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Compressed Air Vehicle

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Abstract - This paper presents an experimental study of an engine driven by compressed air. The compressed air engine is a modified 100 cc internal combustion engine. The engine is modified from a 4-working stroke to a 2- working stroke engine (power and exhaust) by modification of cam-gear system. A temperature decrease from room temperature to 15 °C was observed at exhaust. The project was successfully manufactured and tested. Experimental analysis were carried out on this modified engine to find out its performance characteristics like brake power, indicated power, torque etc. It should be noted that pressure higher than that currently employed can result in increased engine performance in terms of output power, torque and speed. Nevertheless, the main advantage of this engine is that no hydrocarbon fuel is required that means no combustion process is taking place, thus the compressed air vehicle will play important role in reducing air pollution. Another benefit is that it uses air as fuel which is available abundantly in atmosphere. This study presents the atmospheric air which can be used in vehicles as the main or auxiliary source of power system.

***Key Words*:** Compressed air, Alternative Sources of Energy, clean & highly efficient, light weight, Non-polluting.

I .INTRODUCTION

Compressed Air Powered Car utilizes the power of compressed air to operate the engine. In normal 4-stroke engine the engine working is carried out in four cycles i.e., suction, compression, power and exhaust. In our engine we have converted the four working cycles into two working cycle. This has been obtained by modifying the cam-gear arrangement. Cam gears having same size and same number of teeth are used. Thus the two strokes obtained are power and exhaust. The compressed air drives the engine crankshaft and hence the wheel motion is obtained. Our environment must be protected against various contaminations produced by vehicle driven on I.C. engine which produces some of the most adverse environmental effects. These emissions, which are above all caused by road traffic damage the flora and fauna and deteriorate human health. For example Nitrogen Oxide (NOx) after oxidation forming nitric acid, contributes to the acid rain which has caused severe forest damage in the past decades. Compressed air powered car 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, NOx, 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.

II. OBJECTIVE

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. Therefore, in this era of energy shortages, it is essential to create alternative technologies for harnessing renewable energy sources, allowing for the conservation of fossil fuels. A significant area where fossil fuels are utilized is in Internal Combustion Engines. An alternative to the IC Engine is the "Compressed Air Powered Engine."

. It is an engine which uses compressed air to run the engine. It is cheap as it uses air as fuel, which is available abundantly in atmosphere. There are several technical benefits of using this engine, like as no combustion takes place inside the cylinder, working temperature of engine is very close to ambient temperature. This helps in reducing wear and tear of the engine components. Also there is no possibility of knocking. This in turn results in smooth working of engine. One more technical benefit is that there will not be any need for installing cooling system or complex fuel injection systems. This makes the design simpler. Thus compressed air powered car has the capacity to satisfy present demand and can prove to be the future vehicles.

III. DESIGN AND MODELING

The design and modelling consists of various parts and their assembling. The Main components are:

1. Chassis- 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 made to create a sturdy framework to fulfil the role of a support structure. The empty pipe is utilized to reduce the vehicle's weight. Hollow pipes are manufactured to create a sturdy structure to fulfil the function of the frame. The empty pipe is utilized to reduce the vehicle's weight.

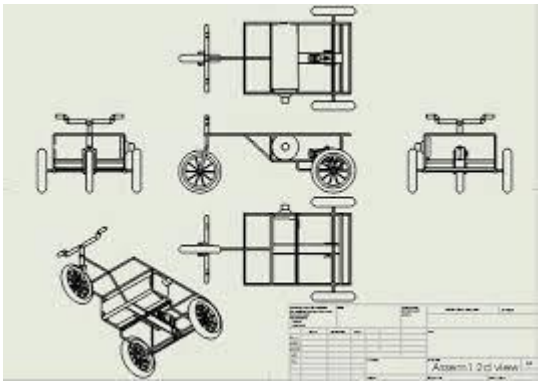

Fig.1 Specification of chassis

2. Air Tank- A gas air tank is a mechanical device that increases the pressure of a gas by reducing its volume. Air tanks are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. The compressibility of the air was first investigated by Robot Boyle in 1962 and that found that the product of pressure and volumes of particular quantity of gas. The usual written as, PV =C (or) P1V1=P2V2. The tank may be able to be refilled more often and in less time, with refuelling rates comparable to liquid fuels. The tanks used in a compressed air motor have a longer lifespan in comparison with pumps, which after a while suffer from a reduction in performance.

Fig.2: Air Tank

3. Air compressor- An air compressor is a machine that transforms energy (via an electric motor, diesel or gasoline engine, etc.) into potential energy held in pressurized air (i.e., compressed air). Through various techniques, an air compressor pushes increasing amounts of air into a storage tank, raising the pressure.

When tank pressure reaches its upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use.

Fig.3: Air Compressor

4. STEERING SYSTEM -The steering system is to achieve angular motion of the front wheels to negotiate a turn. This is done through linkage and steering gear which convert the rotary motion of the steering wheel into angular motion of the front road wheels.

5. CHAIN & SPROCKET MECHANISM -The chain sprocket mechanism used in the compressed air car is of CD100 motorcycle. The chain sprocket mechanism is responsible for transmitting the torque generated by the engine to the axle. Number of teeth on driven gear is 40 teeth and that of driver gear is 14 teeth.

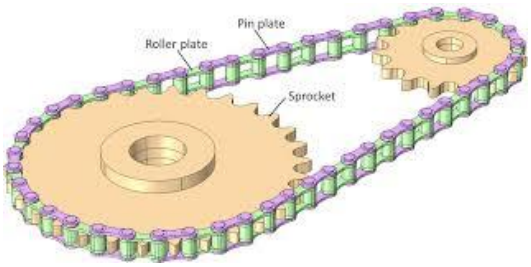

Fig. 4: Chain and Sprocket

Equation's used for calculations

1. Break Power

$$BP = \frac{2\pi NT}{60000}.$$

2. Indicated power

$$IP = \frac{PixLxAxKxN}{60000}$$

3. Air displaced by compressor in m^3

$$\text{Volume of Air} = \frac{\text{RPM x Engine displacement}}{1728}$$

IV. WORKING

The line diagram of the car is as shown in the figure below. In compressed air powered vehicle, the working of engine is carried out in two cycles.

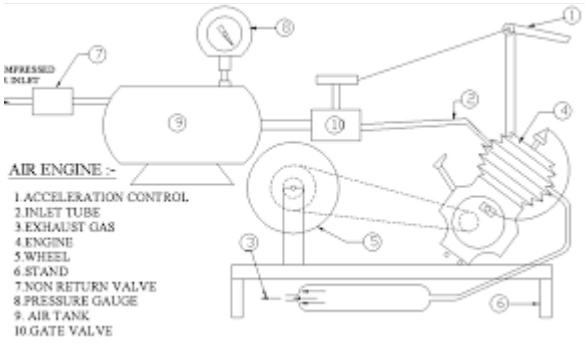

Fig.5: Working of Compressed Engine

This has been achieved by the modifying the 4-stroke engine. The compressed air is fed to the engine through the receiver tank. The pressure regulator valve controls the air pressure that will be supplied to the engine. The engine receives the compressed air from the compressor tank via the pressure regulator valve.

The pressure gauge is employed to indicate the pressure in the line. Initially the piston is at the top dead center position. The compressed air is fed through the inlet valve at a high pressure. Due to this high pressure the air forces the piston to move downward from top dead center position to bottom dead center position. Just before the piston reaches to BDC the exhaust valve opens. Due to inertia the piston starts moving towards TDC & forces the retained gas to move outwards through exhaust valve. In this way the cycle continues the output generated at the crankshaft. This output is transferred to the rear axle through chain sprocket mechanism.

Fig.6: Modified Cam Shaft

Observation

1. Tank pressure =7 bar
2. Weight of car = 150 kg
3. Maximum weight of driver =150 kg
4. Car speed =20-25 km/hrs.
5. Time to fill tank/reservoir =3 min.(7 bar)
6. Exhaust temperature =150C
7. Distance travelled per refill =200m

Table.1: Performance calculations of CAV.

P(bar)	N(rpm)	T(N-m)	BP(KW)	IP(KW)
6	700	1.37	0.10	0.68
7	860	1.57	0.13	0.92
8	1000	1.84	0.19	1.29
9	1110	2.05	0.24	1.61

V. CONCLUSION

Based on the work that has been done on this project, following conclusion has been drawn. The engine used in the project is being subjected to modifications like, Camshaft modification- A new cam was fabricated with a profile such that for one cycle of piston movement inlet and outlet valve opens and closes as required. New set of gears for camshaft and crank-shaft-This was done so that cam does not rotate once in two revolutions of crankshaft. From graph we observed that, RPM Vs. Pressure- As the pressure increases, also engine RPM increases linearly, Also Torque vs. Pressure- As the pressure increases, Torque on

Crankshaft also increases linearly, and Torque Vs.RPM - As RPM increases, Torque also increases linearly. The performance can be improved by increasing inlet pressure, reducing the vehicle weight etc. However excessive research is needed to completely prove the technology for both its commercial and technical viability.

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