Water is the Basis of the Future Energetics

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ABSTRACT

The results of the space-matter-time unity axiom implementation during theoretical description of the water electrolysis process are shown. The experiments confirm the theoretical calculation of production of additional energy from the water during its plasma electrolysis. Energy consumption for hydrogen production is reduced tenfold. It gives the reason to believe that water becomes the main source of energy for future power engineering.

1. INTRODUCTION

The results of our researches are based on the main axiom of natural science: space - matter - time unity axiom. Space, matter and time are the primary elements of the universe, which cannot be separated from each other. This thesis is clear; it requires no experimental check and contains all criteria of an axiom. Let us call it the Unity axiom [1], [2].

In the new millennium, the Unity axiom acts as a judge of trustworthiness of many physical, chemical and other theories, which have been worked out without taking into consideration this axiom, that is why they proved to be incomplete or erroneous.

The Unity axiom makes the theories based on pseudo - Euclidean geometries to become the property of history. It declares that Maxwell's equation, Schrodinger's equation, de Broglie's equation, etc. are incomplete and unable to give us more information about the matters being studied as they give now [1], [2].

The Unity axiom states that the law of conservation of angular momentum (moment of momentum) governs the constancy of velocity of electromagnetic radiation, constancy of Planck's constant, constancy of mass and free electron charge as well as the processes of radiation and absorption of the photons by the atomic electrons. It proves the lack of orbital movement of the electrons in the atoms. The electrons with the atomic nuclei bring together the unlike electric fields, and their like magnetic poles limit this convergence. The electrons have the form of tori. They rotate in relation to their axes of symmetry and precess on atomic nuclei. They unite the atoms into molecules by their unlike magnetic poles [2]. The analysis of the electromagnetic models of the photon and the electron within the framework of the Unity axiom by means of the laws of conservation of angular momentum and the formation of the spectra of the atoms and the ions leads to equality of the wavelengths l of these models to radii r of their rotation [2].

$$\lambda = r \tag{1}$$

Thus, the Unity axiom strengthens the foundations of exact sciences laid down by Euclid, Galileo, Newton and Planck; it restricts the mythological activities of the scientists in development of these sciences. It makes us to revise many theoretical provisions of physics, chemistry and other sciences [1], [2].

The revision process takes place, and some of its results are given below. The detailed proofs of trustworthiness of these results can occupy hundreds of book pages, that's why it is impossible to describe these proofs in brief. Those, who want to possess these facts, have only one opportunity: they should believe them. I'd like to refer the persons, who are willing to know the proof of trustworthiness of the facts in detail, to the publications of the author, or they can attend the course of his lectures.

2. ATOMIC MODELS AND HYDROGEN MOLECULES

A hydrogen atom consists of one proton and one electron. The electron has a form of a rotating hollow torus. Its electric field has the surface, which is similar to the surface of an apple. Magnetic field of the electron and its magnetic poles look like the magnetic field and the magnetic poles of a bar magnet, which role is performed by the torus rotation axis. The proton has also magnetic poles and the electric field, which is opposite in sign to the electric field of the electron [2]. The structure of the hydrogen atom results from the law of formation of the spectra of the atoms and the ions [3]:

$$F = E_i - \frac{E_1}{n^2}. \tag{2}$$

Here $F = h \cdot \nu_f$ are the energies of the photons emitted or absorbed by the electron; $E_i = h \cdot \nu_i$ is ionization energy of the atom; $E_1 = h \cdot \nu_1$ is binding energy of the electron with the atomic nucleus, which corresponds to the first energy level; $n = 2,3,4...$ is the main quantum number or energy level number of the electron. Binding energy E_c of the electron is calculated according to the formula

$$E_c = \frac{E_1}{n^2}. \tag{3}$$

Taking into consideration the fact that the ionization energy E_i of the hydrogen atom is equal to binding energy E_1 of the electron with the nucleus, which corresponds to the first energy level $E_i = E_1 = 13.598eV$, and using the formulas (2) and (3), we'll get the energies of the photons F emitted or absorbed by the electron and binding energies E_c of the electron with the atomic nucleus, which correspond to n-energy levels (Table 1).

Table 1 Spectrum of hydrogen atom

Values	n	2	3	4	5	6
F (exper.)	eV	10.20	12.09	12.75	13.05	13.22
F (theor.)	eV	10.198	12.087	12.748	13.054	13.22
Ec (theor.)	eV	3.40	1.51	0.85	0.54	0.38

It results from the spectroscopy law (2) that during the transition of the electron between the energy levels n and $n+1$ the energies of the absorbed and emitted photons are calculated according to the formula [2]:

$$F = E_1\left[\frac{1}{n^2} - \frac{1}{(n+1)^2}\right]. \quad (4)$$

Analysis of the mathematical model of the law of formation of the spectra of the atoms and ions (2) shows that this model includes: energy of the photons $F = h \cdot \nu_f$ emitted or absorbed by the electron during its energy transitions; energy $E_i = h \cdot \nu_i$ of ionization of the electron and the energy $E_1 = h \cdot \nu_1$, which corresponds to the first energy level of the electron in the atom. Since the Planck's constant h is available in all three formulas, we should pay attention to the essence of its dimensionality [2].

$$h = m\lambda^2\nu = mr^2\nu\left(\frac{kg \cdot m^2}{s}\right) = const. \quad (5)$$

In modern system of measurements this dimensionality corresponds to the following notions of physics and mechanics: angular momentum, moment of momentum and spin. It results from the fact that the law of conservation of angular momentum governs the constancy of Planck's constant. It runs as follows: if the sum of external forces influences a rotating body is equal to zero, angular momentum $\bar{h}$ (moment of momentum, spin) of this body remains constant all the time.

A lack of the orbital component of energy of the electron is the main peculiarity of the mathematical model (2) of the law of formation of the spectra of the atoms and the ions. It draws attention to the lack of the orbital movement of the electron in the atom. The law of formation of the spectra of the atoms and the ions opens the new possibilities for us in cognition of the principles of the microworld [2].

When the hydrogen atom is formed, the unlike electric fields of the electron and the proton draw them together, and the like magnetic poles restrict this rapprochement (Fig. 1, d). If the scale is chosen that the size of the proton is equal to one millimetre, the size of the electron will be nearly one meter, and the distance between the proton and the electron in the hydrogen atom will be 100 metres according to Coulomb law (Fig. 1, e).

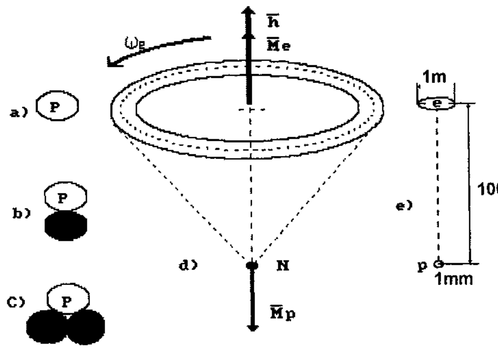

Fig. 1.
Diagrams of models of the nucleus and the atom of hydrogen:
a) the proton, b) deuterium nucleus, c) tritium nucleus, d) hydrogen atom, e) geometrical dimensions of the atom in the scale of the size of the proton (p) 1 mm, $\bar{M}_e$ is magnetic moment of the electron, $\bar{M}_p$ is magnetic moment of the proton, $\bar{h}$ is electron spin

The spins of the electron and the proton are equal to the Planck's constant. It is clear that the electron does not rotate round the nucleus of the atom, it precesses on the nucleus (Fig. 1) [2].

Fig. 2 shows the diagrams of the hydrogen molecules. We'll not describe their formation in details. But we should note that the terms orthohydrogen and parahydrogen originate from the direction of vectors of magnetic moment of the electron, not the proton, because magnetic moment of the electron $M_e = 9{,}27 \cdot 10^{-24}\, J/T$ is by a factor of 10^2 greater than magnetic moment of the proton $M_p = 1{,}41 \cdot 10^{-26}\, J/T$ [2], [6].

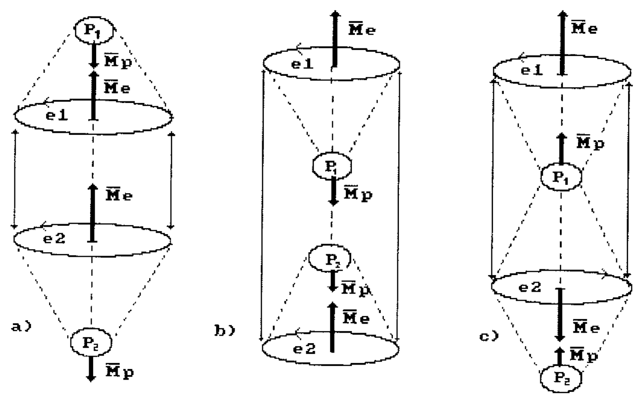

Fig. 2.
Diagram of the hydrogen molecule H_2 : a), b) – orthohydrogen; c) – parahydrogen

The analysis of the diagrams of the atom (Fig. 1) and the molecules (Fig. 2) of hydrogen shows that the hydrogen atom is an ideal binding link. The negatively charged electron is situated on one end of its core, and the positively charged proton is situated on another end [2], [6].

3. MODEL OF OXYGEN ATOM

The oxygen atom consists of eight electrons. They have different binding energies with the nucleus and different energies of ionization [7], [8]. The greater the energy of ionization, the nearer the electron is situated to the atomic nucleus. Let us number the electrons in accordance with their distance from the atomic nucleus (Table 2). As it is clear, the eight electron of the oxygen atom has the least energy of ionization. It means that it is situated at the largest distance from the nucleus and it is the main valency electron of the oxygen atom. Fig. 3 shows the diagram of the oxygen atom. Its eighth and seventh electrons are situated nearer to the surface of the atom then others, that's why they are its main valency electrons [2].

Table 2 Energy of ionization of electrons in oxygen atom

Number of electron	1	2	3	4	5	6	7	8
Energy of ionization, eV	871.39	739.32	138.12	113.90	77.41	54.93	35.12	13.62

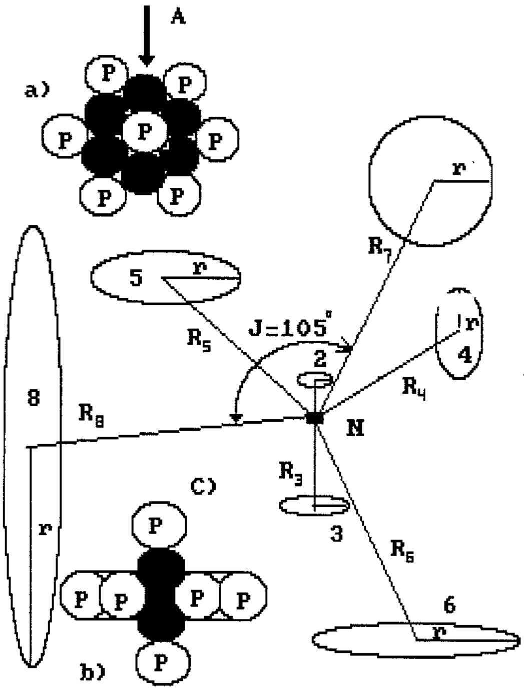

Fig. 3.

Ionization energy of the eighth electron of oxygen atom is equal to $E_i = 13.618 eV$ and its binding energy with the atomic nucleus corresponding to the first energy level is equal to $E_1 = 13.752 eV$. The calculation of energy indices of this electron according to the formula (1) gives the following results (Table 3) [2].

Diagrams of models of oxygen nucleus and atom: a) diagram of the nucleus of oxygen atom (view to the plane of the nucleus); b) view to the nucleus from the face (arrow A); c) diagram of the model of the atom; 1-8- the numbers of the electrons; N – the nucleus of the atom; *r* – radii of the electrons; $R_1, R_2, R_3....R_8$ - radii of energy levels.

Energy of ionization of the seventh electron of the oxygen atom is $E_i = 35.116 eV$, and energy of its binding the nucleus, which corresponds the first energy level, is $E_1 = 83.98 eV$.

Table 3 Spectrum of the 8th electron of oxygen atom

Value	n	2	3	4	5	6
F (exper.)	eV	10.18	12.09	12.76	13.07	13.24
F (theor.)	eV	10.16	12.09	12.76	13.07	13.24
Ec (theor.)	eV	3.44	1.53	0.86	0.55	0.38

We'd like to draw the attention of the reader to the large divergences between the experimental data of spectroscopy concerning the seventh potential of excitation, which are available in reference books [7] and [8]. We have considered the data available in the reference book to be reliable [7].

Taking this fact into consideration, we'll have the following for the seventh electron of oxygen atom (Table 4)

Table 4. Spectrum of the 7th electron of oxygen atom

Quantum number	n	2	3	4	5	6
F (exper.)	eV	14.12	25.83	29.81	31.73	32.88
F (theor.)	eV	14.12	25.79	29.87	31.76	32.78
Ex (theor.)	eV	21.00	9.33	5.25	3.36	2.33

When analysing the structure of the atom or the molecule, one should bear in mind that binding energies of the electrons with the atomic nuclei are increased as they get nearer to the nuclei. The electron, which is the most remote from the nucleus, has the least value. It is the eighth electron in the oxygen atom (Fig. 3, Table 3). The seventh electron of this atom (Table 4) has greater binding energy with the nucleus. It means that it is situated deeper in its cell. When we use the term «cell», we imagine a volume of a cone form with the apex at the atomic nucleus and the base, which is equal to the ring size of the electron [2].

When the photons are absorbed, binding energy of the electron with the nucleus is reduced, and it goes on rotating and precessing on the nucleus, and it moves away from it and gets nearer to the surface of the atom.

When the electron emits the photons, its binding energy with the atomic nucleus is increased, and it gets deeper into its cell [2].Activity of the electron in the chemical reactions is determined by its binding energy with the atomic nucleus. If this energy is decreasing, the chemical activity of the electron and its atom is increasing [1], [2].

4. MODEL OF WATER MOLECULE

Fig. 4 shows the model of water molecule. The electrons of two hydrogen atoms are connected with the eighth electron and the seventh electron of the oxygen atom. Let us call hydrogen atom, which has been attached to the cell of the eighth electron of the oxygen atom, the first H', and let us call the atom, which is attached to the cell of the seventh electron of the oxygen atom, the second H'' hydrogen atom in water molecule. We'll give the same names to the protons and the electrons of hydrogen atoms (Fig, 4) [2].

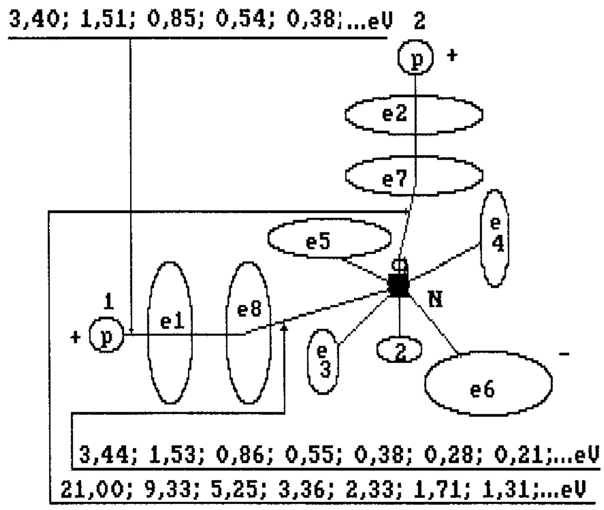

Fig.4

1, 2, 3, 4, 5, 6, 7, 8 - number of the electrons of the oxygen atom; N is the nucleus of the oxygen atom, P denotes the nuclei of the hydrogen atoms (the protons); e_1 and e_2 are the numbers of the electrons of the hydrogen atoms.

Binding energies of the 7th electron and the 8th electron of the oxygen atom with its nuclei, which correspond to their various energy levels, are shown in Fig. 4. Binding energies of the electron of the first hydrogen atom with its proton are given there too. Later on we'll show how to use these energies to calculate the energy of water electrolysis process. Now let us analyse low voltage process of water electrolysis, which has been used in industry to produce hydrogen for a long time [2], [6], [15].

5. LOW VOLTAGE ELECTROLYSIS OF WATER

Usually the solutions *NaOH* or *KOH* are used in low voltage electrolysis of water, that's why it is desirable to know binding energies of alkali metals with ion *OH*. The eleventh electron of sodium atom (*Na*) has the least binding energies with the nucleus, that's why it is the main valency electron of this atom (Table 5). Ionization energy of the eleventh electron of sodium atom is equal to $E_i = 5{,}139 eV$, and the energy, which corresponds to the first energy level, is equal to $E_1 = 13{,}086 eV$. Binding energies E_c of the eleventh electron with the atomic nucleus are near to binding energies of atom *Na* with ion *OH*.

Table 5 Spectrum of the 11th electron of sodium atom

Quantum number	n	2	3	4	5	6
F (exper.)	eV	-	3.68	4.31	4.62	4.78
F (theor.)	eV	-	3.68	4.32	4.62	4.77
Ec (theor.)	eV	3.27	1.45	0.82	0.52	0.36

Table 5 shows the theoretical *F(theor.)* and experimental *F(exper.)* values of energies of the photons emitted and absorbed by this electron as well as energies of its binding E_c*(theor)* with the atomic nucleus calculated according to formulas (2) and (3). Let us pay attention to the fact that the second energy level of this electron is a fictitious one.

Low voltage process of water electrolysis takes place when voltage is 1.6-2.3 V and strength of current is hundreds of amperes. Large strength of current proves large consumption of the electrons. As the eighth electron of the oxygen atom is situated at the larger distance from its nucleus than other electrons, the proton of the hydrogen atom connected with this electron is the first to come nearer to the cathode and to get the electron e_k from it (Fig. 5, a). When each of two water molecules gets the electron e_k, their surface electrons are united and form a cluster, which consists of two water molecules (Fig. 5, a, b) connected by two electrons e_k, emitted by the cathode. As it is clear, there is the orthohydrogen molecule in the chain of the protons and the electrons, which connect two water molecules. As the electrons, which have arrived from the cathode, have passed the free state phase, the hydrogen molecule

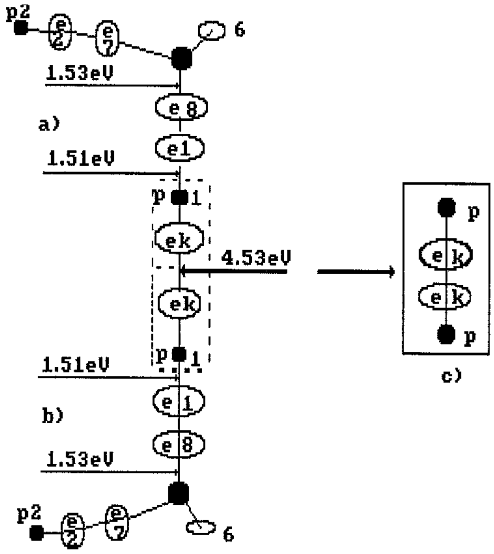

Fig. 5. Diagram of formation of the orthohydrogen molecule

fusion in this chain is accompanied by the release of energy. Fusion energy of one mole of the hydrogen molecule is equal to 436 kJ. Let us convert kJ into eV in reference to one molecule [2].

$$\frac{436 \cdot 1000}{6.02 \cdot 10^{23} \cdot 1.6 \cdot 10^{-19}} = 4.53eV \qquad (6)$$

The amount of this energy is shown on the right-hand side from the hydrogen molecule situated in the cluster chain (Fig. 5). On the left-hand side the binding energies 1.51eV of the hydrogen atoms with the oxygen atoms in water molecules are shown (Table 1).

The fusion energy 4.53eV of the hydrogen molecules redistributes the binding energies in the cluster chain in such a way that the binding energies of 1.51eV of the hydrogen atoms with the oxygen atoms in water molecules become equal to zero, and the orthohydrogen molecule is separated from the cluster chain (Fig. 5, c) [2].

Thus, the difference between the fusion energy 4.53eV of the hydrogen molecule and the total binding energy (1.51+1.51)=3.02eV is equal to (4.53-3.02)=1.51eV. This energy is spent for electrolytic heating of solution. When 1 m^3 of hydrogen is released,

$$\frac{1000 \cdot 1.51 \cdot 6.02 \cdot 10^{23} \cdot 1.6 \cdot 10^{-19}}{22.4 \cdot 1000} = 4058kJ \qquad (7)$$

The following chemical reaction will take place near the cathode

$$2H_2O + 2e^- \Rightarrow H_2 + 2OH^- + 1.51eV. \qquad (8)$$

Fig. 5 shows that two electrons e_k emitted by the cathode are spent to form one hydrogen molecule. In accordance with Faraday's law, two faraday-coulombs of electricity are spent for the formation of one hydrogen mole in this case:

$$2F = 2 \cdot 96485 = 192980 \text{ or}$$
$$192980/3600 = 53.60 A \cdot h/mol$$

If electrolysis takes place when voltage is applied to the electrodes, the energy

$$E = I \cdot V = 53.6 \cdot 1.70 = 91.12$$

watt-hours will be spent for obtaining one hydrogen mole, and the energy

$$E_m = (1000/22.4) \cdot 91.12 = 4.10 kWt \cdot h/m^3,$$

or $4.10 \cdot 3600 = 14760 kJ/m^3$ will be spent for obtaining one cubic metre. It is natural that quantity of heat energy of 4058 kJ (7) is a part of total energy of 14760 kJ spent for production of one cubic metre of hydrogen.

In alkali solution, the hydroxyl ions OH^- have the negative charge and they contact with the anode by its surface electron connected with the eighth electron of the oxygen atom (Fig. 5) and transfer excessive electrons to it. Then four ions OH^- interact with each other to form two water molecules and the oxygen molecule [2], [6].

$$4OH^- \rightarrow 2H_2O + O_2 + 4e^- + 143kJ/mol \qquad (9)$$

One cubic metre of hydrogen produced during water electrolysis is 44.64 moles. At the same time, 22.32 moles of molecular oxygen O_2 are released. Fusion energy of oxygen molecules will be equal to 143.0·22.32=3191.76 kJ.

If we add this value to energy 4058.0 kJ of cluster fusion of hydrogen molecules, we'll get the total amount of released heat energy of 4058.0 + 3191.76= 7249.76 kJ. If we take into account that energy of 14760 kJ is consumed to produce one cubic metre of hydrogen, we'll get index K_T of heat energy efficiency of this process.

$$K_T = \frac{7249.76}{14760.0} = 0.49 \qquad (10)$$

One cubic metre of hydrogen weighs 90 g. Energy content of one gram of hydrogen is equal to 142 kJ. When this hydrogen is burned, energy of 90×142=12780 kJ is released. The total index K_0 of energy efficiency of the process is the following:

$$K_0 = (4058 + 3191.76 + 12780)/14760 = 1.36 \qquad (11)$$

It should be noted that the actual energy expenses for hydrogen production in low voltage water electrolysis give this value. One cubic metre of hydrogen contains

1000/22.4=44.64 moles of molecular hydrogen. During its fusion, energy is released:

$$H + H \to H_2 + (436 \cdot 44.64) = 19463.0 kJ/m^3. \quad (12)$$

Modern electrolyzers spend nearly 4 kWh of electric energy or (3600x4)=14400 kJ in order to produce one cubic metre of hydrogen. Taking into consideration energy (19463.0) of fusion of one cubic metre of hydrogen and energy (14400) spent for its production, we'll find water electrolysis process efficiency index:

$$K = \frac{19463.0}{14400} = 1.35 \quad (13)$$

Thus, ***when low voltage process of water electrolysis takes place, the theoretical index of energy efficiency of this process is more than 100% [2].***

6. PLASMA ELECTROLYSIS OF WATER

There are several patents of plasma-electrolytic devices for production of heat energy, hydrogen and oxygen from water with the heat energy efficiency index more than 100% [9], [10], [11], [12], [14].

The essence of the plasma - electrolytic process is in the fact that current density at the cathode is dozens times greater than current density at the anode during this process. As a result, a flow of positive ions of metal, which is directed to the cathode, is formed in the solution. Due to the kinetic energy of these ions a part of hydrogen atoms is separated from water molecules and they form plasma of atomic hydrogen with the temperature 5000-10000^0 (Fig. 6). In this case, strength of current reduces considerably. A value of voltage can be specified, but in any case it will be greater than at the low voltage electrolysis. In this case, Faraday's law fails to operate, and the energy calculation can be based only on binding energies of the electrons and energies of fusion of atoms and molecules.

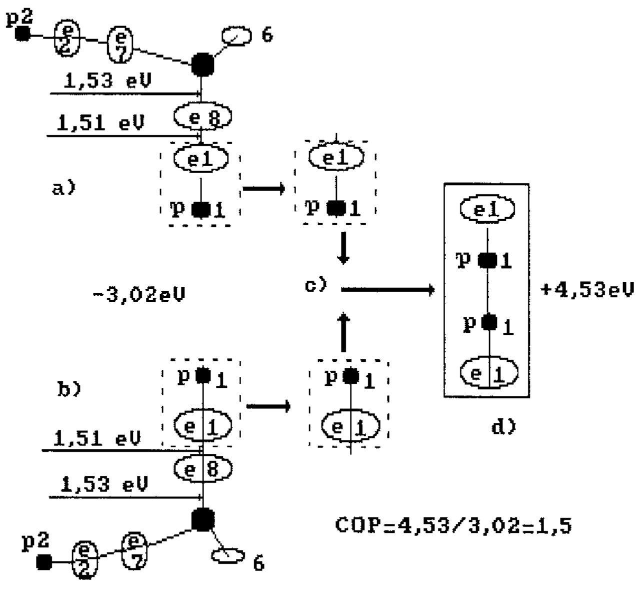

Fig. 6.

Diagram of fusion of the hydrogen molecules during water electrolysis: a), b) - water molecules; c), d) - hydrogen atoms; e) orthohydrogen molecule

Fig. 6 shows a diagram of separation of the hydrogen atoms from eight electrons of the oxygen atoms of two water molecules. The following reaction takes place near the cathode in this case

$$2H_2O + 2e^- \Rightarrow H + H + 2OH^- \Rightarrow H_2 + 2OH^- + 4.53eV. \quad (14)$$

Energy of $1.51 \cdot 2 = 3.02eV$ is spent for the separation of two hydrogen atoms H from two water molecules. Index K_T of heat energy efficiency of this process will be equal to

$$K_T = 4.53/(2x1.51) = 1.50 \quad (15)$$

The results of the experimental test of these theoretical calculations are given in Table 6. The preliminary tests have shown that the values of heat capacity of the solution C do not differ greatly from the values of heat capacity of water; therefore, this parameter has been taken the same as for water: C = 4.19 kJ/(kg degree). Figs 7, 8 and 9 show the diagrams of plasma- electrolytic reactors, which we have used in our research.

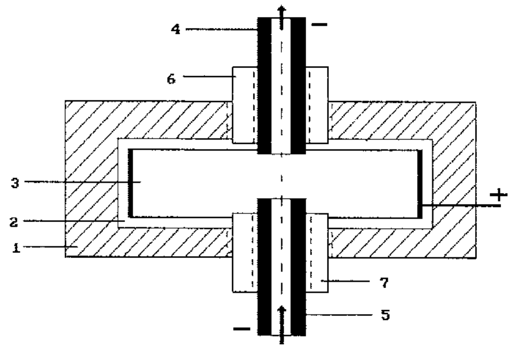

Fig. 7.
Diagram of the plasma - electrolytic reactor (patent No. 2157862): 1 - housing of the reactor, 2 - lid of the reactor, 3 - anode, 4 - cathode (outlet pipe), 5 - (inlet pipe), 6 and 7 - bushings

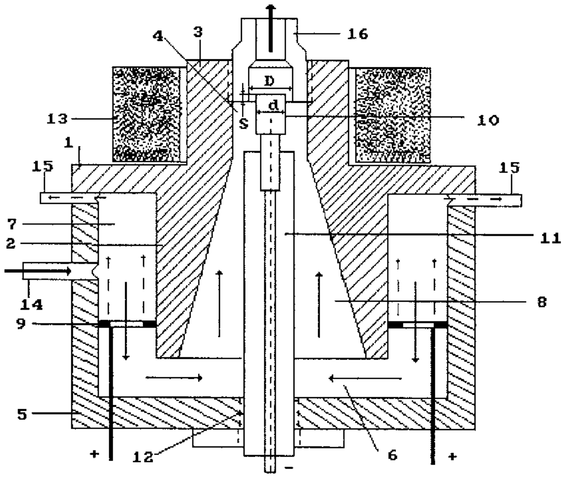

Fig. 8.
Diagram of a model of the plasma - electrolytic reactor (patent No. 2157427): 1 - housing, 5 - lid, 9 - anode, 10 - cathode, 13 - magnet

Table 6

Indices	1	2	3	Average
1 - mass of the solution before the reaction m_1, grams	1200	1195	1200	1198
2 - mass of the solution after the reaction m_2 , grams	1180	1180	1180	1180
3 - mass difference, inlet and outlet, $\Delta m = m_1 - m_2$, grams	20	15	20	18.3
4 - reactor inlet temperature t_1, degrees	21	21	21	21
5 - reactor outlet temperature t_2, degrees	85	85	85	85
6 - temperature difference $\Delta t = t_2 - t_1$, degrees	64	64	64	64
7 - duration of the experiment, τ ,s	279	307	282	289
8 - number of rotations of the electric power disc during the experiment ***n***, rot	39.5	44.5	41.5	41.8
9 - electric energy consumption according to the electric power meter readings, $E_1 = n \cdot 3600/600 kJ$. Note: 600 rotations of the electric power meter correspond to 1 kW h of electric power	237	267	249	251
10 - readings of voltmeter V, volts	196	200	199	198.3
11 - ammeter readings, amperes	3.66	3.30	3.58	3.51
12 - electric energy consumption according to the readings of the voltmeter and the ammeter, $E_2 = I \cdot V \cdot \tau$, kJ	220.1	202.6	200.9	201.2
13 -energy to heat the solution, $E_3 = C_1 \cdot m_1 \cdot \Delta t$, kJ	322.0	320.4	322.0	321.5
14 - energy consumed to form the vapours, $E_4 = C_2 \cdot \Delta m$, kJ	45.4	34.0	45.4	41.6
15 - total energy for heating and vapours $E_0 = E_3 + E_4$, kJ	367.4	354.5	367.4	363.1
16 - COP of the reactor according to the electric power meter readings $K_1 = E_0 / E_1$	**1.55**	**1.33**	**1.47**	**1.45**
17 - COP of the reactor according to the voltmeter and ammeter readings $K_2 = E_0 / E_2$	1.87	1.75	1.85	1.82

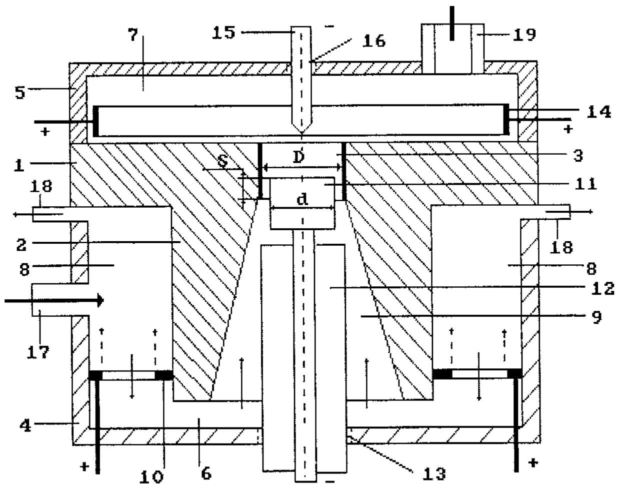

Fig. 9.
Diagram of a model of two chamber plasma- electrolytic reactor (patent No. 2157861):
1 - housing; 4 - lower lid; 5- upper lid; 10 and 14 - anodes; 11 and 15 – cathodes

Let us consider one more variant of formation of the hydrogen molecules from the destroyed water molecule. Fig. 10 a, b, c shows that in order to separate the proton of the hydrogen atom from the water molecule, it is necessary to spend 1.51 eV of energy. Then (0.85·2)=1.72 eV of energy will be released during further fusion of two hydrogen atoms. Then 4.53 eV of energy will be released during fusion of a hydrogen molecule. The total amount of energy will be 1.72+4.53=6.25eV in the process of fusion of two hydrogen atoms and a hydrogen molecule. The following reaction will take place near the cathode:

$$2H_2O \Rightarrow 2OH^- + H^+ + H^+ + 2e^- \Rightarrow H + H + 2OH^- + 2 \cdot 0.86eV \Rightarrow$$
$$\Rightarrow H_2 + 2OH^- + 1.72eV + 4.53eV \Rightarrow H_2 + 2OH^- + 6.25eV \qquad (16)$$

where H^+ is the proton.

In this case the index of heat energy efficiency will be equal to:

$$K = 6.25/3.02 = 2.07, \qquad (17)$$

The results of the experimental check of this theoretical calculation are given in Table 7.

Let us present the second variant of the calculation on the experiment (Table 7) but at this case we are not using the theoretical results of energy consumption for hydrogen production, but the experimental ones. One cubic metre of hydrogen contains 1000/22.4=44.64 moles of molecular hydrogen or 89.28 moles of atomic hydrogen. During the fusion of one hydrogen atom, 0.86 eV of energy is released. During the fusion of 89.28 moles of the hydrogen atoms will be released.

$$H^{+} + e^{-} \rightarrow H + 0.86 \cdot 89.28 \cdot 1.602 \cdot 10^{-19} \cdot 6.023 \cdot 10^{23} = 7322.3kJ / m^{3} \qquad (18)$$

Table 7

Indices	1	2	3	Average
1 - mass of the solution, which has passed through the reactor ***m***, gram	1200	1230	1160	1197
2 - temperature of solution, reactor input t_1, degrees	20	20	20	20
3 - temperature of the solution, reactor output t_2, degrees	31.0	30.5	31.0	30.8
4 - temperature difference $\Delta t = t_2 - t_1$, degrees	11.0	10.5	11.0	10.8
5 - durability of the experiment $\Delta\tau$,s	300	300	300	300
6 - number of rotations of the disc of counter during the experiment ***n***, rotations	4.44	4.44	4.44	4.44
7 - electric power consumption according to the reading of the counter $E_1 = n\ 3600/600\ kJ$ Note: 600 rotations of the counter correspond to 1 kWh of electric power	26.64	26.64	26.64	26.64
8 – voltmeter data, V	40	40	40	40
9 – ammeter data, A	1.80	1.80	1.80	1.80
10 - electric power consumption according to indices of voltmeter and ammeters, $E_2 = I\ V\Delta\tau$, kJ	21.60	21.60	21.60	21.60
11 - power to heat the solution, $E_3 = Cm\Delta\tau$, kJ	55.31	54.11	53.46	54.29
12 - reactor efficiency index according to counter $K_1 = E_3/E_1$	**2.08**	**2.03**	**2.01**	**2.04**

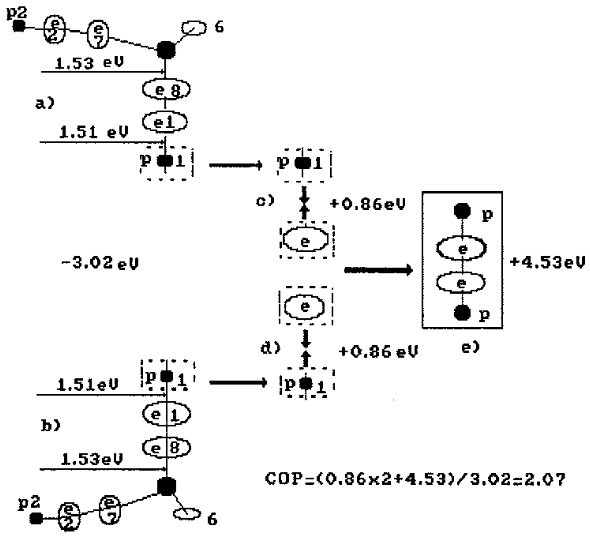

Fig. 10.
Diagram of fusion of the atom and the molecule of hydrogen in water electrolysis process: a), b) - water molecule; c), d) - hydrogen atoms, e) - orhtohydrogen molecule

Further fusion of one cubic metre of the hydrogen molecules will add some energy:

$$H + H \rightarrow H_2 + 436 \cdot 44.64 = 19463.0kJ / m^{3} \quad (19)$$

If we add the energies of fusion of the atoms and the molecules of hydrogen, we will get (7322.3+19463.0)=26785.3 kJ. In order to produce one cubic metre of hydrogen employing the existing technology, it is necessary to spend (4.0x3600)=14400 kJ. Index K of heat energy efficiency of this process of electrolysis will be (Table 7)

$$K = (26785.3/14400) = 1.86. \qquad (20)$$

It is clear, the results of two methods of calculation (16), (17) and (18), (19) and (20) will give the values of indices of energy efficiency of electrolytic process, which are close to the experimental data (Table 7).

7. COLD NUCLEAR FUSION

Earlier we have found out that fusion of the atoms and the molecules of hydrogen are the main source of additional energy for case of usual and plasma electrolysis of light water [1], [2].

During consideration of the model of the electron [1], [2], we have found out that it can exist in a free state only when it has a definite electromagnetic mass. Being combined with the atomic nucleus, it emits a part of energy in the form of the photons, and its electromagnetic mass is reduced. But stability of its condition does not become worse, because the energy carried away by the photon is compensated by binding energy of the electron with the atomic nucleus [1], [2].

If the ambient temperature increases the electron begins to absorb the thermal photons to pass onto higher energy levels of the atom and to reduce the binding with it. When the electron becomes free, it interacts with the atom only if the ambient temperature is reduced. As this temperature is reduced, it will emit the photons and it will change its energy level to the lower one [2].

If the electron is in the free state due to an accidental external influence on the atom and the environment has no photons, which are necessary for it to restore its mass, it begins to form the photons from the environment (the ether) immediately and to absorb them. The electron acquires the stable free state only after it restores its constants: mass, charge, energy and magnetic moment [1], [2].

Thus, if an interchange of the free state and binding state with the atom takes place due to the accidental influences on the atom, the electron restores its electromagnetic mass every time due to absorbing of the ether.

Many researchers think that the atomic nucleus fusion process is a source of additional energy during heavy water electrolysis. We have analysed this hypothesis and have determined that there is a possibility of formation of helium from the nuclei of deuterium and tritium. In this case the predicted process of the conversion of the neutrons into the protons can be generated by gamma radiation, but it is not converted into heat energy. In this case the thermal photons are generated by means of formation process of helium atoms and not by its nuclei. The calculation shows that 47352 kJ of heat energy can be released during the formation of one mole of the helium atoms. ***This energy is enough to evaporate 18 liters of water.***

It means that the accurate measurements of quality of helium should be carried out. As it is supposed, helium is formed during electrolysis of heavy water. If the calculation results and experimental ones are the same, it will be necessary to intensify helium formation process [2].

8. PLASMA-ELECTROLYTIC GENERATOR OF GASES

The new theory of water electrolysis predicts the possibility of significant reduction of energy consumption for production of hydrogen from water. For example, let us pay attention to the structure of orthohydron, its diagram is shown at Fig. 2, b. This structure is formed when the hydrogen atoms of two water molecules get nearer to each other (Fig. 10).

In this case each of two water molecules transfers one proton and one electron to a hydrogen molecule, and the hydrogen molecule is formed without the electrons emitted by the cathode, i.e. without direct expenses of electric energy for this process (Fig. 10, c). In this case electric energy is spent only for the separation of the formed hydrogen molecule. Two water molecules connected in such a way form the simplest cluster. When water molecules are converted into a vaporous state, the bonds between the clusters are broken, and we have an opportunity to find energy of these bonds between water molecules in the cluster at the temperature of 20°C. We use vapour formation energy of 2595.2 kJ/kg for this purpose. Let us convert this energy into electron-volts per one molecule

$$E_C = \frac{2595.2 \cdot 1000}{6.02 \cdot 10^{23} \cdot 1.6 \cdot 10^{-19} \cdot 55.56} = 0.485 eV. \quad (21)$$

On the Fig. 11 the value of this energy is given to the right of the hydrogen molecule situated in a cluster chain. Binding energies of 1.27 eV between hydrogen atoms and the eighth electrons of the oxygen atoms are shown in the left-hand side. Before the cluster was formed, these energies were equal to 1.51 eV. When the cluster was formed, a part of this energy was redistributed for the formation of the bond between the protons of two water molecules with energy of 0.485 eV. That’s why binding energies 1.51 eV were reduced, and they became equal to (1.51·2-0.485)/2=1.27 eV.

Now let us determine the temperature of plasma, at which these bonds will be broken. The temperature of plasma related with the photons, which are emitted and absorbed by the electrons of the atoms during their energy transitions. In order to break the bond with energy of 1.27 eV, the electron should absorb one or a collection of the photons with energy of

$$E_c = mc^2 = 1.27 eV .$$

When this bond is broken, the temperature can be determined approximately. For this purpose, let us use the dependence of kinetic energy of molecule movement of ideal gas on the temperature.

If we equate energy E_c to the energy of thermal movement of the ideal gas molecules, we’ll get

$$E_c = 3 \cdot k \cdot T , \quad (22)$$

where $k = 1.38 \cdot 10^{-23} J/K$ is Boltzmann constant; T is Kelvin temperature.

We’d like to draw your attention to the fact that the dependence (22) is the dependence of binding energy of the hydrogen atom with the water molecule on the temperature when this bond is broken. Temperature T_c according to Celcium scale, which is required to break the bond with energy of 1.27 eV, is determined according to the formula

$$T_C = \frac{E_c}{3\cdot k} - T = \frac{1.27\cdot 1.602\cdot 10^{-19}}{3\cdot 1.38\cdot 10^{-23}} - 273 = 4637.0^0 C \quad (23)$$

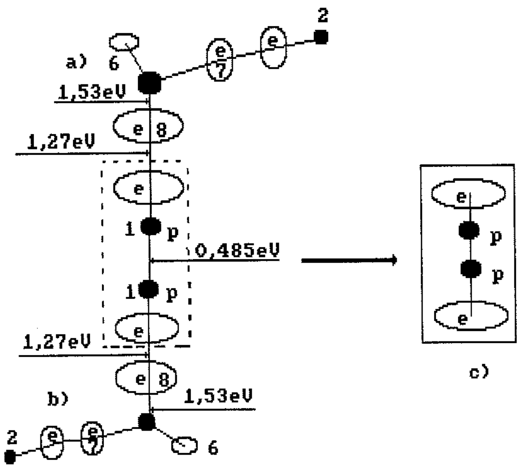

Fig. 11
Diagram of formation of the second model of orthohydrogen molecule: a) and b) diagrams of water molecule; c) orthohydrogen

It is known that plasma of atomic hydrogen has a temperature of 5000 - 10000^{0}C [15]. It means that intensity of the process of separation of the hydrogen molecules from the clusters of water depends on the temperature of atomic hydrogen plasma. When this temperature increases, intensity of hydrogen release should increase too. The temperature of plasma depends mainly on voltage between the electrodes. If the voltage become higher, so the temperature of plasma is greater. Fig. 12 shows the dependence of hydrogen output intensity on voltage in supply mains of the plasma-electrolytic reactor.

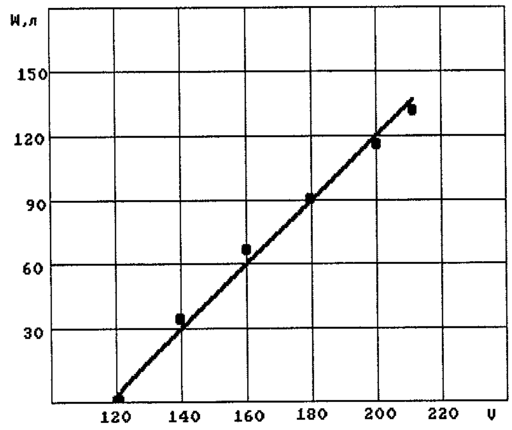

Fig. 12
Dependence of hydrogen output W (liters) on voltage V of power supply source

Let us pay attention to the fact that theoretical dependence of binding energy $E_c=f(T)$ on the temperature, at which this bond is broken, and the experimental dependence of the volume of hydrogen being obtained $W=f(V)$ on voltage are linear. It proves the existence of the bond between these phenomena.

Thus, if it is possible to create the conditions when the clusters of two and more water molecules contact the atomic hydrogen plasma, which temperature is 5000-10000^{0}C, the energy of this plasma is enough to break the bond with energies of 1.27 eV.

As plasma is formed from atomic hydrogen, the process of synthesis of the molecules of hydrogen from its atoms takes place partially as well. It provides this small increase (222.6-180.9)=41.7 kJ, Table 8) of thermal energy, which is registered in the experiment. But the majority of the hydrogen molecules are formed according to the diagram shown in Fig. 10, i.e. without the consumption of the electron emitted by the cathode.

Table 8 Experimental results

Indices	1	2	3	Average
1 – duration of the experiment τ, s	300	300	300	300
2 – input of energy E_1, kJ	157.8	144,0	132,0	144,6
3 – energy of hot water E_2, kJ	209.97	190,20	180,50	193,56
4 – output of gas mixture, liters	136.13	145,62	137,87	139,87
5 – output of hydrogen, liters	108.90	116,50	110,30	111,90
6 – output energy of hydrogen E_3, kJ	1392.74	1488,82	1409,63	1430,04
7 – output common energy E_4 , kJ	1602.71	1679,02	1590,13	1619,95
8 – heat COP of the reactor $K_1 = E_2 / E_1$	**1.33**	**1,32**	**1,37**	**1,34**
9 – common COP of the reactor $K_2 = E_4 / E_1$	**10.16**	**11,66**	**12,05**	**11,29**
10 – electric energy consumption to produce one cubic meter of hydrogen, kWh/m^3	**0.40**	**0,34**	**0,33**	**0,36**

Specialists know that the reduction of energy expenses by obtaining one cubic meter of hydrogen from 4 kWh/m³ to 0.40 kWh/m³ means complete solution of the energy problem [2].

High temperature of plasma forms the conditions, under which several various processes take place near the cathode. Firstly, water is boiled and evaporated. At the same time, a part of the molecules is destroyed, and atomic hydrogen is released, another part of the molecules forms the orthohydrogen molecules. A part of water molecules is destroyed completely, and oxygen is released with hydrogen near the cathode. A part of hydrogen is combined with oxygen to form water again.

Thus, water steam, hydrogen, oxygen and partially ozone are released at the same time. If steam is condensed, a mixture of the gases is released. In the average modes of the operation of the reactor, the mixture of gases, which are formed near the cathode, contains 80% of hydrogen and 20% of oxygen. It is necessary to reduce the concentration of oxygen in this mixture. The new theory of water electrolysis opens the ways to solve this task.

Plasma electrolysis of water reduces energy expenses for production of hydrogen from water by an order of magnitude greater, and it becomes a competitive source of energy. In Table 8 the results of one of such experiments obtained by us together with D.V. Korneev are given.

9. FUEL CELL EFFICIENCY

Fuel cells are considered to be one of the most prospective consumers of hydrogen. But efficiency of the process of the reaction between hydrogen and oxygen in a fuel element and the formation of electric power are studied insufficiently. The data of one of the fuel cells are given in the report [16]. At hydrogen consumption of 2 kg per hour it generates 30 kWh of electric power. As one cubic meter of gaseous hydrogen weighs 90g, 2 kg of liquid hydrogen contain 22.2 m^3 of gaseous hydrogen. If we take into consideration that in order to produce 1 m^3 of hydrogen the best industrial electrolyzers consume 4 kWh and assume the energy value as 100%, we will get energy efficiency of the fuel cell

$$\frac{30\cdot 100}{22.2\cdot 4}=33.8\% \,. \qquad (24)$$

The source of information [17] reports that efficiency of fuel cells of the third generation with solid electrolyte is near 50% and use of the technology in fuel cells allows to increase efficiency of electric power up to 75%; taking into consideration heat generated by them, efficiency is increased by 90% or 95%. Efficiency of fuel cells depends on efficiency of use of electric properties of the hydrogen itself. If quantity of the electrons, which belong to the atoms of hydrogen and take part in the formation of electric power of the fuel cell, is taken into consideration, efficiency of physical and chemical process of this cell is less that 1%. Let us make a calculation for the fuel cell, which is described in the report [6]. This fuel cell generates 30 kW of electric power when 2 kg (22.2 m^3) of liquid hydrogen is consumed per hour. As the mole of gaseous hydrogen is equal to 22.4 litres, it is necessary to consume 22222.22/22.4=992.06 moles of molecular hydrogen for the production of 30kW of electric power. If we take into account this value as well as Faraday's number F = 96485 kl/mole and the number of the electrons in the hydrogen molecule, we will get the total number of coulombs of electricity in 992.06 moles of molecular hydrogen 992.06×2×96485=191437818.2. These are potential possibilities of 22.2 m^3 of molecular hydrogen. In what way are these possibilities used by modern fuel cells? The fuel cell being considered operates at voltage of 100V; that's why when 30 kW are generated, current of 30000/100=300 amperes per hour circulates in its electric circuit. 3600 coulombs of electricity are consumed at 1 ampere per hour and 1080000.0 coulombs are consumed at 300 amperes per hour. If we assume that potential quantity of coulombs of electricity, which 22.2m^3 of hydrogen contain (191437818.2 coulombs) is 100%, actual quantity of coulombs of electricity generated by the fuel cell is

$$\frac{1080000.0\cdot 100}{191437818.2}=0.57\% \qquad (25)$$

The given calculations show that energy possibilities of hydrogen in fuel elements are used only by 0.6%. If this index is increased tenfold, it will mean the global priority of hydrogen energetics in all fields of human activity [18].

10. CONCLUSION

There are the water plasma electrolysis modes when energy expenses for hydrogen production are reduced tenfold minimum, and it becomes the main source of energy in future. Potential possibilities of modern fuel elements are used only by 0.6%. There is a reason to believe that this index will be improved greatly in the nearest future. Theoretical and experimental information obtained by us shows that the ways of the guaranteed solution of the future energy problems have been found.

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Nikola Tesla and Instantaneous Electric Communication

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Nikola Tesla (1856-1943), an outstanding inventor, was and still remains one of the most mysterious persons in the history of electrophysics. Whereas the most scientists were moving together in direction of microparticles investigations, as the basis of matter structure and of nature itself, he was going in opposite direction. He had a keen interest in the investigation of electric charge of the Earth as a whole. He was looking for the ways to influence on it, to control its state and methods of its regulation.

Therefore, exactly, the most of his searches, experiments, the purpose of constructions and buildings, created according to his conceptions, cause perplexity and misunderstanding of scientists even in nowadays.

The most mysterious of his main experiments were made in USA after 1904. After Nikola Tesla death in 1943, all his diaries and records over a period from 1904 year had mysteriously disappeared. Probably they were stolen (it was known, what to take). Lost records could "cast light" on one of the most "strange" of his buildings made in the form of the enough tall tower, on the top of which a specially created toroidal transformer was placed. This transformer could create there a huge electric potential up to the billion volts.

Nikola Tesla switched on this tower-device, what caused the fright and even panic in mind of people from nearby settlements. Of course! Because of very high electric potential there began air ionization, which spread very high to the atmosphere accompanying by the effect of color play. Such luminous, color-playing sky caused even a horror of people, who knew nothing about the experiment made and its goals. They did not guess that Tesla by means of the electric charge, created of the tower, was influencing on the electric charge of the Earth as a whole (about 600000 Coulomb). There was a global scale in Nikola Tesla's investigations.

There is no point in detailed analysis of the fact that the potential of the tower top influenced on the Earth charge. Interaction of charges-balls with the distortion of field lines, distortion-distribution of charge on their surfaces, induced charge, is beautifully described even in school physics textbooks. In Nikola Tesla investigations the Earth had the role of one of the charged balls. It was possible by changing of charge on the tower to deform electric charge distribution on the whole Earth surface at once. This deformation (electric currents) could be fixed at once in every point of the Earth surface. It is alluring to use this effect for data transfer telecommunication, both on the Earth, and in space.

After such introduction the question "How does the system of instantaneous electric communication for any distance look like and work?" is still opened. First of all, the readers need to know, that such instantaneous communication is possible in principle. The proving theoretical calculations, are rather difficult for popular interpretation. Some part of readers can take it on trust, and those who are most interested in can apply to works of Oleinik V.P. (quantum physics) the professor from Kiev Polytechnic University. At the minimum there are two necessary works: Oleinik V.P. "Faster-than-light transfer of a signal in electrodynamics. Instantaneous action-at-a-distance in modern physics" (Nova Science Publishers. Inc. New York. 1999) and Oleinik V.P. "Latest development of quantum electrodynamics: self-organizing electron, faster-than-light signals, dynamical heterogeneity of time." (Physical vacuum and nature. 4. 3-17. 2000).

"PC" magazine has devoted rather big article "Computers and teleportation" to V.P. Oleinik works, concerning instantaneous electric communication ("PC" #6, 2000). Note, that the author of the given article has also found the possibility of instantaneous electric communication, but by means of materialistic methods, absolutely different from Oleinik's ones, what is most