

# Literature Review Paper on the Compressed Air Vehicle with Air Motor

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**Abstract:-** Global climate change is the major problem to be faced today. One of the main factor contributing is the emissions from vehicles i.e. our personal vehicles are the major cause of global warming. When emissions go down the pace of global warming slows. So there is a need to shift from the use of conventional fuels to non-conventional fuels. One such alternative fuel is compressed air. Compressed air is clean fuel. It's behavior is simple and safe which does not cause any adverse effect on environment. This paper deals with the study of compressed air as a fuel for running a 3-wheeler vehicle wherein the compressed air is stored in tank & supplied to the air motor from where rotational motion is obtained. In this project a preliminary investigation is carried out to run a vehicle on compressed air.

**Keywords** – Compressed air, Air Motor, Air Vehicle, Air Tank.

## INTRODUCTION

In the past few decades, energy conservation and carbon reduction have become very crucial issues worldwide. Scientists have been searching for solutions to reduce the extensive use of conventional internal combustion (IC) engines and/or reduce their carbon dioxide emissions. To find a replacement for conventional IC engines, researchers have studied several types of engines that use green energy to determine the feasibilities of installing these engines in motor vehicles. Examples include electric engines, natural gas engines, and hydrogen engines. Electric vehicles are the most common green energy alternatives, and have been developed and commercialized for decades. However, slow battery recharging and a heavy battery weight are critical issues for electric vehicles. Hydrogen engines and natural gas engines can be used in the motor vehicles; however, the required tank size limits their applications. In recent years, high-pressure compressed air has been considered a green energy source for its advantage of zero carbon emissions and potential applications as a main or auxiliary power system in motor vehicles. [6]

Compressed air vehicle is a vehicle that uses a motor powered by compressed air. It is also called as low pollution or zero pollution car. Engineers are directing their efforts to make use of air as an energy source to run the light utility vehicle. It is a method not only efficient and clear but also economical.

Compressed Air Powered Vehicle utilizes the power of compressed air to operate the engine.

Compressed air powered vehicle are zero emission vehicles. This is so because air is used as fuel and exhaust is also in the form of air. Hence, these vehicles does not release any CO, NO<sub>x</sub>, hydrocarbons, soot etc. and hence do not damage the environment. Thus compressed air powered car can prove to be the environment friendly vehicle of 21st century. [2]

## I. LITERATURE REVIEW

In general terminology, sustainability can be stated as; meeting the needs of current and future mankind/generations through simultaneous environmental, social and economic improvements, whereas sustainability of the energy resources to preserve the oil and make brighter future of mankind by adding alternative energy sources such as: non-conventional and or renewable energy which is going to help current problem to some extent. Now worldwide researchers/inventors are paying full attention towards this issue. It is also learnt that there are two distinct reasons for search of alternative to fossil fuel and make sustainable energy source; the first one is depletion of oil resources which is causing civilization vulnerable, thereby many researchers, technologists and scientist have spoken as to why alternative to fossil fuel is required another one is higher rate of emission due to rapid use of hydrocarbon fuel. [4]

Behavior of compressed air Compressed air is clean, safe, simple and efficient. There are no dangerous exhaust fumes of or other harmful by products when compressed air is used as a utility. It is a non-combustible, non-polluting utility. When air at atmospheric pressure is mechanically compressed by a compressor, the transformation of air at 1 bar (atmospheric pressure) into air at higher pressure (up to 414 bar) is determined by the laws of thermodynamics. They state that an increase in pressure equals a rise in heat and compressing air creates a proportional increase in heat. Boyle's law explains that if a volume of a gas (air) halves during compression, then the pressure is doubled. Charles' law states that the volume of a gas changes in direct proportion to the temperature. These laws explain that pressure, volume and temperature are proportional; change one variable and one or two of the

others will also change, according to this equation:  $(P_1 V_1) / T_1 = (P_2 V_2) / T_2$

Compressed air is normally used in pressure ranges from 1 bar to 414 bar (14 to 6004 PSI) at various flow rates from as little as 0.1 m (3.5 CFM - cubic feet per minute) and up.

The first air cars will almost certainly use the Compressed Air Engine (CAE) developed by the French company, Motor Development International (MDI). Air cars using this engine will have tanks that will probably hold about 3,200 cubic feet (90.6 kiloliters) of compressed air.[2]

## II. OBJECTIVE

Due to excessive use of non-renewable sources of energy high amount of fuel is burn out, Air is one of the renewable source of energy can be used as substitute fuel. The Compress Air can be used as an alternative source of energy/fuel. The Compress Air can be stored in tank and used to drive the engine.

Today fossil fuels are widely used as a source of energy in various different fields like internal & external combustion engines, as heat source in manufacturing industries, etc. But its stock is very limited and due to this tremendous use, fossil fuels are depleting at faster rate. So, in this world of energy crisis, it is inevitable to develop alternative technologies to use renewable energy sources, so that fossil fuels can be conserved. One of the major fields in which fossil fuels are used is Internal Combustion Engine.

An alternative of IC Engine is "Compressed Air Powered Vehicle". It is the vehicle which uses compressed air to run motor.[2]

## III. CONSTRUCTION

### A. FRAME

For mounting of all the accessories the base should be strong. The base here is called as the frame. The material used for the making of frame is mild steel. The hollow type pipes are fabricated to form a rigid construction so as to serve the purpose of frame. The hollow pipe is used to minimize the weight of the vehicle.

### B. AIR MOTOR

Air motors provide compact, Lightweight and safe source of smooth vibration less power. Air motors cannot be damaged by overloading, Frequent and continuous stalling or unlimited reversals. Air motors are unaffected by hot, Corrosive or wet atmospheres, Shocks and vibrations, Thereby making them suitable for operations in hazardous areas. High power to weight ratio. Easy installation. Portability and Minimum maintenance. Simple controls.

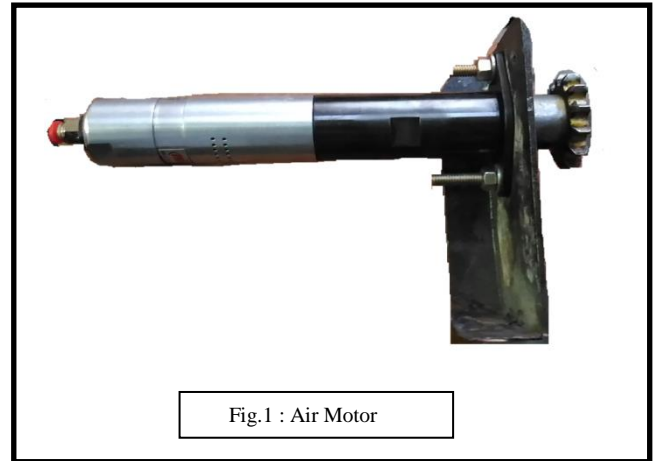


Fig.1 : Air Motor

### Specification of Air Motor

- 1) Torque- 26.7 N-m
- 2) Power -307.56 watts
- 3) RPM -225
- 4) Weight- 1.3 kg

### C. TANK

#### Specification of Tank

- 1) Tank Capacity- 31.8 litre
- 2) Volume -3.18 x 10<sup>7</sup> mm<sup>3</sup>
- 3) Dimensions -457.2 x 304.8 mm
- 4) Thickness- 3mm
- 5) Pressure - 8 bar



Fig.2 : Air Tank

### D. AXLE

The real axle is connected to rear wheels of our car. Both the end of the axle is connected to the wheels and the chain sprocket mechanism is mounted on it.

The material used in axle is Bright Bar, mild steel.

The diameter and length of axle is 30 mm and 540 mm.

### E. BRAKE

The brake system used is of simple drum brake. Simple brake consists of brake liner which is mounted on the brake shoe inside the brake drum. So, when brake pedal is pressed the liners are moves outward against the action the spring and sticks to brake drum and thus brake engage and car stops. And when brake pedal is released the liner along with brake shoe comes to its original position.

F. ACCELERATOR

Foot-Pedal Mechanical Valve Performance Advancements Such As Remarkably High Flow Capacities From Very Compact Designs, Low Power Consumption, High Speed Response, Long Life, Built-In Surge Suppression And Indicator Lights. Manifold Options, Including Built-In One-Touch Fittings, Prewired Electric Connections And Serial Interface Simplify Installation, Maintenance And Control.

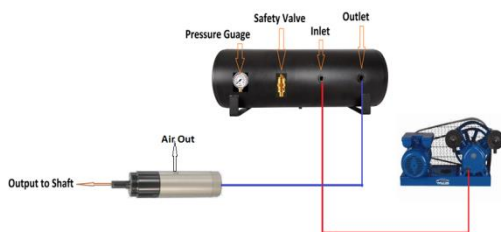


Fig.3 : Foot Pedal Mechanism

IV. WORKING

The Air Motor uses the power of compressed air to generate torque and rotational motion. Compressed air is filled in the storage tank with the help of compressor. The air is filled in storage tank upto the pressure of 6 to 8 bar. The high pressure air is then supplied to air motor which runs the motor. The power developed by the motor is 0.38-0.44 HP depending upon the road condition. The torque developed by the motor is 26.7 N-m at the maximum power of 307.56 watts. Now rotational motion is transferred to wheels via axle. On rear axle one wheel is fixed & other one is free which is connected via bearing.

The working diagram of the vehicle is as shown in the figure.



V. OBSERVATION

1. Tank Pressure : 6 bar
2. Weight of car : 50kg
3. Maximum weight of driver : 90kg
4. Vehicle speed : 15km/hr
5. Distance Travelled per refill : 200m

VI. CONCLUSION

Compressed air for vehicle propulsion is already being explored and now air powered vehicles are being developed as a more fuel-efficient means of transportation. In this project a preliminary investigation is carried out to run a vehicle on compressed air. From the observation it can be concluded that compressed air power vehicles can prove to the future vehicles which is ecofriendly, pollution free, but also very economical. This redresses both the problems of fuel crises and pollution. These are zero emission vehicle. To sum it up, they are non-expensive vehicles that do not pollute and are easy to get around in cities.

VII. REFERENCES

1. COMPRESSED AIR VEHICLE: A REVIEW SAURABH PATHAK, KONTHAM SWETHA, V.SREEDHAR, V.S.V PRABHAKAR Department of Mechanical Engineering, Vardhaman College of Engineering-Shamshabad, India
2. Design and Fabrication of Compressed Air Powered Car by, Bilal Abdullah Baig *M.Tech 1st year (Mechanical Engineering Design) Anjuman College of Engg and Tech, Nagpur, MS, India*
3. Compressed Air Car by, S.S.Thipse
4. Compressed air energy storage system based engine for Running light vehicle by, G.KARTHIKA, KRISHNAWAMY COLLEGE OF ENGINEERING AND TECHNOLOGY, CUDDALORE.
5. Latest Developments of a Compressed Air Vehicle: A Status Report by, S.S.Verma
6. Experimental Investigation on the Performance of a Compressed-Air Driven Piston Engine by, Chih-Yung Huang, Cheng-Kang Hu, Chih-Jie Yu and Cheng-Kuo Sung. Department of Power Mechanical Engineering, National TsingHua University, Hsinchu 30013, Taiwan