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NEW TYPES OF FUEL FOR ROCKET ENGINES

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NEW TYPES OF FUEL FOR JET ENGINES

By: Parfenov, V.

Over one hundred tons of kerosene is supplied to a parking apron of a bomber, which is being prepared for flight. This amounts to two railroad tank cars. To accommodate this fuel reserve in aircraft, the fuel tanks are provided inside the wings, fuselage and underneath the wings.

Thus, aircraft, so to speak, becomes a flying tank car. For example, if its weight was 80 tons then after refueling its weight will be 180 tons.

Is it possible to increase the load lifting capacity of an aircraft by decreasing its fuel reserve and without decreasing its range? The scientists have been working many years to solve this problem, and the physicists and chemists are searching for such small volume high caloric fuels.

What research trends do the scientists follow? It is known, that during burning of any chemical substance, only the energy of an outer layer of atom's electrons is released. In this case, the energy of the substance's atom nuclei remains unused, and the atom nuclei become a ballast which increases the weight of fuel. It is evident, that in selecting a chemical fuel, preference must be given to elements with a small mass of nuclei such as hydrogen, lithium, beryllium and boron, i. e., elements which are found at the top of D. I. Mendeleev's table.

Metals will be burnt in Engines

For a long time, the chemists have been attempting to use the heat released during burning of powders of such metals as aluminum and magnesium.

The fine powder of these metals is expected to be mixed with ordinary fuel. In burning this suspension, the overall calorific value increases sharply.

Of a great interest also are the fuels containing particles of beryllium and boron. A dispersal of lithium or lithium hydrate in kerosene is also contemplated.

The basic shortcoming of these ~~mixix~~ fuels is the fact that complex pumps and filters (which would not become clogged with suspended metal particles) are needed to feed these fuels into combustion chambers.

Recently, to increase the calorific value of liquid fuels, the scientists are attempting to use metal salts, which are easily soluble in liquid fuel. For example, lithium nitrate and lithium perchlorate dissolve very well in alcohol.

Among others' high energy fuels are the boranes, i. e., compositions which include boron. The pentaborane, whose molecule contains five boron and nine hydrogen atoms, is considered to be one of the better fuels. It possesses high amount of energy per unit of weight and volume, and during burning it releases one and half time more energy than the ordinary aviation fuels.

It is clear, however, that even pentaborane will not result in any real technical revolution in production of engines of the future. Its energy will not satisfy the requirements of of reaction and rocket ships designated for interplanetary travels. In addition, pentaborane during its combustion forms a boron oxide, which damages (erodes) turbine blades and other parts of the engine. Therefore, attempts are made to use these type fuels only in ramjet engines, which are not equipped with a compressor or a turbine.

Molecules' Fragments as a New Type of Fuel

If the use of electrically neutral particles of molecules (the so-called free radicals) becomes possible, then the interplanetary flights become a

reality in the near future. To comprehend their nature, we will familiarize ourselves with processes which take place in a rarefied atmosphere at an altitude of 100 km. At this altitude, the earth's air envelope is rarefied strongly, ~~xxxxixix~~ irradiated intensively by ultraviolet rays, and subjected to a continuous bombardment by cosmic particles. As a result of this, many oxygen, hydrogen and nitrogen molecules disintegrate. For example, oxygen molecule which is composed of two atoms splits in these two atoms under the influence of solar radiations. These molecular fragments are energized strongly and possess a great amount of excess energy. Presently, the scientists are trying to utilize these molecular fragments, carrying a great amount of energy, for a new type of chemical fuel.

This fuel has an immense calorific value, and if one were to use a fuel composed of 100% energized hydrogen atoms then during its burning one would obtain six times more heat than from an ordinary diatom hydrogen.

According to some scientists, man knows as much about the free radicals nowadays as he knew about the atomic energy ten years ago. The ~~xxxxixix~~ scientists engaged in this field are on the threshold of great discoveries.

To split an ordinary diatom molecule of oxygen for two electrically neutral atoms, one must introduce into it a sufficient amount of energy.

One of the most appropriate forms of this energy is the heat. Other methods of breaking down of molecules involve the use of high frequency electrical fields, high energy particles, and gamma rays irradiations.

Recently, announcements were made that during the bombardment of a methylene alcohol (pre-cooled to a temperature of liquid nitrogen) one can obtain stable fragments of molecules. For the past six years, other methods were also suggested for obtaining the free radicals under super-low temperatures. The physicists had already succeeded in storing them

under extremely energized condition, and in analyzing the molecular fragments by spectroscopic methods. However, only 1% concentration of free radicals was obtained in laboratories until now, whereas at least 10% concentration of them is needed for a rocket engine.

At a Temperature of Absolute Zero

One obstacle exists on the way of producing a new type of fuel - the complexity of storing the molecular fragments. The fact is, that this fuel is very unstable, since it contains excess energy. The energized atoms, colliding with each other, form anew the ordinary unworthy molecules.

Therefore, it is quite clear that until the chemists discover methods of storing and stabilizing the free radicals, there is no possibility of using this new type of fuel.

Presently, the only method of stabilizing this fuel is by cooling it to a temperature approaching absolute zero. During such a super-low temperature, the activity of molecular fragments fades, the atoms become sluggish and cannot combine into molecules. Under these conditions, the gases in fluid convert into a solid state.

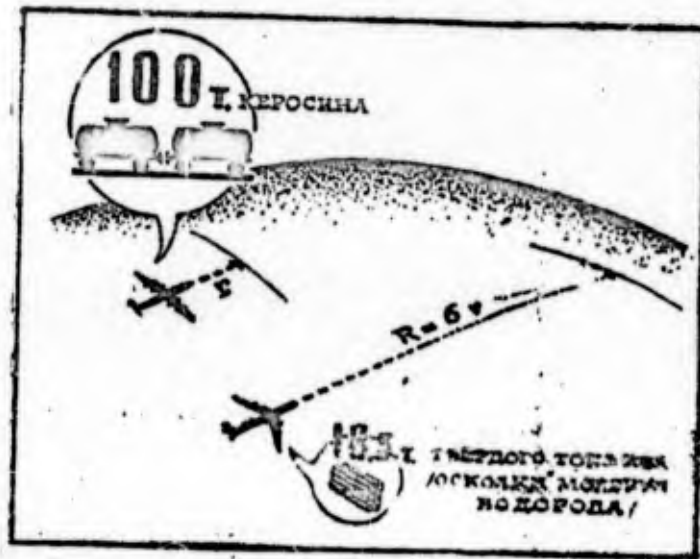
Thus, instead of high capacity tank cars, which supply hundredths of tons of kerosene to the parking aprons of aircraft, solid fuel in the form of rods (See photo) will be supplied in special coolers. To combust solid fuel, one needs reaction engines of special design.

As shown by tests, this singular fuel made of monoatom molecules possesses unusual properties; it has a bright blue glow and periodic color flashes at even ^{at} super-low temperatures, and at a slightly increased temperature of about 20 or 30° above the absolute zero, the energized

atoms in a rod begin to combine actively into molecules, thus releasing a tremendous amount of heat and light.

The scientists assume that this new fuel will be used in certain types of reaction and rocket engines within the next five- to- ten years.

Therefore, it might be expected that its use will increase greatly the radius of action and the payload of aircraft.



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