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Proper Understanding of the Natures of Electrons, Protons, and Modifying Redundancies in Electro-Magnetism

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Abstract

When considering electromagnetism, the unit of the Ammeter's measurement should be limited to its proper unit in "Watt/Volt" which is, according to physical principles, the division quotient of the measured electrical power by its electrical potential. However, the Ammeter's reading has also a traditional definition as the rate of flow of electric charges whose unit is "Ampere". According to recent studies that define the electric charge as energy possessing an electric potential, such traditional definition is wrong as the Ammeter's reading should, then, has the unit "Watt". Such duality of the Ammeter's reading is due to the wrong definition of electric charges as electrons and insertion of the "Ampere", as a wrong unit of the flow of electric charges. This duality represents a "redundancy" in electromagnetism as the proper Ammeter's reading, in Watt/Volt, is a unit of entropy of the flowing energy charges. Such redundancy led to further redundancies in the field of electromagnetism. In this article, it is followed the impacts of inserting the "Ampere" as illogic unit and it is derived the proper modifications of the results of replacing the "Ampere" by its logical substitute "Watt/Volt". Such modifications lead to a robust definition of the electron as an elementary particle which has an elementary charge of energy 1.602×10^{-19} Joules and has a negative electric potential of 1 Volt and to a proper definition of the protons as elementary particles which are charged by a similar charge of electron, but it has a positive potential of 1 Volt. Additionally, the electron-volt is properly defined as an elementary charge whose energy is 1.602×10^{-19} Joules and whose potential is ±1 Volt. Such modifications also lead to improve the understanding of magnetic induction and modifying the equations that characterize the performance of electric machines. The truth of such innovative understandings is verified analytically and experimentally in this article.

Keywords

Electric Charge, Magnetic Flux, Electromagnetic Waves, Entropy, Field-Conductivities, Magnetic Induction

1. Introduction

Recent studies found all forms of energy, thermal, electric, or magnetic, have the same nature as electromagnetic waves which have corresponding potentials, *i.e.*, thermal, electric, or magnetic potentials [1]. According to such studies, the electric charge is properly defined as energy, or electromagnetic (EM) waves, that own its driving electric potential.

Investigating the Ammeter's measuring unit, its proper unit is the division quotient of the measured electrical power by its electrical potential in Watt/Volt [2]. However, the Ammeter's reading is traditionally defined as the rate of flow of electric charges defined as electrons and measured by Ampere. According to recent definition of electric charges as energy, should have the unit Watt [3] [4]. Such contradicting definitions of the Ammeter's reading and dual definitions of the electric charges, as electrons and energy, are called redundancy and led to further redundancies in the field of electromagnetisms [5] [6]. The sources of such redundancies are the wrong definition of the electric charges as electrons which are mass particles whose rate of flow should be in kg/s and insertion of "Ampere" as a unit of the Ammeter's readings [7]. The proper unit of the Ammeter's reading, as Watt/Volt, is thermodynamically known as a unit of the rate of growth of entropy of the Ammeter's circuit [7].

Table 1 shows the impact of such wrong definition of the electric charges as electrons or the double units of the Ammeter's reading on the non-homogeneity of the analogical electrical parameters and magnetic field parameters [8]. Approaches to models that fit the experimental observations of Ampere and Oersted in the field of electromagnetism found their deduced equations as empirical formula due to the wrongly introduced definition of electric current as flow of electrons [9]. Similarly, many researchers found errors and non-homogeneity in formula of electromagnetism [10]. Thinking all forms of energy, thermal,

Table 1. Inhomogeneity between units of analogous magnetic and electric parameters [8].

Magnetic quantity	Electric quantity
magneto-motive force Amp	Electromotive force Volt
magnetic field strength Amp	Electric field strength V/m
permeability kg m/sec^2/Amp^2	Conductivity Sec^3 Amp^2/kg/m^3
magnetic flux m^2·kg/sec^2/Amp	Current Amp
magnetic flux density kg/sec^2/Amp	Current density Amp/m^2
reluctance Amp^2/m^2·kg/sec^2	Resistance m^2·kg/sec^3/Amp^2

electric, or magnetic, have the same nature as electromagnetic waves deletes redundancies and represents a new understanding of the pure and dark energies as introduced in recent researches [11].

The solution to correct the found redundancies is dropping the Ampere, as an unnecessary or a confusing unit of the Ammeter's reading, from the electric literature and the SI system of units. In the following sections, it will be introduced the substitution rules for replacing such confusing unit by the properly derived Ammeter's unit, Watt/Volt, and replacing the Coulomb by Joule/Volt from laws and equations of electricity and electromagnetism. Such replacement leads to find the proper understanding of electron, proton, and the electron-Volt or EV. Regarding the newly defined similarities of thermal, electric, and magnetic energies as EM waves of corresponding potentials, their conductivities through any material are found to be equal. The proper understanding of the electric charges and magnetic flux as energy also leads to improve the understanding of magnetic induction and modify the equations that characterize the performance of electric machines. The truth of such innovative definitions is verified through an entropy approach and by investigating the records of stimulating charges.

2. The Substitution Rules for Dropping the Ampere and Coulomb from Laws of Electromagnetism

According to an entropy approach and results of Faraday's experiments, the electric charges and magnetic flux are properly defined as electrified or magnified electromagnetic waves that have their own driving electric potential or magnetic potentials [12]. According to the previous discussion, the Ampere as a traditionally used unit for measuring the rate of flow of electrons that are incorrectly defined as electric charges should be replaced by the properly postulated unit of the ammeter's reading "Watt/Volt". According to literature, such unit represents the division quotient of the electric power, $\dot{W}$, by the measured electric potential, Volts, as follows:

$$\text{Ammeter's reading} = \frac{\text{Electrical Power}}{\text{Electrical Potential}} \frac{\dot{W}}{E} \frac{\text{Watt}}{\text{Volt}} \quad (1)$$

Thermodynamically, the unit Watt/Volt is the unit of the rate of entropy growth through the tested conductor, denoted as $\dot{S}$ [13]:

$$\dot{S} = \frac{\mathrm{d}S}{\mathrm{d}t} = \frac{\text{electric power}}{\text{electric potential}} \frac{\dot{W}}{E} \frac{\text{Watt}}{\text{Volt}} \quad (2)$$

where, $\dot{W}$ is the electric power passing through the conductor, and E is the measured electric potential across such conductor [14]. According to thermodynamic definitions, the Ammeter shown in **Figure 1** measures the capacity of the connected conductor to allow the flow of electric power $\dot{W}$ per unit potential across the conductor or the rate of growth of entropy though the connected conductor in Watt/Volt [15]. So, the entropy growth through a conductor is defined by the division quotient of the energy of the flowing electric charge

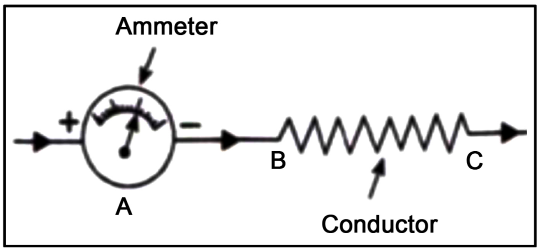

Figure 1. Ammeter's connection to a conductor to measure the rate of growth of entropy though such conductor in Watt/Volt [14].

"$\delta Q_{\text{electric}}$" Joules through the conductor by the potential drop "E" Volts across the conductor according to the following equation [15]:

$$\text{d}S = \frac{\delta Q_{\text{electric}}}{E} \frac{\text{Joule}}{\text{Volt}} \tag{3}$$

Figure 2 shows the record of a stimulating electric charge whose ordinate is the potential of the electric charge, in Volts, and whose abscissa is entropy growth during the injection process, in Joule/Volt [15]. Such change or growth of entropy is found as the product of the Ammeter's readings, $\dot{S}$ Watt/Volt, times the time of injection, δt sec, according to the following equation:

$$\Delta S = \dot{S} \frac{\text{Watt}}{\text{Volt}} (\text{Ammeter's reading}) \times \delta t \text{ sec} \cdot \frac{\text{Joule}}{\text{Volt}} \tag{4}$$

According to **Figure 2** and Equation (4), the energy of the injected charge can be determined as follows:

$$Q_{\text{electric}} = \int E \text{d}S \text{ Joules} \tag{5}$$

So, the "Ampere" will be replaced by the properly postulated unit "Watt/Volt" according to the following equality [16]:

$$\text{Ampere} \equiv \frac{\text{Watt}}{\text{Volt}} \equiv \text{unit ofthe rate of entropy flow } \dot{S} \tag{6}$$

However, the Ampere and the Watt are traditionally defined as follows [15]:

$$\text{Ampere} \equiv \frac{\text{Coulomb}}{\text{sec}} \tag{7}$$

$$\text{Watt} \equiv \frac{\text{Joule}}{\text{sec}} \tag{8}$$

From Equations (5) (6) and (7), we get:

$$\text{Coulomb} \equiv \frac{\text{Joule}}{\text{Volt}} \equiv \text{unit of the entropy flow } S \tag{9}$$

Such equations will be used to replace the Ampere and Coulomb as wrong units by the proper units, Watt, and Joule.

3. Proper Understanding of the Electron and the Electron-Volt

According to the traditional literature, the electron is recently defined as an

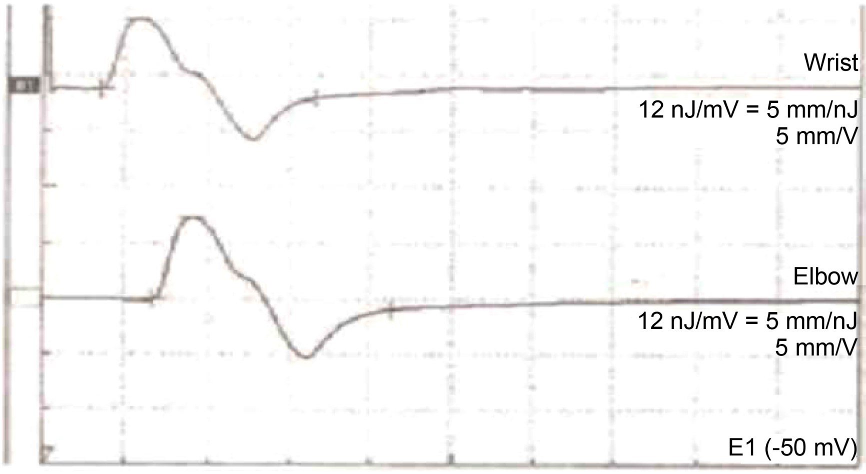

Figure 2. A machine record of a stimulating electric charge injected inside the neural system (the upper wave) and the stimulated response of the neural system (or nerve impulse). The ordinate shows the potential of the electric charge in mV and abscissa shows the entropy growth during the flow through the Ammeter as the product of the Ammeter's reading times the time of flow in nJ/mv [14].

elementary particle consisting of a charge of negative electricity equal to about 1.602×10^{-19} coulomb and having a mass when at rest of about 9.109×10^{-31} kilogram or about 1/1836 that of a proton [16]. This definition involves an entity called "electricity" which has the unit "Coulomb" [17]. Identifying such "electricity" which is measured by an unknown Coulomb as a unit the entropy of the electron's charge in Joule/Volt, it is possible to conclude the following equation:

$$S_{\text{electron}} = 1.602 \times 10^{-19} \frac{\text{Joule}}{\text{Volt}}. \tag{10}$$

According to literature, the electron gains its energy by acceleration in electric field of potential −1 Volt [18]. This indicates that the electron's charge has energy that has an elementary potential of −1 Volt postulated as follows:

$$E_{\text{electron}} = -1\ \text{Volt} \tag{11}$$

According to Equation (5), the electric energy of the electron's charge can be determined as follows:

$$Q_{\text{electron}} = S_{\text{electron}} \frac{\text{Joule}}{\text{Volt}} \times E_{\text{electron}}\ \text{Volt} \tag{12}$$

Substituting the values from Equations (10) & (11) into (12), we get

$$\text{The energy of an electron's charge} = 1.602 \times 10^{-19} \frac{\text{Joule}}{\text{Volt}} \times 1\ \text{Volt} = 1.602 \times 10^{-19}\ \text{Joules} \tag{13}$$

So, it is possible to modify the old traditional definition of electron, which involves a confusing unknown entity called as "electricity", by the following proper or innovative definition: The electron is an elementary particle which is charged by an electric charge whose energy is 1.602×10^{-19} Joule and whose electric potential is −1 Volt.

Denoting the electron's entropy of the value 1.602×10^{-19} Joule/Volt by the symbol "e" as follows:

$$e = 1.602 \times 10^{-19} \frac{\text{Joule}}{\text{Volt}} \tag{14}$$

and using Equation (12) to express Q_{electron} involving the symbol "e":

$$Q_{\text{electron}} = e\frac{\text{Joule}}{\text{Volt}} \times -1\ \text{Volt} = -1\ \text{eV Joules} \tag{15}$$

According to Equation (15), the traditional definitions of the elementary particles and elementary charges can be properly defined as follows: the electron is a charged elementary particle having a mass when at rest of about 9.109×10^{-31} kilogram or about 1/1836 that of a proton and having an elementary charge of energy −1 eV. The elementary charge "±1 eV" has energy of $e = 1.602 \times 10^{-19}$ Joules and potential of −1 Volt if it is a negative charge as the energy of electrons and +1 Volt if it is a positive charge as the energy of protons.

To prove the truth of the innovative definition of the electron as a particle which has an elementary charge of energy 1.6×10^{-19} joule and an electric potential of −1 Volt, it will be analyzed the measured energy and potential required for water separation into Oxygen and Hydrogen. According to the chemical textbooks, Oxygen atom shares one pair of valence electrons with each hydrogen atom [16]. Each pair of shared electrons represents one covalent bond. So, two covalent bonds hold the water molecule together. It is found that the potential required for separation of the Hydrogen atoms by an electrolyzing rod should have a potential just more than +1 Volt that corresponds to the estimated potential of the newly defined electron's charge. It is found experimentally that the required potential for attracting the electron binding the Hydrogen atom to the Oxygen atom is 1.25 to 1.5 Volt that prove the truth of the definition of the electron's potential of −1 Volt. Additionally, it will be estimated the required energy for performing such attraction for every Hydrogen atom which depends on considering the electron's energy = 1.602×10^{-19} Joule. Such estimation, if it is correct, will prove the truth of the innovative definition of the electron as an elementary particle which is charged by energy of −1 eV.

The equation that is used to estimate the separation energy of 1 Mole, or 18 kg, of water, which contains A_g (Avogadro's number) molecules of water to produce 2 kg of Hydrogen "$E_{\text{seperation}}$" is [19]:

$$\begin{aligned} E_{\text{seperation}} &= \text{number of bonding electrons} \\ &\quad \times \text{the energy of charge of each bonding electron} \end{aligned} \tag{16}$$

Substituting the previously mentioned data in Equation (16), the energy required for separation "$E_{\text{seperation}}$" can be estimated as follows [18]:

$$\begin{aligned} E_{\text{seperation}} &= \text{number of bonding electrons} \times \text{energy of the bonding charges} \\ &= 1.6 \times 10^{-19} \times 12.044 \times 10^{26} = 38.54 \times 10^{7}\ \text{Joule} = 53525\ \text{kW} \cdot \text{hr} \end{aligned} \tag{17}$$

However, the measured energy for generation of 2 kg of Hydrogen, by industrial electrolysis is found as 78 kW·hr [20]. Hence, the efficiency of the generation process can be calculated as follows:

$$\text{Efficiency of the separation process} = \frac{\text{ideal energy of seperation}}{\text{measured energy of seperation}} = \frac{53.525}{78} = 68.64\% \quad (18)$$

Such result proves the truth of defining the value of the energy of the elementary charge of the electron = 1.602 × 10^{-19} Joule that has a potential of −1 Volt.

4. Proper Units and Values of the Electric and Magnetic Conductivities

According to the found analogy between the laws that characterize the flow of heat, electric charge, and magnetic flux, and to the common nature of the three forms of energy as electromagnetic waves of corresponding potentials, it is expected to find equal values and dimensions of their conductivities [21]. However, the insertion of the Ampere, as a confusing unit of the Ammeter's reading, represents a source of violating such expected conclusion. As the dimensions and units of the thermal conductivity are based on the Fourier's law of conduction which doesn't involve a term of dependence on the Ampere, it will be considered as the reference guide for estimation the electrical and magnetic conductivities.

The thermal conductivity of a material is usually defined by the Fourier's law as follows [22]:

$$\dot{Q}_{\text{thermal}} = k_{\text{thermal}} A \frac{\mathrm{d}T}{\mathrm{d}x} \text{ Watt} \quad (19)$$

So, the thermal Conductivity can be expressed as follows:

$$k_{\text{thermal}} = \frac{\text{rate of flow of thermal charges as energy}}{l \times \text{thermal potential}} \frac{\text{Watt}}{\text{m} \cdot \text{K}} \quad (20)$$

In electric literature, the definition of the Ammeter's reading as a unit that depends on the "Ampere", as a unit of the rate of flow of electric charges, represents a source of confusions in deriving the dimensions of the electric conductivity. To determine the correct dimensions of the electric resistance, an analogous form of Fourier's law for electrical conduction will be considered as follows:

$$\dot{Q}_{\text{electrical}} = k_{\text{elect}} A \frac{\mathrm{d}E}{\mathrm{d}x} \text{ Watt} \quad (21)$$

So, the electric conductivity will be also expressed as follows:

$$k_{\text{elect}} = \frac{\text{rate of flow of electric charges}}{l \times \text{thermal potential}} \frac{\text{Watt}}{\text{m} \cdot \text{Volt}} \quad (22)$$

According to a previous chapter of an online published book [23], the Volt was assigned as a unique unit for all field-potentials, *i.e.*, the thermal, electrical, and magnetic potentials. Similarly, the temperature can be also measured by a thermocouple in Volts or a thermometer in degrees. To have a common unit for all potentials, the Volt is chosen and the value for converting the "Kelvin", as a unit of the thermodynamic scale, into Volt, as a common unit for all potentials, is found according to the available measurement data of mostly used thermocouples as follows [24]:

$$1\,\text{K} = 0.06\ \text{milli Volts} \tag{23}$$

The value of the electric conductivity of iron is found after modifications to fit to the modified SI dimensions of conductivity as follows [23]:

$$k_{\text{elect,iron}} = 1\times10^{7}\ \text{W/m}\cdot\text{V} \tag{24}$$

While the tabulated value of the thermal conductivity is:

$$k_{\text{thermal,iron}} = 72\ \text{W/m}\cdot\text{K} \tag{25}$$

Replacing the value of 1 Kelvin in Equation (24) by its corresponding value in Volts according to Equation (22), the value of thermal conductivity of iron will be calculated according to the modified SI units as follows:

$$k_{\text{thermal,iron}} = 72/6\times10^{-6} = 1.2\times10^{7}\ \text{W/m}\cdot\text{Volt} \tag{26}$$

By comparing the values of the thermal conductivity and electrical conductivity, Equations (24) and (26), both conductivities are equal, *i.e.*,

$$k_{\text{thermal,iron}} = k_{\text{elect,iron}} \tag{27}$$

Such equality of the thermal and electrical conductivities, Equation (27), proves the common nature of the heat flux and electric charges in the form of EM waves.

However, Lorentz had achieved a similar conclusion of the equality of thermal and electric conductivities and casted such conclusion in the following equation [25]:

$$\frac{k_{\text{thermal}}}{k_{\text{elect}}} = LT \tag{28}$$

where L is called the Lorentz number which equals:

$$L = 2.54\left(\frac{\text{Watt}}{\text{Ampere}\cdot\text{Kelvin}}\right)^{2} \tag{29}$$

Logically the R.H.S. of Equation (25) should have the value 1 as Equation (27). The source of the difference is the dependence of Lorentz equation considering the Ampere, Watt/Volt, as a unit of the rate of flow of electric charge $\dot{Q}$ Watt, while it should be a unit of the rate of flow of energy in Watt. Such error is led to insert the temperature "*T*" in the R.H.S. of Equation (28).

While the magnetic permeability should have similar units as the electric conductivity, its unit in the traditional literature is the reciprocal of its electrical analogous units in Equation (22) [26]. The source of such error is the traditionally misused units of the magnetic flux, *B*, in Volt-sec while it should be in Joule, and the magnetic strength, *H*, in Watt/Volt.m, while it should be in Volt [26]. Following the results of Faraday's experiments, he concluded the similarity of the natures of electric charges and magnetic flux as the magnetic flux may induce electric potential and the electric flux may induce magnetic potential [27]. Hence, the magnetic conductivity would be defined by an analogous equation as Equations (20) and (21) for electric conductivity as follows:

$$\dot{B}_{\text{magnetic}} = k_{\text{magnetic}} A \frac{\mathrm{d}H}{\mathrm{d}x} \tag{30}$$

So, the magnetic permeability or conductivity can be found as follows:

$$k_{\text{magnetic}} = \frac{\text{rate of flow of magnetic flux}}{l \times \text{magnetic potential}} \frac{\text{Watt}}{\text{m} \cdot \text{Volt}} \tag{31}$$

Reforming the tabulated value of magnetic conductivity or permeability according to the units of Equation (26), the adopted value of magnetic conductivity of iron is found to have similar dimensions and an equal value as the electric and thermal conductivities. Such equality also proves the similarity of the natures of the electric and magnetic energies as the nature of the thermal energy.

5. Proper Understanding of the Magnetic Induction, and Calculating the Performance Electric Machines

Faraday discovered that an electric potential "E" is induced in a conductor loop, or coil, if the magnetic flux "B" passing through the conductor loop changes with time, **Figure 3** [28]. Ampere stated the relation between the electric field through the coil and the emerging the magnetic flux is as follows [28]:

$$\dot{B} \,\alpha\, E \tag{32}$$

The proportionality constant in the previous equation can be tailored such that the dimensions of both sides of the equation are similar according to the modified SI system of units as follows [23]:

$$\dot{B} = -\mu_0 \frac{A}{L} E \text{ Watt} \tag{33}$$

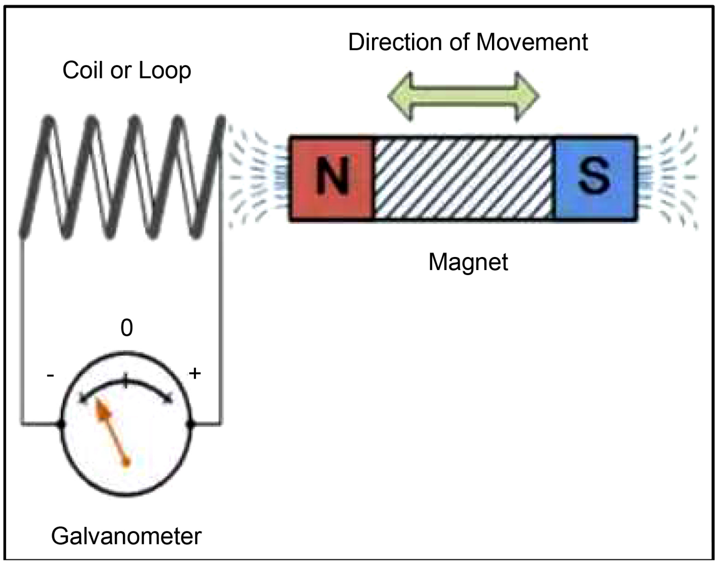

Figure 3. Faraday's law of EM induction.

where A is the cross-section of the coil, L is the length of the coil, $\dot{B}$ is the rate of flow of magnetic flux in Watt, and μ_0 is the permeability of the medium (μ_0 for air and μ_{material} for any material) in Watt/m·Volt.

Such theory is applied in generation of electric energy by an electrical generator shown in **Figure 4** [29]. The generator is formed of a rotating a coil of area A m^2 at angular velocity ω inside a magnetic field of magnetic flux B_0 flowing across the space between the North and South poles of the magnet. It is possible to express the magnetic flux B that perpendicularly crosses the coil of area A as follows [30]:

$$B = B_0 \cos \omega t \quad (34)$$

Hence, it is possible to calculate the rate of change of such flux, $\dot{B}$, as follows:

$$\dot{B} = B_0 \omega \sin \omega t \quad (35)$$

The electric potential that is induced inside the coil can be calculated according to Equation (33) as follows:

$$E = \frac{L}{A \cdot \mu} \dot{B} = \frac{L}{A \cdot \mu} B_0 \omega \sin \omega t \quad (36)$$

The function of the brushes in **Figure 4** is to unify the polarity of the induced electric potential. So, the average value of the output potential can be found as follows [30]:

$$E_{\text{average}} = 0.707 \frac{L\omega}{A \cdot \mu} B_0 \quad (37)$$

However, the output power of the generator depends also on the capacity of the coil to pass electric power by a unit potential, called as the rate of growth of the coil's entropy and denoted by $\dot{S}_{\text{coil}}$. Such rate can be measured directly, as previously discussed, by an inserted Ammeter in the coil's circuit. As a rate of change of a property of the coil's material, $\dot{S}_{\text{coil}}$ can be determined directly by normal differentiation of the entropy function. So, the output power can be found as follows:

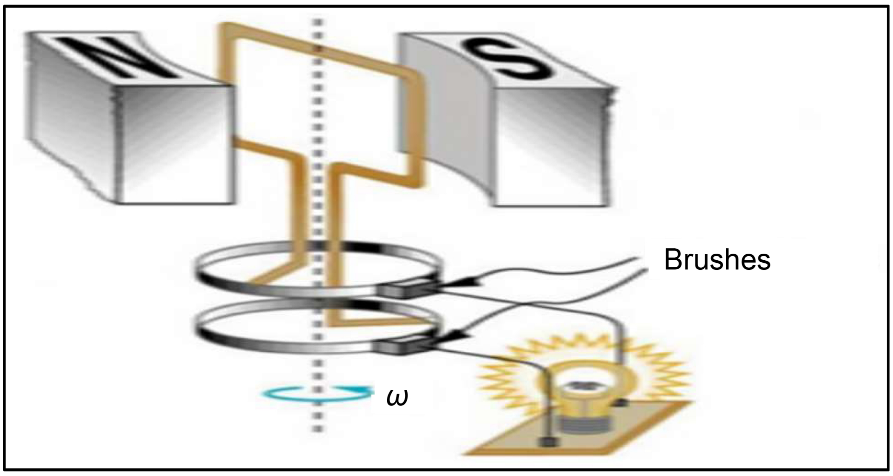

Figure 4. Elements of an electric generator [29].

$$\dot{W}_{\text{generator,output}} = E_{\text{average}}\left(\text{Volt}\right)\times \dot{S}_{\text{coil}}\left(\frac{\text{Watt}}{\text{Volt}}\right) = 0.707\frac{L\omega}{A\cdot\mu}B_0\dot{S}_{\text{coil}} \tag{38}$$

The input power to the generator is the torque of the measured turbine x its angular velocity as follows:

$$\dot{W}_{\text{generator,input}} = T\times\omega \tag{39}$$

So, the efficiency of the generator is:

$$\acute{\eta} = \frac{\text{output}}{\text{input}} = \frac{0.707\frac{L\omega}{A\cdot\mu}B_0\dot{S}_{\text{coil}}}{T\times\omega} \tag{40}$$

The Faraday's discovery of magnet induction also represents the door for inventing the electric motor. Figure 5 shows the basic elements of an electric motor. Electric current passes from the red battery as a source of electric power, through the shown coil inserted between the poles of a magnet, a magnetic field is generated perpendicular to the plane of the coil [30]. The interaction between magnetic field produced from the electric current H_{coil}, and the magnetic field of the shown magnet H_{magnet} generates a force that force the coil to rotate in a direction that can be determined according to Fleming's left-hand rule [31]. However, the electric power that may pass through the coil is restricted to its capacity to pass electric power per unit acting potential which depends on the entropy of the coil and is determined by the allowable growth rate of the entropy of the coil and is denoted, as previously described by $\dot{S}$ Watt/Volt. This capacity can be measured by, as previously discussed, by an Ammeter. So, the electric motor of coil's capacity $\dot{S}$ Watt/Volt generates a magnetic field that interacts with permanent magnetic field of strength H Volt. So, the input power to the electric motor can be evaluated by the product of possible flowing entropy rate through the coil $\dot{S}$ Watt/Volt as measured by the Ammeter times magnetic field of the permanent magnet H Volt as follows:

$$\dot{W}_{\text{motor,input}} = \dot{S}_{\text{coil}}\left(\text{Watt/Volt}\right)\times H\left(\text{Volt}\right) = \dot{S}_{\text{coil}}\times H\ \text{Watt} \tag{41}$$

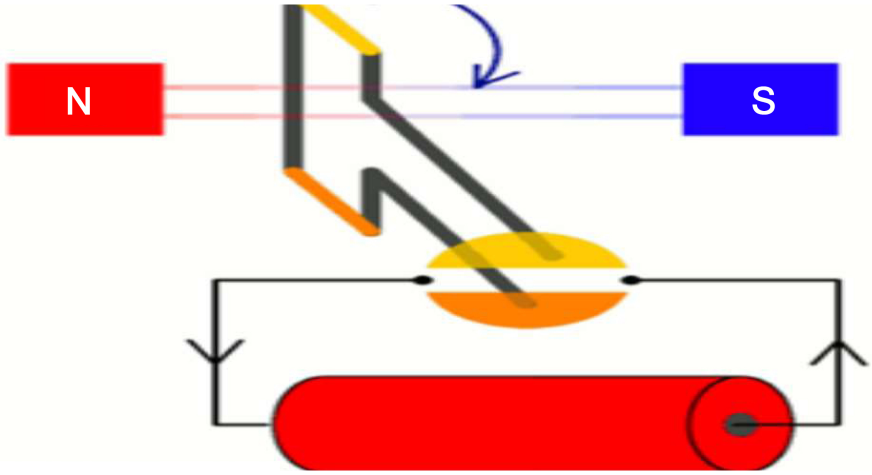

Figure 5. Basic elements of an electric motor [32].

However, this power will be converted into dynamic power as a Force F Newtons pushing the conductor with velocity v m/s or as a torque T N·m/rev pushing the coil, or a rotor, at the radial speed w rad/sec [32].

$$\omega = vr \tag{42}$$

So, the output power of the motor will be found as follows:

$$\dot{W}_{\text{motor}} = w \cdot T \tag{43}$$

6. Conclusions

According to identifying the nature of the electric current as electromagnetic waves which owns electric potential and the nature of magnetic flux as electromagnetic waves which owns magnetic potential, it was possible to:

1) Define the "eV" as an elementary charge which has energy of $e = 1.602 \times 10^{-19}$ Joules and a potential of ±1 Volt.

2) Define the electron as an elementary particle which is charged by an elementary charge of magnitude −1 eV.

3) Define the proton as an elementary particle which is charged by an elementary charge of magnitude 1 eV.

4) Define the thermal, electric, and magnetic conductivities are properties of materials which determine their ability to allow the flow of such electromagnetic waves of corresponding potentials which are measured by the same unit, Volt. So, the conductivities of each material have the same value and the same unit. Watt/m·Volt.

5) Determine the input electric power consumed by electric motors to do mechanical work according to the following equation: $\dot{W}_{\text{motor}} = \dot{S} \cdot H$. Where $\dot{S}$ is the capacity of the rotor windings to allow flow of electric power of magnitude $\dot{S}$ by the force of 1 Volt. $\dot{S}$ is the rate of growth of a property of the coil called entropy that can be measured by Ammeters, H is the strength of the magnetic field forcing the rotor to rotate at angular speed w with torque of magnitude T. So, the output power has the value: $w \cdot T$.

6) Determine the output-power of the electric generator according to the following equation: $\dot{W}_{\text{generator output}} = 0.707 \frac{L\omega}{A \cdot \mu} B_0 \dot{S}_{\text{coil}}$ Where $\dot{S}_{\text{coil}}$ is the capacity of the coil of the rotor to allow flow of electric power of magnitude $\dot{S}$ by the force of 1 Volt as a property of rotor armature which can be measured by Ammeters, B_0 is the magnetic flux of the acting on the coil, w is the angular speed of the rotor, A is the surface area of the coil subjected to the flowing flux, and μ is the permeability of air. Input power to the generator is evaluated as $w \cdot T$, where T is the torque forcing the rotor to rotate at angular velocity w.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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