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Research Paper

Development in the Performance of A Valve Pulse Jet Engine

Engineering

KEYWORDS : Combustion , Fuel injection , Fuel intake , Spark plug

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ABSTRACT

pulse jet engine sucks air in the front and then pushes it out the back. Valve pulsejet engines use a mechanical valve to control the flow of expanding exhaust, forcing the hot gas to go out of the back of the engine through the tailpipe only, and allow fresh air and more fuel to enter through the intake. The valves prevent the explosive gas of the ignited fuel mixture in the combustion chamber from exiting and disrupting the intake airflow, although with all practical valve pulsejets there is some 'blowback' while running statically and at low speed, as the valves cannot close fast enough to stop all the gas from exiting the intake. The superheated exhaust gases exit through an acoustically resonant exhaust pipe.

I. INTRODUCTION:

Russian inventor and artillery officer N. Teleshov patented a pulse jet engine in 1864 but, The first working pulsejet was patented in 1906 by Russian engineer V.V. Karaodin who completed a working model in 1907. Spain patented a pulsejet in Barcelona in 1917, having constructed one beginning in 1913. Engineer Paul Schmidt, pioneered a more efficient design based on modification of the intake valves (or flaps), earning him government support from the German Air Ministry in 1933. In 1934, Georg Madelung and Munich-based Paul Schmidt proposed to the German air ministry a "flying bomb" powered by Schmidt's pulse jet. Pulse jet belongs to a class of gas generators that is fundamentally unsteady in nature. they operate on cycles in which an essential internal-combustion event occurs and from which useful work is extracted. Followed by relaxation through a Taylor wave, results in a state close to that found in constant-volume combustion. The pulsejet cycle, on the other hand, relies on relatively slow deflagration during the combustion event. Confinement is achieved fluidically which, when combined with the relatively slow mode of combustion, results in heat release occurring both before and after the combustible mixture has reached a minimum volume. This aspect of operation, combined with several other factors, tends to render pulsejets relatively inefficient as thrust-producing devices**.**

II. DESIGN AND WORKING:

In the pulse jet engine, The combustion cycle comprises five or six phases depending on the engine: Induction, Compression, (optional) Fuel Injection, Ignition, Combustion, and Exhaust. Starting with ignition within the combustion chamber, a high pressure is raised by the combustion of the fuel-air mixture. The pressurized gas from combustion cannot exit forward through the one-way intake valve and so exits only to the rear through the exhaust tube. The inertia of the traveling exhaust gas causes a low pressure in the combustion chamber. This pressure is less than the inlet pressure (upstream of the one-way valve), and so the induction phase of the cycle begins. In the simplest of pulsejet engines this intake is through a venturi which causes fuel to be drawn from a fuel supply. In more complex engines the fuel may be injected directly into the combustion chamber.

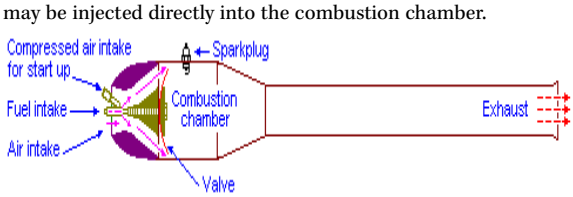

fig1: pulse jet schematic

1. Combustion - Reaction of an air and fuel mixture within the combustion chamber commences. The pressure begins to rise as a result of confinement of the flow. The pressure rise causes the inlet valves to close, preventing backflow. The reaction accelerates as the pressure and temperature rise; this, in turn, accelerates the pressure and temperature rise.
2. Expansion - The hot, high-pressure gases in the combustion chamber expand, forcing flow from the exhaust.
3. Ingestion - The momentum of the exhaust gases causes the combustion-chamber pressure to drop below the ambient value. This allows the inlet valves to open and a fresh charge of air to enter(mixed with fuel). Eventually, the exiting exhaust flow reverses and mixes with the fresh charge. This initiates a new reaction, and the cycle begins again.

Pulsejets have been used to power experimental helicopters, the engines being attached to the ends of the rotor blades. In providing power to helicopter rotors, pulsejets have the advantage over turbine or piston engines of not producing torque upon the fuselage since they don't apply force to the shaft, but push the tips. A helicopter may then be built without a tail rotor and its associated transmission and drive shaft, simplifying the aircraft .This concept was being considered as early as 1947 when the American Helicopter Company started work on its XA-5 Top Sergeant helicopter prototype powered by pulsejet engines at the rotor tips.

III. DEVELOPMENT:

In my design, instead of using single valve at the fuel injection I have used alternative two valves, If first one is open second one will close and second is open first one will close alternatively. If we use this alternative valves, the air/fuel mixture will be mixed step by step continuously and we can stop all the gas from exiting the intake. In my alternative valve design main advantage is that the process will be continuous, and the thrust power will be increases, And another advantage is that the intakes are flared such that the engine is able to breath in fresh air easily.



Fig 2: pulse jet engine valves along with intake

IV. ADVANTAGE:

Pulse jet engines are easy to build on a small scale and can be constructed using few or no moving parts. This means that the total cost of each pulses jet engine is much cheaper than traditional turbine engine. Pulse jet engines do not produce torque like turbine engine do, and have a higher thrust-to weight ratio.

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Pulse jet engines can also run on virtually any substance that can burn, possibly making them a milestone in alternative fuel innovations. In my alternative valve design main advantage is that the process will be continuous, and the thrust power will be increases.

V. APPLICATION AND CONCLUSION:

The pulse jet engine is a new technology, and it have many advantages over the many engines for propulsive purposes. The Experiment provided physical insight into the pulsejet operation. It was observed that for each operational cycle, combustion consumes most of the oxygen in the combustion chamber, and the oxygen comes from the inlet only. Acoustics and fluid mechanics are both important in determining the operating characteristics of these engines. pulsejets are an efficient and simple way to convert fuel into heat, experiments are using them for new industrial applications such as biomass fuel conversion, boiler and heater systems, and other application. Some experiments continue to work on improved designs. The engines are difficult to integrate in to commercial manned aircraft designs because of noise and vibration; through they excel on the smaller-scale unmanned vehicles.

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