

Air Powered Bike

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Abstract:- A bike running with compressed air as fuel is Air powered bike. It is a motorcycle which uses the compressed air as its power source so that it will be truly free of pollution for the environment. The piston cylinder arrangement converts the energy of compressed air into thermomechanical transportation energy.

Keywords: Air Powered Bike, Non conventional energy sources, Air tank

I. INTRODUCTION

Compressed air is the air kept under a pressure that is greater than atmospheric pressure. It serves many commercial purposes. Developing countries like India and China faces severe fuel crisis. Now there is a time to use non conventional sources.

These factors are leading bike manufactures to develop bikes as fuel alternative energies. Cost is not the only problem with using fuel but it also damages to the environment. It will eventually run out. One possible alternative is Air Powered Vehicles. It is hard to believe that compressed air can be used to drive vehicles. However that is true and "air vehicles" as it popularly knows has caught the attention of research worldwide. It has zero emission and is ideal for city driving condition. Compressed air is favorable because of a high energy density, low toxicity, fast filling at low cost and long service life. 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.

It is an engine which will use 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. Here air is compressed using compressor which in turn uses electricity, to run, which is cheaper and widely used. There is also one more interesting thing is that it requires less maintenance.

One more interesting thing is that the exhaust temperature of this engine will be slightly less than the atmospheric

temperature. So this will help in cooling the environment and if this technology is widely used than it will help in controlling global warming. These are some green bytes associated with this technology. Exhaust gases leaving the engine will be only air having low temperature. So this will eliminate the problem of harmful emissions, in conventional engines. This gives us environmental benefit of using this engine. Also as there will be no thermal radiations produced, radar can't detect these vehicles. So this will help our army too. Also the components used in this are: conventional SI engine, air vessel to store compressed air, and timing circuit are economical. These economical and readily available components make the technology easily adaptable.

II. DESIGN

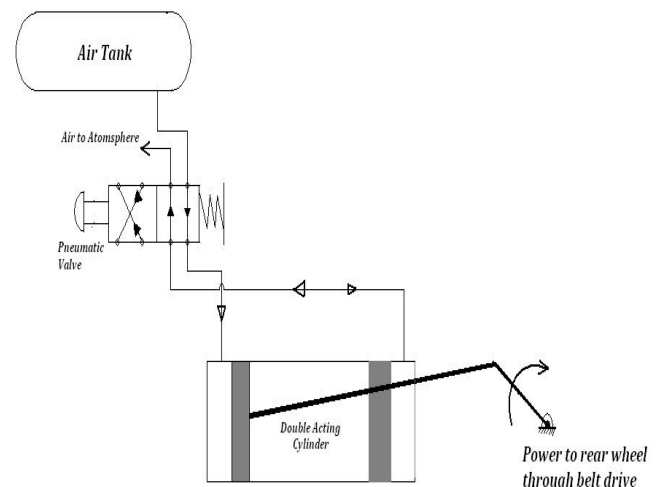


Fig. 1. Air Power Bike Machine Design

Air power bike mechanism consist of following instruments

1. Air Tank.
2. Pneumatic Valve. (Two Position, Four way)
3. Pneumatic Pipes.
4. Double acting Pneumatic Cylinder.
5. Simple belt drive

Air Tank: It is the reservoir of the compressed air. Air at rated pressure and of required volume filled inside the tank. It is crucial part of overall system. The maximum Speed

and maximum number of cycles performed by engine are ultimately controlled by the maximum pressure that tank can sustain and volume of air under that maximum pressure can be filled in tank. It is also provided with safety valve which can blow off air which creates pressure above designed level. Successful Design of overall system is well controlled by Design of air tank.



Fig. 2. Air Tank

Pneumatic valve: A Four way two position Pneumatic valve is used to control and guide the flow of pressurized air. Valve consists of four ports as shown in figure. In one position it allows the pressurized air to enter on one side of cylinder while other low pressure side of the piston air is allowed to pass out of cylinder while in other position valve allows the pressurized air to enter the other side of piston creating pressure on that side and opposite side piston air is allowed to go out of the cylinder.



Fig. 3. Pneumatic Valve

Pneumatic Pipes: This pipe carries pressurized air from air tank to connect it to valve and cylinder. These pipes are usually flexible and made of plastic material up to thickness to withstand designed pressure.



Fig. 4. Pneumatic Pipes

Double acting Pneumatic Cylinder: the compressed air is allowed to expand in cylinder to convert the air pressure in to usable force. Double acting cylinder allows air to expand on both sides of the piston. Force acting on both side of the piston is different although the pressure on both side be the same due to different area.

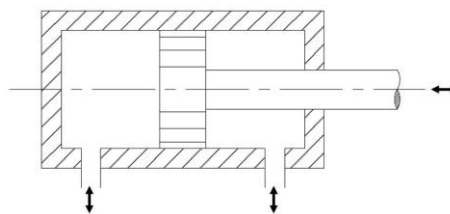


Fig. 5. Double acting pneumatic cylinder

Simple belt drive : power from the piston is transferred to crank and it rotates. Power from this can be transferred to wheel of the bike or bicycle.

III. WORKING

The High Pressure (designed) air is filled inside a pressure tank /Air tank. This air is basically provides the driving force to the piston. Air from pressure tank is made to flow through 4 way 2 position pneumatic valve. This valve basically control the flow of High Pressure air to the cylinder. In one position it allows the high pressure air to flow on forward side of piston inside a cylinder while as air from back side is allowed to pass to atmosphere. Due to this piston travels from one end to another piston which came to another end pushes the pneumatic valve to change its position due to change in position of valve now air flow goes to back side & pushes piston again to come to initial position. This movement of piston again releases the pneumatic valve to change its position and in this way piston movement of to & from is carried out. Piston rotates crank through connecting rod & power from this crank is given to wheel through belt or chain drive.

IV. CALCULATION:

100 kg. Average weight of Person

$$100 \times 9.87 = 987 \text{ N}$$

Max. Speed = 40 Km/h

$$40000 \text{ m} / 3600 \text{ sec.} = 11.11 \text{ m/s}$$

$$P = 987 \times 11.11 \text{ N.m / s}$$

$$(1) \quad P = 10.965 \text{ KW}$$

$$P = 2\pi NT / 60000 \text{ (For } N = 500 \text{ rpm)}$$

$$10.965 = 2 \times 3.14 \times 500 \times T / 60000$$

$$(2) \quad T = 209.41 \text{ N.m}$$

$$T = F \times r$$

$$209.4 = F \times 30/1000$$

$$(3) \quad F = 6980.5 \text{ N}$$

$$F = P_r * A$$

$$F = p_r \pi (d_1^2 - d_2^2) / 4$$

where

d_1 = full bore piston diameter (m)

d_2 = piston rod diameter (m)

$$6980.5 = P_r * (\pi/4 [(100/1000)^2 - (20/1000)^2])$$

$$P_r = 6980.5 \text{ N} / 0.00753$$

$$(4) \quad P_r = 9.25 \text{ bar}$$

$$(5) \quad \text{Max. Pressure} = 9.25 \text{ bar}$$

V. RESULTS:

From above calculation we can say that the air tank with maximum pressure is around 9.25 bar. With 40km/h speed we could able to get power 10.96KW which is sufficient for low distance travel. For same power we need to get 209.41 N. m torque. To achieve same torque, required force should be 6980N.

VI. CONCLUSION

From this mechanism it has been concluded that this system is less toxic, zero emission & cheaper than other fuel alternatives. However to cover more distance we need lot more volume of air than petrol. its speed is too low as compared with fuel though for shorter distance Air Bike is the best option rather than fuel.

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