforms (Figs 2 & 3) are typical examples of these oscillations that are induced from voltage measured across a current sensing resistor, (R_{SHUNT}) and the battery supply. The oscillations are robust and they represent a current flow that continually reverses direction. This results in a wide swing of the battery voltage that climbs and falls, well above and below its rated capacity. Also, of interest is that there is no circuit path afforded for this discharging period of each cycle within the standard reference, as its path is blocked, both by the transistors' body diodes and the negative signal applied at the transistors' gates. Nor indeed have the transistors been compromised to allow for this half of each oscillation. This raises the questions as to what there is in the property of current flow relating to this oscillation that is able to exceed the circuit components' physical restrictions to this flow and what accounts for the extreme range of the battery voltage resulting from this oscillation.

These questions can be answered within a classical context as it relates to the both the Laws of Charge and Inductive Laws, here modelled with a modification to the standard reference. The modifications are to concepts related to Faraday's lines of force (Fig 3) that are extended to incorporate a dual charge in a proposed material property of current. Effectively the proposal is made that while multiple lines of force comprise a magnetic field, each line is structured from magnetic dipoles that are naturally organised at 180 degrees to each other. It is then argued that voltage is an imbalanced, open condition of a magnetic field and that current flow is the transfer of those fields through a circuit and back to its terminal source. By returning to the source it is then able to reduce that charge imbalance by closing those open lines or strings. In this way, the justification or direction of current flow is then led by either a positive or a negative charge depending on the applied voltage and the material source of that voltage. And this charge presentation can then be either repelled by, or attracted to, the ionised condition of various transistor materials or to the charge presented at the transistor's gates. This would then allow for the flow of current or not, depending on the negative or positive charge presented to the circuit and circuit components that are in the path of that flow of current, and on the polarisation of the voltage that has induced that current flow.

The question that remains outside the scope of this study, relates to the location of this source of this energy if it is not, in fact, coming from the battery supply source. This question goes to the heart of a thesis that was developed around a non-classical magnetic field model that predicted these results. The relevant aspect of that model is that it requires this oscillation as a result of the exchange of energy that is supplied by the circuit material. The proposal is that the voltage and the resulting reversing flow of the induced current from the oscillation itself, is led by an opposite charge to the battery primary supply and that the material property of charge is from the circuit material itself. These results are measured in tests that relate to the first part of this two-part paper. What is here intended is to model the current comprising magnetic dipoles and to show that the circuit paths would then allow that current reversal without a discharge of energy from the primary battery supply source.

II The Circuit Apparatus

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.

A The Circuit Operation

The circuit is designed to allow a secondary current flow that is induced from the collapsing fields of inductive components in the material of the circuit, during the OFF period of the duty cycle and as a result of counter electromotive force (CEMF). A reverse current path is enabled by the paralleled Q-array positioning of MOSFETs (Q1 & 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. The 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.

R. Ainslie (Cape Town, South Africa) is the pioneer of this technology having developed a revised electromagnetic model (e-mail: ainslie@mweb.co.za).

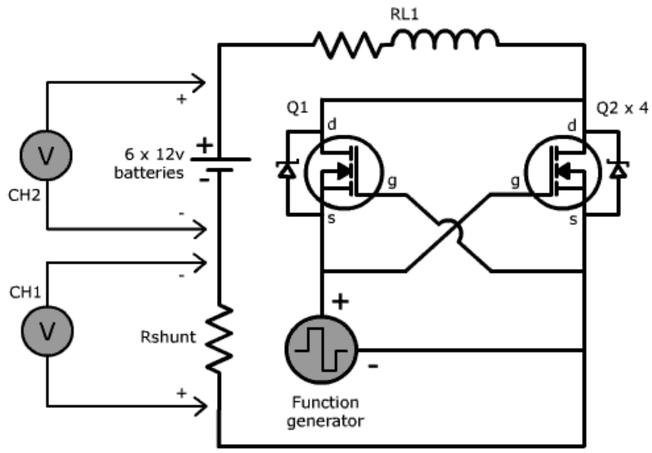

Fig. 1. Circuit schematic including probe positions.

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

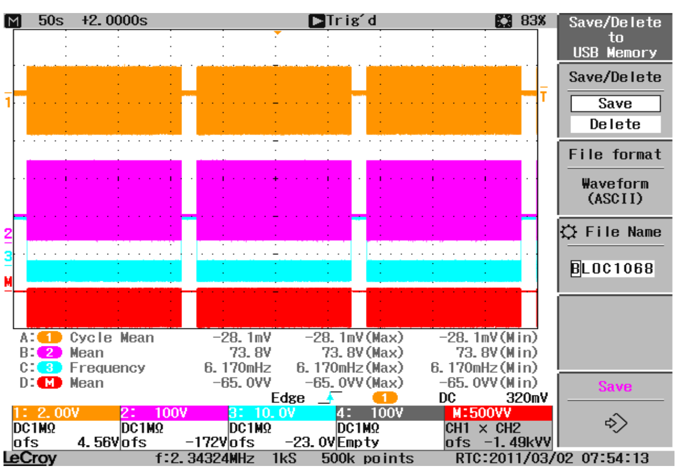

Fig. 2.

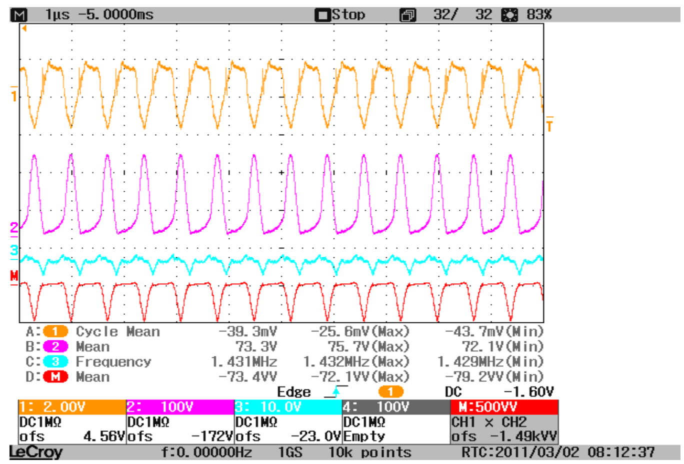

Fig. 3.

B Measuring Instruments

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).

III DISCUSSION

A Lines of Force

It is proposed to extend the model of Faraday's Lines of Force to address certain questions related to solid-state devices that, under usual switched conditions, prevents the flow of current through a circuit (Fig 1). An oscillation is here deliberately induced that results in a reversing current flow, which moves in both directions through the primary battery supply source. This reversal is evident from waveforms of the voltage measured across R_{SHUNT} and the battery supply (Figs 2 & 3). These waveforms present at precisely 180 degrees in anti-phase to each other and, as they persist for the duration that a negative signal is applied to the gate of Q1, they are seen to be self-reinforcing. Of special interest is that, during the discharge half of each oscillating cycle, the current is able to find a path through the circuit notwithstanding the restrictions to this flow that are presented by both the transistors' body diodes and the negative signal that is applied at the gate of Q1. Nor is there evidence that the transistors or any components are compromised to allow for this reversal. The question then is to find a path that will allow this discharge cycle, which can be answered by modelling a dual charge on the material property of current. This then allows for the flow of current in either direction.

Inductive Laws rest on the concepts proposed by Faraday that include magnetic fields that are structured along Lines of Force (Fig 4). On a permanent magnet, these Lines of Force are modelled as a coherent field condition arranged in multiple closed lines or strings. A magnet comprises not less than two opposing poles or charges that are spatially separated. The preferred alignment for permanent magnets is at an angle of 180 degrees at the opposing poles of each magnet. Correspondingly, the Lines of Force resulting from that alignment would then be consistent with the aligned magnets creating a magnetic field as a single composite of their individual fields.

It is here proposed to extend that model of Lines of Force to include the material property of magnetic dipoles (Fig 5). This extended model proposes that each magnetic dipole would comprise two opposite charges that are spatially separated. And their preferred alignment to other dipoles would also then be at an angle of 180 degrees. Therefore in line with the Laws of Charge, each dipole would then align against the opposite charge of proximate dipoles, thereby forming a closed string. This charge alignment would result in those magnetic dipoles structuring themselves into naturally occurring fundamental Lines of Force.

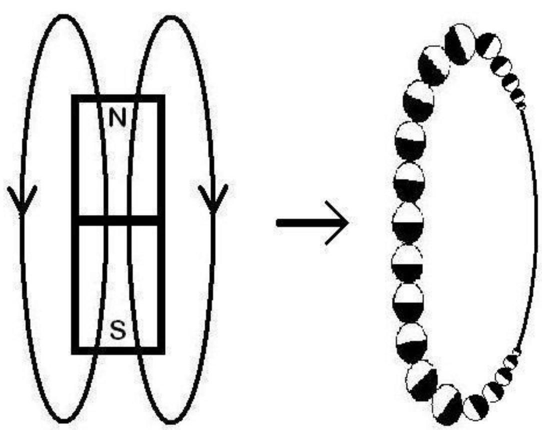

Fig. 4. & Fig. 5. Magnetic Lines of Force & magnetic dipoles

Current is widely ascribed to the movement of charge and it is known to induce electromotive force (EMF) on circuit material. EMF is measured as potential difference or voltage. And voltage, in turn, is a measure of an imbalance where the negative and positive charges are separated at the terminals of a supply source or across circuit components including the wire. This charge separation that is evident in voltage is consistent with the separation of the charge in magnets where the distinction is drawn that a magnet does not have a measured voltage imbalance. Negative and positive charge imbalance that is measured as voltage is reduced, proportional to the rate of current flow. As electromotive force is known to be proportional to the rate of change of magnetic flux, and as current flow is proportional to the rate of change of the electromotive force then it can be argued that both voltage and current flow may have this material magnetic property. (See Fig 6).

In line with this magnetic property, both current and voltage can, in turn, be modelled along Faraday's lines of force. However, since a magnet only shows a spatial separation of charge but does not have a measured voltage imbalance, then the further distinction is drawn that its field can be modelled as closed strings, which would result in a neutral charge. Conversely, it is then proposed that the charge separation that is evident in voltage is the result of open strings where the dipoles at each extremity present opposite but unattached charges. (See Fig 6) This would then allow for the measured voltage across that field where the predominance of charge is either positive or negative. Current would then comprise this material magnetic property to transfer those fields from one terminal to another, thereby effectively and systematically reducing the quantised number of those open strings to equalize the charge imbalance. If, as it is here theorised, current comprises the material property of magnetic dipoles, then this flow of current through a circuit, would then result in a redistribution of that magnetic field material from one terminal of the supply to the other, thereby corresponding to a reduction in the measure of voltage

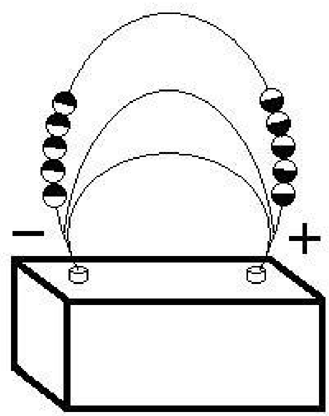

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Fig. 6. Voltage as Lines of Force

In summary therefore, it is proposed that current is the dynamic condition of voltage as it moves through space to transfer the material Lines of Force from voltage. And current may then lead with either a positive or a negative charge depending on the induced and corresponding positive or negative voltage and the source that initiates that potential difference. Therefore too, this model proposes that current returns the magnetic material from the open Lines of Force of voltage back to the opposite terminal of the supply source being either the primary battery supply source or the circuit material. When the induced current returns to its opposite terminal it reestablishes a charge balance by closing those open strings. This neutral condition allows for the redistribution of that charge material that can now reorganise its orbits, or spins to establish a charge balance. This adjustment re-establishes the balanced charge distribution of the material at the supply source, which results in a reduction to the potential difference that is induced from EMF. And this in turn, raises questions as to what it is that is dissipated from circuit components if, as is here proposed, there is a total conservation of this charge material. This last question is answered in a discursive analysis included in the Appendix.

What follows is a detailed account of the phases of the oscillation, the induced CEMF, the charge nature of the resulting induced current flow and the circuit paths that are proposed to allow this flow.

B Circuit Paths

Under typical conditions of a switched ciruict (Fig 7) and during the ON period of a duty cycle, closed circuit conditions allow the flow of current from the anode to the cathode of the battery supply. The arrows in Figure 7 indicate a clockwise justification of this current flow. This justification or direction of flow is modelled that the current leads with the positive charge of each dipole. This is consistent with the positive voltage imbalance at the source and is measured as a positive voltage across R_{SHUNT}. The ionised condition of the body diodes and the applied charge at Q2 repel a positive flow of current. The path for current flow is therefore permitted through Q1 across the applied positive signal at the gate and then through to the source back to the negative terminal of the battery. Under conventional conditions, this current then results in the potential difference that is developed across the circuit components including R_{L1}. Also, under typical switching conditions the discharge of energy during this ON period of the duty cycle corresponds to a negligible, if any discernible drop in battery voltage except as this is seen over time and as it relates to the rate of current flow.

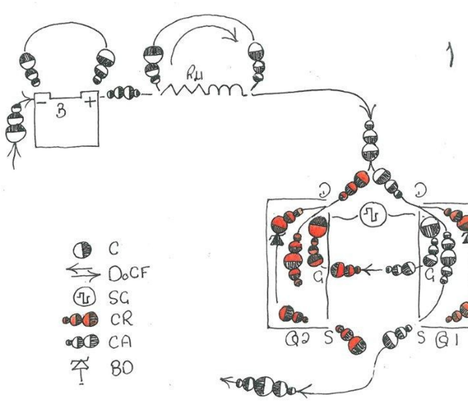

Fig. 7. Standard Clockwise justification of current from ON period of a switching cycle. C – charge -/+, DoCF - direction of current flow, SG - signal generator, CR – charge repulsion, CA – charge attraction, BD – body diode.

It is possible to tune the offset of the signal generator that no current is delivered during the ON period of the duty cycle which is the setting required for this test example as seen in Fig 8. A small voltage spike is induced on the circuit at the termination of the ON period, which initiates the oscillation. This then ramps up in gradual increments until it establishes a peak at an oscillating frequency when the amplitude of the oscillation becomes fully established. The frequency of the oscillation is determined by the inductance and impedance of the circuit components. But no current flow that is generated from this oscillation can have been discharged by the battery supply, under open circuit conditions.

It is proposed that the oscillation is established in phases. As mentioned, a small voltage spike is first induced at the termination of the ON period when the circuit is opened. Effectively R_{L1} and the circuit wire develop an initialising potential difference where the amplitude of the voltage is restricted to an induced voltage across the circuit components for a short duration. It then collapses to zero and the resulting CEMF then initialises this first phase of the oscillating cycle (Fig 9).

In line with these proposals voltage comprises open Lines of Force that, in turn, comprise the magnetic material of dipoles. Therefore, in collapsing from that small positive value back to zero this initialising potential difference represents magnetic fields that are changing in time. Magnetic fields that are changing in time induce electric fields in line with Inductive Laws.

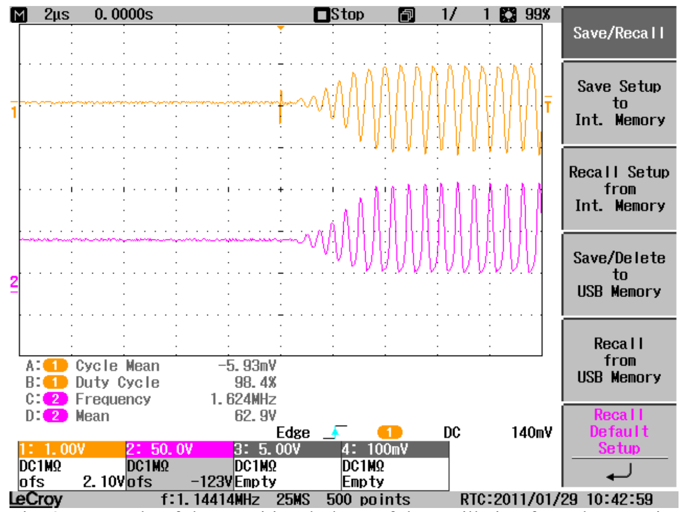

Fig. 8. Example of the transitional phase of the oscillation from the negative triggering at the termination of the ON period of the duty cycle.

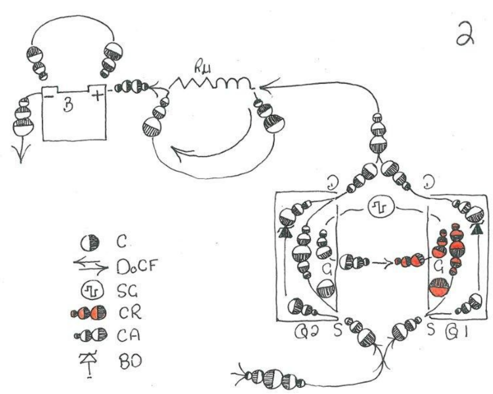

Fig. 9. The Counter-clockwise justification of current from CEMF 1st phase of oscillation. C – charge -/+, DoCF - direction of current flow, SG - signal generator, CR – charge repulsion, CA – charge attraction, BD – body diode.

Therefore CEMF is established on that same circuit material with a reversed polarity to the supply. The resulting induced current now leads with a negative charge (Figure 9) induced from the negative voltage across R_{L1} and other inductive and conductive circuit material including the wire. This voltage or potential difference generates a current flow in a counter-clockwise direction. And the path for this flow is first allowed through the battery supply, then through either or both of Q1 and Q2s' body diodes and/or across the gate of Q2 where the applied charge is sympathetically aligned. In effect there are multiple paths and no material restrictions to this counter-clockwise justification of current flow at the transistors during this phase of the oscillation.

The current then discharges this small potential difference or voltage, which then induces the next phase of the oscillating cycle. As in the both the preceding phases including the spike and the subsequent first phase of the oscillation, the collapsing EMF would again represent magnetic fields changing in time (Fig 10). Changing magnetic fields induce electric fields in line with Inductive Laws and therefore again, these collapsing fields, also, and in turn, induce a reversed EMF over the same inductive circuit components including R_{L1} and the wire. This CEMF therefore reverses from a negative to a positive voltage or potential difference. But the model requires that the current induced from the circuit material remains negative and conversely the current discharged from the primary battery supply remains positive. Therefore the alignment of the magnetic dipoles from this induced current flow would now lead with negative charge, which, nonetheless, would reverse to move clockwise through the circuit. And the path for this phase of the oscillation is through the battery which still has an open circuit condition and through either or both the body diodes of Q1 and Q2 and a further optional path across Q1 with the applied negative signal. As in the discharge of the initialising EMF there are, therefore multiple circuit paths to enable this reversed current flow that now leads with a negative charge during this phase of each oscillation.

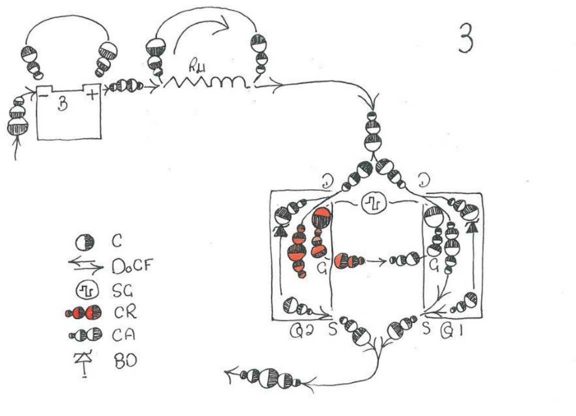

Fig. 10. The Clockwise justification of current from CEMF 2^{st} phase of oscillation. C – charge -/+, DoCF - direction of current flow, SG - signal generator, CR – charge repulsion, CA – charge attraction, BD – body diode.

These cycles are repeated with small increments to the applied voltage from CEMF until a peak negative and positive voltage is reached that corresponds to the full value of the induced EMF that is available from the inductive and conductive circuit material. The peak positive and negative of each cycle represents the moment that current flow reverses. And this peak, in turn, corresponds to an increase or decrease of the voltage across the battery supply. This is when the oscillation is fully established and it will continue to oscillate at this level, for an indefinite period provided only that the negative charge is applied at the gate of Q1. In effect, the circuit material itself is now proposed to be the energy supply source to enable the continued oscillation.

Of interest is that whether the voltage across the circuit material is positive or negative, in terms of this model the circuit material always induces a current flow that leads with an opposite charge relative to the primary supply. Also of interest is that the paths that allow this oscillation may be provided exclusively by the material structure of Q2 provided that the transistor includes a body diode as provided by a the MOSFET IRFPG50. The use of Q1 is only required to determine the amount of energy applied during the ON period of the duty cycle from the battery supply source, which would be determined by the circuit's intended application. But it is evident then that Q1 is able to add to the potential paths, as the induced current itself would lead with a negative charge during this phase of the oscillation.

IV Conclusion

The voltages across the battery and R_{SHUNT} are at 180 degrees in anti-phase indicating that the battery is charged and discharged depending on the directional flow of current. When the full oscillation amplitude is established, then the counter-clockwise current is seen to peak when the battery voltage is approximately double its rated capacity. And, correspondingly, the clockwise current peaks when the battery voltage approximates zero (Fig 3). If the CEMF from inductive circuit components, including R_{L1} and the wire, are in fact the energy supply sources driving this oscillation, then it appears that the amount of energy that it is able to generate is somehow related to and, possibly, indirectly determined by, the amount of potential difference at the battery. This can be explained as the current that is induced from the oscillation, adds to or subtracts from the potential difference at the supply. It thereby imposes the battery supply's innate imbalance into each phase, which increases the potential difference available to the circuit to drive that oscillation.

Effectively, therefore, the battery primary supply represents the only component on the circuit that has an intrinsic charge imbalance. Therefore at each zero crossing, which is the point when the current entirely discharges the potential difference across the circuit material, then the voltage across the battery moves to its average voltage which, unlike the circuit components, is always greater than zero. Therefore too, the CEMF will add to or subtract from that battery average depending on the applied voltage and direction of current flow. This, in turn, thereby imposes a greater potential difference at the battery than its rated capacity.

A capacitor has no retained potential difference after a discharge of its energy. Therefore, to test whether this retained potential difference is a required condition to enable the oscillation, capacitors were applied to the circuit during operation when the oscillation was fully established. The batteries were then disconnected leaving the capacitors in series with the circuit and the oscillation then collapsed to a zero voltage. This evidence may support the conclusion that the retained potential difference at the primary supply source is required, if not entirely responsible, for driving this oscillation. Which, in turn, points to the need for any applications of this technology that are either restricted to battery supply sources or, if a grid supply is used, that the circuit is applied directly in series with that supply source thereby being able to access the potential difference at that supply.

If CEMF is indeed the result of generated rather than stored energy then correctly the sum of the energy that is thereby induced will be added to or subtracted from the potential difference at the battery supply. Effectively, P = vi dt where both the induced voltage and the resulting amperage are from the circuit material rather than from the battery supply source. Therefore, with the proposal that the circuit material is a potential energy supply source, these results would conform to Kirchhoff's unity requirements and would indicate that there is indeed a net loss of energy to each oscillating cycle that then corresponds to the amount of energy dissipated as heat at R_{L1}.

However, the distinction is drawn that the battery primary supply is a passive component during this oscillation. And while it is evident that it fluctuates in line with the applied current flow from the oscillation, yet its average voltage does not appear to rise significantly above its rating either during or after these tests which would be proof of a recharge in the oscillation cycle. But nor is there evidence of a loss of voltage. In fact these results point to an energy supply potential in circuit material that may be exploited without a corresponding loss of energy from the battery supply source. This requires a fuller study, which is the overarching intention of this publication.

The theorised imposition of a dual charge potential on the properties of current may answer the questions related to the path for the flow of current through this circuit during the oscillation phase. But it is stressed that this extended charge potential to current flow, in no way contradicts the established model. What is does confront is the wide assumption that electrons are the carrier particles in the electromagnetic interaction as electrons are known to be negatively charged. The further concern is that the proposed magnetic dipole remains speculative, as it has never been detected. The appendix includes a discursive analysis that may qualify the use of the magnetic dipole model as a material property of current.

The hope is that publication of these results recorded in this second part of the 2-part paper as well as the first part, will encourage wider research and investigation to either prove or disprove these claims and the premises of those claims which is the overriding requirement of publication. The actual rate of charge and the condition of charge of the battery primary supply requires the analysis and expertise of chemists, which is also hoped will be included in a broader investigation of these effects. There is, however indication that this oscillation may be exploited to generate clean, non-pollutant energy.

V Appendix

A A Discursive Analysis to Justify the Existence of the Magnetic Dipole

It seems that much is known about the conditions required to sustain a fire or flame, while little is actually understood about its material properties. For instance, it is known that fire requires oxygen in the atmosphere for it to burn, but a nuclear fire, such as in the sun, does not require this. The following simplistic and hypothetical experiment is used to explore the property of fire and, by extension, the material property of the magnetic field.

Place a pile of wood under a ceramic pot holding iron filings. Then set the wood alight. Flames would heat the ceramic pot and this heat would then transfer to the environment inside that pot. With a required sufficiency, the heat would then melt the filings to form a liquid. This experiment would conclude precisely when the fire extinguishes which, in this theorized example, would also be precisely when the filings will have coalesced into a liquid. Then the ceramic pot would cool and the liquid iron solidify, and in the process of solidifying it would also shrink in volume compared to its liquid state.

Assume also that, at the beginning of that experiment, a detailed account is made of the number and type of atoms and molecules in the wood, in the ceramic pot and in the iron filings. Then at the end of that experiment all those atoms and molecules associated with that energy exchange during the fire, would still be fully accounted for. For instance, some of the carbon atoms in the wood may have combined with oxygen in the atmosphere to form carbon di-oxide. Yet other exotic gas molecules may have escaped. The small volumes of moisture in the wood may be vaporized into steam. But the structure and weight of the ceramic pot would remain substantially the same except that it may show evidence of cracking and heat fatigue. The amount of the iron would match its quantity as filings. And the most of the carbon atoms in the wood would be there in the loose ash condition of its burnt out state.

Which begs the question, what actually has changed as a result of that fire if the atoms themselves remain inviolate? And the answer is evident in the wood that will have lost its bound condition. Conversely, the previously unbound condition of the iron filings would have become bound. And other than a few escaping gas atoms and molecules, all those atoms involved in and associated with that fire, may not only be entirely accounted for, but they would and do remain substantially unchanged. The actual atoms comprising all parts of that experiment and its experimental apparatus remain exactly as they were prior to their exposure to those flames. It is only their bound condition that would have been altered.

In as much as the atoms are known to remain unchanged as a result of the fire, then the material source of fire may have little, if anything, to do with an interaction between those atoms. The fire itself may have a material cause that is extraneous to the atomic material from its source. If so, and as it results in an unbinding in that transfer of its heat from the material of the wood to a binding of the material of the filings then, what is actually being transferred in that exchange of energy, may be that binding material. By extension, therefore, this binding material may also be the material property of that flame. Which allows for the possibility that three-dimensional bound structures, be they liquid, solid, or molecular, may be bound by something that is extraneous to the atom.

It is this 'something', this binding material, which is here proposed to be the hidden material structure behind all the forces. A magnetic field model identifies this as a single discrete, one-dimensional closed string of orbiting magnetic dipoles structured as a Line of Force (Fig 5). And this precise one-dimensional field is identified as the fundamental structure upon which all the Lines of Force are developed because it is, in fact, all that is needed. It is the essential and profoundly elementary structure required to potentiate and interact with the three valence conditions of atomic charge. For ease of reference this orbiting string of dipoles will be called a 'binding field'.

The assumption is made that these binding fields are magnetic and that they are constrained to only interact with other magnetic fields. They obey an immutable imperative to move to a condition of charge balance. And this, the actual atomic binding could, therefore, be managed by an orbit of these strings, which can be seen, in the mind's eye, as a small cog, (the binding field), interacting with the boundary of a bigger cog, (the atom's outer energy levels). Both fields are proposed to comprise Lines of Force. And, being closed strings, then the charge of both the atom's energy levels and the binding fields are perfectly balanced and thereby rendered undetectable. The difference in these two fields is proposed to be only that of size. The atomic energy levels are proposed to be more complex, two-dimensional magnetic Lines of Force, having length and breadth.

But the question remains. Why are these fields undetectable? And the proposed answer to this is that they are indeed detectable. They are seen every time we light a fire. In effect, flame itself is proposed to be the hot material property of magnetic dipoles that have moved out of their field condition as a coherent Line of Force into a chaotic imbalanced mass of conflicting raw charge. As there is a proposed and immutable imperative for these dipoles to structure in an orderly field, then they needs must search out material in their immediate environment to reassemble into those discrete and structured fields. In effect, they are looking for something to 'bind'. And having found the required disassociated atoms or molecules they can then transfer through space to reassemble into those discrete packages of their coherent field condition, by binding disassociated atomic material.

A variation of this 'unbinding' and 'binding' is proposed to be the motor that drives the electromotive force. But to explain this first requires a close analysis of the closed Line of Force. One half of each of those closed strings will oppose the other half. And if they orbit, then one half of every orbit will still oppose the other half. The orbit itself is always a composite of a potential bi-directional path through space. And whether the orbit is clockwise or a counter-clockwise, then that neutral condition of the whole of the field would yet pertain. In effect, each Line of Force, whether or not it is orbiting, would be balanced by its own innate structure, which would render the binding field neutral. The field therefore, essentially comprises the sum of two opposite potential spins and therefore, two opposite charges. Yet each part of each field would be charged, determined by the alignment and/or the justification of those magnetic dipoles.

Current flow, on the other hand, is proposed to be the dynamic condition of voltage that comprises open strings. And its movement through the circuit is led by a single justification or direction or charge. It is either the negative or positive half of each dipole leading the string that also leads the current. See figures 7, 9 & 10. And unlike the binding fields, current is known to be mono directional therefore it only has one charge. The binding fields are located in that circuit material that is presenting a path for the flow of current. Therefore when current flows through the circuit material it repels that half of each of those binding fields in its path that present a 'like' charge. And this force of repulsion is then proposed to break the symmetry of that orbit of these binding fields.

Broken Lines of Force would also be open Lines of Force. And unlike their closed condition, open Lines of force have an identifiable charge. In terms of the Laws of Charge, like charges repel. So one half of that field will, of necessity, be repelled by the current charge. And having been repelled it then restructures as an open field outside that structure to be measured as voltage. This is proposed to be the source of the voltage that results from EMF.

The remaining half of those Lines of Force, are now no longer able to attach or to orbit. These fields remain within the structure of the circuit material. But they have lost that interaction with the atom's valence energy levels, which thereby become unbound. These broken Lines of Force tumble out of their coherent field condition and, like the sparks in the flame, they get bigger and hotter as more and more of these fields move into this shared state of chaos. These broken strings then lose their orbital momentum. This unbinding, or unbundling of the field string structure, represents a chaotic condition where the level of binding of the circuit material becomes compromised. The early evidence of this is that the material itself expands to accommodate the increased volume of these, now big, hot and slow, magnetic dipoles. So it is that the particles themselves are here proposed to be the source of heat, which is exploited in electrical applications.

The magnetic field model referenced hereunder, has proposed that these Lines of Force comprise magnetic dipoles. It further proposes that all particles are composites of these tachyons. And as the model is able to resolve the mass/size ratios of the proton to the electron, it may thereby constitute some proof of postulate. The objective of this appendix is to summarize these concepts relating to the electromotive force. It is stressed, however, that there is no material departure of these concepts to mainstream physics other than in the proposal of a magnetic dipole being the fundamental construct or 'building block' both of the magnetic field and of matter. The significant and further departure from mainstream is that these dipoles are here identified as the material structure of 'flame'. This, in turn, begs the ratio that in the field condition the particles are as fast and cold and invisible as, out of a field condition they are as hot and slow and visible. And their quantized value of spin and charge is required to be intimately variable depending on the atoms that they bind.

Also of significance is that these fields may be the source of the 'dark force' that has been proved by astrophysicists. And on a broader scale it may also be the source of the strings that are required by our string theorists. But, as it is based on Faraday's Lines of Force, then there are no significant departures from mainstream thinking. The hope is that it will resolve some outstanding questions related to those many paradoxes that are identified within mainstream that relate to quantum and classical physics.

VI References

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