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Innovative Design Idea of the Rotor

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Abstract: Based on the traditional triangular rotor engine, a certain degree of innovation is put forward, and the innovative idea worthy of study is proposed. The new energy concept in line with the future environmental protection green requirement and the future development direction of the rotor engine are proposed.

Keywords: Rotor engine; Lighter; Combustion chamber; Output shaft; Laminar inflatable rotor engine

1. Introduction

1.1. Rotor engines

Triangle rotor engine (referred to as the rotor engine) is a 1950s appeared in the rotation of the rotor to replace the piston reciprocating motion of the new internal combustion engine. Invented by the German Felix Wankel (1902-1988), he summed up the previous research results, to solve some of the key technical problems, the successful development of the first rotor engine. Compared with the traditional reciprocating piston engine, the crank and connecting rod mechanism and the valve mechanism of the structure are loose and complex, and the reciprocating inertia force is not produced. The mechanism is very simple and compact, and the rotary engine is controlled by the rotary motion of the triangular rotor to control the compression and discharge. Both the reciprocating engine and the rotor engine rely on the inflation pressure generated by the combustion of the air-fuel-mixture combustion gas to obtain the rotational force. In a reciprocating engine, the expansion pressure generated on the top surface of the piston pushes the piston downward, and the mechanical force is transmitted to the connecting rod to drive the crankshaft to rotate. For a rotary engine, the expansion pressure acts on the side of the rotor. Thereby pushing one of the three faces of the triangular rotor toward the center of the eccentric shaft. This movement is carried out under the influence of two components. One is the centripetal force at the center of the output shaft, and the other is the tangential force (Ft) that rotates the output shaft[1].

The role of a compact and lightweight engine, first in 1964 by COMMIBIL company cited in the car. In 1967, has always been a soft spot for the new technology of Japan's Toyo Industrial Company will also install the rotor engine in the Mazda sedan began mass production. And from the 1960s to the present, the United States has been committed to its use in military applications, and as a complementary power applied to the various military equipment, has made many, multi-angle, multi-level innovation and development. At present, the world's combustion of various types of fuels (gasoline, diesel, aviation fuel, natural gas) of the rotor engine, is widely used in military and civilian fields.

1.2. Purpose

Mechanical engineering is an engineering discipline involving the use of physical laws for the analysis, design,

manufacture and maintenance of mechanical systems. Based on the relevant natural science and technology science as the theoretical basis, combined with the production practice of technical experience, research and solve in the development, design, manufacture, installation, use and maintenance of all the mechanical theory and practical problems of applied disciplines. With the deepening of the process of industrialization and modernization, mechanical automation and advanced manufacturing technology development is particularly important. Especially in the mechanical aspects of simplification, practical requirements are getting higher and higher.

In the traditional reciprocating internal combustion engine, there are energy consumption, complex structure, difficult to manufacture, installation, maintenance and other shortcomings, I learned the relevant mechanical knowledge and after careful consideration to the formation of the following innovative prototype of the rotor engine. Compared with the traditional rotor engine has three innovative ideas, greatly improving the practicality of the rotor engine, environmental protection, energy saving, and to improve the working conditions of the rotor and the combustion method has been innovative.

2. Innovative Ideas

2.1. Lighter combustion

As shown in Figure 2.1, this type of combustion with the traditional lighter is not large, is the air and oil combustion without compression and mixing, but combustion and mixing at the same time, the air oxygen and nitrogen separation device for air separation of oxygen and nitrogen, (12) combination into the lighter, and finally in the combustion chamber is fully inflated to get the driving force after the expansion of the combustion chamber, the combustion chamber is divided into a number of nozzles, the latest KIVA program software for 3D computer hydrodynamic analysis (CFD) completed by John Deere and Princeton University is not only used to optimize the fuel jet and improve the nozzle design, but also to improve the ignition system, optimize Engine-turbocharger matching and cylinder line modification[2].

By means of such combustion, the amount of fuel required at different times is obtained by the hydraulic device by analyzing the sensor of the throttle opening degree of the throttle valve and the sensor for analyzing the operating condition, supplying the corresponding oxygen in accordance with the optimum combustion ratio, Type of ventilation so that the two fully mixed in the combustion chamber to be fully burned. So that the fuel combustion efficiency to achieve the most efficient, to energy saving, environmental protection, green requirements. The amount of unused combustion can be quickly and easily adjusted by controlling the injection rate, which can be obtained by controlling the ratio of the oxygen and vaporized LPG injection velocities.

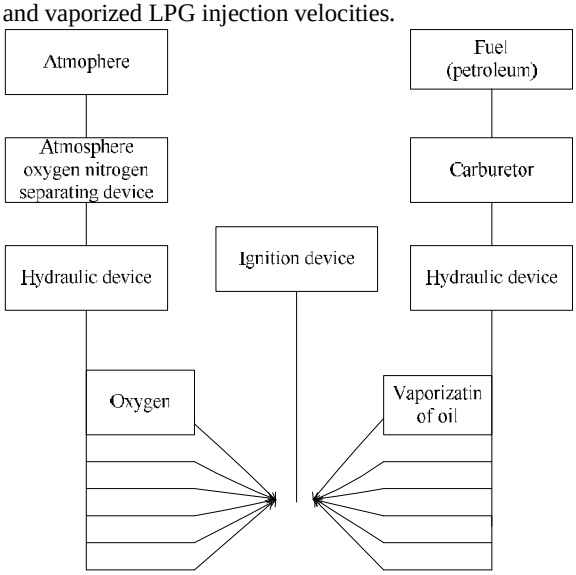

Figure 1. Sketch map of constant ratio combustion ignition device

2.2. Combustion chamber

Combustion chamber as an important component of the engine, fuel or propellant to generate high-temperature gas device, in order to meet the multi-nozzle ignition mode, the fuel combustion, the use of aerodynamics related knowledge, abstracted from the water droplet model in Figure 2.2 Combustion chamber model, the lower part of the combustion chamber to the apex of the ignition center, around the uniform distribution of 12 nozzles, a large space, the pressure is small, oxygen and LPG fully mixed combustion. The upper space is small, the pressure, and the main drive shaft connected directly to the main drive gear to provide power[3].

Combining the aerodynamic design concept with the combustion chamber model, the combustion of oxygen and vaporized fuel is more complete and efficient, which meets the requirements of the sustainable development concept. And the lower part of the combustion gas can be fully expanded gas along the inner wall of the water droplets flow to the upper part of the automatic flow of gas successfully replaced the swirl device. This not only meets the original power requirements of the engine, but also successfully simplifies its structure.

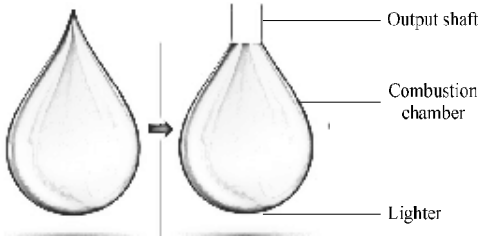

Figure 2. Water droplet combustion chamber model

2.3. Output shaft mode of action

As the power output device of the whole machine (automobile), the main output shaft needs to transform the gas pressure into the torque of the shaft. Its efficiency not only affects the energy loss, but also directly relates to the dynamic performance of the vehicle. The traditional reciprocating internal combustion engine uses the crank-connecting rod mechanism to output mechanical energy to the working machine through the power torque. The reciprocating motion of the piston needs to be changed into the rotation motion of the crankshaft, and the structure is complex and the installation, protection and maintenance are greatly inconvenient. In the triangular rotor engine[4], although there is no reciprocating internal combustion engine defects, but also in the spindle on a certain size of the centripetal force, making high energy consumption, and poor working conditions, the need for regular inspection and maintenance.

As shown in Figure 2.3, the gas exiting from the upper part of the water droplet model combustion chamber directly acts on the teeth of the fan-shaped gears. The different gas pressures give different torques and rotational speeds, and the gas pressure is directly converted to the gear Moment, and then discharged through the exhaust pipe, reducing the intermediate process, which reduces energy consumption[5].

Fan-type output shaft mode of action directly to the gas expansion pressure into the main output shaft torque, and almost no centripetal force, greatly improving the energy efficiency, not only eliminates the reciprocating internal combustion engine crank connecting rod mechanism, But also to improve the traditional triangular rotor power transmission way, which is advocated by modern development concepts and needs.

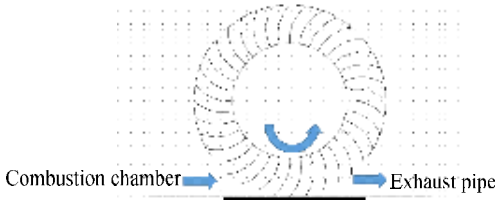

Figure 3. Fan-type output shaft mode of action

3. Future Development Trend

With the social progress, economic development, energy scarcity and environmental pollution has become one of the major problems facing the world, new energy and new technology development is imminent.

3.1. Energy

The use of energy has been the subject of much concern, scientists have also been committed to the development of new energy. In order to improve the efficiency of energy use and diversity, the United States developed a variety of fuel rotary engine. A variety of fuel rotary engine is able to burn a variety of different physical and chemical properties of fuel for its important features of the rotary engine. Because of its intake charge in the combustion chamber was layered distribution and controllable laminar combustion process, also known as layered inflatable rotor engine, can burn diesel, aviation kerosene and other fuel and has a small size, Light weight, smooth operation, good high-speed performance characteristics of the rotor engine is a small engine, pump, light (micro) aircraft and boats ideal power. A variety of fuel rotor engine from research and development so far, has been continuously improved and improved to meet the requirements of the new environment and a new era.

In recent years the new development of new fuel energy ethanol gasoline, Bio-gasoline, methanol gasoline, coal oil, etc., so the combustion of new fuel energy rotor engine is the future development trend of the rotor engine. Ethanol gasoline with self-oxygen, can increase the oxygen content of gasoline, gasoline combustion more fully. The use of gasoline containing 10% fuel ethanol can reduce vehicle exhaust CO emissions by more than 30%. Biodiesel is a typical "green energy", vigorously develop biodiesel for economic sustainable development, promote energy substitution, reduce environmental stress, control of urban air pollution is of great strategic significance. Methanol itself can be burned, compared with gasoline, methanol octane number higher than 110, antiknock is good, the value of large evaporation. China's coal resources are rich in oil and natural gas resources, coal oil has a certain amount of resources to protect, so the future for these new energy fuel R & D of the rotor engine will be one of the development trend of the rotor engine.

3.2. Technical aspects

The 21st century is the critical period for the world to mature and modernize. Most of the rotor engines are used in civilian equipment, such as children's toys, daily tools, daily necessities and small machines. In order to improve the quality of life, people's requirements for intelligent environmental protection and high technology More and