

New Electric Fire Technology

Valery D. Dudyshev

Doctor of Technical Science, Professor,
Corresponding Member of Russian Ecological Academy
ecolog@samaramail.ru
<http://www.intrasoft.ru/nizot>

Abstract

The article proves importance and prospects of development of combustion technologies. In particular there is considered application of a new electric fire technology for environmentally appropriate combustion of any matters and gases. The technology uses electric fields as combustion catalyst. There is observed application of technology in heat-and-power engineering, transport heat engines, disposal units etc. [1, 2]. It is demonstrated that the new technology allows intensify combustion processes and increase their controllability (i.e. the control of temperature, gases pressure, gradient of heat conductivity, and so on). There is made a conclusion about availability of the technology to solve critical energetic and ecological problems of the civilization.

We hope that this article will excite interest of a wide circle of readers, i.e. of professionals in the area of combustion and heat technologies, physicists, ecologists, and those people who are interested in new scientific ideas.

Global Ecological Problems are the Problems of Ineffective Combustion of Hydrocarbon Fuel

The ecological problems become more and more serious and threaten to grow into world ecological catastrophe. The main cause of the atmosphere pollution in megapolises is imperfection of combustion technologies (of heat-and-power engineering, heat machines, transport engines, waste combustion...). It has been proved that their share of pollution of the planet atmosphere comes to 70-80%. The combustion technologies mean any technologies of combustion of fuel, matters and gases. The combustion technologies are the most popular technologies in the world. The modern civilization without the combustion technologies is impossible. There are many industries, which apply these technologies, such as heat-and-power engineering, transport, metallurgy, food industry, oil-and-gas refining industry, chemical industry, waste combustion neutralization.

Therefore the global ecological problems will not be solved until the mankind develops the combustion technologies. The article describes and discloses the essence of the new technology of ecologically appropriate and effective combustion of fuel and wastes of any type.

Why is it difficult for ecologists to conserve nature?

Modern methods and technology used for solving of the ecological problems consist in **analysis** of extent and sources of the environment pollution (ecological monitoring), and, moreover, in **refinement of atmosphere, water and soil, which are used in different technologies or have been polluted due to the imperfection of the technologies** (it is refinement from such toxic components as drinking and run-off water, exhaust and waste gases etc.).

Unfortunately, methods of measuring of the huge spectrum of toxic matters, which are thrown into the atmosphere at matters combustion, as well as the methods of their utilization are impartially difficult, expensive and imperfect. Even using of an ideal technics for measuring of the atmosphere pollution is not effective since it is a struggle with **consequences** of the combustion and other technologies imperfection but not with **causes** of the atmosphere pollution.

Ecological and energetic effectiveness of the known combustion technologies

It is known that real effectiveness of transformation of chemical energy of fuel in the combustion process is low. For example, in heat engines it comes to 25%, effectiveness of transformation of heat energy into electric energy in thermoelectric power stations does not exceed 40%. If energy consumptions of mining, processing and delivery of the fuel to consumers are taken into account then the summary efficiency of the existent combustion technologies (of heat machines and devices) comes to no more than 10 – 15%! It means that more than the half of chemical energy of the fuel is transformed into heat and different toxic matters and waste gases, which pollute the planet atmosphere. They cause acid precipitation, a global "greenhouse" effect, which threaten to cause the climate warming, the world flood, and final poisoning of the living nature. Thus the share of imperfect power engineering in the nature pollution comes to 70 – 80%! How is it possible to cleanse the planet atmosphere, especially the environment of world megapolises, in the situation when the amount of toxic matters produced by transport and industries is comparable with the amount of rest pure air?

Until the mankind learns burn matters and gases by effective and ecologically appropriate way the planet atmosphere will remain polluted and in near future it can become uninhabitable. Thus we will not solve the ecological problems until we gain the understanding of the combustion processes and processes of combustion transformation of matter chemical energy into heat energy, and then into other useful types of energy (i.e. electric energy, mechanical energy, light energy).

Physical Essence and Problem of Classical Combustion of Matters

Combustion is one of the most difficult phenomena, which are known by the humankind. From the scientific point this phenomenon is a chain reaction of sequential fragmentation of fuel particles into smaller charged radicals; it is physical chemical processes of transformation of chemical energy of intermolecular connections as well as combustion also includes physical processes of transformation of energy into heat and light on molecular and atomic levels. Many other processes, which proceed simultaneously, are involved.

From school years we know that combustion is a process of interaction of fuel with an oxidant that is accompanied by heat and light energy generation. In higher school the words of "as well as by cryptic energy of chemical connection of waste gases" are added to the school definition. The combustion processes are studied and improved by scientists and experts of different areas (chemists, physicists, heat-and-power engineering specialists, thermalphysicists etc.). There are known fundamental investigations of combustion chain reactions made by such Russian scientists as N.N. Semenov, Ya.B. Zeldovich and their followers.

Until now intensiveness of fuel combustion is increased by air blowing into the combustion zone that increases the amount of waste toxic gases thrown into the atmosphere. **Let us arouse several questions, which seem naive at first sight. Why is an oxidant (air or oxygen) needed for matter combustion? Is it possible to do it without any oxidant?** How does the combustion process begin and proceed? There are a lot of vague questions in physics of combustion. For example, how can the temperature and the intensiveness of the combustion be regulated? Can the heat conductivity of the flame be controlled? How can heat motion of particles be regulated in the flame and in the waste gases, and what can it cause? There is another problem of combustion. It is the very hydrocarbon fuels, which are applied at modern heat processes. The great Russian scientist, D.I. Mendeleev stated that to use oil is the same thing as to stoke a stove with banknotes.

Since the hydrocarbon fuels are complicated chemical matters and the combustion processes are imperfect then in the process of their combustion a great amount of different by-product matters and toxic gases are produced. They waste unused self-energy of fuel into the atmosphere and pollute our planet.

Physical essence of the new electric combustion technology

How is it possible to burn the hydrocarbon fuel by environmentally appropriate way? How can this environmentally appropriate technology be realized in

practice? A brief answer is following: **it is necessary to make such conditions of combustion of organic fuel, and to introduce such a combustion catalyst that the energy of intermolecular and intramolecular connections of the organic fuel becomes absolutely free. At that the chemical energy can be transformed into energy of electromagnetic radiation, for example, into light energy and heat energy without generation of by-product polluting matters and gases. Then a working body (for example, water) is effectively heated by this directed concentrated electromagnetic radiation. In this process effects of electromagnetic waves reflection and concentration are used, or the electromagnetic radiation is directly transformed into electric energy.** In this case there is a new opportunity to regulate flame temperature and to extremely decrease quantity of the oxidant, i.e. to create organics combustion with minimal quantity of waste gases.

Is it principally possible to burn organic matters and gases without the atmosphere pollution using electric field as a catalyst? It is possible if parameters of this field are correctly chosen. More precisely it is possible if huge Coulomb forces of the electric field are correctly regulated by interaction of electrically charged particles of the fuel and the oxidant with force lines of the electric field.

One variant of an experimental device is represented in Fig. 1.

Devices for approbation of the new electric combustion technology

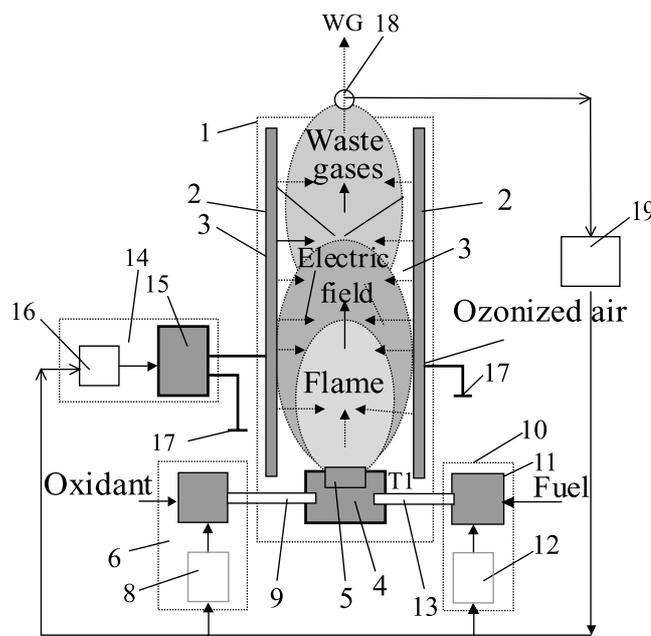


Fig.1 a

Plan of the experimental device

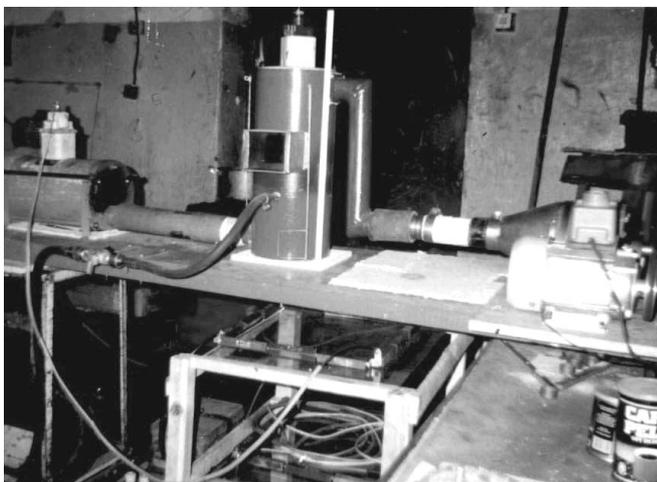


Fig. 1 b

Photo of the experimental system

A structure chart of the experimental device, which was designed to investigate the new electric combustion technology, is demonstrated in Fig.1a. The device contains a body (1) equipped with flat electrodes, which are insulated from the body (2), (they can be placed in either horizontal flat or vertical flat). The electrodes (2) are located on opposite inner walls of a combustion chamber (3). The device is equipped with a mixer (4) with a device for supplying of blended fuel to the zone of combustion. At the same time the device (5) is used for electrical combustion of the blend. The described device is equipped with an air track (6), which contains an oxidant activator (7) joined with a regulator (8) by a control circuit and with the mixer (4) by an air pipe (9). The regulator (8) serves for regulation of the oxidant activation extent. At the end of the air pipe it is possible to place a vortex device (it is not shown in the figure). Also the device is equipped with a fuel track (10) containing a fuel activator (11) and a regulator (12) of the activator and consumption of fuel. The block (11) is joined with the mixer (4) by a fuel pipe. The device is equipped with an electric combustion activator (14) containing a high-voltage transformer (15) of intensity and frequency joined to its regulator (16) by a control circuit. An electric outlet of the block (15) is joined to one of the electrodes (2), and the second outlet is safely electrically grounded by a grounding mat (17). The high-voltage wire of the outlet of the block (15) is connected with the electrode (2) through a bushing insulator (it is not demonstrated in Fig.1a). The device is equipped with a gas toxicity calculator (18) joined to the inlet of a mode optimizer (19), which is a control system for interacted regulating of all the parameters of combustion. For that the outlet of the mode optimizer (19) is joined to the inlets of control of the regulators (8), (12), (16).

The device operates in the following way. At first an activated oxidant of O1 is applied through the air track (6), activator (7) and air pipe (9) to the mixer (4). Then an activated fuel of F1 is applied through the fuel track (10)

and the activator (11) to the same mixer (4). A blended fuel is prepared in the mixer (4) and then is atomized and combusted by a sparkle of the block (5). In the combustion chamber (3) flame and waste gases are processed by strong alternating electric field, which is generated by the block (14) in a gap between the electrodes (2). In the process of combustion waste gases toxicity is measured by the special toxicity sensor (18). Depending on current toxicity the parameters of flame combustion are regulated by the mode optimizer (19). More precisely the oxidant consumption and the extent of its activation are changed by the regulator (6), the fuel consumption and the extent of its activation are changed by the regulator (12), the intensity and frequency of the alternating electric field generated by the block (14) in the combustion chamber (3) is changed by the regulator (16). Let us note that the electric field in the combustion chamber (3), viz in the gap between the electrodes (2), catalytically influences on both the flame and the waste gases. The essence of the process lies in the fact that the processes of fragmentation and oxidation of fuel radicals and of toxic oxide molecules are accelerated. Intensiveness of combustion and of toxic gases refinement increases as well as the intensity of this field and its frequency do. As a result of the interconnected regulation of all the listed parameters fuel of any kind can be fully, intensively, "cleanly" combusted.

In Fig.1b there is a photo of the operating experimental device designed to investigate the processes of influence of electric field on the process of matters combustion and of cleaning of waste gases. The photo represents following things.

1. In the left side there is a furnace with a high-voltage electrode in a higher part of its body.
2. In the centre there is a vertical column of the electric combustion cleaning (after-burning) of toxic gases in the electric field; on the top of the column a high-voltage electrode can be seen. Gas pipes designed for toxic gases supply-withdrawal are connected with the column and located to the right and to the left from it.
3. A regulable blower is represented in the upper right side of the picture. It is designed for toxic gases withdrawal and connected with the gas pipe by the column.
4. At the foot of the picture there is a regulable high-voltage tension source (the electric field source), which is connected with the furnace and the column of toxic gases cleaning by high-voltage wires.

It is experimentally proved that combination of two stages of the combustion activation (i.e. in the furnace and the column) ensures ideal cleaning of toxic gases at combustion of any toxic matters.

Some Results of Experiments

Our experiments and investigations of many-sided influence of electric and high-voltage electromagnetic fields on the combustion process have proved that such practically ideal condition of fuel and matters combustion is possible to be realized in practice [1].

Low-powered static and alternating electric fields (i.e. the fields of constant sign and of variable sign) of more than 1kV/cm intensity were used as combustion catalysts as well as high-frequency electromagnetic fields of low power with some frequency of oscillations of molecules in the flame (flame power is 0.1 – 1% of heat power of the flame of the combusted organic fuel).

Peculiarities of Oxidants Application in the New Technology

It is known from the thermodynamics and combustion theory that optimal ratio of the oxidant mass, for example air, and the fuel is approximately 1:16 in an average combustion process. In our experiments with the electro-field catalyst the ecologically appropriate combustion of the hydrocarbon fuel (mazut, straw oil) was achieved at oxidant deficiency (for example, at the ratio of oxidant mass and the fuel of 1:1). For experts it means that there is a real possibility for 10 – 15 times decrease of amount of waste gases of any heat machines and to while their former power is the same. As the experiments demonstrate carbon and hydrocarbon are absolutely removed from the waste gases. In the experiments oxides of hydrogen and nitrogen were 4 – 8 times decreased and flame existence was 5 – 10 times increased.

The issues of the experiments prove the hypothesis about possibility of effective environmentally appropriate combustion as a process of direct transformation of chemical energy of organic fuel into electromagnetic radiation energy of the flame (including heat and optic diapasons). The transformation is accompanied by removal of polluting toxic components from the waste gases that occurs due to many times intensification of the combustion process under action of electromagnetic catalysts.

Operations of regulable activation of fuel oxidants (simultaneous or separate), which are introduced into the combustion technology, ensure additional improving of the combustion process. Especially it occurs at heavy oil fuel combustion and water-fuel emulsion combustion that was experimentally tested by us. The process becomes especially effective if the flame of the combusted activated blended fuel is additionally processed by alternating electric field. Due to introduction of the operation of all the combustion parameters regulation (of consumption of fuel, oxidant, of their activation extent, and of their combustion

intensiveness extent), according to the information of the waste gases toxicity, it is possible to achieve effective combustion of fuel and waste products of practically all kinds.

Our experiments demonstrate that combination of the very flame procession with procession of the waste gases and air (i.e. an oxidant) by electric field is very effective for the waste gases cleaning. The essence of this additional cleaning of the waste gases lies in fragmentation of carbon particles and exhaust opacity by electric forces of an alternating field as well as in after-oxidation of some toxic oxides in the medium of an ozonized oxidant. Energy consumption for activation of the flame combustion by strong electric fields is small and does not exceed 1–3% of heat energy of the flame. Advantage of this invention is universality of the application for combustion of any inflammables. It is possible due to widening of the diapason of the electric field parameters regulation (of intensity and frequency), especially in the mode of their interconnected regulation.

The essence of catalytic action of the alternating electric field on the flame combustion process consists in effective breaking of dipole radicals of fuel by an activated (dipole) oxidant. Moreover, the essence lies in better mixing of layers of combusting flame with the oxidant that occurs due to removal of a doubled electric layer from the limit line of the flame. Thus this technical solution allows achieve new positive effects due to its significant peculiarities, i.e. extending of application area of the known electric combustion method over the combustion process of any inflammables as well as it allows significantly increase controllability of the flame combustion process.

Let us note that in the experiments on the combustion of organic fuel in strong electric fields the regulation of the flame temperature and of its existence was achieved at unchanged consumption of fuel and of oxidant. That was achieved by changing of the parameters of the combustion electric-field catalyst (intensity and frequency) of a longitudinal electric (electromagnetic) field. Rotation and stabilization of the flame was achieved by a rotating transversal electric field. Changing of the flame height was realized by the longitudinal electric field.

The investigation, which has been performed by us, proves that directly acting on the flame the very electric field which directly influences on the flame and emission of electrons flow (ideal type of oxidation) into the flame can most effectively intensify the combustion process and make it harmless for the humankind and for the environment!

It has already been experimentally proved that energy consumption required for generation and regulation of this electric field and of the electrons flow for intensification and environmental

appropriateness of the combustion is quite small relatively the combustion energy and comes to fractions of a percent of the flame energy. Thus our experiments prove that the best “**oxidants**” and **combustion catalysts** are not superfluous air but the **electron and the electric field!**

Regulation of Heat Conductance of the Flame and the Heat Flow

As our experiments have demonstrated, the electric field can act as an effective combustion catalyst as well as a regulator of its intensiveness; moreover, it can control even a vector of heat conductance. It is proved by the experiments that the parameters of this field can be regulated as well as temperature of the flame and gradient of the flame heat conductance. Interesting experimental results were obtained measuring full heat of combustion of the same quantity of fuel at the usual method of fuel combustion and at the method, which uses combustion electric catalysts, even in the case of oxidant deficiency. In the last case the energy of fuel combustion almost 1.5 times increases that can be explained by fuller transformation of fuel chemical energy into electromagnetic radiation. At the usual combustion methods the chemical energy of the organic fuel was not completely used and remained as a cryptic summary chemical energy of intermolecular connections of many toxic waste gases, which were exhausted into the atmosphere by heat devices. Basing on the performed experiments it may be supposed that, evidently, specific heats of matters are 20-50% higher at this method than at their usual combustion method. The essence of the new electric combustion technologies consists in this new physics of combustion.

The author has already got patents for invention of Russian Federation [3 – 12] for the methods of regulation and intensification of matters combustion processes.

Some peculiarities of atomization, inflammation and combustion of organic fuel in electric fields

We have not discussed all the potential capabilities and advantages of the new electric combustion technology for different areas of technics. Let us demonstrate them in more details.

One of characters of the new electric combustion technology is **effects of oxidant ozonization, of electrostatic atomization and electrostatic injection of electrically charged particles of fuel and the oxidant that is followed by generation of the finest aerofuel opacity on a molecular level in a combustion chamber.** Naturally, such fine atomization of the fuel causes its easier evaporation, inflammation

and combustion especially in the medium of the ozonized oxidant. **The mechanism of fuel electrostatic fragmentation is physically explained by Coulomb interaction of repulsion from each other of electrically likely charged fuel drops (particles) that is accompanied by their progressing fragmentation and corresponding decrease of their mass and electric charge.** As the experiments have shown the extent of the fuel drops (particles) fragmentation depends on initial electric potential of fuel charging and initial size of injected fuel drops (particles), which for their part depend on configuration and size of a fuel-injection nozzle as well as on pressure occurring in a fuel line of the heat machine.

Generated by dipolar high-voltage potentials catalyzing electric field can be introduced into the atomization zone or (and) the combustion zone of the combustion chamber of an engine. Its Coulomb forces accelerate motion of electrically charged particles of fuel and oxidant to an opposite electric potential, which is connected with, for example, a piston of an engine. Thus electric field acts as an electrostatic pump that allows decrease pressure in a fuel line as well as allows practically ideally atomize the fuel and mix it with the oxidant. Moreover, it lets simplify and improve the systems of injection and inflammation of the blended fuel in heat machines and devices, for example, in internal combustion engines or in boiler plants. Their application can cause additional improving of energetic and ecological characters of the combustion technologies. According to our information, such high-performance fuel-injection nozzles have yet been unknown in technics therefore they have not been applied in heat machines (injector internal combustion engine).

Is it possible to combust water? Water as a fuel!

More amazing experimental results were obtained at 40-80% dilution (emulsification) of liquid organic **fuel**, for example diesel oil, with **habitual water**. Summary energy as heat and light, which is generated in the process of such blend combustion, was not practically changed that can be explained by liberation of energy of chemical connections of water as well as of fuel. In the process of the experiments on combustion of the emulsion at first **it was transformed into the finest water vapor on the molecular level by means of capillary electroosmosis and of electrostatic atomization. Then dipolar water molecules, which had been electrified by field, were fragmented into hydrogen and oxygen, and then the hydrogen was effectively combusted in the medium of the ozonized oxygen.** Let us note that at this mechanism of water “evaporation” and of following splitting of water molecules into hydrogen and oxygen the electric field expends energy, and heat of organic fuel combustion just accelerates (catalyze) this process.

Editor: It is necessary to note that electric field can not expend energy. If there are no conduction currents then the field source does not decrease difference of potentials. Hence it can be concluded that effectiveness of such power systems is possible to be UNRESTRICTEDLY HIGH. The author writes about it below as about an "incomprehensible phenomenon".

The most amazing and incomprehensible fact is that the electric field transforms water into "vapor" and breaks the water molecule into hydrogen and oxygen practically **without any expenditure at minimum of energy consumption**. Electric power of the intensity high-voltage transformer, which is necessary for strong field generation, lies in the interval from several watts to tens of watts. As the experiments have demonstrated electric consumption of the high-voltage source practically is not changed at correct shunting of the flame by the electric field (i.e. through an air gap). Current consumption practically did not increase depending on mode of fuel atomization and its combustion (of flame height, of combustion intensiveness...).

There are only two conditions of effective work of static electric field as an electrostatic pump-atomizer of fuel and as a catalyst of blended fuel combustion. The first one is intensity of the field in the zone of fuel atomization and in the zone of flame combustion. The second one is enough emission of electrons into the blended fuel flow. In this mode Coulomb forces make work of electrostatic pressure generation and of electrostatic fragmentation of particles and molecules of fuel and water. The forces repulse likely charged drops of water. Heat motion of fuel radicals, which are combusted and fragmentized in the flame, impedes their chemical recompounding into water molecules in the zone of combustion. Moreover, it causes proceeding of a very physical chain reaction of hydrogen combustion in the flame.

Therefore additional light and heat energy, which is generated in the flame by combustion of hydrogen generated from water molecules that occurs in the ozonized oxygen, does not decrease summary energy of combustion of blend of fuel with water but increases it.

Thus using of electric and electromagnetic fields as the strongest catalysts of combustion of organic fuels and any matters clears great **prospects** of combustion technologies improving. Moreover it allows create ecologically appropriate heat machines and devices and 20-50% increase their effectiveness due to fuller transformation of chemical energy of inflammables into heat or light energy.

Ways of radical improvement of heat machines or about a new mechanism of transformation of heat energy into mechanical energy and into kinetic one

For clear realization of causes of extremely low output of modern heat machines that has generally lead the civilization to the ecological catastrophe it is necessary to understand their common principle of operation as well as a cause of heat energy non-effective using in them.

A mechanism of transformation of heat energy, which is generated by fuel combustion, is the same for all known heat machines. It consists in generation and transformation of superfluous pressure of a heated working body (i.e. gas, vapor etc.) into kinetic energy of a working element of the heat machine (i.e. a piston of an internal combustion engine, a turbine of an aviation engine, a reaction jet flowing out a rocket nozzle etc.) in special chambers of the machines.

It is also known that the higher the temperature of the heated working body, for example of a gas, the higher initial pressure in the working chamber of a heat machine. **Why output of heat machines is so low?** Any expert of thermal physics, thermodynamics, and heat machines can answer that efficiency (output) of heat energy transformation into mechanical one is defined by the second law of thermodynamics and is clearly illustrated by Carno heat cycle. According to these postulates, **output** of an ideal heat engine does not depend on a working matter and on the engine construction but is defined by temperatures of the working body in the starting point and in the final point of the cycle, i.e. by the temperatures of the heater and of the refrigerator of the **heat machine**. Real output of the heat machines is limited by heat stability of materials and by imperfection of engine constructions.

Nevertheless known thermodynamic processes and laws of heat motion of particles and molecules are significantly changed in strong electric fields and demonstrate new prospects for improving of heat machines.

A solution of the problem can be briefly formulated as: to increase output of heat machines it is necessary to use a new mechanism of redistribution of heat energy into energy of directed pressure of a compressed working body (i.e. gas, vapor, etc.) on the working element of the heat machine. At the minimal pressure it should be redistributed on sidewalls of the working chamber.

Can it be realized in practice? On the face of it the technical solution is unrealizable nevertheless it exists. It is possible to redistribute and to regulate heat motion

(pressure) of heated gas inside a closed reservoir and, hence, its temperature in a certain direction. To achieve this aim **it is necessary to introduce static electric field into the combustion chamber of a heat machine and to orient heat motion of electrically charged and dipolar molecules of expanding working bodies (i.e. gas, vapor) along force lines of the electric field by electric Coulomb forces.** Something similar occurs, for example, in liquid crystal cells of electronic timer, in Kerr cells (electric optic effect) at periodical application of electric field to them that causes dipolar molecules turn along a field vector as well as change of light penetrability of these matters.

There is a difference between this known in electrooptics phenomenon and our case. The difference lies in the fact that polarized gas molecules remain movable along force lines of the electric field in contrast to liquid crystals, which do not. This fact causes redistribution of parameters of heat energy (i.e. pressure, temperature, and heat penetrability) of dipolar molecules of heated gas just along force lines of the field. The more the intensity of the field at the initial temperature of the working body is the more the difference of pressures on the sidewalls of the chamber and on the working element, for example, on an engine piston.

Heat motion of polarized particles of heated gas can be decelerated by combination of three electric fields of constant sign in accordance with all three coordinate axes; hence it is possible to significantly and quickly decrease temperature and pressure of the gas. In this case the heat energy of the heated gas makes jump transformation into electromagnetic radiation.

Editor: Historically this method, i.e. plasma retention by electric field, was proposed by Oleg Lavrentiev in 1948. He had 7-grade education and served as a sergeant in Armed Forces in Sakhalin. After he sent Stalin a letter containing a phrase, as "I know a secret of hydrogen bomb creation" he was invited to Moscow to set his ideas out to academicians. His ideas were not lost nevertheless the scheme of plasma electrostatic retention was not applied ("Expert" magazine #23, 18 of July of 2001). In 1950 Sakharov and Tamm proposed a scheme of a toroidal magnetic thermonuclear reactor which has been developed until now. Why is it so? It is difficult, expensive and practically unreal...

Thus introduction of strong electric fields into heat machines allows significantly increase effectiveness of transformation of heat energy of a working body into mechanical and kinetic energy of working elements of the machines by means of directed regulation of temperature and pressure of heated gas,

for example, in the starting point and in the final point of a working stroke of a piston. In other words it allows increase output of the machines.

APPLICATION AREA OF NEW ELECTRIC COMBUSTION TECHNOLOGY

Practical application of the new combustion and thermal technologies

The new technology is universal and applicable in practically all spheres of technics. Therefore we believe that further development and application of this new technology of fuel and waste products combustion is very important for radical improving of all the heat machines and of all thermal technologies. As the civilization uses hydrocarbon fuel and matters in its life circle then just this new technology can solve critical ecological and energetic problems of the civilization.

It is impossible to view in details all proposed perspective technical solutions based on this technology [1-25] within one article. Therefore we give only one striking example.

Environmentally appropriate engine for motor transport

Since the transport, which uses thermal internal combustion engine (ICE), is most harmful for the environment then let us discuss ways of their ecological and energy improving. Several years ago the author patented "method of intensification of ICE operation" [7]. The essence of the invention consists in introduction of controllable electric field into combustion chambers during the whole operation period of an engine by special monoelectrode spark-plugs (Fig.2).

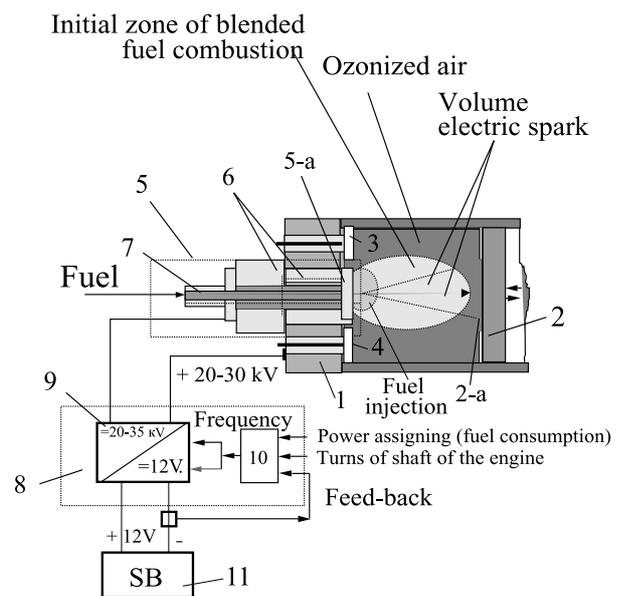


Fig.2a
Plan of an environmentally appropriate ICE (for transport)

1. – combustion chamber;
2. – piston, 2a – heat-resistant surface of the piston (zone of electric-spark discharge)
3. – admission valve (its canal is not indicated)
4. – exhaust valve (its canal is not indicated)
5. – combined mono-electrode spark-plug; 5a – fuel nozzle with hollow central electrode and end disk electrode
6. – electric insulator of the spark-plug – fuel nozzle
7. – fuel pump (for example, an electrostatic one)
8. – high-voltage regulable transformer (electric field source)
9. – force block of tension high-voltage transformer (= 12V/25kV)
10. – system of regulation of electric field source (9)
11. – board current network = 12V (SB is a storage battery of an automobile).

This structure chart briefly demonstrates basic components of a new ICE, where there is directed pressure of gases on a piston. In particular, many inventions of the author are realized in practice here, i.e. semi-digital spark-plug, electrostatic fuel nozzle (5), electrostatic fuel pump (7). A new mode of volume inflammation of blended fuel has been realized in practice, i.e. "a spark coming from a disk electrode (5-a) to a piston (2-a)". Since it is possible to regulate the electric field intensity generated by a high-voltage source of tension then an advance angle of blended fuel inflammation can be regulated, gases pressure on the piston at explosion stroke of ICE operation can be regulated as well.

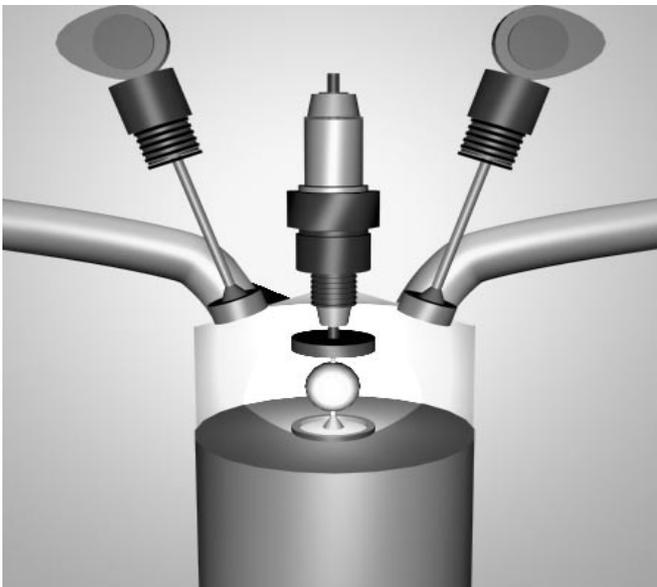


Fig.2b

Photo of a simplified construction of the new ICE

Fig.2b demonstrates simplified three-dimensional construction of the proposed energetically and ecologically perfect ICE. There are observable elements such as a combustion chamber, a piston, valves, a monoelectrode spark-plug, and an electrostatic fuel nozzle (in the centre on top), which is connected with the spark-plug. In the centre of the combustion chamber

it can be seen volume inflammation of the blended fuel at spark appearance from end electrode to the piston.

As a result a summary positive effect of ecological, construction and energetic improving of ICE is achieved, i.e. effective cleaning of exhausted gases directly in the combustion chambers of the engine, significant simplification and perfection of a fuel injection system, improvement of system of distribution and electric inflammation of the blended fuel. In this engine a distributor (as well as its analogues) is removed at all since sparking and intensive inflammation of the blended fuel automatically appears between central electrode of the spark-plug and the piston which comes to the upper "dead" point. The central electrode of the spark-plug is constantly under high tension. The advance angle of ignition is regulated by change of the electric field intensity. Powerful multipoint ignition causes simultaneous intensive inflammation of the blended fuel that occurs throughout the whole chamber. The electric field as a powerful combustion catalyst intensifies the process of the blend combustion at the explosion stroke of the engine and at after-burning of waste gases directly in the combustion chambers at the following output stroke of the engine operation. Directed along the axis of the piston in the combustion chambers this electric field serves as a transformer of gases heat energy into mechanical energy of the thermal engine pistons. That is caused by the fact that the field orients heat motion of the expanding gases along the axis of the pistons in combustion chambers of the engine at explosion stroke of ICE just. It causes redistribution of heat energy and increase of the gases pressure on the very pistons that significantly improves effectiveness of transformation of heat energy of the fuel combustion into mechanical energy of the piston motion (theoretically the improvement is by two-three times), i.e. it two-three times increases output of a classical thermal engine making it come to 70-80%.

The electric field, which is introduced into the combustion chambers of an internal combustion engine, ensures significant economy of fuel (up to 30-40%) at saving of its working characteristics. It occurs due to fog electrostatic spray of fuel and to the fuel electrization as well as due to oxide ozonization. Moreover it occurs as a result of deep after-burning of hydrocarbon components of fuel, combusting blend and waste exhaust gases. This method allows effectively regulate temperature of the blend combustion in the chambers while required compression in cylinders is the same, for example, to minimize nitric oxide generation in the exhaust gases. As a result there is no necessity in external devices for cleaning of exhaust gases of internal combustion engines; ecological appropriateness improvement can be simultaneously achieved. Additional aerosol hydro-alkaline processing of these gases can allow totally clean **exhaust gases** of the transport, which operates on thermal engines.

Workability of such an environmentally appropriate engine in two-stroke and four-stroke variants is experimentally demonstrated. There are also experimentally shown decrease of all toxic components in exhaust gases, 20-30% increase of useful power of the engine, and simultaneous decrease of fuel consumption.

Thus practical application of the new electric combustion technology can exert revolutionary influence upon propulsion engineering development and upon increasing of ecological compatibility and effectiveness of the transport, which operates on thermal engines.

Diagram of operations of technology of effective using of refinery wastes in heat-and-power engineering

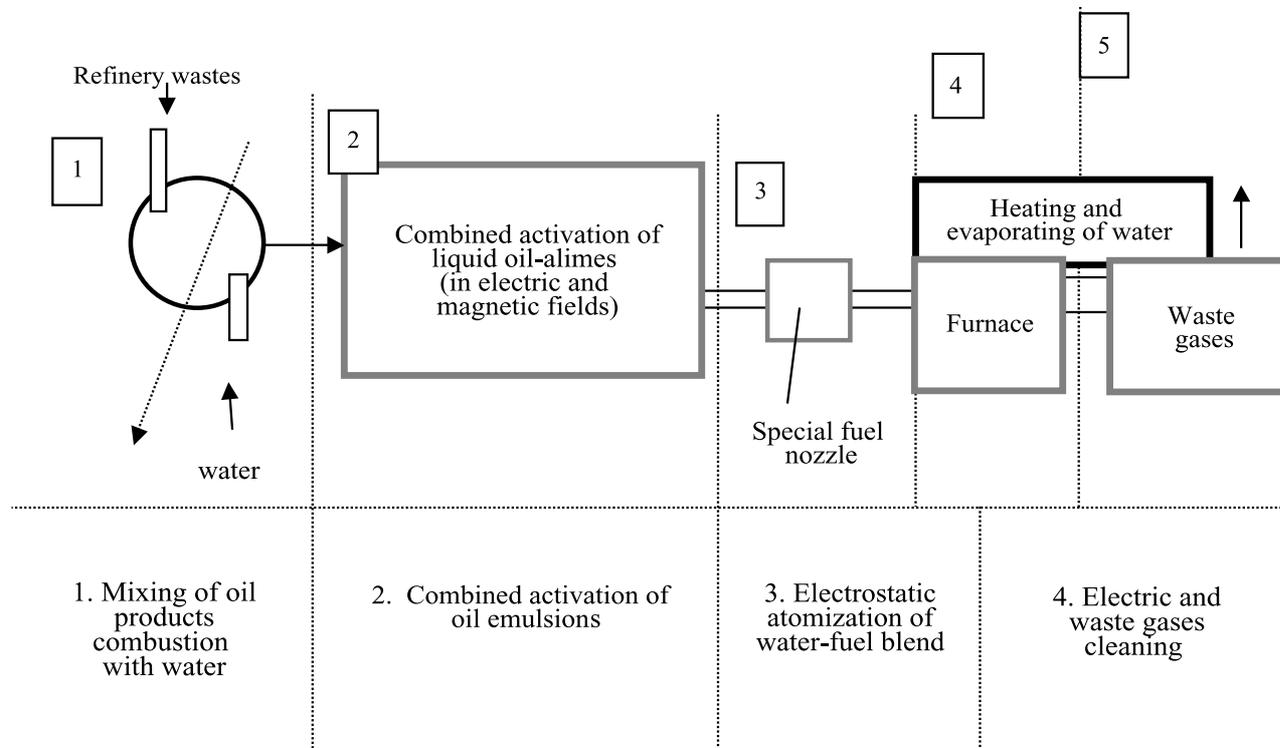


Fig.3

Technology of environmentally appropriate combustion of refinery wastes as fuel for boiler plants

The author has patented other technical solutions of improvement of different devices, which are based on these technologies. These solutions concerning boiler plants, gas turbine engines and jet engines and many other heat machines and devices allow increase their effectiveness and simultaneously significantly improve their ecological factors. As an example of application of this technology in heat-and-power engineering there is a diagram of operations of the technology of the environmentally appropriate combustion of refinery waste as a fuel for boiler plants (Fig.3). Unfortunately the limits of one article do not allow discuss these inventions in details nevertheless the author will realize it in practice in future works.

Conclusions:

1. The existent methods of solving of the ecological problems are ineffective as well as work of organizations, which deal with ecological and nature conservation activity. It is caused by the fact that they are oriented to search and remove consequences of ecological pollution of the nature instead of their causes.
2. The article demonstrates real causes of global ecological problems, which consist in imperfection of technologies of generation and transformation of energy.
3. Using of strong electric and electromagnetic fields of low power as combustion catalysts allow significantly improve ecological factors of combustion technologies and of devices, which realize the technologies in practice. In other words it allows realize in practice "clean combustion of fuels and wastes and possible existence of "clean" heat technics".
4. Application of electric and electromagnetic fields in the combustion technologies allows significantly increase effectiveness of transformation of chemical and heat energies of fuel into mechanical and electric energies.
5. The electric combustion technology allows realize in practice principally new ways to control combustion process as well as to control many thermal and kinetic processes (i.e. processes of pressure, heat conductance, temperature, etc.), i.e. allows increase output of heat machines.

6. The new electric combustion technology is a universal method of solving of ecological and energetic problems of the civilization and a universal way of radical improvement of technics (i.e. of the transport, boiler plants, oil-and-gas processing plants, combustion wastes recycling plants, etc.).

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