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Design And Fabrication of Flame Stabilization Technique Using Conical Flame Holder

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Abstract - Flame stabilization is a critical aspect of combustion systems, as it directly impacts efficiency, stability, and emissions. This study presents an innovative flame stabilization technique using a conical flame holder. The conical geometry creates a region of low velocity and high turbulence, enabling the flame to anchor and stabilize. An experimental investigation was conducted using a laboratory-scale combustion rig, and the results were validated using numerical simulations. The effects of cone angle, flame holder location, and inlet velocity on flame stability were systematically examined. The results show that the conical flame holder significantly enhances flame stability, reduces emissions, and improves combustion efficiency. The optimized design parameters and operating conditions were identified, providing valuable insights for the development of efficient and stable combustion systems. This technique has potential applications in various industrial sectors, including power generation, aerospace, and chemical processing.

1. INTRODUCTION *(Size 11, Times New roman)*

Our project is implemented here to stabilize the flame by fabricating the single can type combustion chamber.An internal combustion engine has the difficult task of transforming chemically bound energy into mechanical work. The first stage of the process is to transform the chemical energy in the fuel into heat by combustion, this can be done with almost 100 % efficiency, the difficult part is to turn the heat into mechanical work with high efficiency.

2. FUEL INJECTION & IGNITION SYSTEM

Fuel injection is a system for introducing fuel into internal combustion engines, and into automotive engines, in particular. On diesel engines, fuel injection is a necessity, whilst on petrol engines fuel injection is an alternative to the carburetor.

An ignition system generates a spark or heats an electrode to a high temperature to ignite a fuel-air mixture in spark ignition internal combustion engines oil-fired and gas-fired boilers, rocket engines, etc. The widest application for spark ignition internal combustion engines is in petrol road vehicles: cars (autos), four-by fours (SUVs), pickups, vans, trucks, buses.

3. COMBUSTION CHAMBER

In order to match with the required design performance goals of good ignition, wide combustion stability limits and relatively high combustion efficiency at low power conditions, the primary zone of the combustor is designed to operate with approximately stoichiometric airfuel ratio in the primary zone at an equivalence ratio of 0.95. The chamber is designed with a central vaporizer unit. The vaporization method involves the injection of the fuel along with the pre-determined amount of air that flows through the vaporizer tube in order to vaporize the fuel as well to cool the tube. With this air allocation, fuel coking is precluded and carbon formation in the combustor primary zone is minimized. The fuel is directed from the fuel tube and injected into the vaporizer with low injection velocity

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Fig -1: Figure

4. CONCLUSION S

Finally we designed the single can type COMBUSTION CHAMBER with stabilized flame. Initially using CATIA software, we can design the part of the combustion chamber and the nozzle section. First we had designed combustion chamber without flame stabilizer, where the flame is irregular and unsteady. Then with the help of circular flame stabilizer we obtained the flame with No Swirl. With the help of the blower using constant air flowing into it the combustion process have been carried out with stabilized flame holder. At future research we are going to do a combustion chamber using hemisphere flame holder. Thus by increasing the performance and the efficiency of the engine.

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