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Diamagnetism Flame. Faraday Mystery

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Abstract- Earth's surface acts the electromagnetic force, which distributes charges. Under action this force the positive charges are moved up and negative charges – down. Especially, this force distributes the electric charges generated in flame. For this reason, in the flames generate electric currents. So the flames interact with the artificial magnetic fields like the typical electric currents. Proposed calculation show that the true cause of diamagnetism flame is its movement in the geomagnetic field.

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Diamagnetism Flame. Faraday Mystery

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Abstract- Earth's surface acts the electromagnetic force, which distributes charges. Under action this force the positive charges are moved up and negative charges – down. Especially, this force distributes the electric charges generated in flame. For this reason, in the flames generate electric currents. So the flames interact with the artificial magnetic fields like the typical electric currents. Proposed calculation show that the true cause of diamagnetism flame is its movement in the geomagnetic field.

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I. Introduction

It is known that flame is pushed out of magnetic field (Fig. 1).

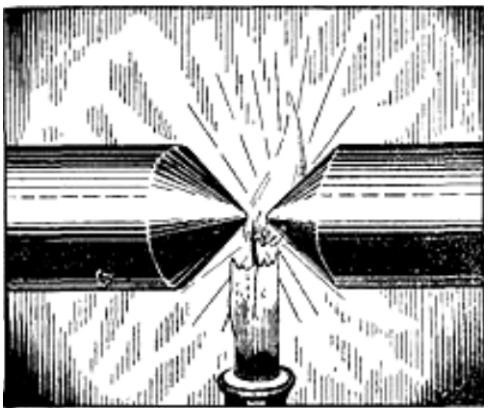

Fig. 1 : The flame is pushed out of magnetic field

What the nature of diamagnetism flame? – Faraday was the first who asked this question (Faraday, 1847).

Many researchers have tried to answer this question. However, the nature of this phenomenon remains unclear (Ueno at al., 1987; Baker at al., 2001; Khaldi at al., 2010).

Faraday answering the question, we were based on such facts:

1. The Earth has daily rotation. Since studied objects located on the earth's surface, they rotate together with it.
2. The Earth has a magnetic field, namely, the geomagnetic field.
3. Magnetic fields push out the wires with electrical currents (Kuchling, 1980).

Based only on these facts, we came to the following conclusions:

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During the daily rotation of Earth all objects on its surface cross the horizontal lines of force of the geomagnetic field (Fig. 2). For this reason, all such objects, including flames, operates electromagnetic nature force (in fact, it is the Lorenz force, $F_L = q\bullet[v\bullet B]$).

Under action this force, the generated in flame positively charged particles move up and negatively charged particles – down (Pivovarenko, 2015).

Fig. 2 : As the Earth has daily rotation all objects on its surface cross the horizontal lines of force of the geomagnetic field. The appeared electromagnetic force distributes the charges located near the earth's surface. Wherein the positively charged particles move up and negatively charged – down

Need to say separately, this force causes the evaporation of positively charged water vapor (Krasnogorskaja, 1984; Pivovarenko, 2015), providing the positive charge of the upper layers of Earth's atmosphere and negative charge of the earth's surface (Feinman at al., 1961; Pivovarenko, 2015).

This force causes the flow of charged particles of the flame, which interact with the artificial magnetic fields of the wire with an electric current.

Here we propose our calculations.

II. Results and Discussion

The positively and negatively charged particles can be formed in many hydrocarbon flames. Because the composition of hydrocarbons is very variable, we offer our calculations made for methane flame:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O \rightarrow H_2CO_3 + H_2O \Rightarrow$$
$$\Rightarrow HCO_3^- + H_3O^+ \text{ (or } H^+ + H_2O) \Rightarrow \ldots$$

(Here we don't take into account the further dissociation of carbonic acid: $HCO_3^- \Rightarrow H^+ + CO_3^{2-}$).

It follows from this equation, of 1M methane (16 g) can theoretically be formed 1M of HCO_3^- with a total charge –96484,56 C and 1M of H_3O^+ with a total charge +96484,56 C; 96484,56 C is number of Faraday, F (Kuchling, 1980).

Based on our previous calculations (Pivovarenko, 2015), the Lorenz force, F_L, which acts on 1M of these charges, is:

$$|F_L| = \pm F \bullet |v_e| \bullet \mu_0 |H| =$$
$$= \pm 9{,}648456 \bullet 10^4 \text{ A}\bullet\text{s}\bullet 463 \text{ m}\bullet\text{s}^{-1} \bullet 1{,}257 \bullet 10^{-6} \text{ V}\bullet\text{s}\bullet\text{A}^{-1}\bullet\text{m}^{-1} \bullet 27{,}06 \text{ A}\bullet\text{m}^{-1} = \sim 1519{,}8 \text{ kg}\bullet\text{m}\bullet\text{s}^{-2} = \sim 1{,}52 \bullet 10^3 \text{ N},$$

where: $\pm F$ ($= \pm 9{,}648456 \bullet 10^4 A\bullet s$) – the number of Faraday,
$|v_e|$ ($= 463 \text{ m}\bullet\text{s}^{-1}$) – linear speed of earth's surface at equator,
μ_0 ($= 1{,}257 \bullet 10^{-6} \text{ V}\bullet\text{s}\bullet\text{A}^{-1}\bullet\text{m}^{-1}$) – magnetic constant,
$|H|$ ($= 27{,}06 \text{ A}\bullet\text{m}^{-1}$) – intensity of geomagnetic field at equator.

This force distributes the charged particles formed in methane flame. For this reason, the negatively charged HCO_3^--particles move downward acceleration, which is equal to:

$$|a| = |F_L| / M(HCO_3^-) = 1{,}52 \bullet 10^3 \text{ kg}\bullet\text{m}\bullet\text{s}^{-2} / 61 \bullet 10^{-3} \text{ kg} = 24918 \text{ m}\bullet\text{s}^{-2},$$

where: $|F_L|$ ($=1{,}52 \bullet 10^3$ N) – Lorenz force acting on the equator line,
$M(HCO_3^-)$ ($= 61 \bullet 10^{-3}$ Kg) – mass 1 mole of HCO_3^-.

However, the positively charged H_3O^+-particles move upward acceleration, which is equals to:

$$|a| = |F_L| / M(H_3O^+) = 1{,}52 \bullet 10^3 \text{ kg}\bullet\text{m}\bullet\text{s}^{-2} / 19 \bullet 10^{-3} \text{ kg} = 80000 \text{ m}\bullet\text{s}^{-2},$$

where: $|F_L|$ ($=1{,}52 \bullet 10^3$ N) – Lorenz force acting on the equator line,
$M(H_3O^+)$ ($= 19 \bullet 10^{-3}$ Kg) – mass 1 mole of H_3O^+.

If the anions HCO_3^- are under vacuum, then for 1 second to overcome a distance greater than 12 km in down direction:

$$S = |a| t^2/2 = 24918 \text{ m}\bullet\text{s}^{-2} \bullet 1 \text{ s}^2/2 = 12459 \text{ m}.$$

If the H_3O^+-cations are under vacuum, then for 1 second to overcome a distance 40 km in up direction:

$$S = |a| t^2/2 = 80000 \text{ m}\bullet\text{s}^{-2} \bullet 1 \text{ s}^2/2 = 40000 \text{ m}.$$

Thus, the opposite charges form oppositely directed streams. At the same time, these form an electric current flows in one direction, the upwardly directed:

$$\uparrow + \downarrow \Rightarrow \uparrow + \uparrow,$$

where: $\uparrow$ – the current positive charges in up direction;
$\downarrow$ – the current negative charges in down direction.

Thus, assuming that 1M of methane (22,4 liters) will burn for 5 minutes (300 seconds), we theoretically obtain an electric current I directed upwards:

$$I = 2 \bullet 96484{,}56 \text{ C}/300 \text{ s} = \sim 643{,}2 \text{ A}.$$

It is incredibly high current. But, as you know, carbonic acid is a weak: its first dissociation constant, K_1 (20 °C) = $[H^+][HCO_3^-]/[H_2CO_3] = 2 \bullet 10^{-4}$ M (Nekrasov, 1974). Whereas this constant can be assumed that 1M of methane will be formed $\sim 1{,}415 \bullet 10^{-2}$ M of H^+ (or H_3O^+) and $\sim 1{,}415 \bullet 10^{-2}$ M of HCO_3^-.

Thus, given the constraint K_1 (20 °C), it may be formed of $\sim 2 \bullet 1{,}415 \bullet 10^{-2}$ M = $\sim 2{,}83 \bullet 10^{-2}$ M of charged particles. Therefore it can be concluded that the methane flame could be an electric current:

$$I = \sim 2{,}83 \bullet 10^{-2} \text{ M} \bullet 96484{,}56 \text{ C}/300 \text{ s} = \sim 9{,}1 \text{ A}.$$

In any case, it is also a significant electric current. No surprisingly, the current is so strong interacts with an external magnetic field. (At the same time, we have ignored a significant increase in the dissociation of carbonic acid, which occurs with increasing temperature (Akolzin, 1988)

It should be noted that the distribution of charges in a hydrocarbon flames was probably used many years ago. So, the charge distribution in the flame of kerosene, C_9H_{20} – $C_{16}H_{34}$ (Pacak, 1986), was used early to produce electric current sufficient for radio receivers (Fig. 3).

We know that the action of such a generator to explain the distribution of the electrons in the heated thermocouple. In our opinion, this explanation is incomplete bekause it does not take into account the distribution of charges in the flame of kerosene lamp.

In view of the proposed calculations, not also surprising that the flame has a spherical shape in space (Fig. 4): there is no movement of the flame relative to the geomagnetic field. In view of our assumptions, diamagnetism flame is not observed in the space. We think that it will be confirmed.

Fig. 3 : Charge distribution in the flame of a kerosene lamp can be used to obtain the electric current required to function the radio receiver.

Fig. 4 : It is the flame is in the space

It must be said that our ideas can also be used to explain other phenomena. In particular it is known, that pH of the water decreases when it is heated. So, it is known that increasing temperature of the water from 25 to 100 °C, followed by a decrease of the pH from 7.0 to 6.0 (Nekrasov, 1974). This could mean an increase in H^+-ion molar concentration 10 times ($10^{-6}/10^{-7} = 10$). If the water is heated over an open fire, it can be hypothesized that such H^+-ions have the flame origin. Thus, increase acidity of boiling water caused its positive electrization H^+-ions generated in the flame.

III. Conclusion

Objects on the earth's surface move together with it and cross the horizontal lines of force of the geomagnetic field. For this reason, the object of the earth's surface is always acting the force of electromagnetic nature. Under action this force the positive charges move up and negative charges – down. Thus, the flame generated electric currents are directed upwards. Therefore, the external magnetic fields act on the flames as on the wires with electric currents. As a result, the flames pushed out magnetic fields.

Hence, the true cause of diamagnetism flame is its movement in the geomagnetic field.

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