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# Development and Modification of 2-Stroke IC Engine

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***Abstract***

*Today world is concerned more about saving the environment, everywhere precautionary measures have been taken up to reduce pollution. Major amount of air pollution is caused by mechanical animals running on roads; they contribute to most of the air pollution, hence, engineers today to focus on how to build an eco-friendly engine which can reduce the pollution caused by vehicles. A compressed air engine works on air as fuel to drive the pistons and produce mechanical output without causing any harm to the environment. The engine takes in compressed air instead of using traditional fuels such as petrol diesel etc. Here, this compressed air engine takes the intake of air from the vertically above the piston head. The design of the camshaft has been changed to alter the timing of the valves. It is found that, experimental speed of 60 km/h was achieved by the use of this engine which is better than other works produced on the same topic. It is also efficient as the pollution caused is zero. It is efficient then electrically operated vehicles Hence, this engine can prove to be very successful and sustainable in future.*

**Keywords:** Compressed air, 2-stroke engine, pollution, combustion, emissions

## INTRODUCTION

When compared to other fuel, the compressed air is favourable as it possesses high energy, low toxicity, fast filling at low cost and long service life. An issue like this, make it technically challenging to design air engines for all kind of compressed air driven vehicle.

Due to limited stock and excessive use, fossil fuels are getting finished at rapid rate. Hence, it is advisable to develop alternate technologies in order to use renewable energy sources, so that conserving the fossil fuels will be possible [6].

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There is less chance of knocking. It results in smooth working of engine. The various forms of energy available are: solar, electric, atmospheric air etc. An additional technical benefit is (i) will be no need for installing cooling system, (ii) complex fuel injection systems. It makes the design simple. The exhaust gases leaving the engine will be only air having low temperature. It reduces the problem of harmful emissions, in conventional engines [7].

In recent years, the use of compressed air as a source of power generation in engines has been gaining momentum. Using the potential energy of stored compressed air for moving the piston and

 

propelling the vehicle is a clean as well as cheap alternative. Air is abundantly available in atmosphere and can be compressed to higher pressures in very low costs. So far, all the attempts in replacing fossil fuels have led to a reduction in the amount of polluting gases from the vehicle, but air being non-polluting can help in completely eradicating the pollution from automobiles permanently [8–10].

**HISTORY**

The use of compressed air as an energy source is not exactly a recent technology. The mankind uses uncompressed airpower since ancient time was the first pneumatic locomotive used in mining. 1st patented compressed air vehicle was established in France by a Polish engineer Louis Mekarski in 1870. The patent was filed in 1872–1873 and was tested in 1876. The Mekarski air engine became the first creation to be used for street transportation. Henceforth, the first urban transport locomotive was not introduced until 1898, by Hoadley and Knight. The Charles B. Hodges will really be remembered as the true father of the compressed air concept for cars.

**Objective**

1. Modification of IC Engine into an Air Powered Engine.
2. To develop an Engine that has zero emissions.
3. Designing our own test rig.
4. In today's scenario 2-stroke engine are outdated. It does not have any value in market. It is suitable for work compressed air after some changes.
5. Nowadays petrol and diesel engine are produced a harmful gas, that is so we used a compressed air as fuel to run the engine. Which helps to reduce pollution.

**Literature Review**

*Prof. B.S. Patel [1]* He developed a compressed air engine by modifying a 4-stroke, single cylinder SI engine by replacing the spark plug with a pulsed pressure valve, and using compressed air as the working fluid. The working of the engine is explained theoretically. Its cost analysis is made showing the compressed air engine is cheaper as compared to the conventional SI engine.

*Arjit Mourya [2]* They manufactured the prototype of compressed air engine which had a vertical intake of air above the piston head. To alter the timing of the valves they changed the design of camshaft

*Prof. Sapkal Vishal [3]* publish paper on **"**Future Trends in Automobile: Air Powered Vehicles" Air powered vehicles is a realization of latest technology in automobile field. It estimates the use of non-renewable fuels and thereby preventing pollution and step to a healthier environment.

*Dr. Bharat Raj Singh [4]* They experimented and tried to gain an output of 6.50 to 7.20 HP for the starting torque requirements of 500 to 750 rpm at 4 to 6 bars air pressure to running speeds of 2000 to 3000 rpm using 2 to 3 bars air pressure.

*Ulf Bossel [5]* analyzed thermodynamic processes and observed that at 20°C, 300 Liter tank filled with air at 300 bar carries 51 MJ of energy. This energy could be entirely converted to mechanical work at ideal reversible isothermal conditions.

*Prof. S Angappan* published a paper on "Investigation of Modified Engine Operated using Compressed Air". 1) The compressed air powered engine can be used in two wheelers, mopeds, cars,

 

trams. 2) Speed of the engine can be increases with increase in pressure supplied to it. IJSRD/Volume Published Year: '2017'.

**Engine Specification**

Table 1 Shows engine specification.

**Exprimental Setup**

Figure 1 Shows Experimental setup.

**Table 1.** Engine specification

| Engine Specification | |
|---|---|
| Model | TVS ES |
| Engine Displacement | 59.9 CC |
| Engine Type | 2-STROKE |
| Number Of Cylinders | 1 |
| Valves Per Cylinder | 2 |
| Fuel Type | Petrol |
| Starter | Manual |
| Maximum power | 3.5 PS @5500rpm |
| Transmission Type | Belt |
| Maximum Torque | 4.5 NM @5000rpm |

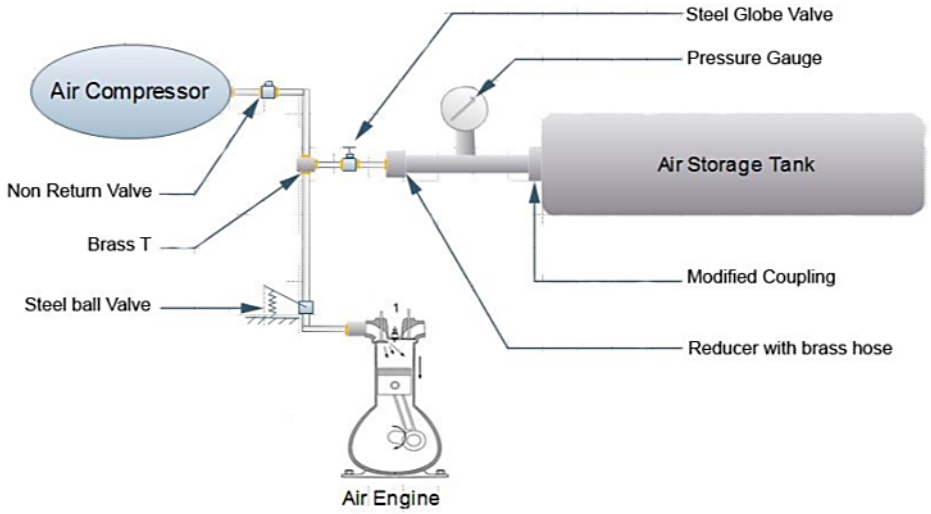


**Figure 1.** Experimental setup.

Torque developed in engine was based on the formulation:

$T = (9.81 \times W \times R)$

T – Torque (N-m)
W – Mass added (Kg)
R – Radius of the Brake drum (meters)

Brake Power of the Engine was based on B.P. = $\frac{(2 \times \times N \times T)/}{60{,}000}$

B.P. – Brake Power (KW)

- Bore diameter = 38 mm = 0.038 m

 

- Stroke length = 43 mm = 0.043 m

Displacement= stroke length × Π × $\left(\frac{1}{2}\right) \times bore)^2$ × No. of cylinders
Displacement= 0.043 × Π × [(½) × 0.038]$^2$ × 1
Displacement= 48.8 m$^3$

Indicated Power= [Pm × L × A × N] × [60000 × 2]
Brake Power = [Pmb × L × A × N] × [60000]
Pm = Actual mean effective pressure
Pmb = Actual mean effective brake pressure
L = Length of stroke
A = Area of cylinder
N = RPM of engine crankshaft

Ƞmech = $\frac{Brake\ power}{Indicated\ power}$
Ƞvol= [Actual volume charge/Air sucked at atmosphere] ÷ [Swept volume]

## CONCLUSIONS

The conventional engine used is subjected to following modification:

i. The camshaft modification.
ii. The timing valve arrangement a profile such that for one cycle of piston movement inlet and outlet valve opens and closes as required in compressed air engine.
iii. The compressed air is non-conventional energy and Due to global warming, it is demand of time to adopt green technology.

### Future Scope

1. Use of cam less inlet and outlet valves improve efficiency as the part of output power use to run cams through chain drives will not be needed.
2. An all-new technology combining Gasoline internal combustion engine and compressed air storage can be developed.
3. Focus on the development of air motor technology. The invention of engine air motor would virtually eliminate vibration, internal wear, and friction, in order to obtain superior performance for a wide variety of applications.

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