© 2016 IJSRST | Volume 2 | Issue 5 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

The Influence of External Impact in Transfer of the Energy between Material Objects

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ABSTRACT

The article deals with energy as a value characterizing the motionof material objects qualitatively and quantitatively. Energy transfer is the result of external impact to a system that alter the structural and energy compliance of "chemical individuals". The one-time consideration the state of a system at micro – and macroscopic levels allow to propose the energy transmission mechanism by elementary particles.

Keywords: Energy, Movement, "Chemical Individual", Particles, Structural and Energy Compliance.

I. INTRODUCTION

To describe the general characteristics of the forms of motion of matter in science was introduced conceptual term " an energy" [1-8]. It is believed that the "energy" as a scalar physical value it qualitatively and quantitatively expresses the various forms of motion of material objects in their interactions, and is a measure of the transition of one form of motion into another. Initially, the laws of conservation of energy and matter dealt with collectively. Over time, they become often treated separately, although, in our opinion the law of conservation of energy is a direct manifestation of the law conservation of matter. There would be no matter, there would be no moving object. In turn, any substance consisting of "a chemical individual" [9,10] is at rest with respect to the elementary particles which are in motion, and characterizes some part of an internal energy of a system. Changing the internal energy is expressed in various forms of energy transfer, i.e., transition from one type of energy to another, or one type of motion into another. Many phenomena of the potential energy (E=mgh), in the process of transformation is converted into kinetic energy ($E= mv^2/2$), which makes a certain kind of "work". The "work" as a form of energy transfer can be "mechanical", "electric", "chemical" and others. For example, the flow of water falling from a certain height performs mechanical work, resulting in rotation turbine blades. The collective motion of water molecules at flow as "working fluid" in the process does mechanical work. Some part of the falling water flow energy is lost to overcome the internal and external friction. And to continue the rotation of the turbine blades again, it needs to raise a lot of water to original position. It requires to spend the equivalent of mechanical work, and the system doesn't perform useful work. In other words, to produce useful work in this system implies the need to consider this process as similar to the Carnot cycle. From this simple example, it is obvious that the mechanism of energy transfer in any system requires a detailed study.

In this article discusses energy transfer under the impact of external factors between material objects.

II. DISCUSSION

It is well known "energy" is one of the basic concepts of natural science, and is inextricably linked with the idea of turning one form of motion into another. In turn, the technological advances encourage science to new discoveries that make it possible to use effectively all forms of energy; sunlight, sea waves, controlled thermonuclear energy, etc. All of this requires a fundamental knowledge of the energy transmission mechanism. It seems necessary to examine the manifestations of energy in material objects in relation to the micro-macroscopic level. There is a sufficient number of causal relationships that are based on a comprehensive philosophical category - the law of unity and struggle of opposites which characterizes the behavior of processes and the material objects from giant mass to meager sizes. Most energy manifestations of macroscopic formation are based on the change in the microstructure of matter and elementary particles of a system.

Elementary unit "a chemical individual" as proposed in [10], basically consist of chemical elements and a set of elementary particles which are also responsible for a form of energy transfer phenomena. Based on the analysis of a large amount of experimental data accumulated by modern science, which reflect the reality of the material objects, we have assumed that all objects can form a microscopic "ensembles" with dipole properties [11]. It determines the behaviour of the atoms and the formation of "chemical individuals" which show the appropriate physical and chemical characteristics such as temperature, characteristic colour, aggregate-phase state, etc. When the material object is in equilibrium with the environment, in the system established structural and energy compliance. In the case of outside impact on the system varies structural - energy state of "chemical individuals," which leads to the appearance of new physical and chemical properties. Naturally, the participants in this process are various elementary particles which are the energy transfer employees. The proposal about analogy manifestation of energy in the interaction of different substances given by M. Faraday[12], we suggested the hypothesis of the existence elementary particles in the microstructure of the materials such as "teplotron" which responsible for the transfer of heat from one material object to another[13,14]. Carriers of energy during the process are changed from one structural - energy state to another, but the nature of carrier remains the same. Micro- and macrostructure of substances only affects the speed of their movement and the calculation of these values for thermal energy carriers given in [13, 14, 15, and 16]. It should be noted that from the purposeful movement of "elementary particles" under external influence, under controlled energy transmission parameters depend, ultimately, hardware design and technical solution of various technological processes. The external influences change the character of the movement of elementary particles of “chemical individual", in particular, responsible for the formation of various particles such as "dipoles", creating “an electromagnetic field” which was proposed by M.Faraday [12]. Since the "electromagnetic field" is created by microstructural elements of matter, then the energy (ε) of each "particle" according to quantum mechanics is proportionality to the frequency «ν» of heat emitter by following formula :

$$\varepsilon = h\nu \qquad (1)$$

where h- Planck's constant. On the basis of molecular-kinetic theory and thermodynamics static [3.6] can be assumed that the energy of the particle is composed of its forward motion - 1,5kT, rotational motion - 1,5kT (taking into account the degrees of freedom) and kT- the work expended on the interaction elementary particles with each other or with the elements of the environment. In that case the sum of energy for the particle equal:

$$\varepsilon = 4kT \qquad (2)$$

where k- is Boltzmann’s constant and T - thermodynamic temperature. Since the formula (1) and (2) refer to the same micro-object, which makes true equality:

$$4kT = h\nu \qquad (3)$$

Hence the temperature of a "particle"is described by the following equation:

$$T=(1/4)\cdot(h/k)\cdot\nu \qquad (4)$$

It can be concluded that the temperature of the particles from the data of the conventional equations engages in the space of movement is determined by the frequency of the source of radiant heat fluctuations. For the applicability of the equation (4) finding the characteristic values of infrared radiation, which is usually attributed to the heat given in [17] and compare the value of the radiation temperature calculated from equation (4) with the reference data. For the near-range at a frequency of 4· 1014 Hz corresponds to T = 4000K. The value of temperature by calculating formula (4):

$$T = (1/4)\cdot(h/k)\nu = (0.25)\cdot(6.62\cdot10^{-34}/1.38\cdot10^{-23})\cdot4\cdot10^{14} = 4797K \qquad (5)$$

For the medium and long ranges with frequencies $6\cdot10^{13}$Hz and $1\cdot10^{13}$Hz in referencing the temperature equal 600K and 90K, respectively. Calculation the temperature by equation (4) gives the value 719K and 120K respectively, and similar obtained values allow us to apply the equation (4) to approximate the parameters of the "T" or "v". For example, under standard condition, the melting temperature for iron is 1812K and 3673K for tungsten. For the release of heat when they are in the solid state at a temperature close to the melting temperature, for example, iron is heated up to 1800 K and allocates carriers of heat "particles", where the frequency of vibrations of the radiator is calculated by formula(4):

$$\mathbf{1800 = (0,25)\cdot(6,62\cdot10^{-34}/1,38\cdot10^{-23})\cdot}\boldsymbol{v} \quad (6)$$

$$\boldsymbol{v = 1,5\cdot10^{14}Hz} \quad (7)$$

For tungsten at 3600K:

$$\boldsymbol{v=3,0\cdot10^{14}Hz} \quad (7')$$

At the same time, the degree of heating of the body describing by temperature should be determined by the specific heat which proportional to amount of elementary particles - "teplotrons" proposed in [18] by the following equation:

$$\boldsymbol{T=k\cdot n \text{ or } T= n/C} \quad (8)$$

where T- thermodynamic temperature, K; k is the proportionality factor equal to the reciprocal of the specific heat C(K·mol)/J; n- specific molar heat corresponding to temperature T, J / mol. The heat capacity of iron and tungsten at corrospending temperature are 44,78J/(mol·K) and 42,90J/(mol·K) respectively. Determining the amount of heat for one "teplotron" (q), in iron (1800 K) and tungsten (3600K) at appropriate temperatures by the formula (8) based on the number of Avogadro give following values:

$$\boldsymbol{n(Fe) = T\cdot C;\ n(Fe) = 1800\cdot44,78 = 80604J/mol} \quad (9)$$

$$\boldsymbol{q\ (Fe) =80,604/6.02\cdot1023 = 13.39\cdot10^{-20}J/\ particle} \quad (10)$$

$$\boldsymbol{n(W) = 3600\cdot42,90 = 151\ 200\ J\ /\ mol} \quad (11)$$

$$\boldsymbol{q\ (W)=151200/6.02\cdot1023=25.12\cdot10^{-20}J/particle} \quad (12)$$

Comparing the values of q(Fe) and q(W) show that the heat carried by "particles" depends upon the nature of the material object. Well-known, the thermal conductivity of iron and tungsten are 92,0W / (m · K) (at 1800K) and 101,0W / (m · K) (at 3600K) [19]. The unit W / (m·K) means that in material one joule of energy is transmitted per second (i.e., one watt) over a distance of one meter due to a temperature difference one Kelvin. With these values we can calculate the number of "teplotron" under predetermined conditions of heat conductivity ratio (æ) to heat one particle (q):

$$\boldsymbol{(æ/q)(Fe)=92.0/13.39\cdot10\text{-}20=6.87\cdot1020 \text{ particles}} \quad (13)$$

$$\boldsymbol{(æ/q)(W)=101.0/25.12\cdot10\text{-}20=4.02\cdot1020 \text{ particles}} \quad (14)$$

The calculated data show that the heat transfer is carried out with different number of discrete particles of "teplotron" at different temperatures. In considering the objects that have incomparably greater weight than in the example there are similar patterns. For example, heat transfer from the surface of the Sun to our planet can be calculated using the above formula, neglecting the different resistances of the space environment and the Earth's atmosphere. The temperature of the Sun's surface according to the literature equal TSun ≈ 6000K, the temperature of the Earth's surface take on average TEarth ≈ 300K. If assume that the basic equation of molecular-kinetic theory is true for elementary particles, it will be possible to calculate the energy loss at the change in temperature from 6000K to 300K:

$$\boldsymbol{\varepsilon Sun\text{-}\varepsilon Earth=4k\ (TSun\text{-}TEarth)} \quad (15)$$

$$\boldsymbol{\Delta\varepsilon=4\cdot1.38\cdot10\text{-}23\cdot(6000\text{-}\ 300) = 31.4\cdot10^{-20}Hz.} \quad (15')$$

We calculate the energy of an elementary particle at 6000K:

$$\boldsymbol{\varepsilon Sun=4k\cdot TSun=33.12\cdot10^{-20}J} \quad (16)$$

Then we may calculate the mass of elementary particle from the well-known equation $\boldsymbol{\varepsilon = mv^2/2}$ **or** $\boldsymbol{\varepsilon = mc^2}$**:**

$$\boldsymbol{m=2\varepsilon/v^2=2\cdot33.12\cdot10\text{-}20/(3\cdot108)^2=7.36\cdot10^{-36}kg.} \quad (17)$$

The calculated value of elementary particle mass is very close to the "teplotron" weight, which is designed by us earlier [13, 15]. We determine the energy of an elementary particle at 300K:

$$\boldsymbol{\varepsilon_{Earth}=4k\cdot T_{Earth}=4\cdot1.38\cdot10^{-23}\cdot300=1.656\cdot10^{-20}J} \quad (18)$$

The velocity of the particle corresponding to $\boldsymbol{1,656\cdot10^{-20}J}$ energy:

$$v = (2\ \varepsilon_{Earth} / m)^{0,5} = (2\cdot 1.656\cdot 10^{-20} / 7.36 \cdot 10^{-36})^{0.5} = 0.67 \cdot 10^{8}\ m/s \quad (19)$$

The velocity of particles reduces slightly from 3·108 m/s to 0.67·108 m/s. These particles are so fast and have a relativistic mass about $7.36\cdot 10^{-36}$kg facing with the constituent parts of the environment are absorbed, giving them an impulse.

Absorbed "teplotron" go unnoticed, and as result will be dominated “a concept” that the heat is transferred by motion of molecules, although, air molecules also changed their internal energy. In this context, for the calculation of the speed of the elementary particles that carry thermal energy in the air, we use the equation of thermal conductivity (ϰ), arising from the molecular-kinetic theory of gases:

$$\varkappa \sim \frac{1}{3}\rho c_v \lambda \bar{v} \quad (20)$$

where - the mean free path of the molecules; - is the mean speed of their movement; r- density of the material; cv-specific heat capacity [9,14]. For air thermal conductivity is 0,026W/(m · K); specific heat capacity 1000J / (kg · K); density of air at 293 K equal 1.14kg / m^3 and the mean free path of air molecules is 4·10-7m. The rate of elementary particles of heat carrier:

$$\bar{\upsilon} = \mathbf{3\cdot 0{,}026/(1{,}14\cdot 1000\cdot 4\cdot 10^{-7})=170\ m/s} \quad \mathbf{(21)}$$

As reference data, at atmospheric pressure and temperature of 293 K, the average speed of the air molecules are 480-500 m / s. In comparison with air molecules elementary particles of heat carrier ("teplotron") moves more slowly than air. However, the speed of 170m/s is sufficient magnitude to feel the heat at close distances from the heat source. For example, the combustion of natural gas on a hot plate generates heat and light, where the flame temperature peaks reached 2300K why “teplotron" propagating in the air at speed of 170m/s is not so strongly felt at a distance of 2-3m. To answer it we again use the equation of molecular-kinetic theory of ideal gas. At the burning of natural gas is generating some heat which makes a work of expansion, overcoming the resistance of the surrounding air. The combustion of one mole of gas expansion work forward on the well-known formula:

$$P \cdot \Delta V = R\,(T_2 - T_1) \quad (22)$$

where P is the atmospheric pressure - $1.01\cdot 10^5$Pa; ΔV - volume expandable air; R- universal gas constant; T_2 and T_1 - the flame temperature and the average temperature of surrounding. Substituting numerical values we get:

$$1.01 \cdot 10^5 \cdot \Delta V = 8{,}314\,(2300-300) \quad (23)$$

$$\Delta V = 0{,}16 m^3$$

Assuming the heat distribution in the space has a spherical shape, then can be calculated the radius of the sphere:

$$(4/3)\,\pi R^3 = 0.16 m^3 \quad (24)$$

We determine the radius of the prevalent heat in the space:

$$R = 0{,}34 m. \quad (25)$$

Consequently, due to the fulfilment of the work of expansion of the ambient air "teplotron" can not overcome long distance and are absorbed by the components of the environment. Thus, energy transfer as heat is a chaotic movement of elementary particles of "a chemical individual" of massive bodies. The movement of these particles are caused by external events. Depending on the nature of the external influence there are various types of motion of its components in the system. For example, the hardware design and technical solutions allow transformation of mechanical motion into the inner movement of elementary particles and to produce alternate current and creating electricity. Since, at the alternating current the poles change occurs at a certain frequency, the orientation of the "particles" is also carried out intermittently, i.e., discontinuity allocation "electromagnetic waves" is stored in this case. In the scientific literature and in practice, electromagnetic radiation can be divided into frequency bands [17], and no sharp transitions between bands, they sometimes overlap, and the boundaries between them are conditional. It can be assumed that these "frequency bands" are directly related to the nature of "particles" and the manifestation of various physical and chemical properties. For example, a set of optical photons, representing visible light, can decay into monochromatic components and serves as a source of laser and others.

Likewise, solar thermo elements cause the flow of electrons and "teplotron", where commission of useful work or other forms of transmission depend on the nature of the movement of "particles". The rational engineering solutions of directed motion "teplotrons" emitted as a result of any impact power to a system could be done useful work with high efficiency, in contrast to the chaotic dispersal into the environment as heat. In other words, innovative technical solutions at the organization of a focused stream "teplotron" could lead to a dramatic increase in efficiency of thermal machines and processes based on the use of thermal energy.

III. CONCLUSION

The energy transfer occurs at the impact to system with power from outside as a result of changing the microstructure in the "chemical individual" of a substance. Violation the structural and energy compliance in any material system gives rise to different types of energy transfer such as light, heat, electricity and others, which depend on the nature of elementary particles (photons, electrons, "teplotrons" and others.).

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