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A Research Paper: Study on Pneumatic Vehicle

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Abstract — *The paper describes how the pneumatic vehicle is operated by Compressed air with the help of belt pulley arrangement. The system consist the merits over the conventional fuels. In this paper prototype system is developed which is operated by compressed air as well as theoretical calculation done for the system. The Prototype contributes to reduce the air pollution and tend to minimized pollution level.*

Keywords- *Pressure tank, belt-pulley transmission system, pneumatic cylinder, solenoid valve, eco-friendly.*

I. INTRODUCTION

In 1903 the liquid air company located in London England manufactured a no of compressed air and liquefied aircrafts. The major problem with this car and all compressed air cars is the lack of torque produced by the engine and the cost of compressing the air. A compressed air motor cycle called the green speed air power motor cycle made by yi yuwanon the s.suzuki GP100 and using the Angelo Deptro compressed air engine.

The motor which is operated by air was first applied to the field of transportation in the mid-19th century. A Two centuries before Dennis Papin came up with the idea of using compressed air. The first successful application of the pneumatic motor in transportation was the Mekarski system which is used in locomotives. Mekarski engines was first used by Tramway de Nantes in December 13, 1879 to power their fleet of locomotives. It is located in Nantes, France.[1]

The compressed air vehicle works on the simple mechanism light weight vehicles are the next advancement in the development the automobiles.
Compressed air vehicle project in the form of light utility vehicle (LUV) (i.e., air car in particular) has been topic of great interest for the last decade and many theoretical and experimental investigations have appeared on the subject in the literature. Many largest car manufacturers [2] all over the world have taken up the lead in this direction based on the initial technological concept of the pioneer-the French company Motor Development International (MDI) in the field. In 2008, India's largest car manufacturer also announced that it would begin production of world's first commercial vehicle to run on nothing but compressed air.[3]

As we know that internal combustion engines have been used in automobiles for several decades and in order to obtain the power ,a very complicated energy is carried in the engine,fossile fuels are used to produce the required energy, which leads to many environmental disaster like global warming, greenhouse effect, ozone depletion along with the pollution of the air and environment.[4]

II. WORKING

A principle of pneumatic air vehicle is the engine which does mechanical work by just expanding the compressed air. The pneumatic vehicle is convert the compressed air energy into mechanical work either in the into linear motion or rotary motion.

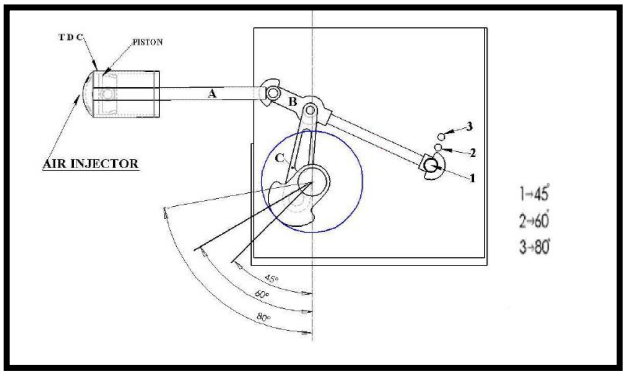

Figure 1.1: The construction of CAE.

Figure 1.2: Arrangement of components

Many compressed air engines improve their performance by modifying their performance by modifying their compressed air tank and heating the incoming air or the engine itself. The fig. shows that the arrangement of the various components which are used to operate the vehicle. Where compressed air supply directly to the pneumatic cylinder and solenoid valve solenoid valve is used for control the direction of the air supply, the piston will move and compressed air expands in the cylinder, and piston will reciprocate, and the connecting rod is connected with the crank so the linear motion transfer into rotary motion, the mechanical power is generated and transmit to the another shaft by means of pulley. In the whole process occurrence of the combustion is nowhere, so this vehicle is 100% free of pollution.

III. ARRANGEMENT OF THE AIR COMPRESSED VEHICLE COMPONENTS

For the Air compressed vehicle the arrangement of the various components according to its process is shown in below figure, and also the table below show the components detail as well as its function, the dotted line shows the flow of air through the system as below,

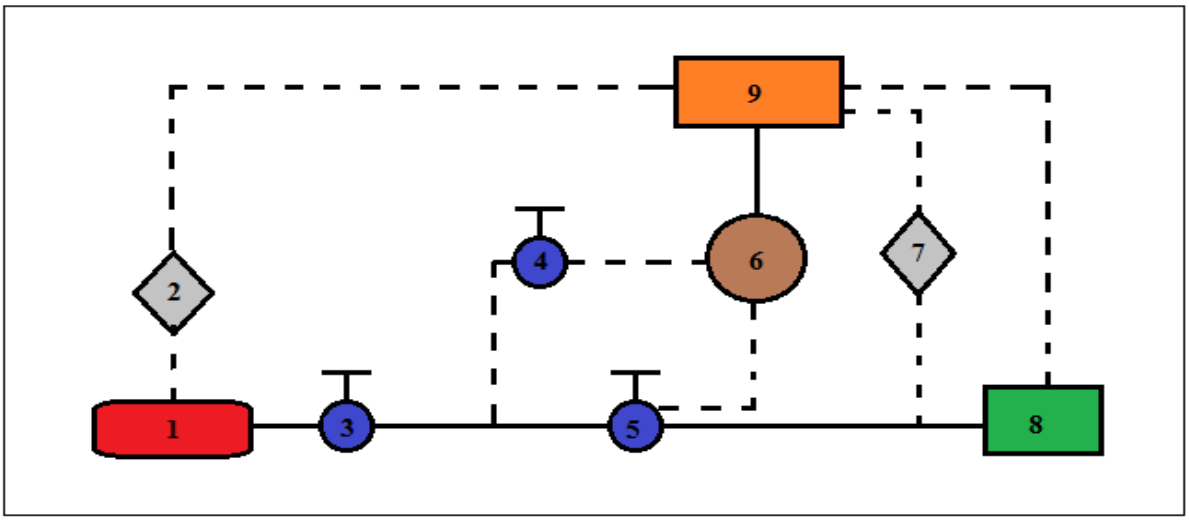

Figure: 1.3: Pneumatic Circuit Of The Compressed Air Vehicle

Table 3.1 ***The equipment of CAE automobile.***

1	High pressure air tank	Store up and provide high pressure air
2	Pressure sensor	Calculate the pressure of storage tank
3	Regulator	Regulate gas pressure
4	Regulator	Regulate gas pressure
5	Air operated regulator	Modulate the pressure of entering air and control of CAE
6	directional control valve	Modulate the amount of entering air
7	Pressure Sensor	Calculate the pressure of airflow
8	CAE	Provide the power
9	Controller	Measure pressure and output

Design of pressure vessel

Pressure required for Pneumatic cylinder,(Pi) = 0.689 Mpa …… (1)

Storage volume (V) = 0.0628m^3 …….... (2)

Material:
Assuming plain carbon steel
Ultimate tensile strength =410N/mm^2 …….. (3)
Factor of safety (f.o.s) = 2 ……. (4)

Determination of the length and diameter of the pressure tank

$$V = \frac{\pi}{4} * D^2 * L \quad \text{..... (5)}$$

$$V = \frac{\pi}{4} * D^2 * 2D \quad \text{Where L = 2D} \quad \text{..... (6)}$$

Design of pressure vessel

Tensile strength of pressure tank:

$$\sigma t = \frac{Sut}{f.o.s} \quad \text{..... (7)}$$

Thickness of cylinder shell.

$$T = \frac{Pi*Di}{2\sigma t\eta - Pi} + C.A \quad \text{..... (8)}$$

Where,
Design of pressure (P_d):
=1.05 * max.working pressure
η = Efficiency of welded joint
= 0.7
(According to table for double welded butt joint with full penetration not radiograph)
C.A=corrosion allowances
= 2mm

Thickness of semi elliptical held:

$$Th = \frac{Pi*Di}{2\sigma t\eta - Pi} + C.A \quad \text{..... (9)}$$

According to eq.1 to 10 the following table is obtained

Sr. no	Detail	Value	Unit
1	Pressure required for Pneumatic cylinder(Pi)	0.689	Mpa
2	Storage Volume	0.0628	m^3
3.	Material: plain carbon steel	-	-
4.	Factor of safety(f.o.s)	2	-
5.	Length of pressure tank(L)	330	Mm
6.	Diameter of pressure tank(D)	200	Mm
7.	Tensile strength of pressure tank(σt)	205	N/mm^2
8.	Thickness of cylinder shell(T)	3	Mm
9.	Thickness of semi elliptical held (T_h)	3	Mm

IV. CONCLUSION

According to study, we conclude that the compressed air vehicle is considered as alternate fuel. Further improvement can be achieved by carried out force analysis. While considered to be availability of fuel, it will be economical and minimized environmental pollution. And it does seem like the very vital application of this vehicle if the hybrid technology is implementing on it.

REFERENCES

[1] Mistry Manish k, Dr.pravin p.rathod and prof.sorathiya Arvind, s "Study and development of compressed air engine single cylinder: a review story",e-issn 0976-3945.

[2] Graham Kazak, Make way for air-powered cars maybe, http://www.autoweek.com/article/20120821/ green /120829984 (assessed November 2012).

[3] A car that runs on air, in India soon http://www.rediff.com/money/2007/mar/21car.htm (assessed November 2012)

[4] S,S Verma's Latest development of a compressed air vehicle : a status report ,Global journal Inc.(USA),online ISSN:2249-4596 & Print ISSN:0975-5876.

