

Design and Construction of Pneumatic Vehicle

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Abstract— It is hard to believe that compressed air can be used to drive vehicles. However that is true, and the “compressed air operated car”, as it is popularly known, has caught the attention of researchers worldwide. It has zero emissions and is ideal for city driving conditions. MDI is one company that holds the international patents for the compressed air operated car. Although it seems to be an environmentally-friendly solution, one must consider its well to wheel efficiency. The electricity requirement for compressing air has to be considered while computing overall efficiency. Nevertheless, the compressed air vehicle will contribute to reducing urban air pollution in the long run.

Keywords: Air compressor, Battery, Pneumatic cylinder, Chain sprocket, etc..

I. INTRODUCTION

A compressed-air vehicle (CAV) 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 use the expansion of compressed air to drive their pistons.

Compressed-air propulsion may also be incorporated in hybrid systems, such as with battery electric propulsion. This kind of system is called a hybrid-pneumatic electric propulsion. Additionally, regenerative braking can also be used in conjunction with this system.

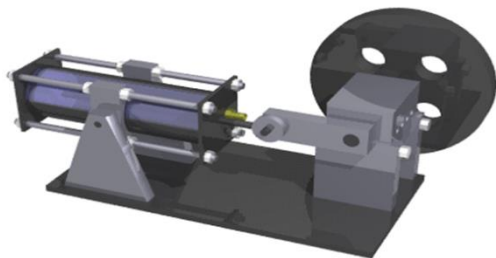


Fig.1: Cylinder piston work

A. Working principle

The working principle of “air compressed car” works on principle of alternatively power supply to the solenoid valves. Solenoid valves operates double acting pneumatic cylinder which will act as crank and connecting rod.

The Reciprocating motion of pneumatic cylinder will converted into rotary motion by crank mechanism which will rotates the wheel. Thus motion of the car can be generated.

B. Component

The different component of “air compressed car” are as follows:

- DC Motor
- Battery
- Air Compressor
- Pneumatic Tubes
- Solenoid Control Valves
- Pneumatic Cylinders/Motors
- Wheels
- Steel Shafts
- Plywood Board
- Battery
- Wires

C. Basic material used

- **D C Motor:** Powers the solenoid valve through relay switch
- **Battery:** Powers the Air Compressor
- **Air Compressor:** Compresses the air and transmits pressurized air to the valves
- **Pneumatic Tubes:** Transmits high pressure air to valves and to the pneumatic cylinder.
- **Solenoid Control Valves:** Controls flow, direction, rate of compressed air.
- **Pneumatic Cylinders /Motors:** Converts pneumatic energy to AUTOMOBILE linear motion.
- **Wheels:** Runs the vehicle
- **Steel Shafts:** Transmits power to the wheels
- **Wires:** For electrical connections
- **Plywood Board:** Frame of the Model
- **Transformer:** Converts 220V AC Supply to 12V AC supply for powering the relay switches.

D. Applications

- It can be used by Car Manufacturing Companies.
- It can be used as Family car.
- It can be used as Van.
- As Taxi Purpose
- Personel uses
- Industries by workmen

II. LITERATURE REVIEW

The Pneumatic vehicle is a new technology developed that allows a car to be powered by compressed air.

- Venkatesh Boddapati [1] says compressed air storage tanks built with carbon fibers will carry high amount of pressure with minimum volume space which obviously meets the requirement with the conventional engines with zero emission. Air powered Vehicle is realization of most advanced technology in the field of Automotive. It eliminates the use of Non-Renewable energy fuels. We can develop this type of vehicle into Multi-fuel Engine that runs on both compressed air and/or Fuel (Gasoline) mode.
- Gaurav sugandh [2] says that this paper describes the working of a four-stroke single cylinder Engine which can run on pneumatic power as by compressed air. Since it is an old technique which can attracted many scientist as well as Engineer's for many years. This paper describes on the same with some new modification which is main objective of this research paper . Since engine is operated by Compressed air which contribute to reduce the air pollution and tend to zero pollution level of atmosphere and making a great a environment. While developing it some parameters as like temperature,density, input power, emission control have be mastered for development of safety.Since the Gasoline is a thing of past sothe main advantage of CAE is no hydrocarbon fuel is required i.e. No combustion is occur during this process.
- S. S. Verma. [3] says that Compressed air as a source of energy in different uses in general and as a nonpolluting fuel in compressed air vehicles has attracted scientists and engineers for centuries. Efforts are being made by many developers and manufacturers to master the compressed air vehicle technology in all respects for its earliest use by the mankind. The present paper gives a brief introduction to the latest developments of a compressed-air vehicle along with an introduction to various problems associated with the technology and their solution. While developing of compressed air vehicle, control of compressed air parameters like temperature, energy density, requirement of input power, energy release and emission control have to be mastered for the development of a safe, light and cost effective compressed air vehicle in near future.

- Pramod kumar [4] studied In this project, an SI engine is converted into a compressed air engine. A four stroke single cylinder SI engine is converted to two stroke engine which operates using compressed air because of its design simplicity. As we converted the already existing conventional engine into an air powered one, this new technology is easy to adapt. Another benefit is that it uses air as fuel which is available abundantly in atmosphere.
- Gopal sahu [5] says that Compressed air as a source of energy in different uses as a non-polluting fuel in compressed air vehicles has attracted scientists and engineers for centuries.. Compressed air filled by electricity using a compressor. The electricity requirement for compressing air has to be considered while computing overall efficiency. Compressed air vehicle will contribute to reducing air pollution and tend to zero pollution. No combustion process is occurring there. Light utility vehicles are becoming very popular means of independent transportation for short distances.

III. PROBLEM DEFINITION

- Now days with use of modern technologies new automobile vehicles/Machines or instruments are being automatically operated or controlled.
- During survey (Survey of local Roads, Visiting garage) we found that in automobile vehicles like car, Truck, Rickshaws. It spreads lots of pollution which is very dangerous gases like SO₂, CO₂, SO₃, Co, etc.
- We want to try to reduce pollution by use of alternate solution of combustion fuels.
- So we take at project title as "DESIGN AND CONSTRUCTION OF PNEUMATIC VEHICLE".

Working Procedure

Battery Powers the air compressor starts pressurizing the air and transmits it to valves via tubes. The AC 220V supply is provided to the transformers pair to convert it into 24V AC Supply.

The 24V AC supply is converted to Dc using rectifier and the supply is fed to the DC Motor. The DC Motor rotates and runs the switch rod over the switch plate. The switch plate has 4 divisions and each division is a conducting surface connected to 1 relay switch.

When the switch rod rotates over the switch plate, it powers the relay switches and in-turn powers the solenoid valves in phase due to the construction of the plate. As the valves turn On, it transmits the air through its opening to the pneumatic cylinder and actuates the piston.

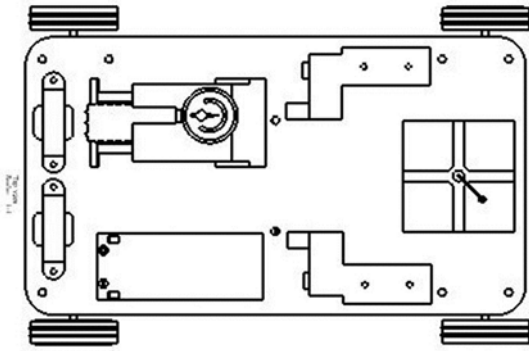


Fig.2: 2D deisgn of Pneumatic Vehicle in CATIA

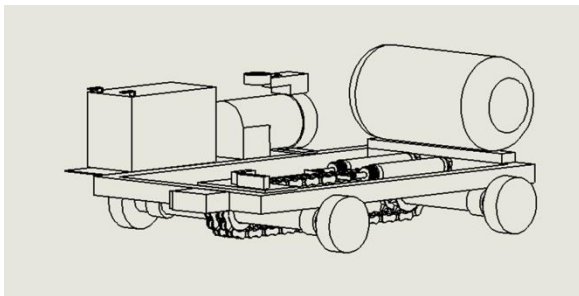


Fig. 3: Wirefram design in CATIA

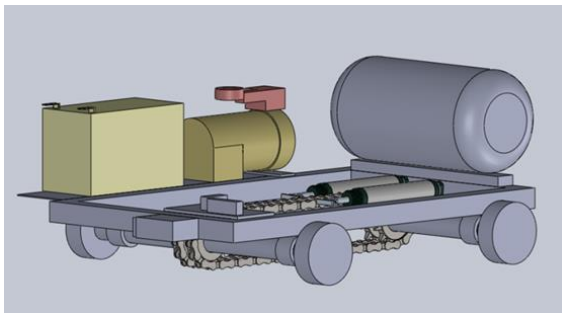


Fig. 4: 3D View of finally assembly in CATIA

Simultaneous switching of each of 4 valves produce continues actuation of each piston which transmits of its linear motion to the shaft. The shafts rotates continuously due to the cylinder movement and drives the wheels of the car.

IV DESIGN PARAMETER

PART NAME	DIMENSION
Dc motor	Std with 25teethed gear mounted
Battery	Std 12 V
Air compressor	Std
Pneumatic Tubes (Pipes)	6ft.
Solenoid Control Valves	Std
Pneumatic cylinder/Motors	Std
Wheels	500mm Diameter
Steel Shafts	500mmx6mm Diameter
Wires	3ft.
Ply Board	450x250x5mm
Transformer	Std

Design Procedure

For better design and required output we need to calculate different parameters and find dimensions of the product:

- Now for double acting pneumatic cylinder there are some basic dimensions are as per market availability as followed:
- Compressed air energy storage is a way to store energy generated at one time for use at another time
- Air driven motors use the energy of a compressed gas to do useful work
- The power output is simply the inlet enthalpy minus the discharge enthalpy times your mass flow rate.
- The inlet enthalpy is a known state which we can calculate knowing the inlet pressure and temperature.
- Internal energy gives the energy contained in the compressed air and the idea about how much work can thus be extracted from it.

V CONCLUSION

The technology of compressed air vehicles is not new. In fact, it has been around for years. Compressed air technology allows for engines that are both non-polluting and economical. After ten years of research and development, the compressed air vehicle will be introduced worldwide. Unlike electric or hydrogen powered vehicles, compressed air vehicles are not expensive and do not have a limited driving range. Compressed air vehicles are affordable and have a performance rate that stands up to current standards. To sum it up, they are non-expensive cars that do not pollute and are easy to get around in cities. The emission benefits of introducing this zero emission technology are obvious. At the same time the well to wheels efficiency of these vehicles need to be improved

VI FUTURE SCOPE

- As there is no combustion use of lighter engine parts like carbon fiber for piston and connecting rod will give more efficiency.
- Reduction of diameter of piston improves volumetric efficiency.
- 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.
- An all-new technology combining Gasoline internal combustion engine and compressed air storage can be developed. It is developing this vehicle in response to the global need for energy efficient vehicles.

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