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Development in the Performance of Valve less Pulsejet Engine

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Abstract- Pulsejet engine is a type of air breathing engine. The combustion takes place in the form of pulses in the combustion chamber that is 300 times per second. Pulsejet engines were commonly used in the military purposes in which Germans were able to produce a thrust of 300 pounds carrying a load of two tones. Usually pulsejet engine is the two type valved and valveless engine. The valved type consists of single moving part "valve" which controls the flow of fresh air in to the combustion chamber .The valveless engine is hollow type with "Zero" moving parts .Recently a research is going on over PDE (Pulse Detonation Engine) in NASA which is believed that its more efficient when compared to conventional turbojet engines. Here I have designed pulsejet engine which may overcome some of the disadvantages of the valve less pulsejet engine. The designed engine is made in such a way that the air/fuel mixture may in an efficient way such that the engine self starts when it is turned on without any external air supply .The TSFC (Thrust Fuel Specific Consumption) may decrease from 1 to 0 .72 .Thrust augmenter is also included in this engine which may increase the thrust by reducing the TSFC.

I. INTRODUCTION

The first working pulsejet was patented in 1906 by Russian engineer V.V.Karavodin, who completed a working model in 1907. The French Inventor Georges Marconnet patented his valvaless pulsejet engine in 1908,which many commentators argue greatly influenced the V-1 flying bomb through engineer Paul Schmidt, who 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. Pulsejet engines are characterized by simplicity, low cost of construction, and high noise levels. Pulsejet fuel efficiency is a topic for hot debate, as efficiency is a relative term. While the thrust-to-weight ratio is excellent, thrust specific fuel consumption is generally very poor. The pulsejet uses the Lenoir cycle which lacking an external compressive driver such as the Otto cycle's piston, or the Brayton cycle's compression turbine, drives compression with acoustic resonance in a tube. This limits the maximum (pre-combustion) pressure ratio, to perhaps 1.2 to 1. Pulsejets can run on almost anything that burns, including particulate fuels such as sawdust or coal powered. Pulsejets have also been used in both control-line and ratio-controlled model aircraft. The speed record for control-line model aircraft is greater than 200 miles per hour (323 km/h) although the long control lines create 70% of the drag of the system.

II. DESIGN AND WORKING

This is the first stage in the working; here we use LPG (liquefied petroleum gas) as fuel which is supplied through the four intake pipes to the combustion chamber. Here there is no need to use blower to start the engine because the four intakes + the flared end in the intake pipes allows the engines to self start. This is known as the mixing stage

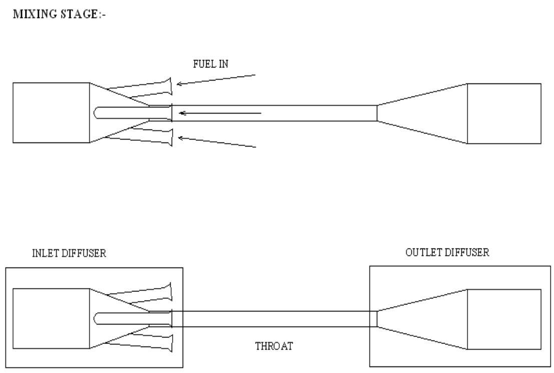

Figure I: mixing stage and inlet diffuser

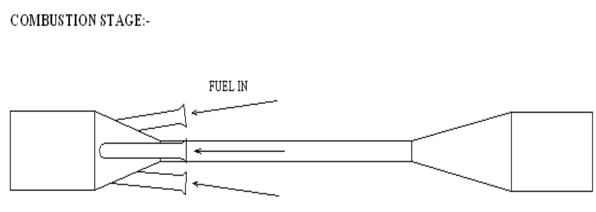

Figure II: combustion stage

The second stage is combustion stage or professionally called as deflagration stage in which deflagration means explosion. When the air/fuel mixture is mixed in a proper proportion combustion takes place take place inside the combustion chamber which can be achieved using a spark plugs or sparklers. After combustion took place the hot gases escape through the exhaust side of the engine.

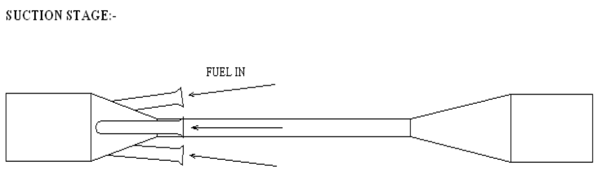

Figure III: suction stage

The Final stage is the suction stage, after the combusted gases escaped through the exhaust pipes vacuum is created inside the combustion chamber which initiates the intake pipe to pull the fresh air/ fuel into the combustion chamber where some parts of exhaust gases are also pulled into the combustion chamber and again the cycle continues.

Here in pulsejet engines there is no use of continuous ignitors, Ignitors should be used only to start the engine after the engine is started the ignitors should be switched off otherwise it may disturb the combustion cycle.

III. DEVELOPMENT

In my design instead of using a single intake I have used four intakes, because instead if we have four intakes the fuelling will be easy and the air/fuel mixture will be mixed in an efficient way, Which is shown In the figure 2.And another advantage is that the intakes are flared such that the engine is able to breath in fresh air easily, which is shown in the before figure.

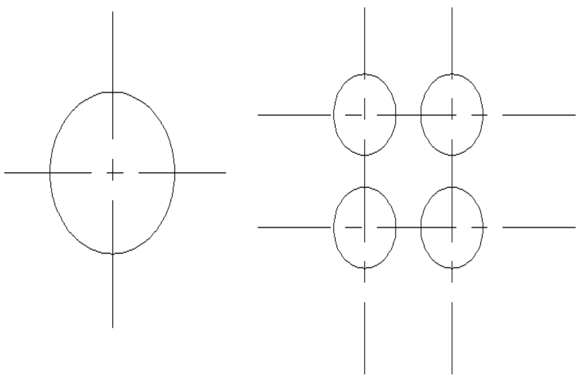

Figure IV: inlet /outlet sport

Augmentation is the special feature included in the pulsejet engine which is very useful in decreasing the TSFC (thrust specific fuel consumption) by increasing the thrust of the engine. Augmenter is a part or device which has small opening at the front end in bell mouth shape and an larger opening In the rear end. In this design the engine without augmentation produces a thrust of 40 pounds with TSFC valve =1, and with augmentation the engine is capable of producing a thrust of 55 pounds with TSFC value =0.72.

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. Pulse jet engines can also run on virtually any substance that can burn, possibly making them a milestone in alternative fuel innovations.

V. APPLICATION AND CONCLUSION

Pulsejets are used today in target drone aircraft, flying control line model aircraft (as well as radio-controlled aircraft), fog generators, and industrial drying and home heating equipment. Because 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.

The pulse detonation engine (PDE) marks a new approach toward non-continuous jet engines and promises higher fuel efficiency compared to turbofan jet engines, at least at very high speeds. Pratt & Whitney and General Electric now have active PDE research programs. Most PDE research programs use pulsejet engines for testing ideas early in the design phase.

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