Technical Description of Remote Control (RC)- Jet engine

Model # FD3-64 RC (Non-branded)

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Paper #1 Final

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Introduction of Engine:

Background

Heat engine is a system that converts heat (thermal energy) to mechanical energy that performs mechanical work. Heat engine is one of the most powerful tools that human invented. Back to 18th century, the first usable heat engine was patented by Watt. In 1781, a Scottish engineer named James Watt patented a steam engine that performed instant rotary motion. (Hills, Richard L,1989) The engine that Watt built had ten-horsepower. The engines enabled a wide range of manufacturing machinery to be powered. The heat engines were a crucial part of the industrial revolution; they lead human entered to a next generation of civilization – industrial civilization. The working mode of the heat engine can generally be simplified to the model of the thermodynamic cycle. The types of heat engines are also named after different thermal models, such as the Carnot heat engine, the diesel heat engine and so on. In addition, according to the heat source or working characteristics, they also have their own customary names, such as diesel engines, gasoline engines, steam engines, and so on. In engineering field, there are two major types of engine, external combustion engine and internal combustion engine. A famous example of external combustion engine is steam engine, which powered the first industrial revolution. Internal combustion engine, as well as piston engine, it is an engine that uses one or more pistons to convert pressure into rotational kinetic energy. Heat is transferred from the high-temperature heat source to the working system, one part is converted into mechanical energy by work, and the other part is transferred to low-temperature heat source. On the one hand, people use existing heat, or burn fuel to create heat for the heat engine, but on the other hand, they waste a lot of heat. For example, many power plants have to use a lot of water to cool. French engineer Nikola Carnot introduced the Carnot theorem in a study in 1824. This theorem means that even an ideal heat engine, its efficiency in converting thermal energy into mechanical energy is less than 100%. The turbojet engine is divided into two types: centrifugal and axial flow. The centrifugal type was patented by the British engineer, Frank Whittl, in 1930, but it was not until 1941 that the aircraft equipped with this engine was the first to go to sky. Participated in the Second World War, the axial flow was born in Germany, and participated in the battle of the end of 1944 as the power of the first practical jet fighter Me-262. (BBC,2010)

Historical Background Information and Beyond

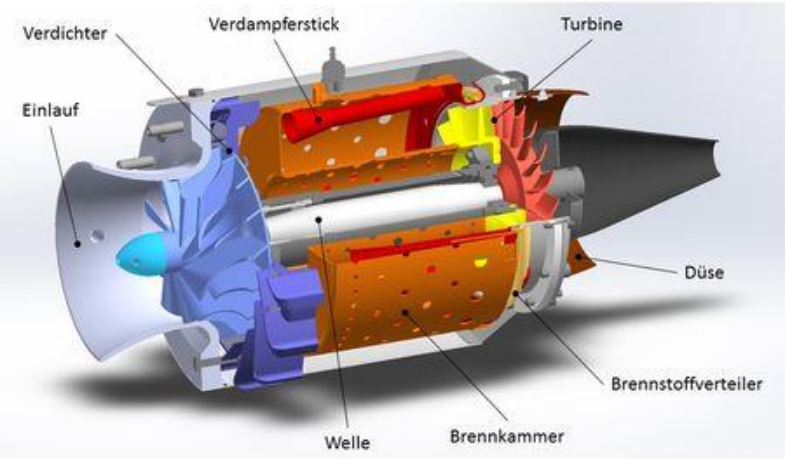

Figure 2. Inner Components

The heat engine that I am interested in is jet engine. A jet engine is a heat engine or motor that works by accelerating and discharging high-speed fluids. It can output both thrust and shaft power. Most jet engines are internal combustion engines that rely on Newton's third law, but there are some exceptions. Gas propulsion is the practical application of the jet engine of the famous British physicist Isaac Newton's third law of motion. The law states: "Every force acting on an object has a counter-force of equal magnitude and opposite magnitude." In terms of aircraft propulsion, the "object" is the air that is accelerated through the engine. The force required to produce this acceleration has a counter-acting force of equal magnitude and opposite direction acting on the device that produces this acceleration. Jet engines generate thrust in a manner similar to an engine/propeller combination. Both push the aircraft back by pushing a large amount of gas, one in the form of a relatively low-speed, large-scale air-slip, and the other in the form of a very high-speed gas jet. Common jet engines include turbofan engines, turbojet engines, rocket engines, ramjets, pulsed jet engines (NASA Glenn Research Center,2009).

General types and Inner Components of Turbo Jet:

Basic Structure and Components

Inlet, Compressor, Combustion Chamber and Turbine, Nozzle and Afterburner are the structure components of a jet engine. The turbine blades of the compressor are composed of stator blades and rotor blades, and a pair of stator blades and rotor blades are referred to as one stage, the stator is fixed to the engine frame, and the rotor is connected to the turbine by the rotor shaft. Active turbojet engines are generally 8-12 compressors. (Rolls-Royce Derwent, 1945) After being compressed by the compressor, the air enters the combustion chamber and is mixed

with kerosene to burn and expands to work; then flows through the turbine to push the turbine to rotate at a high speed. Since the turbine and the compressor rotor are connected to one shaft to the compressor, the compressor and the turbine rotate at the same speed. Finally, the high-temperature high-speed gas is sprayed through the nozzle to provide power by reaction force. The initial form of the combustion chamber is a small cylindrical combustion chamber that is annularly juxtaposed around the rotor shaft. Each cylinder is not sealed, but has holes in the appropriate place, so the entire combustion chamber is connected and then developed into a ring. The combustion chamber is compact, but the entire fluid environment is not as good as the cylindrical combustion chamber, and there is a combined combustion chamber that combines the advantages of both. The turbine always works under extreme conditions and has extremely demanding requirements for its materials and manufacturing processes. At present, powder metallurgy hollow blades are mostly used for integral casting, that is, all blades and leaf discs are cast once. Compared to the early days, each blade and leaf disc are separately cast and then spliced together, eliminating the mass of joints. The manufacturing materials are mostly high temperature resistant alloy materials, and the hollow blades can be cooled by cold air. The new engine developed for the fourth generation of fighters will be equipped with ceramic powder metallurgy blades with superior high temperature performance. These tools are all designed to improve one of the most important parameters of a turbojet engine: the temperature before the turbine. The high vortex front temperature means high efficiency and high power.

Components

RC-Jet overall

The turbojet of the model aircraft works exactly the same as the turbojet of the real aircraft: the compressed air is mixed with the fuel and burned. The gas expands rapidly at high temperatures and is ejected at a very high speed to generate thrust and push the gas turbine operates at high speed, and the turbine drives the compression vanes to continuously deliver compressed air to the combustion chamber to form a compression-combustion-expansion-jet process.

The engine used in the model is not scaled down by the larger engine, and any attempt to do so is likely to fail. The FD3-64 RC turbojet engine designed by the British-Kurt Schreckling,

who created the first open source jet engine computer aid drawing maps. It pioneered the design of a small engine, a radial compressor made by a simple method, a ring-shaped combustion chamber, and a simple method. The turbine that came out achieved good results. His philosophy has been confirmed by the latest improvements in various new designs, and is based on his design. The figures show that many enthusiasts have successfully used the engine on the model according to his theory of work. (Hills, Richard L,1989)

The shaft

It consists of a central shaft and two bearing sleeves. The center shaft is lowered to a diameter of about 14.5 mm and has a length of about 0.5 mm. A 10 mm hole and cut the M6 thread to remove the bearing sleeve. The permanent connection consists of an M6 threaded joint and a 10 mm nominal diameter hole, where the bearing sleeve is an interference fit. (Hills, Richard L,1989)

Compressor/Pump wheel

The pump wheel and the turbine are connected by a shaft, that is, the rotor. The exhaust gas from the engine drives the pump wheel. The pump wheel drives the turbine to rotate, and the turbine rotates to pressurize the intake system. The supercharger is installed on the exhaust side of the engine, so the operating temperature of the supercharger is very high, and the speed of the rotor is very high when the supercharger is working, which can reach hundreds of thousands of revolutions per minute, such high speed and temperature. This makes the common mechanical needle roller or ball bearing unable to work for the rotor. Therefore, the turbocharger generally uses a fully floating bearing, which is lubricated by oil, and the coolant is cooled by the supercharger (Hills,1989).

Compression Impeller

The shape of the compression impeller of the turbocharger is a complex ternary curved surface ultra-thin impeller blade. Generally, there are 12 to 30 blades, which are arranged in a radial curve. The blade thickness is less than 0.5 mm, and the aluminum is made by a special casting method. The shape of the blade directly affects the performance of the turbocharged engine. The more reasonable the angle of the impeller shape, the lighter the mass, the more sensitive the starter of the impeller. (Hills, Richard L,1989)

Functions and Performance

Jet engines have very high power and efficiency; however, jet engine is not the highest power engine that human invented. Rocket engines, although they are also jet engines, have significant differences. That is, the rocket engine does not use the atmosphere as a propellant fluid, but uses the liquid fuel it carries or the chemical decomposition of the fuel and oxygen to produce its own propellant fluid, which can work outside the Earth's atmosphere, but it is also only applicable to the earth. Short working hours are more suitable for emergency power systems. It is characterized by high thrust and high fuel consumption, which is not affected by the working speed. As the result, even tough jet engine does not have much power as a rocket engine, it has a mush longer life time that allows people reach sky overtime, and has an enormous commercial values.

Sky and outer space were the untouchable world, what people dreamed to be discover. Jet engine are using to drive airplanes and rocket which allow people have ability to discover the world where we are not able to arrive, design and built better performance and efficiency thermal engines to improve our industry. I also thought drones will be the future aircraft and cargo carriers. A better thermal engine means a better efficiency; people would have a great benefit in transportation, physical distribution and environment (Yang He, 2018).

Advantages of Turbo Jet Engine

Since engineers have a demand on better efficiency and powerful engine, and jet engine was the one of the most developed power engines, engineers decided improved the efficient on exciting jet engines, turbojet was the engine that satisfied our demand. The use of turbojets in jet propulsion avoids the inherent weaknesses of rockets and ramjet engines because of the use of turbine-driven compressors, so that at low speeds the engine is also under sufficient pressure to generate strong thrust. Turbojets work according to the "work cycle." It draws in air from the atmosphere, and after compression and heating, the energy and momentum of the air is obtained at speeds of up to 2000 ft/sec (611 m/s) or about 1400 mph (2254 km/h) push out the nozzle. When the high-speed jet is ejected from the engine, the compressor and the turbine are continuously rotated to maintain the working cycle. (Rolls-Royce Derwent, 1945) The RC jet,

which is a smaller scale Jet engine, has the same advantages as a bigger turbo jet engine. RC jet is a powerful power machine that helping people accomplished their goal that reached sky.

Summary

In compression, the piston engine has low power, large weight, large shape resistance, low efficiency when the propeller rotates at high speed, and the tip of the propeller is easy to generate shock waves and wave resistance, which limits its application in high-speed flight. Instead of an air jet engine, however, for low-speed aircraft, it has the unparalleled advantages of jet engines, namely high efficiency, low fuel consumption and low price. In addition, due to the relatively complete combustion, the environmental pollution is relatively small, and the noise is smaller than that of the jet engine. As a result, piston engines are still widely used on small low-speed aircraft such as small business jets, agricultural aircraft, feeder lines and small multi-purpose transport aircraft (forest fire fighting, search, rescue and patrol). The outstanding advantage of the turbofan engine is its good economic performance. Whether the aircraft is flying at supersonic speed or sub-sonic speed, the fuel consumption rate is relatively low. However, the turbofan engine has a large windward area, and at low subsonic speeds, the fuel consumption rate is higher than that of the turboprop engine.

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Yang He, ENGL 210 Diagnostic Writing Assignment, 2018-08-27.

Figure 1. Model # FD3-64 RC https://www.der-schweighofer.net/Turbine-JetCat-P-80-SE-a69396

Figure 2. Inner Components https://www.pinterest.co.uk/pin/449797081522249061/

Reflection

When I was assigned this paper, I must admit that I was a little scared. Writing that says I am not well versed in object and process descriptions will be a complete understatement. This assignment requires an intensive research. When I was writing the assignment, I was learning from where I read the articles. Before this assignment, I was not understanding the jet engines in detail. I like to write about jet engine is because my interest. After this assignment, especially after I did some research about jet engine, I am feeling more passionate in designing a new type of jet engine. I have learned that fast speed is the main advantage of jet aircraft. I also compared jet with propeller air planes. Propeller airplanes are more fuel efficient. Propeller airplanes can only fly to the level of Mach 0.6, because the relative speed of the propeller tip has been supersonic at this flight speed. Compared with piston engines, turbojet engines have the advantages of large power-to-weight ratio, low fuel consumption, low vibration and high-altitude performance. Compared with the turbojet engine, since the displacement of the propeller is much larger than that of the turbojet engine, the turboprop engine has high efficiency at low subsonic speed (below 700km/h), low fuel consumption and economic performance. it is good. For a future engineer, I believe that state data and evidence is crucial for an engineering report, as well as an engineering proposal. In addition, historical information is very important for designing a new machine. For instance, in 1781, James Watt patented a steam engine that performed instant rotary motion; however, before that the world's first steam engine was made by the ancient Greek mathematician Alexandria in the 1st century, which was two thousand years earlier than the industrial revolution, but it was just a prototype. James Watt learned from the past, and understood all the disadvantages that old type steam engine had, then he improved the

performance of steam engine, then the steam engine had an ability to lead people into industry revolution.

The media of this assignment is multimodal including both print and digital. Audience what I am writing, is heavily considered in writing for engineering, or profession Engineers and people interested in RC-model. Understand the fundamental physical phenomena is also important for reading this engineering report. This instruction provided a basic concept about the RC-jet engine. The person who read this paper should have experience in computer aid drawing (CAD) and manufacturing, or experience in DIY projects. It provides overall design of the RC-jet engine. The engineering process must follow the basic physics laws. For example, the efficiency of a steam engine is now defined as the ratio between the mechanical work produced by the heat engine divided by the energy produced by the combustion fuel. According to the second law of thermodynamics, the efficiency of any pure heat engine cannot exceed the efficiency of the Carnot cycle. The efficiency of the Carnot cycle is related to the temperature difference in the cycle. Therefore, the steam temperature of the steam engine is higher (superheated steam), and the lower the steam temperature after the work is done, the greater the temperature difference, the higher its efficiency. If an engineer is saying something like "invented a 100% efficient heat engine", then no one would believe him/her, because the statement is totally wrong and disobey the fundamental physics laws. To make an engineering report more reliable, author must clear the concept behind the report, otherwise the report will not be published and no one will trust what the author says.

AUDIENCE PROFILE SHEET

Reader's Name: Profession Engineers and people interested in RC-model

Reader's Job Title: Profession Engineers and people interested in RC-model

Education: Hight School, Bachelor's, Master's, Doctoral (or any)

Professional Experience: Has experience in computer aid drawing (CAD) and manufacturing, or experience in DIY projects.

Job Responsibilities: NONE

Personal Characteristics: NONE

Cultural Characteristics: NONE

Attitude Toward the Writer: Provided a basic concept about the RC-jet engine

Attitude Toward the Subject: Provide overall design of the RC-jet engine

Expectations About the Subject: People who interested in RC model would make their own jet engine

Expectations About the Document: Help people understanding RC jet engine

Reasons for Reading the Document: Interesting, or professional usage, such as competition.

Ways of Reading the Document:

Skim it ___ Study It _X__ Read a portion of it ___ Which portion?

Modify it and submit it to another reader ___

Attempt to implement recommendations ___

Use it to perform a task or carry out a procedure ___

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Other ___ Explain

Reading Skills: needs a basic reading skill

Reader's Physical Environment: ANY