iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 4 **Issue:** VI **Month of publication:** June 2016

**DOI:**

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

Volume 4 Issue VI, June 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

# Compressed Air Vehicle

I.I.Sayyad[1], Aniket Karandikar[2], Anuja Murkute[3], Ravikiran Karmankar[4], Madhavi Wagh[5]
[1]*Assistant Prof. ,* [2,3,4,5]*U.G. students S.R.E.S.C.O.E.Kop, Savitribai Phule Pune University,Pune(M.S.),INDIA..*

***Abstract— This paper focuses on design, fabrication, testing of a vehicle that is powered by compressed air. As we all are aware that conventional fossil fuels obtained from natural oils and gases are depleting very rapidly, the mankind is desperately in need of an alternative source of power to run its vehicles. Air is the most abundantly available and never depleting source of power when compressed. An air driven engine is an eco-friendly engine which operates with compressed air. This engine uses the expansion of compressed air to drive the pistons of an engine. It is a pneumatic actuator that creates useful work by expanding compressed air. There is no mixing of fuel with air as there is no combustion. This makes use of Compressed Air Technology for its operation the compressed air technology is quite simple. Through this energy can be utilized for useful purposes.***

***Keywords:— air engine, compressed air, compressor, cylinder.***

## I. INTRODUCTION

One of the major problems most developing countries facing now a days is pollution and the major source of which is automobiles running on the roads. Concerning resource availability there has been a strong warning that petroleum resources may be depleted in the relative near future. Gasoline which has been the main source of fuel for the history of cars, produces carbon monoxide, nitrogen oxides and unburned hydrocarbons which are the main pollutants and are responsible for bad effect of pollution. There comes need to think about alternatives such as Biodiesel and Natural gas, electric cars, hybrid cars, hydrogen fuel cells but these alternative fuels also have some drawbacks. One possible alternative fuel is the compressed air. Fossil fuels (i.e., petroleum, diesel, natural gas and coal) which meet most of the world's energy demand are being depleted rapidly. Also, their combustion products are causing global problems, such as the green house effect, ozone layer depletion, acid rains and pollution which are posing great danger for environment and eventually for the total life on planet. These factors are leading automobile manufactures to develop cars fueled by alternatives energies. Hybrid cars, Fuel cell powered cars, Hydrogen fueled cars will be soon in the market as a result of it. One possible alternative is the air powered car. Air, which is abundantly available and is free from pollution, can be compressed to higher pressure at a very low cost, is one of the prime option since atmospheric pollution can be permanently eradicated. Whereas so far all the attempts made to eliminate the pollution has however to reduce it, but complete eradication is still rigorously pursued. Compressed air utilization in the pneumatic application has been long proven. Air motors, pneumatic actuators and others various such pneumatic equipments are in use. Compressed air was also used in some of vehicle for boosting the initial torque. Turbo charging has become one of the popular techniques to enhance power and improve the efficiencies of the automotive engine that completely runs on compressed air. There are two ongoing projects (in France, by MDI and in S. Korea) that are developing a new type of car that will run only on compressed air. Similar attempt has been made but to modify the existing engine and to test on compressed air.

## II. WORKING OF COMPRESSED AIR VEHICLE

Through literature survey following observations are made.

### *A. Air Engine*

Compressed air vehicle is powered by an air engine, using compressed air, which is stored in a tank. Instead of mixing fuel with air and burning it in the engine to drive pistons with hot expanding gases, compressed air vehicles (CAV) use the expansion of compressed air to drive their pistons. Compressed air propulsion may also be incorporated in hybrid systems, e.g., battery electric propulsion and fuel tanks to recharge the batteries. This kind of system is called hybrid-pneumatic electric propulsion. Additionally, regenerative braking can also be used in conjunction with this system.

Volume 4 Issue VI, June 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

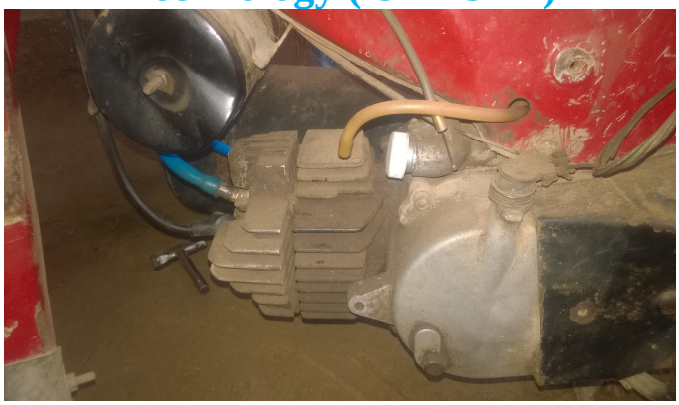


Fig No:-1 Air engine

*B. Cylinder*

Cylinders are mechanical devices which produce force, often in combination with movement, and are powered by compressed gas. To perform their function; pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. Once actuated, compressed air enters into the tube at one end of the piston and, hence, imparts force on the piston. Consequently, the piston becomes displaced by the compressed air expanding in an attempt to reach atmospheric pressure.[ ]

Cylinder dimensions:-

Outer Diameter-290mm=0.029m

Height-480mm=0.048m

Thickness-3mm=0.003m

Inner diameter =O.D-Thickness=0.029-0.003=0.026m

Fig No:-2 cyllinders

*C. Compressor*

A gas compressor is a mechanical device that increases the pressure of a gas by reducing its volume. Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. As gases are compressible, the compressor also reduces the volume of a gas. Liquids are relatively incompressible, so the main action of a pump is to pressurize and transport liquids. Compressed air engine operates between 0-4 kW producing working pressures about 50 bars to 200bar.

*D. Air Tank*

The air tanks in air powered cars are composed of an interior thermoplastic container which ensures it is airtight. This is held in a

coiled and crossed carbon fiber shell. This technique is the result of many studies into factors such as: mechanical specifications, density of material, choice of fibers etc.

The specifications of tank,

Maximum effective pressure: (200 bars)

The tanks weigh 22-25 kg for 100 liters of air at 200 bars

In this system a double acting pneumatic cylinder operated as a slider crank mechanism that converts the linear reciprocation of the cylinder piston rod into oscillatory motion of the driver crank about the pinion shaft. The pinion shaft further drives the pinion, which will turn the gear wheel on the output shaft. The output shaft carries the system that converts the oscillatory motion of the gear into the single direction rotation of the chain vehicle by means of a unidirectional clutch arrangement. supplies compressed air by means of an appropriate filter-regulator-lubricator (FRL) unit and a 5/2 foot operated pneumatic direction control valve. This system is capable of being driven to given intermittent as well as continuous motion to the chain vehicle system. The system uses pneumatic cylinder, which is fast actuation system, hence the vehicle has fast response. The system incorporates a provision to arrest the stroke of the actuator to a desired level there by deciding the length of travel of the vehicle thus making the system flexible enough to serve the needs of the flexible production system.

*Working*

Compressed air engine

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.

The first air cars will have air compressors built into them. After a brisk drive, you'll be able to take the car home, put it into the garage and plug in the compressor. The compressor will use air from around the car to refill the compressed air tank. Unfortunately, this is a rather slow method of refuelling and will probably take up to two hours for a complete refill. If the idea of an air car catches on, air refuelling stations will become available at ordinary gas stations, where the tank can be refilled much more rapidly with air that's already been compressed. Filling your tank at the pump will probably take about three minutes.

Pneumatic cylinders are mechanical devices which produce force, often in combination with movement and are powered by compressed gas. To perform their function, pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. Once actuated, compressed air enters into the tube at one end of the piston imparts force on the piston.

Most applications of compressed air engines focus on auxiliary systems or systems that assist IC engines. Only a few studies or industrial projects have focused on the application of a compressed air engine as the main power system. Schechter studied the feasibility of using compressed air in conventional IC engines with two power strokes; one stroke is driven by combustion and the other stroke is driven by compressed air. Driving the additional power cycle by compressed air instead of combustion reduces fuel consumption by half.

At the beginning of the intake process, the intake valve opens immediately, and the exhaust valve stays closed while the piston moves from the top dead center (TDC) toward the bottom dead center (BDC). During this process, the incoming compressed air pushes the piston downward, producing the power stroke. The intake valve closes before the piston reaches the BDC to reduce the air consumption, and thus changing the process from a constant pressure expansion to an isentropic expansion. The downward movement of piston produces work while the compressed air feeds into the cylinder during the intake process, and even after the intake valve closes during the isentropic expansion process. At the start of the exhaust process, the exhaust valve opens immediately while the intake valve remains closed. The piston moves from the BDC toward the TDC to discharge the compressed air from inside the cylinder. The simplicity in design, durability and compact size of pneumatic systems make them well suited for mobile applications. Pneumatic control system plays very important role in industrial system owing to the advantages of low cost, easy maintenance, cleanliness, readily available, and cheap source, etc. A particularly well suited application for vehicle operating on

compressed air is material handling and for visitors in industry. Compressed air storage energy (CASE) is a promising method of energy storage, with high efficiency and environmental friendliness. Compressed air is regarded as fourth utility, after electricity, natural gas, water and the facilitating production activities in industrial environment.

The laws of physics dictate that uncontained gases will fill any given space. The easiest way to see this in action is to inflate a balloon. The elastic skin of the balloon holds the air tightly inside, but the moment you use a pin to create a hole in the balloon's surface, the air expands outward with so much energy that the balloon explodes. Compressing a gas into a small space is a way to store energy. An inventor in California (USA) has made a car running on compressed air, stored in scuba diving tanks. He modified an engine used on the Honda RC51 998 cc Superbike. He blocked off one of the cylinders of the engine and used the spark plug hole on the other cylinder to feed the compressed air.

Fig. No.:-*3* Working-Compressed air engine

The compressed air drives the piston down as the power stroke. At the end of the power stroke, the compressed air is released through the exhaust valves and the exhaust is only air. The pistons were connected to the wheels through the Honda bike's six-speed transmission. This modified engine was mounted on a tubular frame and a body that looked like a curious crossbreed of a motorbike with a racing car. A bank of three scuba tanks was used to store compressed air at 3500 psi and throttled it to 250 psi at the engine inlet with a self-designed throttle valve, linked to the accelerator pedal. The three tanks were sufficient for the test run over the 2 mile, where an average speed of 46.723 mph was achieved with a top speed of 54.058 mph. Further, a speed to the level of 300 mph is expected with compressed air.

As compared to batteries, compressed air is favourable because of a high energy density, low toxicity, fast filling at low cost and long service life. These issues make it technically challenging to design air engines for all kind of compressed air driven vehicles. To meet the growing demand of public transportation, sustainable with environmental consciousness, people are in the search for the ultimate clean car with zero-emissions. Many concept vehicles were proposed that run on everything from solar power to algae, but most of them are expensive and require hard-to-find fuels. Compressed air vehicle project in the form of light utility vehicle (LUV) (i.e., air car in particular) has been a topic of great interest for the last decade and many theoretical and experimental investigations have appeared on the subject in the literature. Many largest car manufacturers all over the world have taken up the lead in this direction based on the initial technological concept of the pioneer-the French company Motor Development International (MDI) in the field. In 2008, India's largest car manufacturer also announced that it would begin production of world's first commercial vehicle to run on nothing but compressed air. In Europe inventors have made a simple air engine, thus opening a new field for compressed air car technology. These engines allow cars to run on compressed air instead of fuel. The air, super compressed and powerful, pumps the pistons in the car instead of small gas explosions. Pumping air instead of exploding gasoline means these cars have zero emission motors–no pollution, no oil. In addition, current average family cost of fuel is 60 dollars a week and half that for a hybrid car. The new air engines will give a whole week of driving for a few dollars. The company, MDI plans to sell this clean fuel vehicle and a

compressed air hybrid in Europe for less than 15,000 dollars in near future.

SOLENOAID VALVE - Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

A solenoid valve is an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid coil. Solenoid valves may have two or more ports: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. A solenoid valve has two main parts: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically. A direct acting valve has only a small flow circuit, shown within section E of this diagram. This diaphragm piloted valve multiplies this small flow by using it to control the flow through a Much larger orifice.

Fig. no.:-4 Solenoid valve assembly

Solenoid valves may use metal seals or rubber seals, and may also have electrical interfaces to allow for easy control. A spring may be used to hold the valve opened or closed while the valve is not activated.

Valve actuation system -

The main components of the valve actuation system are the following

- Infrared pair
  - Infrared emitter
  - Infrared sensor
- Electronic circuit
- Batteries
- Wiring system
- Valve Timing Disc

The pipe system - The pipe system is used to connect the components involved in the passage of the compressed air. It is used to connect the cylinder to the solenoid valve and the solenoid valve to the cylinder head.

Here polyurethane pipes are used of diameter of 12mm and length of 1m. They are made of hard and flexible material so that they are able to pass the compressed air more efficiently and are highly flexible. These pipes are able to withstand high pressure and so are used to transport compressed air. They are perfectly suited to be inserted to the one touch male connector.

Volume 4 Issue VI, June 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Fig No.:-5 Pipe system

Pressure gauge system - The pressure gauges are used to measure or display the pressure at the position at which the pressure gauge is installed. There are different ranges of the pressure gauges. 0 to 10 bar pressure gauges are used in this project. A t shaped female connector is used to install the pressure gauge in the system and it also holds the pressure gauge at position. The pressure gauge is connected to the inlet of the solenoid valve. This helps to measure the pressure inlet to the solenoid valve.

Fig. No.:-6 Pressure Gauge System

## III. CONCLUSION

The air powered vehicle are the best options which provide most comprehensive answer to the present urban pollution problems in simple, economic and inoffensive manner. This is clean, easy to drive, comparatively low cost and does not take a life time to pay off. Thus these vehicles are safe to manufacture, safe to use, safe to users and also Environment friendly.

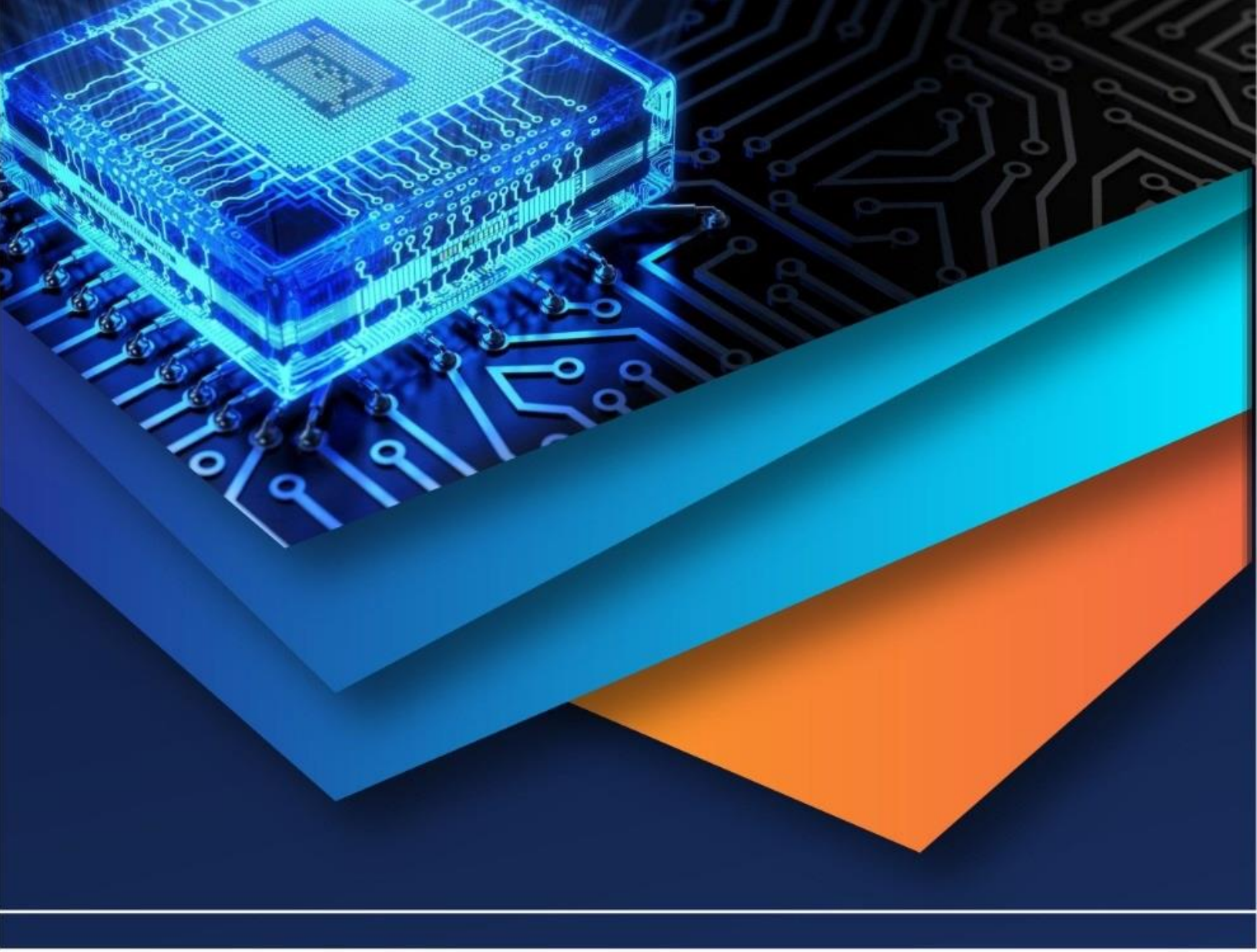
We were able to successfully complete the design and fabrication of the air driven engine. The air driven engine provides an effective method for power production and transmission. Even though its applications are limited currently, further research could provide wider applications.

## IV. ACKNOWLEDGEMENT

It is our great pleasure to acknowledge sense of gratitude to all those who have helped and inspired us to make this work the reality. It gives us a great pleasure to express our deep gratitude to our Project guide Prof. I. I. Sayyad for his valuable support and help from time to time during this work. We are also grateful to our Head of Department, Mechanical Engineering, Dr. A. G. Thakur for providing us the opportunity to present this project. We are also grateful to the library staff of our college who helped us in our literature survey

## REFERENCES

[1] J. P. Yadav, Bharat Raj Singh, "Study and Fabrication of Compressed Air Engine",S-JPSET : ISSN : 2229-7111, Vol. 2, Issue 1,2011.
[2] Chih-Yung Huang, Cheng-Kang Hu, Chih-Jie Yu and Cheng-Kuo Sung, "Experimental Investigation on the Performance of a Compressed-Air Driven Piston Engine", ISSN 1996-1073, Vol. 6,1731-1745,2013.
[3] A.A.Keste, S. B. Vise,A. N. Adik, P. R. Borase , "Vehicle Operating on Compressed Air by Inversion of Slider Crank Mechanism" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN(e) : 2278-1684, ISSN(p) : 2320–334X, PP : 50-54.
[4] S. S. Verma S.L.I.E.T., "Latest Developments of a Compressed Air Vehicle: A Status Report" presented by Longowal Global Journal of Researches in Engineering Automotive Engineering Volume 13 Issue 1 Version 1.0 Year 2013 Type: Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA) Online ISSN: 2249-4596 & Print ISSN: 0975-5861.
[5] Prof. Kalpesh Chavda, Patel Manish D, Suthar Umang P, Patel Krunal V, "Study and Development of Compressed Air Engine-Single Cylinder: A Review Study" presented at the International Journal for Scientific Research & Development ISSN: 2321-0613 Vol. 2, Issue 05, 2014



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY