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A Review Paper on Future Possible Investigations in Two Stroke Petrol Engine

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Abstract: The demand for IC engine in transportation sector is very much high. In this regard, the cylinder head & piston shape, piston head & material decides the combination process and so is the performance characteristic of the engine. In the current proposal, literature review on the piston head modifications & cylinder cover alteration is done and based on this the future possible suggestions for the further investigations in two stroke petrol engine.

Keywords: Internal combustion(IC) Engine, Piston head, Cylinder cover.

I. INTRODUCTION

With a growing demand for transportation, IC engines have gained lot of importance in automobile industry. It is therefore necessary to produce efficient and economical engines. Piston, a component of reciprocating engines, is a moving component that is present in a cylinder. In an Internal Combustion (IC) engine, it is acted upon by the pressure of the expanding combustion gases in the combustion chamber and the motion is transmitted to through the piston-connecting rod assembly to the crankshaft. A piston is a major component in an IC engine and its design/analysis is based on structural and thermal considerations. Piston head is the top surface of the piston which is subjected to pressure fluctuation, thermal stresses and mechanical load during normal engine operation. In order to increase the efficiency of operation and better functionality, the piston material should satisfy the following requirements like light weight, Good wear resistance, Good thermal conductivity, High strength to weight ratio, Free from rust, Easy to cast, Easy to machine, be non-magnetic, and Non-toxic. So the effect of piston (shape size and material) on performance of engine is very considerable.

II. MATERIAL AND METHODOLOGY

A DESIGN OF THE ENGINE HEADS

In early designs, the purging gas was directed from under the piston towards the exhaust valve while not performing proper cylinder purging. In the first design modifications, the inlet valve was fitted with some kind of a screen, which was also used with the four-stroke self-ignition diesel engines. This arrangement caused the injection gas flow to assume a spiral shape. This solution however had two significant flaws. First, the unwanted rotation had to be eliminated by blocking the valve at an exact, fixed position. Second, the area between the valve and the socket was reduced by 30 to 50%.

The second modification of the two-stroke engine was one with a chalice shaped chamber. The purpose was to direct the purging air stream as well as combustion under the valve. Calculations were made for the air velocity distribution. The final results for this design showed an inferior performance when compared to the piston-controlled cam.

The third modification was a system with a double inlet valves connected with each other and a pit, which forms a chamber. The net effect was an increase in the cross-section for the gas flow with the concurrent reduction in the air flow resistance.

Another modification was one in which an in-fixed bushing is being used to place the inlet valve in a vertical position. This scheme allows shaping of the walls of the chamber to control the purging air flow. The problem with this approach is its complicated design.

In the thesis written under the supervision of prof. Andrzej Kazmierczak at the Wroclaw University of Technology, Dr. K Kishor proposed a design that improved on the idea of a deflector as well as improvements in the combustion and purging efficiencies of the two-stroke engine. In addition, he has modified the design of the head. Also the deflector, which he designed, is not part of the head and is manufactured as a separate element. This allows it to be built into

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different shapes as well as using different materials of construction. Such approach to the manufacture of the deflector also simplifies its servicing when removed from the engine, thus reducing the costs of service or maintenance. The deflector is attached by a screw and placed into a special pit assuring its exact position as well as immobility under the pressure of the flowing gases. Along the axis of symmetry, he has placed the location for the spark plug. This construction allows the gas to be directed at the spark plug thus assuring a more complete combustion process carried out the investigations on Bajaj 150cc scooter engine using various blends of ethyl alcohol and methyl alcohol with petrol and also pure alcohol. They reported that there was an overall improvement in engine performance. However, some modifications were required to be incorporated to run the engine with pure alcohol. Being a good conductor of heat that promotes combustion, copper coating on piston crown increased combustion stabilization and improved the performance of the engine. Maji et al. conducted an experiment and found that, methanol blended gasoline (90% methanol +10% gasoline) when used as a fuel in a two-stroke si engine gave rise to abnormal combustion even at a low compression ratio. Pankhaniya et al. conducted an experiment to study the effect of methyl alcohol blend when being used as fuel in an SI engine. These performance tests were conducted at an engine speed of 2000 rpm and variable load condition, using various blends of M0 to M20 fuels and reported improved performance. Murali Krishna et al. evaluated the performance of four-stroke, single cylinder SI engine. With methyl alcohol blend in various configurations of the engine

This section deals with fabrication of copper coated engine, description of experimental set up and definition of used values.

In the copper coated engine, by flame spraying technique, a high thermal conductive catalytic material like copper was coated on the top surface of piston crown. For 100μ thickness, nickel-cobalt-chromium bond coating was sprayed. On this coating, for another 300μ thickness, an alloy of copper (89.5%), aluminium (9.5%) and iron (1%) was coated with a METCO (Trade name of the company) flame spray gun. The bond strength of the coating was so high that it does not wear off even after operating it for 50 hrs continuously.

An air-cooled single-cylinder 2.2 kW BP two-stroke SI engine with a rated speed of 3000 rpm was provided with an electrical swinging field dynamometer for the measurement of brake power (BP). The fuel consumption, speed, torque, air flow rate and exhaust gas temperature were measured with digital electronic sensors. A pressure-feed system provides the engine oil. Performance parameters of brake thermal efficiency (BTE), exhaust gas temperature (EGT) and volumetric efficiency (VE) are evaluated at different values of brake mean effective pressure (BMEP) of the engine. Brake specific energy consumption was determined at full load operation of the engine. Experiments were carried out on CE with pure gasoline and copper coated engine (CCE) with methanol blended gasoline (gasoline-80%, methanol-20% by volume]. were measured with digital electronic sensors. A pressure-feed system provides the engine oil.

Definitions of used values

Brake mean effective pressure: It is defined as specific torque of the engine. Its unit is bar.

(1) $$BP = \frac{BMEP*10^5*L*A*n*K}{60000}$$

BP =Brake power of the engine in kW;

BMEP= Brake mean effective pressure of the engine in bar L= Stroke of the piston in m, A= Area of the piston = (πD2)/4 Where D= Bore of the cylinder in m, n= Effective number of power cycles= N, where N=Speed of the engine = 3000 rpm, k = no. of cylinders = 1

Brake thermal efficiency (BTE); It is the ratio of brake power of the engine to the energy supplied to the engine. Brake power was measured with dynamometer. Energy supplied to the engine is the product of rate of fuel consumed (mf) and calorific value (cv) of the fuel. Higher the efficiency betters the performance of the engine is.

(2) $$BTE = \frac{BP}{M_f*C_v}$$

Brake specific energy consumption (BSEC): It is measured at full load operation of the engine. Lesser the value, the better the performance of the engine is. It is defined as energy consumed by the engine in producing 1 kW brake power. When different fuels having different properties are tested in engine, brake specific fuel consumption is not the criteria to evaluate the performance of the engine. Peak BTE and BSEC at full load are important parameters to be considered to evaluate the performance of the engine.

(3) BSFC= 1/BTE

Volumetric efficiency: It is the ratio of the volume of air drawn into a cylinder to the piston displacement.

Calculation of actual discharge of air: By means of water tube manometer and an orifice flow meter, head of air (ha) can be calculated. Velocity of air (Va) can be calculated using the formula

(4) $Va=2(gha)^{\wedge .5}$

Actual discharge of air = , where a= area of an orifice flow meter, cd = Coefficient of discharge. Performance parameters of brake thermal efficiency (BTE), exhaust gas temperature (EGT) and volumetric efficiency (VE) are evaluated at different values of brake mean effective pressure (BMEP) of the engine. Brake specific energy consumption was determined at full load operation of the engine. Experiments were carried out on CE with pure gasoline and copper coated engine (CCE) with methanol blended gasoline (gasoline-80%, methanol-20% by volume].

III.CONCLUSION

1. Brake Thermal efficiency (BTE) increased by 22% with alcohol blended gasoline operation in CCE over pure gasoline operation in CE. Comparative Studies on Performance Parameters of Two Stroke Spark Ignition Engine with Copper Coated Piston with Methanol Blended Gasoline 145editor@iaeme.com
2. Exhaust gas temperature decreased by 32% with alcohol blended gasoline operation in CCCC over pure gasoline operation in CE.
3. Volumetric efficiency increased by 4% with alcohol blended gasoline operation in CCCC over pure gasoline operation in CE.
4. CCE with alcohol blended gasoline showed lower value of BSEC in comparison to CE with pure gasoline operation.

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