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Fabrication of Compressed Air Bike

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Abstract - *The compressed air bike is an eco-friendly bike that uses compressed air as the source of energy .Here the normal piston engine is replaced with a turbine. The turbine is used as the energy converter in this bike, the pneumatic energy of compressed air is converted into mechanical work with help of turbine. The air under pressure which have energy is given into the turbine .As this compressed air enters into the turbine the compressed air expands and the energy is released which is used to move the turbine vane and produce work output through the turbine shaft .The turbine output shaft is coupled to the rear wheel shaft with the help of gear arrangement. The efficiency of compressed air bike is increased by implementing an air pressure amplifier and a pneumatic shock-absorber connected to the compressed air storage tank to kept constant pressure and volume of compressed air. The concept of compressed air bike in practice reduces the air pollution to large extend as its exhaust is nothing but cool air.*

Key Words: Air Turbine, Compressed Air Tank, Ball Valve, Novel Type Turbine, Bike Frame, Low Running Cost.

1. INTRODUCTION

Fossil fuels (i.e., petroleum, diesel, natural gas and coal) which meet most of the world's energy demand today are being depleted rapidly. Also, their combustion products are causing global problems, such as the greenhouse 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 fuelled by alternatives energies. Hybrid cars, Fuel cell powered cars, Hydrogen fuelled cars will be soon in the market as a result of it One possible alternative is the air powered vehicle. 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 to use as the following purpose, Air motors, pneumatic actuators and others various such pneumatic equipment's are in use. Compressed air was also used in some of vehicle for boosting the initial torque.

1.1 The history of compressed air vehicles

- The first compressed-air vehicle was devised by Bompas, a patent for a locomotive being taken out in England in 1828. There were two storage tanks between the frames, with conventional cylinders and cranks. It is not clear if it was actually built. (Knight, 1880)
- The first recorded compressed-air vehicle in France was built by the Frenchmen Andraud and Tessie of Motay in 1838. A car ran on a test track at Chaillot on the 9th July 1840, and worked well, but the idea was not pursued further.
- In 1848 Barin von Rathlen constructed a vehicle which was reported to have been driven from Putney to Wandsworth (London) at an average speed of 10 to 12 mph.
- At the end of 1855, a constructor called Julienne ran some sort of vehicle at Saint-Denis in France, driven by air at 25 atmospheres (350 psi), for it to be used in coal mines.
- Compressed air locomotives were used for haulage in 1874 while the Simplon tunnel was being dug. An advantage was that the cold exhaust air aided the ventilation of the tunnel.
- Louis Mékarski built a standard gauge self-contained tramcar which was tested in February 1876 on the Courbevoie-Etoile Line of the Paris Tramways Nord (TN), where it much impressed the current president and minister of transport Maréchal de

MacMahon. The tramcar was also shown at the exhibition of 1878 as it seemed to be an ideal transport method, quiet, smooth, without smoke, fire or the possibility of boiler explosion.

- The compressed-air locos were soon withdrawn due to a number of accidents, possibly caused by icing in the pipes of the brakes, which were also worked by compressed air.
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Fig -1: working model of compressed air bike

2. COMPONENTS

The major components of our Compressed air Bike consist of:

2.1 AIR TURBINE

2.2 COMPRESSED AIR TANK

2.3. CONNECTORS

2.4 BALL VALVES

2.5 FRAME

2.1 Air turbine

The engine of compressed air bike is a vaned type air turbine as shown in Fig.2.It has been considered and proposed to work on the reverse of working principle of vane type compressor. This turbine consists of 4 vanes. The vanes are made of Teflon. It is found to be high in strength and less wear resistance. The casing is made up of cast iron due to its higher compressive strength and the rotor is made of aluminum for light weight with air tight inside. The output shaft is coupled to the rotor with key arrangement. Rubber seal is used prevent air leakage through the shaft and ball bearing arrangement. The leakage through the casing and cover plate is prevented with help of Teflon seal.

In this arrangement total shaft work is cumulative effect of isobaric admission of compressed air jet on the vanes and adiabatic expansion of the high pressure air. This air turbine has capability to yield output of 5HP at 6 bar air pressure and for speed of 2000–3000 rpm, which is suitable for a motorbike.

Construction details:

Casing diameter: 60mm

Rotor diameter: 50mm

Vane length= 40mm

Injection angles = 60°

Vane angles = 30°

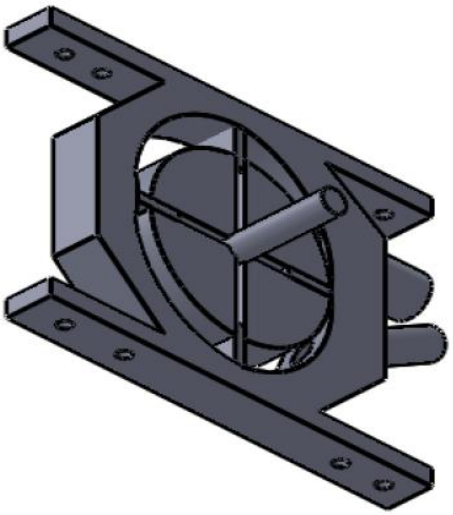

Fig-2: Vane type air turbine

2.2 Compressed air tank

Compressed air tank is used to store the compressed air at high pressure and supply it to the turbine according to the demand. The compressed air tanks have minimum capacity of storing air for

requirement of 30 min running at initial stage and maximum pressure of 200-300 psi.

2.3 Connectors

Connectors are used to confirm that the passage of compressed air is leak proof. To achieve a better pressure resistance, hoses can be reinforced with fibers or steel cord. Connectors are made of stainless steel for high strength and corrosion resistance.

2.4 Ball valve

A ball valve is type of quarter-turn valve which uses a hollow, perforated and pivoting ball to control the flow through it. The handle lies flat in alignment with the flow when open and is perpendicular to it when closed, making it easy for confirmation of the valve's status. Ball valves are durable, performing well after many cycles and reliable, closing securely even after long periods of disuse.

The accelerator cable is connected to ball valve for controlling the air flow to the turbine.

3. WORKING PRINCIPLE

The compressed air tank of the bike stores the compressed air .The high pressure air is given into the turbine at required pressure with the help of valves which is connected to the accelerator. Compressed air has stored energy in it .Once compressed air enters into the turbine and it expands inside the space between rotor vanes.. This expansion of high pressure air produces rotational torque causing the rotor to rotate which in turn rotate the shaft coupled to it. In this way the pneumatic energy is converted into useful shaft work. Expanded air is then released into the atmosphere through an exit port as exhaust. The exhaust is usually just air and cool exhaust is generated. There is only one gear, which is just a sprocket bolted directly to the axis of the turbine and chained to the rear wheel.

4. CALCULATION

For novel air turbine the high pressure air is the driving force at ambient temperature. The impulse and dynamic action of high pressure are responsible or the shaft work from air turbine. It is reverse process of vane type air compressor. Considering the isotropic expansion of air entering the Air Motor having n vanes, power obtained is given as under:

Power obtained, $P = \frac{n \times t}{5252}$

Where,

Speed (n) = 3000 rpm

Air pressure = 120 psi

Torque = 10 Nm

Running Time of the turbine (t) =15 min

Thus putting the above values we get,

Power (P) = $\frac{3000 \times 10}{5252}$

= 5.71 HP

= (5.71 × 0.74) = 4.25 kW

5. CONCLUSIONS

It's important to remember that while vehicles running on only compressed air might seem like a distant dream, but they still have public interest due to their environmental friendly nature. Efforts should be to make them light, safe, cost effective and economical for deriving. Compressed air for vehicle propulsion is already being explored and now air powered vehicles are being developed as a more fuel-efficient means of transportation. Some automobile companies are further exploring compressed air hybrids and compressed fluids to store energy for vehicles which might point the way for the development of a cost effective air powered vehicles design. Unfortunately there are still serious problems to be sorted out before air powered vehicles become a reality for common use but there is a hope that with the development in science & technology well supported by the environmental conscious attitude it will be possible.

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