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Fabrication of Compressed Air Vehicle

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ABSTRACT

To meet the increasing demand for the fossil fuel consumption with increasing population and automobiles, various advancements such as hybrid electric vehicles, solar vehicles, hydrogen fuel cell powered vehicles are being attained in automobile sector. Also the increasing level of automobile pollutants and global warming due to increase in the percentage of CO_2 demands a cleaner technology like compressed air technology (CAT).

Keywords: compressed air technology, effective renewable alternative energy, zero pollution vehicle

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INTRODUCTION

Many research have been carried out in the field of automotive sector to find a fuel which best suits the requirements.

Though hydrogen, liquid nitrogen, etc. proved to be good alternatives the environmental degradation also demanded a cleaner fuel.

This led to the development of air engine in the middle of 19th century by Andraud and Tessie' Du Motay in Paris. [1–5]

The air engine is the one which uses compressed air as a fuel.

Here the pressure energy of the compressed air is converted into kinetic energy. Because it is devoid of combustion the exhaust consists nothing but cold air thus making it a zero pollution engine.

Objective

The main objectives are:

- To find an effective alternative fuel for the future.
- To develop a zero pollution vehicle and hence contribute to the act of reducing global warming.
- To make automobile common for a common man.
- To formulate economic way of transportation.
- To minimize the usage of fast depleting non-renewable resources especially gasoline and diesel.

PREVIOUS WORKS

Here few researches are outlined as given below related to compressed air engine.

Air fueled zero emission road transportation: In a comparative study, Haisheng Chen et al. adopted two technologies typical compressed air and liquid air power systems for co.

Figures 1–4 show schematic diagram and working of cycle on temperature – entropy diagram for the both systems.

As per author's knowledge and belief only few works reported on this study. [6–17]

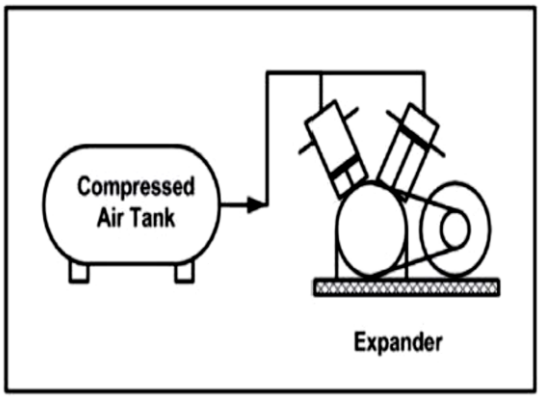

Fig. 1. *Compressed air engine.*

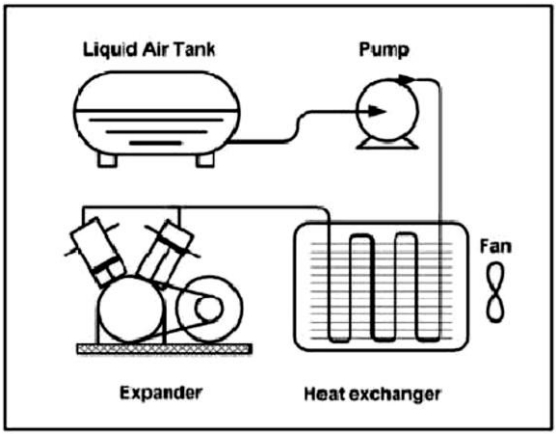

Fig. 2. *Liquid air engine.*

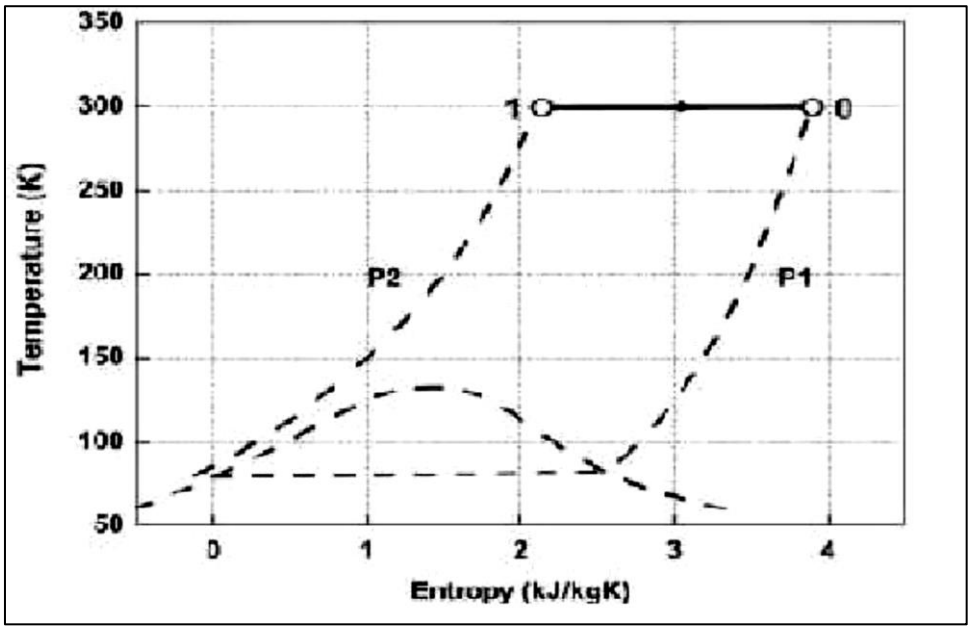

Fig. 3. *T–S diagram of engines compressed air engine.*

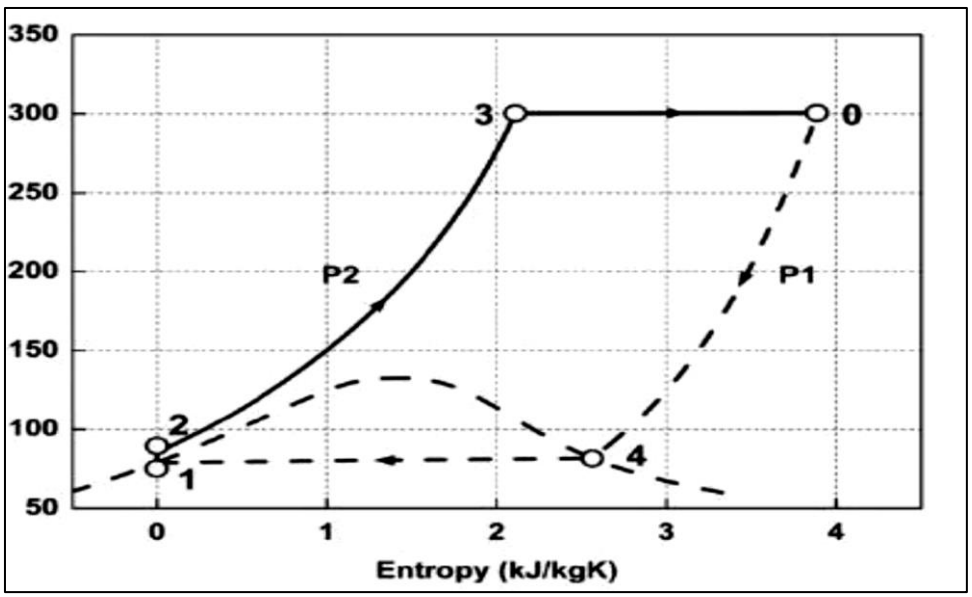

Fig. 4. *T–S diagram of engines liquid air engine.*

Following conditions are used in the analyses Ambient pressure: P1 = 1.013bar. Working pressure: P2 = 300 bar. Ambient temperature: T0 = 300 K. Volume of tank: V = 300 lit.

The reasons to consider a fuel tank with 300 lit volume and 300 bar working pressure include:

(i) 300 l and 300 bar are technically feasible
(ii) A high pressure and a large volume are essential to give sufficient work output for an acceptable travel distance
(iii) Compressed air vehicles with a 300 lit fuel tank within initial pressure of 300 bar have been demonstrated practically

They have concluded in their paper is two types of air fueled engines for zero emission road transportation are compared in terms of their shaft work, cloth, efficiency and energy density.

Given the working pressure and temperature, liquid air powered engines have a slightly lower specific work outputs than compressed air powered engines. At P = 300 bar and T = 300 K, the practical network outputs of the compressed air engine for isothermal ties of γ= 0.75 and 0.90 are respectively 222.8 and 284.2 kJ/kg, whereas the corresponding values for the liquid air engines are 184.1 and 245.6 kJ/kg. In this comparison of two technologies typically compressed air and liquid air power systems, authors concluded that the volumetric energy density of liquid air fuel, however, is about 2.45 times that of compressed air fuel, and liquid air engines produce much more cooled than compressed air engines.[18–23]

COMPRESSED AIR VEHICLE (CAV)

The CAT which aims at using compressed air as a fuel for running the automobiles has been in development for so many years. It derives its principle from steam engine in which the potential energy of steam is converted into kinetic energy. Here air substitutes steam.

This aims at overcoming all the above cited constraints and applying the technology to take the automotive world one step forward. This paper is all about converting an existing two stroke petrol engine into an engine which is powered only by a single source, namely compressed air.

The air engine besides being an effective renewable alternative energy, it also aids to minimize the pollution level (eco-friendly) since exhaust of which contains nothing but cold air. This qualifies it to be a zero pollution vehicle.

It is hard to believe that compressed air can be used to drive vehicles. However that is true and “air car” as it popularly knows has caught the attention of research worldwide. It has zero emission and is ideal for city driving condition. Moteur Development International (MDI) is one company that holds the international patents for compressed air car. This review study reveals aim is to run the four strokes bike with help of compressed air, it will try to achieve a 50 km/h speed and range of refilling compressed air is after running of 70–80 km.

Two technologies have been developed to meet different need:

(1) Single energy compressed air engines.
(2) Dual energy compressed air plus fuel engines

The single energy engines will be available in both Minicats and Citycats. These engines have been conceived for city use, where the maximum speed is 50 km/h and where MDI believes polluting will soon be prohibited with use of

compressed air technology which having zero pollution level.

The dual energy engine, on the other hand, has been conceived as much for the city as the open road and will be available in all MDI vehicles.

The engines will work exclusively with compressed air while it is running under 50 km/h in urban areas. But when the car is used outside urban areas at speeds over 50 km/h, the engines will switch to fuel mode. The engine will be able to use gasoline, gas oil, bio-diesel, gas, liquidized gas, ecological fuel, alcohol, etc. Both engines will be available with 2, 4 and 6 cylinders, When the air tanks are empty the driver will be able to switch to fuel mode, by car's on board computer.

Engine Working

High pressure air is introduced to the engine that pushes the piston and creates movement. The atmospheric temperature is used to re-heat the engine and increase the road coverage. The air condition system makes use of the expelled cold air. Due to there is no pollution, oil change is necessary every 50,000 km.

A NOVEL COMPRESSION STRATEGY FOR AIR HYBRID ENGINES

Amir Fazeli et al have proposed utilizing of two storage tanks which increases the efficiency of regenerative braking of air hybrid vehicles significantly by increasing the stored air mass and, consequently, the storing pressure in the tank. Air hybrid engines have different operational modes (Figure 5).

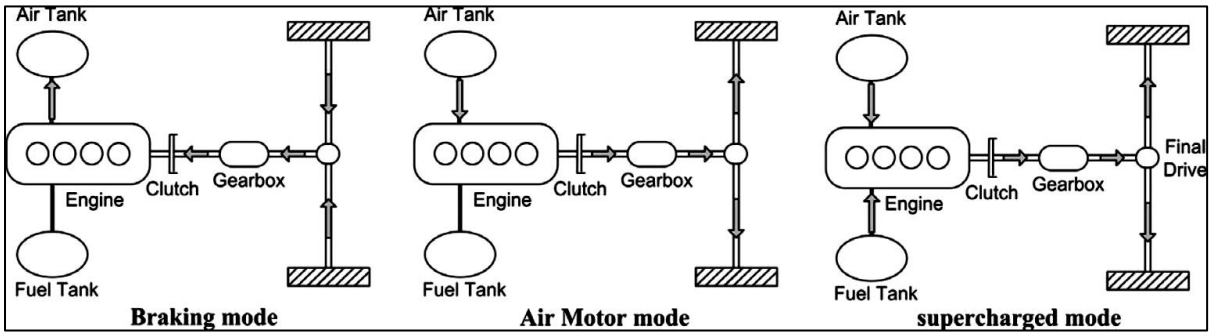

Fig. 5. *Energy flow at different operational mode.*

The theoretical and experimental results showed the advantage of the proposed strategy over the conventional single-storage system.

The proposed compression algorithm can be utilized in an air hybrid vehicle to increase the efficiency of energy recovery by the compression braking system.

Compared to the double-stage regenerative braking, the double-tank system doubles the air flow rate because only one cylinder is needed to implement the proposed concept and thus, all the cylinders can be connected directly to the main tank.

The proposed compression algorithm can be applied not only in air hybrid vehicle compression braking system, but also in any other applications, where higher pressure with higher air mass flow rate is demanded such as typical reciprocating compressors.

CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work.

We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the limited time successfully. The AIR ENGINE is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed an "AIR ENGINE" which helps to know how to achieve compressed air vehicle. The application of pneumatics produces smooth operation. By using more techniques, they can be modified and developed according to the applications.

VISION OF THE PROJECT

From this paper we infer that compressed air stored in a tank can be used as a substitute fuel for diesel and gasoline. The future of gasoline and diesel is at risk due to fast depletion of fossil fuels. More over these diesel and gasoline engines emit considerable quantities of noxious gases into the ambience resulting in the increase in percentage of greenhouse gases and thus enhancing global warming.

An effort such as the compressed air vehicle is one such measure to stop air pollution and thereby using the large quantities of air available in the atmosphere to a maximum profitable extent. The vehicle becomes a purely zero polluting vehicle if the compressor for compressing the air is run on current generated by renewable energy source.

More over the cost to run the air engine is less compared to gasoline and diesel engines giving an extra edge over those engines. If the design is further optimized for mass production of these vehicles then it will create a revolution in automotive sector thereby giving its users an eco-friendly vehicle for the future.

The significance of the project lies-the data obtained can be made use for future research in this field.

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