



DESIGN AND FABRICATION OF GREEN CAR POWERED BY SOLAR BASED AIR COMPRESSOR

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ABSTRACT

A pneumatic vehicle uses compressed air as a source of energy for locomotion today, the heavy vehicles are known for producing a large amount of harmful gases like CO₂, SO₂ 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. 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. So in this an effort is made to study the extent of research done and the potential advantages and disadvantages of the compressed air technology.

1. INTRODUCTION

A car (or automobile) is a wheeled motor vehicle used for transportation. Most definitions of *car* say they run primarily on roads, seat one to eight people, have four tyres, and mainly transport people rather than goods cars came into global use during the 20th century, and developed economies depend on them. One of the first cars accessible to the masses was the 1908 Model T, an American car manufactured by the Ford Motor Company. Cars were rapidly adopted in the US, where they replaced animal-drawn carriages and carts, but took much longer to be accepted in Western Europe and other parts of the world.

The latest trend in the automotive industry is to develop light weight vehicles. Light utility vehicles are becoming very popular means of independent transportation for short distances. 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. The Cost and pollution with petrol & diesel vehicles is very high manufacturers to develop vehicles fueled by alternative energies such as compressed air.

The first compressed air vehicle was established in France by a Polish engineer Louis Mekarski in 1870. It was patented in 1872 and 1873 and was tested in Paris in 1876. The working principle of Mekarski's engine was the use of energy stored in compressed air to increase gas enthalpy of hot water when it is passed through hot water. Another application of the compressed air to drive vehicles comes from Uruguay in 1984, where Armando Regusci has been involved in constructing these machines. He constructed a four-wheeler with pneumatic engine which travelled 100 km on a



single tank in 1992. The Air Car was developed by Luxembourg-based MDI Group founder and former Formula One engineer Guy Negre is which works on compressed air engine (CAE). He developed compressed air- 4- cylinders engine run on air and gasoline in 1998 which he claims to be zero pollution cars.

2. LITERATURE REVIEW

Saurabh Pathak et al [1] speaks about the importance of reduction in the weight of the automobile as it effects the performance of the vehicle as well as contributing to the global warming. Prof. B.S.Patel et al. [2] tried to develop a compressed air engine by modifying an 4-stroke, single cylinder SI engine by replacing the spark plug with a pulsed pressure valve, and using compressed air as the working fluid. Air is abundantly available in atmosphere and can be used to run the vehicle by compressing it [3,4]. A.A.Keste et al [5] worked on the concept of inversed slider crank mechanism to utilize the compressed air to run a vehicle. In this experiment a double acting pneumatic cylinder was used in which the piston attached to a pinion which generated rotation motion. Prof. Kalpesh Chavda

4. DESIGN AND FABRICATION

Frame of the vehicle was designed using unigraphics NX as it is user friendly and complex parts can easily be modeled.

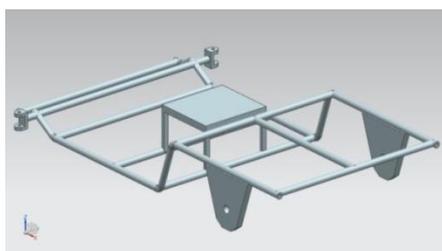


Fig 1: Frame design 3D model.

[6] details about reports on the review of compressed air engine for the design and development of single cylinder engine which can be run by the compressed air. Mr. Kunjan Shinde et al [7] journal on Electric Bike describes the idea of harnessing the various energy and use it in today's existence of human life. Electric bike which will be driven with the help of battery and thus provide required voltage to the motor. The focus of this report is to perform power calculations and system design of this Electric Bike.

3. SYSTEM ARCHITECTURE

Solar energy is converted into electrical energy by photovoltaic cells and direct current is stored inside the battery, which is used to power the dc air compressor. Compressed atmospheric air is then sent to the double acting linear actuator. Pressurized air actuates the linear actuator which is controlled by the microcontroller unit with the help of solenoid valve. Here crankshaft converts linear motion of the actuator into rotary motion by slider crank mechanism. The rotary power is transmitted to the shaft of the wheels resulting in vehicle motion

The above Fig.1 shows the design model of the frame which is used for assembly of automobile and pneumatic components.

4.1 Views of the design

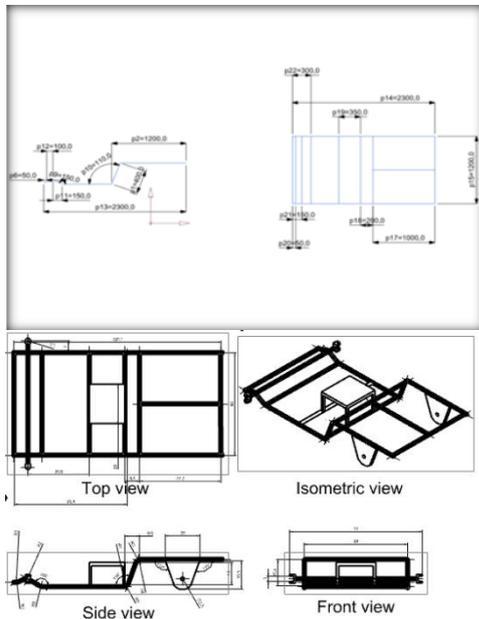


Fig. 2: Dimensions and different views of Chassis

Fig. 2 shows the various views of the chassis used for the air compressed vehicle designed.

4.2 Fabrication process

Rectangular hollow mild steel is used which composes of iron and carbon. Composition of iron is more compared to that of carbon which is 2.1%. It is widely used in fabrication due to its excellent strength, weldability and resistance to breakage. The carbon content of this steel may vary from quite low levels up to approximately 0.3%. Generally, commercial mild steel can be expected to be readily weldable and have reasonable cold bending properties. Mild steel is the most widely used steel which is strong and can sustain certain amount of shock and load. It also is cheaper when compared to the materials which offer same properties. Mild steel is not readily tempered or hardened but possesses enough strength. Hence this material was chosen for fabrication.

4.2.1 Material joining process and removal process

Arc welding and gas welding were used for material joining process as it is cost effective and easy to weld as the Fig. 3 shows the welded joint through arc and gas welding. For material removal Grinding, drilling and gas cutting were used which are also easy and cost effective.



Fig. 3 welded joint

5. Result and analysis

A Compressed-air engine is a pneumatic actuator that does work by expanding compressed air which is stored in the tank. An air driven vehicle is powered by an air compressor, in which air is stored in a tank. The vehicle is run by considering the various valve conditions. The three different valve conditions is full open, 3/4th open and half open as shown in table 1. By connecting tachometer to the wheel, speed of the engine for the three different valve condition is calculated. Table 1 gives the details of speed, velocity, acceleration, force required to pull the vehicle, total force and power for the full open, 3/4th open and half open valve condition.



Table 1 speed and velocity

Condition of the valve	Speed(rpm)	Velocity(m/s)
Half open	158	2.48
3/4 open	168	2.64
Full open	214	3.36

5.1 Load carrying capacity

Table 2 load and time taken

Load (kg)	Time taken to reach 10m distance (sec)
60	15.80
75	19.76
90	22.45

Time taken to reach a distance of 10m is tested by applying three different loads of 60, 75 and 90 kg for the full open, 3/4th open and half open valve conditions is shown in table 2

6. Conclusion

As there is a need for low emission vehicles in order to maintain the pollution free environment this projects aims in designing and fabrication of such an automobile. The automobile which uses nothing but air to run is fabricated using mild steel. It could be seen from the table 4.1 that the current air compressed vehicle can run at a maximum speed of 3.36 m/s when the throttle valve is completely open. For a maximum load of 90 kg the vehicle can cover 10 m within 22.25 seconds. As it uses only air to run it is also a cheaper vehicle to run.

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