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To Improve Efficiency of CNG Engine by Maintaining its Compression Ratio and Fuel Pressure inside Cylinder

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A B S T R A C T

Now a day there is also issue of pollution and day by day this issue is increased by using of petrol and diesel vehicles so diesel vehicles are banned in some state of India to reduce the pollution till it's not a complete solution to control the pollution created in the metro city. If one is going to use the CNG vehicles then there will be a great help to the environment to control the pollution and by this way there is a large reduction in the generation of carbon dioxide and carbon monoxide and also other unwanted gases.

CNG engine is most fuel efficient engine but issue is that whenever one is going to use this CNG and engine He will get the less power in the same engine that He is getting in the petrol engine. So there is issue of large volume storage for CNG engine because to generate the same power, large amount of compressed natural gas is required and its storage is a main issue for long driving session. There is also found that in CNG engine 20 % less amount of heat is transferred to the cylinder so power generation is less and also 18 % less power produced compared to the petrol engine so some kind of changes that are needed to improve the efficiency of CNG engine.

Developers are also focusing on the area of spark ignition engine and they are trying to ignite the fuel inside the cylinder at the moment after the suction stroke so there will be no delay in the ignition of fuel and large amount of heat can be produced at a required time so efficiency of the engine can be increased by proper combustion of fuel and by proper suction of Oxygen and fuel

Keywords: CNG Engine, Power generation, Compression ratio, Brake power ; Efficiency of engine, Exhaust recovery system, Heat released.

1. Introduction.

Pollution is a worldwide issue because in each and every country internal combustion engines are used and these engines are large source of carbon monoxide and nitrogen oxides. Internal combustion engines are using petrol ,diesel and compressed natural gas as a fuel. Other than this fuels liquefied petroleum gas is also used but there are some issues of LPG so now a day's compressed natural gas is very familiar for the public to use as a fuel in an internal combustion engine. In internal combustion engines whenever combustion is not going properly at that time fuel will not burn properly and it will create large amount of unwanted gases like nitrogen oxides, sulphur oxides ,carbon dioxide and large amount of carbon monoxide.

These all gases are responsible to create pollution in the atmosphere and after all people are breathing the same air in the lungs and they are becoming victim of unwanted disease. So developer must have to think to reduce the pollution and He must have introduced the engine which is creating less amount of carbon monoxide and carbon dioxide and oxides of nitrogen.

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For the depletion of Ozone layer number of unwanted gases is responsible and for greenhouse effect amount of carbon dioxide is responsible. Now a day's all internal combustion engines that are running on the diesel engine they are creating large amount of pollution in the atmosphere because in diesel engine there is high compression ratio and extreme temperature inside the cylinder, this high temperature will lead to the generation of nitrogen oxides.

In metro City diesel engines are banned to enter if they are public transport vehicle only goods transportation systems which are related to transfer of goods and other food things they are only permitted to enter in the metro city. Main reason behind the restriction is that when our diesel engines are used in heavy trucks buses they are overheated due to their lord and temperature in that engines are near about 800^0C. Whenever temperature inside the engine rises above 800^0C, it will mix up with the nitrogen and create unwanted oxides of nitrogen and that unwanted gases lead the people to the highly risk disease

So in diesel engine there is also area of research to reduce the compression ratio and reduce the inside temperature of the engine. But number of technical reasons are available that are directly related with the efficiency of the engine. If efficiency of the engine is decreased by decreasing the compression ratio of the engine then more amount fuel will be burnt and it will lead more pollution.

Nomenclature

DS	Diesel Engine
CNG	Compressed natural Gas
AC	Alternative current (%)
Work-O	Outlet shaft work
D	Piston diameter
Qr	Heat released
G	Gravitational force
Qin	Input heat .
A =	Cylinder area [m^2]

2. Schematic diagram of CNG engine operation

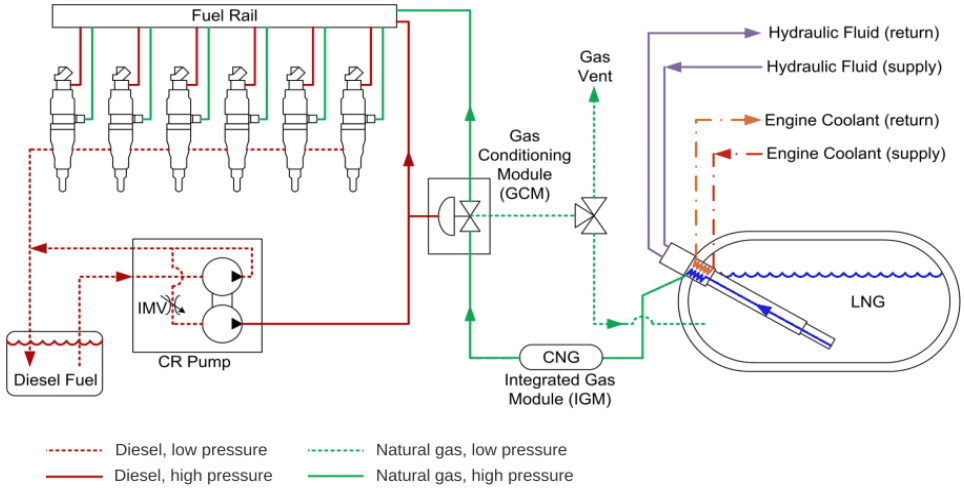

Figure 1 Operation of CNG engine

Pressure regulator is used in CNG engine to control the regulated pressure to the downstream lines. In CNG tank compressed natural gas is filled with 200 bar pressure but WHEN the consumption is continuous and tank will become empty after a period of time therefore inside pressure of the tank will be decreased. So pressure regulator is used to maintain the required pressure to the down streamlines so combustion can be carried out properly till tank is not filled with 100% amount of compressed natural gas.

Hydraulic mechanism is also preferred in the CNG engine to maintain the optimal pressure inside the system. There is also electronic control valve and that is controlled by the fuzzy logic system and lambda system. This electronic control valve opens whenever accelerator is applied by the driver because signal is passing from the accelerator lines to the electronic control valve by the signals and that signals are working in closed loop in the controller. In CNG engines fuel lines are also managed properly for the better flow of compressed natural gas. Sometime non return valve is applied between the lines for better safety. CNG manufacturer are always providing 1 non return valve in the CNG tank.

3. Basis Precaution for CNG engine

In this Era one does not prefer CNG car due to its less power issue, but one has never thought about the basis care that can be taken for its better performance. There are some precautions that can be taken by the owner for better performance of CNG car. If this simple care is taken then one can definitely get better mileage and less maintenance of the car.

1. Start CNG car rate first in the petrol.
2. Make the all parts perfect and do a periodic service as per the terms and norms.
3. Maintain a complete pressure inside the downstream lines and that periodic check up of CNG flow system.
4. Replace necessary components and spark plugs at perfect interval.
5. Don't make a tank 100% empty just the fill the gas as it is 70% empty.

4. Lubrication system in used in CNG car

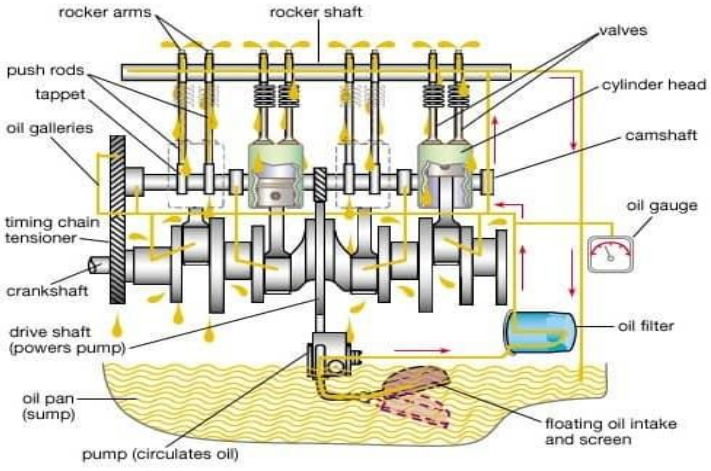

Figure 2 Lubrication of Engine

In lubrication system oil is stored in oil Pan then it is sent with high pressure pump to the required upstream pressure line full stop to measure the pressure of oil gauge is attached and it is continuously measuring the pressure of oil for complete lubrication inside the cylinder. Rocker arms are arranged for continuous movement of the oil inside the cylinders.

Camshaft works properly to manage the crankshaft and flow of oil is maintained by the rotation of crankshaft. Complete mechanism of various components like Rocker arm, Rocker arms, camshaft, push roads are synchronised as per the timely working. Number of lubrication systems is available like splash lubrication, half pressure lubrication, full pressure lubrication as for the application one can install the lubrication system. For high loaded vehicles full pressure lubrication system is preferred for better heat transfer inside the cylinder and to reduce the amount of friction that is happening between the parts. oil is entering with higher pressure and making all the parts smooth and highly efficient.

5. Measurement of efficiency CNG vs. petrol engine

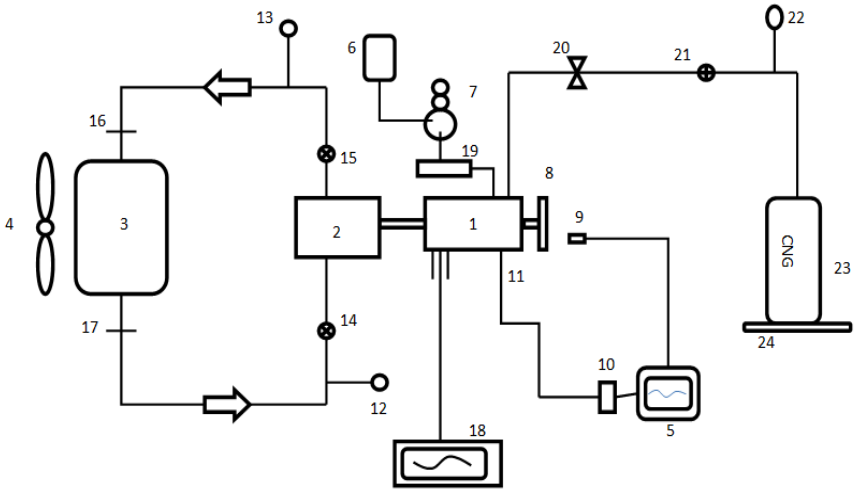

Figure 3. Measurement of fuel consumption

One should also check the fuel consumption in the petrol engine and CNG engine by the mentioned operational figure. Whenever CNG is fed inside the cylinder with the help of hydraulic pump the data are taken and in next experiment the petrol is also fed inside the cylinder and brake power is measured. From the result it can be concluded that petrol is generating more power compared to the CNG so large amount of storage capacity is required whenever one is going to use the CNG as a fuel in a long driving session there is also another conclusion that CNG is producing less power in the same engine and same operating condition compared to the petrol as a fuel.

Till specific fuel consumption for CNG engine is very less compared to the petrol engine. Research shows that CNG engine is using approximate half fuel compared to the petrol engine. Petrol car for medium passenger is giving nearly about 20 km mileage and CNG car for the same capacity will give 33 km mileage in same condition. So overall efficiency of the CNG car is extremely higher compared to the patrol car so if developers are doing some required changes in the engine of CNG car than large amount of pollution can be reduced and amount of conventional fuels may be saved for future generation

4. Conclusion

One can run CNG car with better efficiency if he is making its all components hundred percent perfect and he is doing periodic service as per the terms and requirement given by the developer. That should be one thing also be noted that octane number of CNG is higher compared to the petrol so overall mileage of CNG car is higher compared to the patrol car. There is also one advantage of that cost of the CNG tar is almost half compared to the petrol car but there are some limitations of filling CNG at interior places. Government has to implement number of CNG stations at an interior places and also encourage the people to use CNG as a fuel for that government must have to introduce some subsidy to the people for maximum use of CNG vehicles.

For better performance of CNG car spark plugs of the petrol engine must be changed within a period of time for better ignition inside the cylinder sometimes spark plug are not science and miss firing happens that will create to the engine at unbalanced forces and also reduce the thermal efficiency of the CNG engines. If one is running his CNG car search a mod then high maintenance maybe e occurred to that CNG engines. CNG has higher octane number nearly about 120 and petrol has 100 octane number so overall efficiency of the CNG fuel is better compare to the petrol. Till some medications are required for proper and dedicated CNG engines for its better thermal efficiency.

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