# Compressed Air Driven Vehicle

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**ABSTRACT:** The latest trend in the automotive industry is to develop light weight vehicles. Every automotive industry is looking to reduce the weight of the vehicle as it helps in the better handling of the vehicle and increases the efficiency of the vehicle. Today, the heavy vehicles are known for producing a large amount of harmful gases like $CO_2$, $SO_2$ etc. which act as the major source for global warming. So research is going on to find a light weight vehicle which does not pollute the environment. The present study focuses on engine it is modified from a 4-stroke to a 2-stroke engine using a cam system driven by a crankshaft and the intake and exhaust valves have a small lift due to this modification. The electricity requirement for compressing air has to be considered while computing overall efficiency. Nevertheless the compressed air vehicle will contribute to reducing air pollution and tend to zero pollution level. Main advantage of this engine is that no hydrocarbon fuel required means no combustion process is take place.The design and experimental test result presented here can be used for further research and modification of the technique.

**Keywords :** Compressed air; 4-stroke; Hydrocarbon; Efficiency; Harmful gases

## 1 INTRODUCTION

we know Fossil fuel which fills the energy production demand of the world is decreasing rapidly and also polluting our ecosystem due to which greenhouse effect, ozone layer depletion, acid rains and air pollution takes place. Energy crisis is due to two reasons, firstly due to population of the world has increased rapidly and secondly the standard of living of human being has increased. So research is going on to find a light weight vehicle which does not pollute the environment. One of the alternatives is the use of compressed air to generate power to run an automobile. Due to the unique and environmental friendly properties of air, it is considered as one of the future fuels which will run the vehicles. The environmental pollution in the metropolitan cities is increasing rapidly mostly because of the increased number of fossil fuel powered vehicles. The main objective of this paper is to design a high power to weight ratio compressed air engine which doesn't require start up power. It can be said as a green environmental protection vehicle with near zero pollution in the metropolitan cities. Many alternative options are now being studied throughout the world .This can be reduce and controlled by using compressed air engine to produce energy, which runs on air which is abundantly available in atmosphere.. One of the alternative solutions can be a compressed air driven vehicle.A four stroke single cylinder SI engine is converted to operate using compressed air because of its design simplicity.The greatest advantages of compressed air driven vehicle are no burning process and no waste gas discharge to the surrounding environment.The present study focuses on converting an SI engine into a compressed air engine. The air pressure used in the present study is 7 bar which is obtained using a compressor.

## 2 DESIGN

### 2.1 CONVENTIONAL CAM SHAFT-

***Fig .1:*** *Cam-shaft of conventional engine*

The cam shaft originally had two cams with one lobe each which were mutually perpendicular to each other. The crank rotates due to the movement of the piston; the camshaft is attached with the crankshaft by a timing chain or a timing belt. And as the crank rotates the camshaft also rotates and hence the timing of the valves is managed. In the traditional camshaft the inlet and exhaust valve both functions.

### 2.2 VALVE TIMING DIAGRAM-

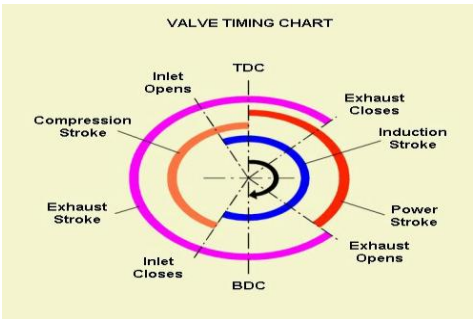



***Fig .2-*** *valve timing diagram of conventional engine*

### 2.3 Modification Of Cam-Shaft-

Cam profiling represents basic idea of converting the four strokes engine to the two strokes engine. Below drawing describes the dimension and present view of cam. For replacing the original cylinder head, a new set two flank cams has been designed for operating the inlet and exhaust valves of the modified engine. Both the exhaust and inlet cams are symmetric about the center line of the cam shaft. The cams are made of mild steels.

***Fig. 3:*** *Modified cam shaft*

### 2.4 Modified Valve Timing Diagram-

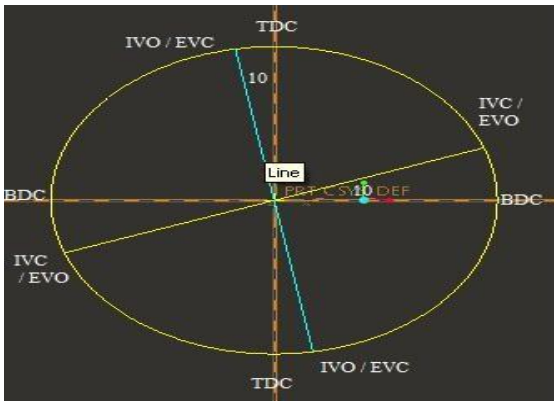



***Fig.4:*** *Modified valve timing diagram*

### 2.5 Inlet Plate Design-

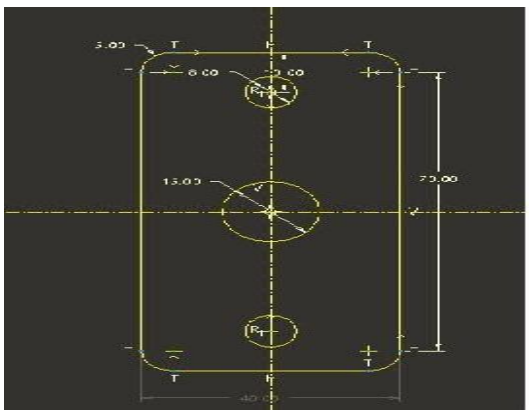


***Fig.5:*** *design og inlet plate*

## 3 Experimental Set Up

### 3.1 Basic elements of CADV

Set up represent the basic arrangement of the Compressed driven air engine. Basic elements of compressed air engine are

1. Air cylinder
2. Single cylinder four strokes SI Engine
3. Air pipe
4. Pressure gauge (measuring device)
5. Cam mechanism.
6. Control valve
7. Tachometer (measuring device)

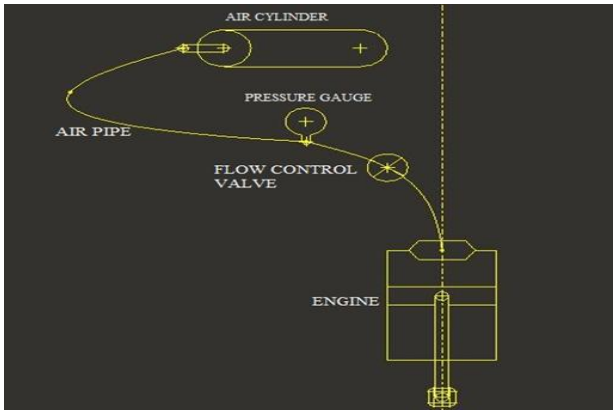



***Fig. 6****: Block diagram of experimental set up*

Air cylinder is used for storing the compressed air.this air is passes through air pipe to inlet valve by adjusting flow control valve, we adjust the flow of air vto the engine.

### 3.2 Engine Technical Specifications

Technical data of engine which used as a compressed air engine is given below. Given data is related four strokes engine which will be converting in to two strokes engine with helps of new cam.

***Table 1***

*Technical specifications of engine*

| | |
|---|---|
| No of cylinder | Single cylinder |
| Engine type | Air cooled |
| Engine Displacement | 97.2 cc |
| Bore diameter | 50mm |
| Stroke length | 49.5 mm |
| No of stroke | 4 |
| Transmission | 4-speed |
| Maximum power | 6 bhp @ 7500 rpm |
| Maximum torque | 5.3955 N.m@ 5500 rpm |
| Start | Kick start |

### 3.3 AIR COMPRESSOR SPECIFICATION

***Table 2***
*Technical specifications of air compressor*

| | |
|---|---|
| Serial No. | 111010 |
| Model | AI-6 |
| PSI | 150 |
| RPM | 700 |
| H.P. | 1 |
| Type | Single piston reciprocating |

## 4. EQUATION'S USED FOR CALCULATIONS

1. Break Power

$$B.P = \frac{2\pi NT}{60 \times 10^3}$$

2. Mean effective pressure In Mpa

$$M.E.P = \frac{B.P \times 6 \times 10^4 \times 4}{\pi \times d^2 \times L \times K \times n}$$

3. Air displaced by compressor in $m^3$

$$\text{Volume of Air} = \frac{RPM \times enginedisplacement}{1728}$$

4. Power consumed by compressor in KW

$$\text{Power} = 202 \times V \times \ln\left[\frac{deliverypressure}{inletpressure}\right]$$

## 5 EXPERIMENTATION FOR CADV

### 5.1 OBSERVATION TABLE

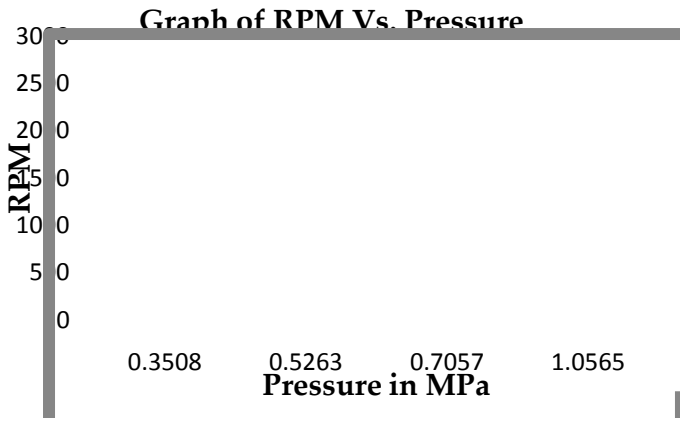
***Table 3***
*Observations of CADV*

| PRESSURE (Mpa) | Torque(N.m) | RPM |
|---|---|---|
| 0.3508 | 16.3385 | 800 |
| 0.5263 | 24.5053 | 1450 |
| 0.7017 | 32.6771 | 1800 |
| 1.0565 | 49.0100 | 2400 |

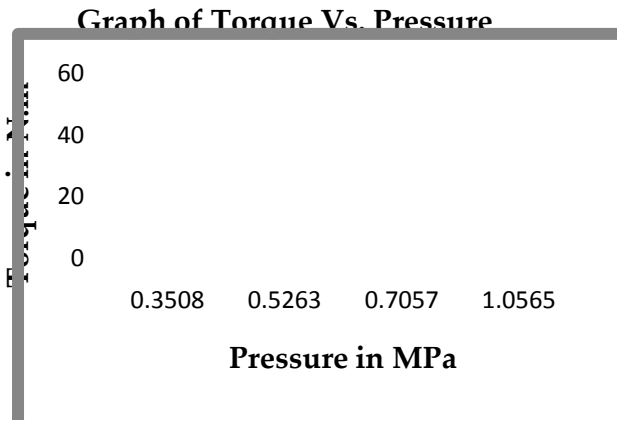
### 5.2 OBSERVATION RESULT

After fabrication & Testing of the engine, the following Results were obtained and respective graphs were drawn out of the tested data which was

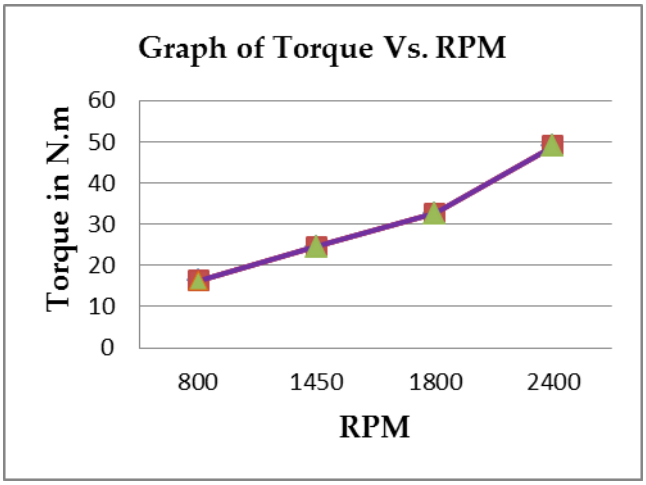
*A. Graph showing the Engine RPM Vs. Pressure supplied characteristics*




*B. Graph depicting the Torque output on the Crankshaft And Pressure supplied*




*C. Graph showing Torque Vs. RPM characteristics*



## 6 Conclusion

Based on the work that has been done on this project, following conclusion has been drawn. The engine used in the project is being subjected to modifications like,Cam-shaft modification- A new cam was fabricated with a profile such that for one cycle of piston movement inlet and outlet valve opens and closes as required.New set of gears for camshaft and crankshaft-This was done so that cam does not rotate once in two revolutions of crankshaft. From graph we observed that, RPM Vs. Pressure- As the pressure increases, also engine RPM increases linearly, AlsoTorque Vs. Pressure- As the pressure increases, Torque on crankshaft also increases linearly,and Torque Vs.RPM - As RPM increases, Torque also increases linearly.

## Acknowledgment

We express our deep sense of gratitude from the bottom of our heart to our guide Prof.MANJUNATH MINAJAGI under the valuable guidance, we gained the insights and ideas without which project could not have seen the light of the day. We also express our thanks to Dr. V.K. Naik**,** Principal, Jaywant college of engineering and management, K.M.Gad and Prof. Sangmesh Sheelawant**,** HOD of Mechanical engineering department for their constant support and guidance.And providing all requisite facilities for carrying out this project. We also express our thanks to executive director Prof. S.K. Joshi, who motivated to us for doing project. Lastly but most important, we would like to pay our regards to our beloved parents and faculty members for their blessing without which success is a mirage.

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