Effect of internally threaded inlet manifold and beads in a flow on exhaust emission of spark ignition engine

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Abstract— For a better performance of an internal combustion engine, modification of intake manifold is one of the important factors. It is required that equal mass of air fuel mixture (homogeneous) is delivered to the cylinder of the engine. Heterogeneous (unequal) distribution of charge reduces the efficiency of the engine. Presented work aims at the modification of the intake manifold and adding moving beads in flow. so that almost swirling effect created and turbulence effect can be obtained by providing moving beads in flow. For the study purpose Intake manifold of four strokes was used. Experimental investigation has been carried out to find the effect of beads in flow and threaded inlet manifold to create swirling effect in the four stroke SI engine. Creating turbulence in flow using moving beads and inducing in inlet manifolds, the results indicate that beads in a flow and threads inlet manifold shows better reduction in exhausts emission of engine.

***Keywords*:**Turbulence, Swirling, Obstacle, Thread inlet manifold, SI engine, Emission. Beads

I. INTRODUCTION

In automotive engineering an inlet manifold is the important part of engine that supplies the fresh charge (air-fuel) to the cylinder. The primary function of the intake manifold is to supply the combustion mixture to each stroke of the engine.Even distribution is important to optimize the efficiency and performance of the engine there are various factors that influence the performance of engine such as compression ratio, atomization of air-fuel, and quality of fuel, air fuel charge ratio, intake temperature and pressure and also based on piston design, inlet manifold, and combustion chamber designs etc. Growing demand on reduction of exhaust emission and fuel consumption with increase of its performance new designs and optimization of existing ones are introduced. An inlet manifold or intake manifold is the part of an engine that supplies the only fresh air fuel charge to the engine cylinder .The primary function of the intake manifold is to evenly distribute the combustion mixture to each stroke of engine. In this experiment reduce the exhaust emission of engine by providing obstaclein flow by using synthetic beads that is in between carburetor to engine manifold and also provide internal threads thread to inlet manifold. Because of this modification in inlet condition of engine their chances of creating turbulence and swirling effect in engine

Turbulence of the air in the combustion chamber is vital to the operation of all modern gasoline engines. The main effect of the turbulence is to speed up the burning of the fuel/air mixture. A gasoline vapor/ air mixture actually burns quite slowly, in the order of a few meters per second .So aflame starting at a central spark plug would take about 10 milliseconds to reach the edge of the combustion chamber, if the air in the combustion chamber is moving rapidly, it will" stir up" the flame and help it to propagate much faster .Turbulence is generated whenever air flows quickly pasta stationary surface, but rapidly decays way through viscosity once the bulk airspeed reduces. So modern thinking is to use careful design of the engine's inlet ports. By aiming the intake flow correctly; rapid air motion is set up during the induction stroke. This rapid motion breaks down in to turbulence as the piston rise so n the compression stroke, and if the engine is correctly designed, hits just the right level at the point of ignition.

Swirl is usually defined as organized rotation of the charge about the cylinder axis. Swirl created by bringing the intake flow into the cylinder with an initial angular momentum. While some decay in swirl due to friction occurs during the engine cycle, intake generated Swirl usually persists through the compression, combustion, and expansion process. In engine design with bowl-in-piston combustion chambers, the rotation motion set up during intake is substantially modified during compression. Swirl is used in diesels and some stratified-charge engine concepts to promote more rapid mixing between the inducted air charge and the injected fuel. Swirl is also used to speed up the combustion process in spark-ignition engines.

In two-stroke engines, it is used to improve scavenging. In some designs of pre-chamber engines, organized rotation about the pre-chamber axis is also called swirl. In the engine where swirl within the pre-combustion chamber is important, the flow into the pre-chamberDuring the compression process creates the rotating flow

II.EXPERIMENTAL WORK

In the present work the effects of obstacle in flow (beads) and internally threaded inlet manifold on the performance and emission of the engine, experiment is carried out on different condition stated below

1. Simple inlet manifold. (SIM)
2. Beadsand simple inlet manifold. (B&SIM)
3. Threaded inlet manifold. (TIM)
4. Beads and threaded inlet manifold. (B&TIM)

2.2 Specification

Table 1 Specifications of Engine

Sr. No.	Engine Parameters	Specifications
1.	Engine Type	4 Stroke, Single Cylinder, Air Cooled
2.	Number of cylinders	One
3.	Bore Diameter	80mm
4.	Stroke Length	110mm
5.	Rated Power	7.4 BHP @ 8000 RRPM
6.	Rated Speed	8000 RRPM
7.	Compression Ratio	6.5-10

Fig.2.1 Simple inlet manifold.

Fig.2.2beads and simple inlet manifold.

Fig.2.3 Threaded inlet manifold

Fig.2.4beads and internally thread inlet manifold

III.RESULT AND DISCUSSION

The performance of this engine has been extracted before and after fixing the device in order study its effect. The test is performed on hero Honda four stroke engines that classified as a carburetor gasoline engine T he engine is set-up with the required measurement rig. The experiments were carried out on the four different conditions that mention above. All tests were conducted at steady state conditions after the engine had reached its operating temperature .The engine has been set at the constant speeds .The results then recorded, CO, CO2 and O2 was plotted on percentage volume basis where as HC emission was plotted on part per million basis HC emission was plotted in parts per million and CO, CO2, and oxygen were plotted on volume percentage basis. While using beads with threaded internal manifold there is a significant amount of decrease in carbon monoxide emission and the results are plotted (Chart-1)

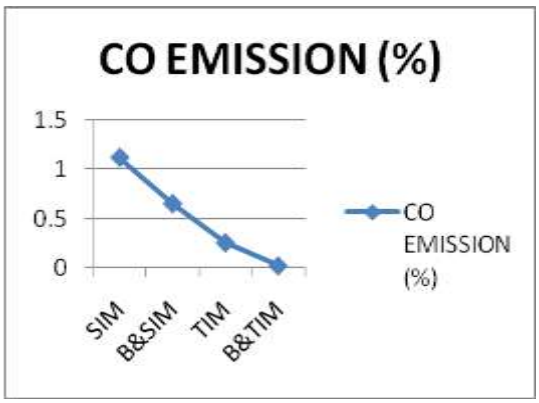

Chart 1 CO Emission

Fuel contains hydrocarbons, which are its primary source of energy. Any hydrocarbons emitted from a vehicle indicate unused fuel, which results from incomplete fuel combustion. Emissions are measured in parts per million, or ppm.Hydrocarbon emission decreases while using beads in flow with threaded inlet manifold.

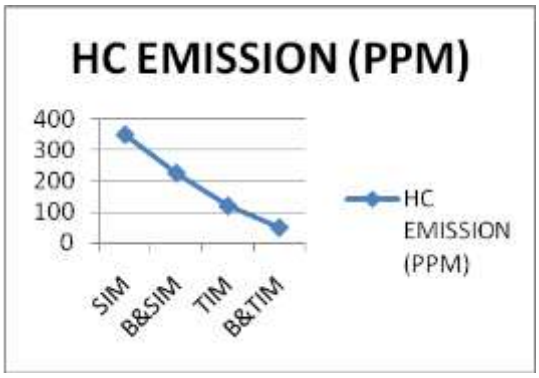

Chart 2 Hydrocarbon Emission

The largest human source of carbon dioxide emissions is from the combustion of fossil fuels. This produces 87% of human carbon dioxide emissions. Burning these fuels releases energy which is most commonly turned into heatCarbon dioxide emission decreases while using beads with internally threaded inlet manifold

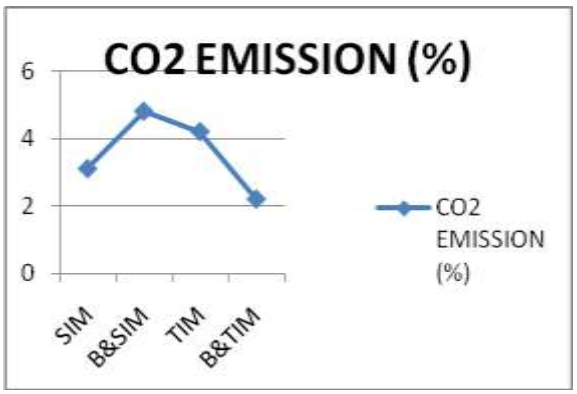

Chart 3 Carbon Monoxide

Also the significant impact on o2 emission when using four different conditions

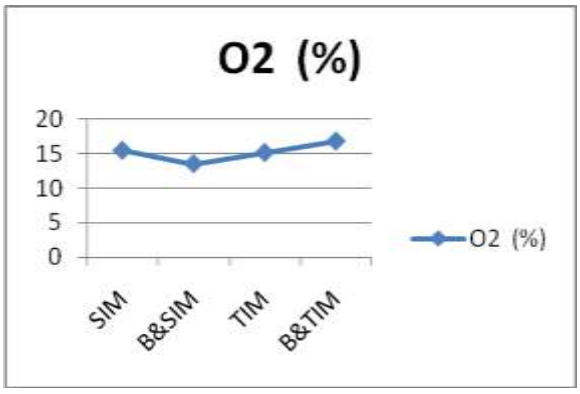

Chart 4 O2 Emission

3.1 Discussion

The results may say well because of the above result. Since by using beads with internally threaded inlet manifold show very good result compare to some other three conditions. Carbon dioxide, carbon mono oxide and hydro carbon reduces so much because of using beads with internally threaded inlet manifold

IV.CONCLUSION

This assemble (beads and internally threaded inlet manifold) is simple in shape, easy to manufacture, easy in installation, and there is no need for any Adjustments of the engine for this device to work. Through scientific experiment sit was found that the device does not cause any aerodynamic resistance in the intake manifold, therefore does not affect the running of the engine. The tests showed that the assemble provide a relatively efficient mixing of air and fuel inside the Intake Manifold,

Improved fuel economy and increased stability of the engine . Using this assemble reduces the emission, and this in return reduces the pollution caused by incomplete combustion problems caused by bad mixing in the carburetor and intake manifold.

REFERENCES

1. AmmarA. Al-Rousan and Mousa Al-Ajloun,(2008), Study on Improvement of Fuel Economy and Reduction Emission for a Gasoline Engines by Homogeneity Enhancement of the Charge,*AJBAS*,2,1012-1020.
2. Dr. Rajeshkumar U. Sambhe , Dr. Pankaj N. Shrirao,(2014) Performance analysis of single cylinder (di) diesel engine by air swirl induction with internally threaded inlet manifolds, *IJMET*,5,144-150.
3. Chirag V. Kapuria , Dr. Pravin Rathod,(2015) Experimental Investigation on Performance and Emission of IC-Engine by Modifying Inlet Manifold, *IJAERD*,2,585-592.
4. Pravin D. Solanki, Prof. V. Y Gajjar,(2014) A Review Paper on Effects of Intake Manifold Design on Diesel Engine Performance and Emissions, *JSRD*,2,276-280.

