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A PROVISION OF AIR INDUCTION VALVE IN 4-STROKE PETROL ENGINE TO REDUCE THE EXHAUST EMISSION- A CASE STUDY

DURGESHCHANDRASINH I RATHOD[1] CHIRAG D SINGAL[2] (B.E. Mechanical) (B.E. Automobile) BHARAT C DADHI[3] (B.E. Automobile) PARESH K PATEL[4] (B.E. Automobile) RONAK V PATEL[5] (B.E. Automobile)

Abstract: *Automobile uses the internal combustion engine as a power generating source, plays the effective and important role in transportation of passenger and goods in cost of atmospheric pollution. Internal combustion engines using various fuels like petrol, diesel and CNG for Self propulsion of vehicle. In engine exhaust mainly three pollutants HC, CO and NOx are produced which increases the atmospheric pollution. Now a day's its near about impossible to avoid the use of vehicles as maximum human needs, services, business and agriculture is linked up with it and on other side atmospheric pollution is increasing day by day because of exhaust is released by vehicles in atmosphere. To reduce the quantity of pollutant in exhaust gases if provide extra valve arrangement(AI-valve) which allows more air to enter in combustion chamber to burn the charge(Air+fuel) effectively than maximum chances to reduce the amount of hydrocarbons and carbon monoxide and other pollutants.*

Keyword: *IC engine, 4-stroke engine, air-induction valve, emission, scavenging*

I. INTRODUCTION

The conventional single cylinder I.C. engine is provided with one inlet and one outlet valve. The charge (Air+fuel) enters into combustion chamber during the suction stroke. The charge is compressed by the piston approaching to the TDC (top dead centre) of cylinder at this time both valves remains close. When piston reaches some of degree near to TDC spark occurs in the two electrodes of spark plug and charge starts to get burning. The pressure and temperature of combustion chamber is rapidly increased. The pressure in combustion chamber pushes the piston in backward, the direction to BDC (bottom dead centre) in cylinder. Due to expansion, gases get more space to expand and cause remaining atoms of fuel burns but some of unburned atoms of fuel are covered by the byproduct of burned fuel which not get proper amount of oxygen to burn. So some amount of fuel is directly goes out as it is through exhaust valve in exhaust stroke and releases in atmosphere, which is responsible for atmospheric pollution.

The provision of extra air induction valve in the engine which is operated by the same camshaft operates the exhaust valve when the combustion process is about to finish. The exhaust valve and air induction valve start to open at same time by matching a valve timing of both valves with the crankshaft rotation. Through the A.I-valve, fresh air starts to inject in the combustion chamber and provide oxygen to unburned atoms of fuel to complete the combustion. Complete combustion of fuel leads to reduction in quantity of HC, CO and NOx.

II. TYPES OF EXHAUST EMISSION

1**) Hydrocarbon (HC)**: The amount of HC is closely related to,

-Induction system and combustion chamber design

-Air-fuel ratio, load, and speed

-Idling, running and accelerating

When the mixture supplied is rich or lean; the flame propagation becomes weak which causes incomplete combustion and result in HC emission.

2**) Carbon monoxide (CO)**: If the oxidation of CO to CO_2 is not complete, CO remains in the exhaust. Petrol engine exhaust can be made free from CO by operation at Air-fuel ratio higher.

3) Oxides of nitrogen (NOx): Oxides of nitrogen occurs mainly in the form of NO and NO_2 and are generally formed at higher temperature. The maximum NOx levels are observed with Air-fuel ratios higher than the stoichiometric. More air than this reduces peak temperature and therefore NOx concentration falls, even free O_2 is available.

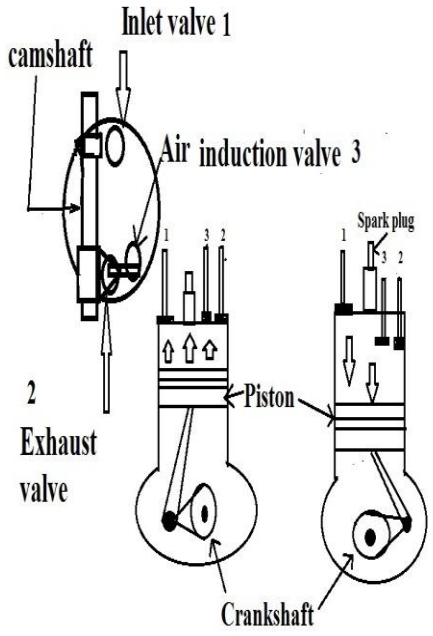
III. WORKING EFFECT OF AIR-INJECTION VALVE

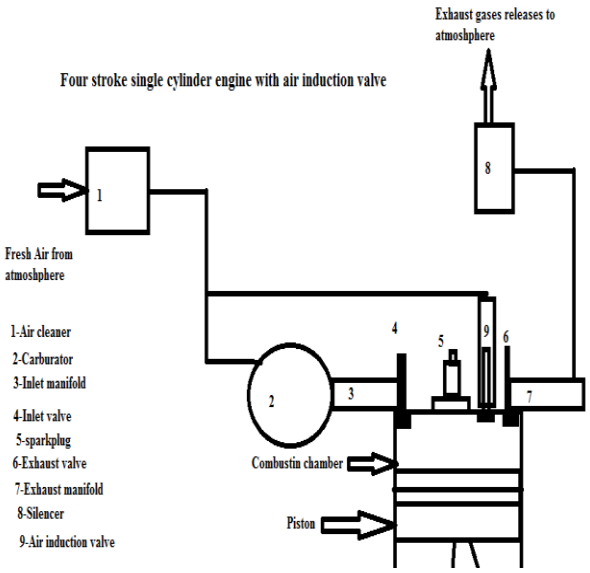
1) Provide fresh and cool air which pushes out the exhaust gases from the combustion chamber so better scavenging of combustion chamber is achieved.

2) Provide extra air in combustion chamber to burn the unburned atoms of fuel. So maximum power is achieved and reduces the emission of HC and CO.

3) Provide lower temperature air to reduce the temperature of combustion chamber.

IV. EXPERIMENTAL SETUP





Working of Air-induction valve engine is similar to conventional single cylinder four stroke engines.

1) Suction stroke: During this stroke the piston moves from the Top Dead Centre (TDC) to Bottom Dead Centre (BDC) of the cylinder; the inlet valve opens and proportionate air-fuel mixture is sucked in the engine cylinder. The exhaust valve remains closed throughout the stroke

2) Compression stroke: In this stroke, piston moves from BDC to TDC and compresses the enclosed air-fuel mixture drawn in the engine cylinder during suction stroke. Just before the end of this stroke the spark-plug initiates a spark which ignites the mixture and combustion takes place. Both the inlet and exhaust valves remains closed during the stroke.

3) Power stroke: When the mixture is ignited by the spark-plug the hot gases are produced which drive or throw the piston from TDC to BDC and thus the work is obtained in this stroke. It is during this stroke when we get work from the engine. Both the valves remain closed during the start of this stroke but when the piston just reaches the BDC the exhaust valve opens.

4) Exhaust stroke +Air Induction stroke: In this stroke piston starts to move from BDC to TDC but when the piston approaching to BDC, before some degree of BDC the exhaust valve and air induction valve starts to open together and inlet valve remains close. Fresh air starts to enter into combustion chamber through the air induction valve which reduces the combustion chamber temperature and pushes out the exhaust gases from engine cylinder through the exhaust valve and provide efficient scavenging. It should be noted that air induction valve and exhaust valve both open and closes at same degree of rotation of crankshaft.

V. FUTURE SCOPE

Air –induction valve system needed more research work for achieving reduction in exhaust emission. Considerable change in design of combustion chamber, design of valves and camshaft provide the proper placing for air induction valve. This valve system is applicable for both 4-stroke and 2-stroke engine with using different fuels like petrol and diesel. If we provide this arrangement with EGR system and turbocharged engine than maximum possibility of achieving good result. We can do more research work in field of cooling of engine cylinder by using air induction valve arrangement.

VI. CONCLUSION

Single cylinder four stroke petrol engine equipped with air induction valve provide fresh air into the combustion chamber for smooth completion of combustion process. It reduces the amount of pollutant and effective scavenging of combustion chamber for smooth operation of engine. Moreover it keeps clean the combustion chamber, valves and spark plugs as most of exhaust gases removes from combustion chamber.

REFERENCES

[1]. Norihiko Nakamura, Toyokazu Baika and Yoshiaki Shibata, (1986), “Multipoint spark ignition for lean combustion”, SAE paper no. 852092.
[2]. Ajay K.Singh , A.Rehman, The Effect of Dual Spark Plug on Engine Performance Parameter in Two Stroke Gasoline Engine International Journal of Applied Research and Studies (IJARS) ISSN: 2278-9480 Volume 2, Issue 7 (July- 2013) www.ijars.in
[3]. Manoj Kumar Sharma, K. P. Chandraiah & Gohil Priyank In recognition of the publication of the paper entitled Using Blends of Jatropha Methyl Easter as Alternative Fuel: An Experimental Investigation for a Diesel Engine Published in ‘The IJST’ Journal Volume III, Issue I, January, 2015
[4]. Murari Mohan Roy, S.M. Najmul, “Use of exhaust gas recirculation (EGR) and cyclonic separator for simultaneous NOx and PM reduction in DI diesel engines”, Journal of Petroleum and Gas engineering, Vol. 2(3), ISSN 2141-2677, 2011.
[5]. Jaffar Hussain , K. Palaniradja, N. Alagumurthi, R. Manimaran, Effect of Exhaust Gas Recirculation (EGR) on Performance and Emission characteristics of a Three Cylinder Direct Injection Compression Ignition Engine. Alexandria Engineering Journal (2012) xxx, xxx–xxx

