Design and Fabrication of Compressed Air Vehicle

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Abstract- Compacted air as a wellspring of vitality in various uses when all is said in done and as a nonpolluting fuel in packed air vehicles has pulled in researchers and specialists for quite a long time. Endeavors are being made by numerous designers and makers to ace the packed air vehicle innovation in all regards for its most punctual use by the humanity. The present paper gives a short portrayal of how a packed air vehicle utilizing this innovation was made. While creating of this vehicle, control of packed air parameters like temperature, vitality thickness, prerequisite of information control, vitality discharge and emanation control must be aced for the improvement of a protected, light and financially savvy compacted air vehicle in not so distant future.

Keywords: compressed air vehicle, technological trends, energy input, energy released, emission control, storage & fueling, temperature.

1. INTRODUCTION

A packed air motor is a pneumatic actuator that makes helpful work by growing the compacted air and changing over the potential vitality into movement. (A pneumatic actuator is a gadget that changes over vitality into movement.) The movement can be rotational or direct, contingent upon the kind of actuator. Packed Air Engine (CAE) is fuelled by compacted air, which is put away in a tank at a high weight. A Compressed Air Vehicle (CAV) utilizes this packed air motor as its system for drive. Packed air vehicle venture as light utility vehicle (LUV) (i.e., air vehicle specifically) has been a theme of incredible enthusiasm for the most recent decade and numerous hypothetical and test examinations The distinction between the compacted air motor and IC motor is that as opposed to blending fuel

With air and consuming it to drive cylinders with hot ex-pending gases, CAE's utilization the extension of recently packed air to drive their cylinders. The best advertisement - vantages of packed air vehicle is no

copying procedure and no waste gas release to the encompassing condition. It tends to be said as a green ecological insurance vehicle with almost zero contamination in the metropolitan urban areas.

With the strategy of vitality preservation and condition assurance. The motors of packed air autos are cylinder type, vane type, rotational sort and the cylinder motor. At present, the cylinder motor power framework has a few disservices, for example, complex structure, simple wearing, high clam or and low productivity. Along these lines, to create and upgrade motor power framework is

The key strategy for compacted air vehicle urban areas.

2. ENGINE SPECIFICATIONS

The motor utilized for compacted air vehicle is 110cc 4-stroke TVS VICTOR motor. The slight adjustments are finished with the motor to fill the need of compacted air vehicle.

Fig 5: IC Engine Used For The Project

Engine	: TVS VICTOR GS 110CC
Stroke Length	: 55 mm
Bore	: 51 mm
Displacement	: 109.3 cc
Engine cycle	: Four stroke
Engine output power	
(Before modifications)	: 8.1bhp@7250rpm

Torque : 8.1 Nm@5500rpm

Cooling System : Air cooler

3. DESIGN PROCEDURE & FABRICATION

First we drawn some rough sketches of the chassis with different dimensions and then based upon our loading requirements we finalized the chassis model. Then we created the sketch in cam software then we carried on the static analysis by using the NX-NASTRAN software by assigning point loads at different points on the chassis.

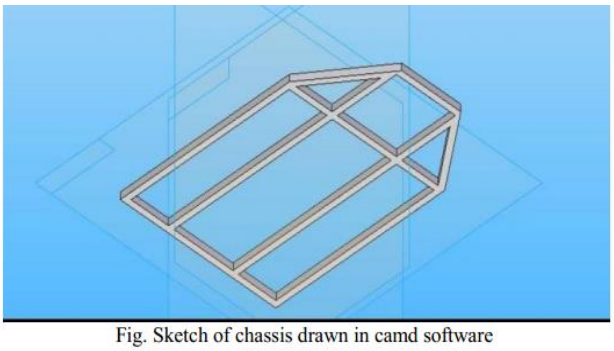

Fig. Sketch of chassis drawn in camd software

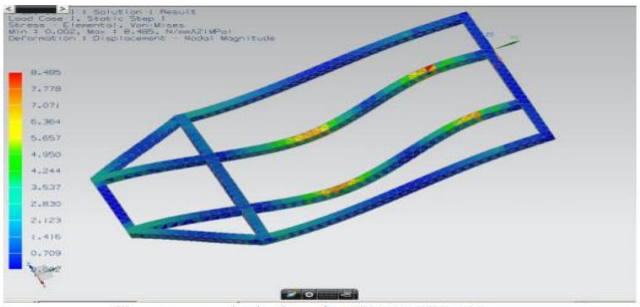

Fig.stress analysis done in NX-NASTRAN.

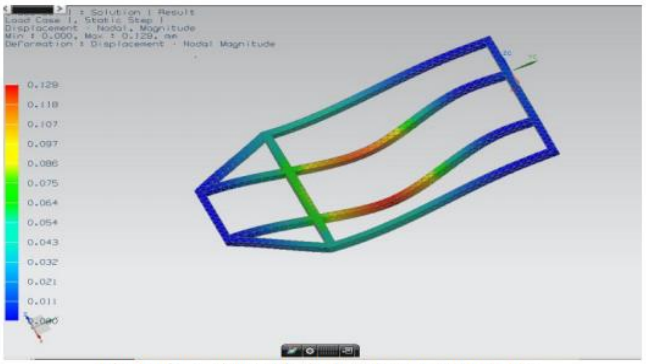

Fig. Deformation analysis done in NX-NASTRAN.

FABRICATION

"Body" outline is the fundamental casing work of the vehicle. It bolsters every one of the parts of the car joined to it. It is made of drop manufactured steel. Every one of the parts identified with autos is appended to it as it were. Every one of the frameworks identified with car like power plant, transmission, guiding, suspension, stopping mechanism and so forth are appended to and bolstered by it as it were.

For mounting of the considerable number of adornments the base ought to be solid. The base here is called as the casing. The material utilized for the creation of casing is mellow steel. The empty sort channels are created to shape an inflexible development in order to fill the need of edge. The empty pipe is utilized to limit the heaviness of the vehicle.

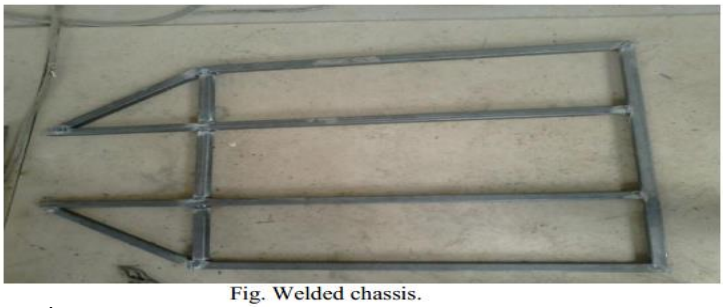

Fig. Welded chassis.

4.1: Analysis on Air

SERIAL NUMER	OPERATING PRESSURE	RPM OFCMPRESSOR
1	0 bar	1460
2	3 bar	1440
3	5 bar	1438
4	6 bar	1432
5	7 bar	1431

Table 1: Analysis of air compressor during working condition

P = OPERATING PRESSURE = 6 BAR

N = RPM OF COMPRESSOR = 1432

D = DIAMETER OF CYLINDER = 47MM L = LENGTH OF THE STROKE = 55MM d= DIAMETER OF THE INLET = 8 MM

D = DIAMETER OF THE ROTOR = 80 MM

Assuming atmospheric conditions,

$$\text{Free air delivery} = (\pi * D^2 * L * N)/(4*60)$$

$$= (\pi*0.047*0.047*0.055*1432)/(4*60)$$

$$= 2.27*10^{-3}\ m^3s^{-1}$$

By continuity equation,

$$Q = \text{Area}*\text{velocity}$$

$$2.27 * 10^{-3} = (\pi/4)*d^2*V$$

$$V = 45\ m/s$$

By impulse momentum equation

Impact force = $\rho * A * V$

P = Density of air at P pressure

$\rho = P/(RT)$

$= (6*10^2)/(0.287*298)$

$= 7 \text{ Kg m}^{-3}$

Impact force $F = \rho*A*V^2$

$= 7*45^2*15^2*10^{-6}$

$= 3.3 \text{ N}$

Torque = force * (D/2)

$= 3.3 * 0.050$

$= 0.165 \text{ N-m}$

Assuming the rotor is rotating with the same velocity, as

$U = (\pi*D*N)/60$

$45 = (3.14*0.1*N)/60$

$N = 8598$

Brake power = $(2*\pi*N*T)/60$

$= (2* \pi*8598*0.165)/60$

$= 148.487 \text{ WATTS}$

$= 0.199 \text{ bhp}$

RESULTS TABLE

SERIAL NUMBER	OPERATING PRESSURE	RPM OF COMPRESSOR	TORQUE	BRAKE HORSE POWER
1	3	1440	0.08	0.0976
2	5	1438	0.172	0.209
3	6	1432	0.165	0.199
4	7	1431	0.158	0.182

Table 2: Results obtained during experimentation at various pressures and speeds

PRESSURE VS RPM:

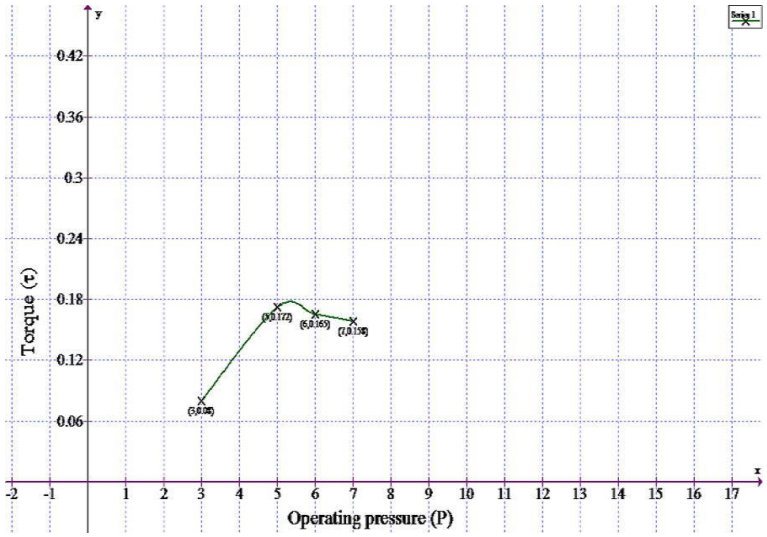

Fig: Graph between pressure and torque of air compressor during experimen

PRESSURE VS BHP

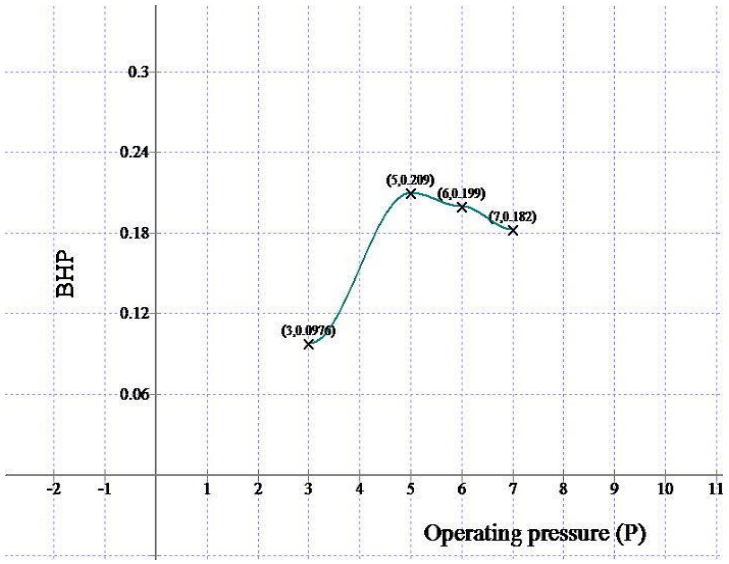

Fig: Graph between pressure and brake horse power (bhp) of air compressor during Experimentation

4.2 Analysis On Engine

Torque and Bhp Calculations:

Diameter of cylinder=50mm

Length of stroke =55mm

Mass of car (approx) = 180Kg

R.P.M = 5000

Frictional coefficient of cement road and rubber tyre (μ) = 0.8

Force required to move the car

$$(F) = \mu*m*g$$

$$= 0.8*180*9.8$$

$$= 1411 \text{ Kg-f}$$

Area of contact of tyre and road (A) = π*d*t

$$= \pi*0.08*0.05$$

$$= 0.01256 \text{ m}^2$$

Therefore pressure required to run the car (P) = F/A

$$= 1411/0.012$$

$$= 117600 \text{ Kg/m}^2$$

$$= 11 \text{ bar}$$

Area of the cylinder (A) = $\pi*(d^2/4)$

$$= \pi*0.05^2/4$$

$$=0.0019625\text{m}^2$$

Force acting on the piston = P*A

=117600 * 0.0019625

=230 Kg-f

Brake horse power of engine (B.H.P) = (2*π*N*T)/60

= (2* π*5000*230*0.05)/60

= 6018.33 Watts

= 6.018 KW = 8bhp

LOAD VS BHP:

LOAD (KG)	BHP
4	3.92
5	4.56
6	5.252

Table 3: Results obtained during experimentation at various loads and bhp

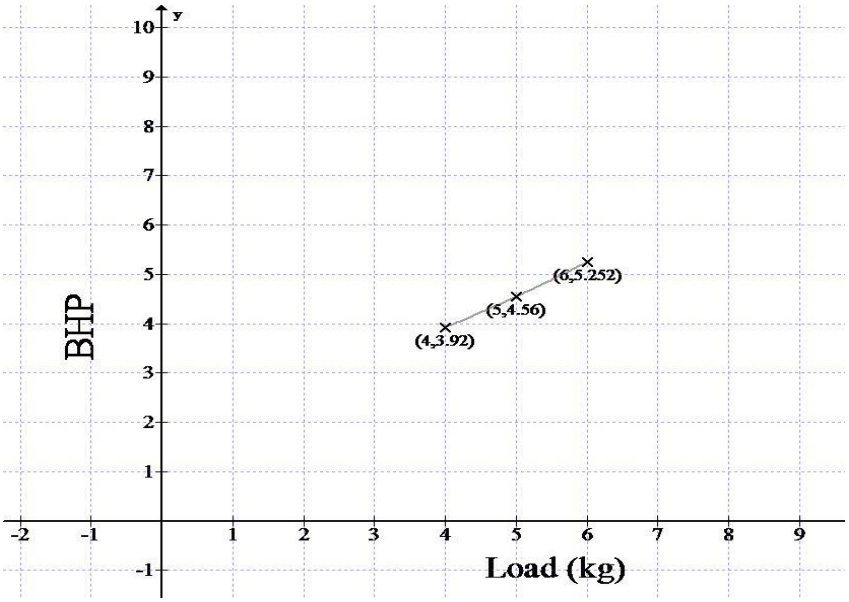

Fig: Graph between load and brake horse power of air compressor during experimentation

4.3:Final Assembly

Fig: FINAL ASSEMBLY OF COMPRESSED AIR VEHICLE

4.4advantages:

1. Significant preferred standpoint of utilizing compacted motor is that an unadulterated packed air vehicle delivers no contamination at the tailpipe.
2. Use of renewable fuel.
3. Compacted air innovation decreases the expense of vehicle creation by about 20%, in light of the fact that there is no compelling reason to fabricate a cooling framework, fuel tank, Ignition Systems or silencers.
4. Air, on its own, is non-flammable.
5. Low fabricate and support costs and also simple upkeep.
6. The air tank may be refilled more often and in less time than batteries can be recharged, with rates comparable to liquid fuels.
7. Lighter vehicles cause less damage to roads, resulting in lower maintenance cost.
8. The price of filling air powered vehicles is significantly cheaper than petrol, diesel or biofuel. If electricity is cheap, then compressing air will also be relatively cheap.

5. CONCLUSION

The model planned by us is a little scale working mod - el of the packed air motor. At the point when scaled to larger amount it very well may be utilized for driving autos autonomously or joined (cross breed) with different motors like I.C. motors. The innovation of packed air vehicles isn't new.

Compacted air innovation takes into account motor that are both non-dirtying and temperate. Following ten years of innovative work, the compacted air vehicle will be presented around the world. In contrast to electric or hydro-gen controlled vehicles, compacted air vehicles are not costly and don't have a restricted driving reach.

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This is a progressive vehicle which isn't just eco-accommodating, contamination free, yet in addition exceptionally temperate. This promotion - dresses both the issues of fuel emergencies and contamination. Anyway unreasonable research is expected to totally demonstrate the innovation for the two its business and tech - pleasantly reasonability.

6. FUTURE SCOPE

1. Compressed air vehicles are our near future and advancements in the presented project can be taken up by doing some ideal methods like: Inserting an intermediate compressor after the gas leaves the motor and pack the air again to the repositories.

2. Making a hybrid engine comprised of multiple ways of powering up the vehicle like gasoline and compressed air; electric and compressed air; recycle modules etc.

3. Making the chassis light weight by selecting proper materials can also greatly affect the efficiency of the CAV.

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