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3D Design and Optimization of Noise Reduction Engine

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Abstract*: The gas discharged from the exhaust port of a jet aero engine has an important impact on the environment. In view of the current design of the exhaust port, there are two aspects of the problem, this paper carries out the optimization design of the exhaust port. First, we analyzed jet aero engines. Secondly, based on the aero engine, a discussion was carried out on the exhaust port of the parts of the jet aero engine. Finally, we used 3D modeling software to optimize the design of the exhaust port. The design results show that the exhaust port optimization device can be realized.*
Keywords: jet engine; aero engines; exhaust port optimization; lip design

1 Introduction

The development of science is getting faster and faster, people's living standards have improved sharply, and in the past, people relied on roaring for communication and transportation on walking. It's different now, everyone has a cell phone[1-3]. Cars and planes right outside. But at the same time as the standard of living has risen. Our planet. It is also becoming more and more overwhelmed[4]. All kinds of automobile exhaust gas, industrial waste, noise pollution[5]. Everywhere. Therefore, we designed an engine exhaust port that reduces noise and reduces exhaust gas emissions.

2 Exhaust port shape design method

The main body of the exhaust port is designed according to the dolphin streamline type, and the streamlined design will reduce the resistance in the engine work, making the jet flying engine more efficient and reducing the area of the exhaust port.

3 Design Discussions with Results

3.1 Overall design

The exhaust port is one of the important components to ensure the normal operation of the jet engine, which most directly affects the work efficiency of the engine and plays a vital role in whether the engine can work normally. Many of today's aircraft use jet engines, especially in the use of fighter jets, relying on the large amount of high-temperature and high-pressure gas produced by the combustion of air and kerosene to push the aircraft forward. So the exhaust port is especially important. The higher the temperature when the airflow comes out of the combustion chamber, the greater the energy input and the greater the thrust of the engine. However, due to the limitations of turbine materials, etc., it can only reach about 1 650K at present, and modern fighters sometimes need to increase the thrust for a short time, just after the turbine plus a force combustion chamber to inject fuel, so that the under-burned gas is mixed with the injected fuel to burn again, because there are no rotating parts in the afterburner combustion chamber, the temperature can reach 2000K, which can increase the thrust of the engine to about 1.5 times. The disadvantage is that the fuel consumption increases sharply, and the excessive temperature also affects the life of the engine. But the engine jets we designed completely solve these problems. The design result is shown in Figure 1.

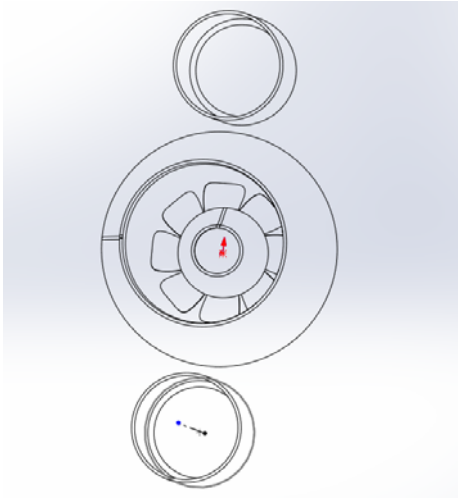

Fig. 1 Overall design of the exhaust port of an aero engine

High heat-resistant metal materials, completely will not cause the aircraft to fly for a long time because of high temperatures, hesitant jets are smaller than ordinary jets, so more power, less fuel consumption. Therefore, we designed the filtration design of the exhaust port, which will reduce the pollution of the exhaust gas generated by the engine to the atmosphere and speed up the exhaust speed. The design result is shown in Figure 2.

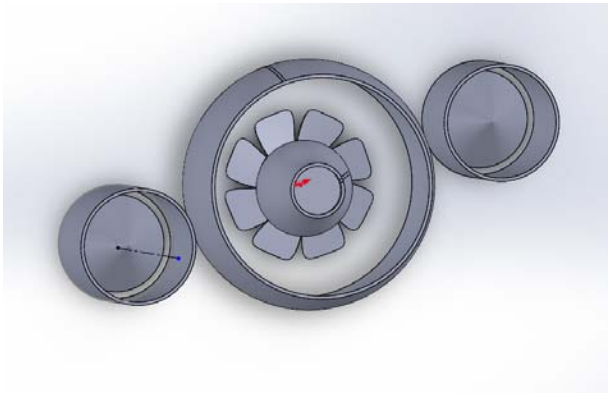

Fig.. 2 3D rendering of the overall design of the exhaust port

3.2 Parts key parts design

The role of the exhaust system is to discharge the gas from the turbine backwards into the atmosphere to generate enough power to push the aircraft forward. The airflow from the

turbine will cause friction because it will swirl at high speed. In order to reduce frictional losses, the exhaust channel is usually set to diffuse. But because we use the most advanced high-temperature resistant material titanium alloy. Don't worry about this. We designed the vents to be smaller. So that the engine gets more power. In other words, it can make the plane fly faster and longer. Secondly, the exhaust port is generally composed of an exhaust cone, a fairing branch and a nozzle. In order to get more power, our nozzle is designed to become a convergent expansion nozzle. The nozzle area is adjustable. This allows for more emergencies. Finally we also added a layer of filtration on the outside. The air pollution of the exhaust gases is greatly reduced. as well as noise pollution. The key components are shown in Figure 3.

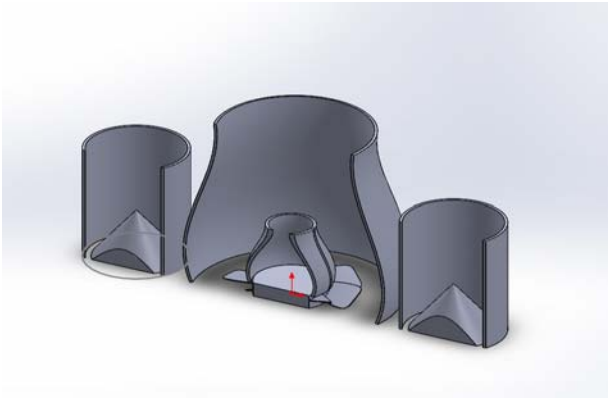

Fig. 3 Exhaust port profile

Another risk factor is exhaust temperature. Although the tail jet exhaust has been mixed and cooled by the outer culvert airflow, its temperature is still very high. In addition to the exhaust velocity and temperature can pose a hazard, there is also a certain danger in the jet containing small amounts of carbon monoxide, unburned hydrocarbons and nitrogen oxides with certain toxicity. The atmospheric environment causes some pollution. Carbon monoxide and unburned hydrocarbons are usually produced when the engine is slow and other low-power states when the fuel is not completely burned. The design is shown in Figure 4.

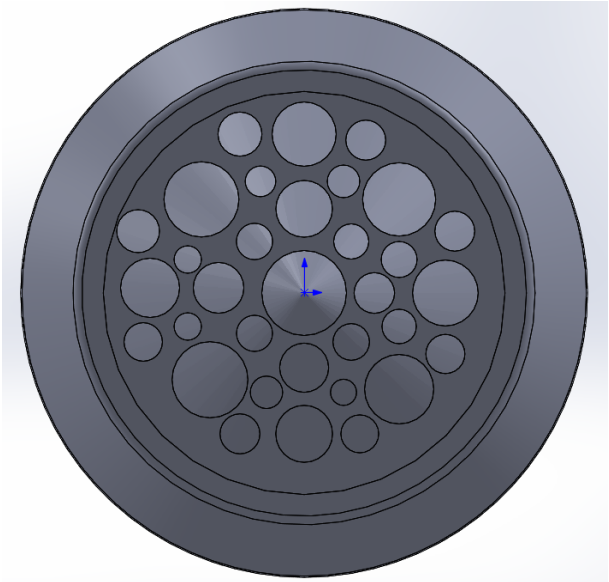

Fig. 4 Front view of the exhaust port

Our jet engines exhaust in reverse thrust. When the reverse push is turned on in the slow state, the danger area is within a radius of 12.2 meters in the center of the engine.

We can see from the source analysis of exhaust velocity, temperature and toxicity that it is necessary to take appropriate measures. Therefore, in the maintenance implementation of the aircraft maintenance manual, it is necessary to clearly indicate the scope of the exhaust danger area and emphasize in the form of a warning that personnel and equipment are prohibited from entering these areas; It also explains the runway status at the time of start-up of the aircraft, the exhaust space and various objects that may be affected by the exhaust gas, and informs the protection of toxic gases and flammable materials. And our design can greatly improve these problems.

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