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Study About Engine Operated By Compressed Air (C.A.E): A Pneumatic Power Source

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Abstract: *this paper describes the working of a four-stroke single cylinder Engine which can run on pneumatic power as by compressed air. Since it is an old technique which can attracted many scientist as well as Engineer's for many years. This paper describes on the same with some new modification which is main objective of this research paper . Since engine is operated by Compressed air which contribute to reduce the air pollution and tend to zero pollution level of atmosphere and making a great a environment. While developing it some parameters as like temperature,density, input power, emission control have be mastered for development of safety.Since the Gasoline is a thing of past sothe main advantage of CAE is no hydrocarbon fuel is required i.e. No combustion process is occur there.*

Keywords: *Pneumatic motor,Storage tank, Compressed air engine, Emission output, Eco friendly, CAT, Energyreleased*

I. Introduction

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 indecember 13, 1879 to power their fleet of locomotives. It is located in Nantes,France.

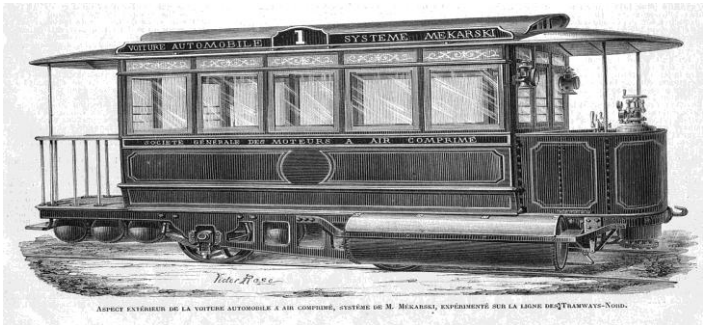

Fig 1: Mekarski Compressed Air Tram

Robert Hardie had introduced a new method of heating which increases the range of the engine which helped to increase in distance in 1892.

Charles B Hodges,will also be remembered as a true father of compressed air concept because he didn't invent only cars which run by compressed air but also have a considerable commercial success with it.After the. hard work of twelve years of researches and developmentsa French engineer by profession Guy Negre ,has also designed low consumption and low pollution engine for urban motoring that runs on compressed air technology(CAT).In year 2008,India largest car manufacturer company TATA was also announced that it would introduce world's first commercial vehicle that will run on compressed air.

II. Working

A compressed air engine is a type of engine which does mechanical work by expanding compressed air. Pneumatic engine generally convert compressed air energy to mechanical work either into linear motion or rotatory motion. Where Linear motion is come from diaphragm and rotary motion is come from either a vane type air motor or piston air motor.Pneumatic motors which are existed in many forms from the past two centuries, Many compressed air engines improve their performance by modifying their compressed air tank and heating the incoming air or the engine itself. The given Fig: show a newly design engine that operated by compressed air, here modification is done with tank where compressed air is stored.

Fig2: Compressed Air Engine with modified tank

III. Compressed Air Technology (Cat)

The basic object with Compressed air Technology is to implement in vehicle for consumption of minimum amount of energy and remain the output work same.

In today's world, everyone wants to afford a vehicle and it's energy to power it. Engine air technology makes it happen from many aspects. It is very less in term of mass as compared with other sources of energy for transportation of man or material.

It also improve urban life style through sustainability & Non-polluting vehicle. It's impact on the environment is also considerly low. It remains with intelligency, lighter, style and comfort.

Most of the work done by an air compressor is during compression stroke. Which will addenergyto the air by increasing its pressure.Compression also produce heat, however, and the amount of work required to compress a quantity of air to a given pressure depends on how fast this heat is removed.

The compressed work done will lie between the theoretical work requirements of two processes and they are :-

Adiabatic:

A process which have no cooling and the heat does remains in the air which causing pressure rise that increases compression work requirements for the maximum value.

Isothermal:

A process that provides perfect cooling, in which no changing in temperature of air and the work required for compression is tends to the minimum."

But the given fig: indicates that isothermal expansion is higher than adiabatic expansion, the volume of the compressed air and flow rate are controlled at a particular compressed pressure.

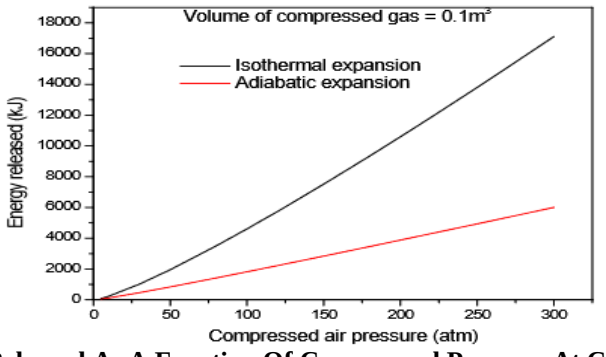

Fig3.1:Energy Released As A Function Of Compressed Pressure At Constant Volume

Without any combustion the motor is driven by the compressed air in which after combustion, dangerous and harmful gases were comes out which results in a zero-pollution mobility concept ideal for current global warming concerns which makes the environment eco-friendly.

But as a sensible species of our planet, We doesn't tend to continue these fossil fuels that we have and the renewable energy is most sensible way forward is to use it effectively

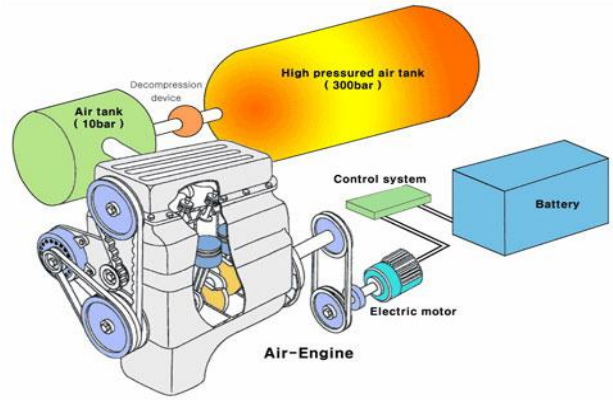

Fig3.2: 3D-Diagram of an Engine that operated by compressed air

IV. The Basic Principle Of Cat

The innovative system is used to control the movement of the 2nd generation pistons and single crankshaft. The pistons work in two phases: first is motor stage and the other one intermediatephase of either compression or expansion. The engine consist of 4 two-stage pistons, i.e. 4 compression and 4 expansion chambers. Ithas two functions: to compress ambient air and refill in the air storage tanks & and also to make successive then by approaching isothermicexpansion.

Fig4:The Outline Of Air Compressed Engine

How Compressed Air Can Fuel An Engine

- First of all inflate a balloon
- Then the elastic skin of balloon is hold the air very tightly from inside, but at the same time when use to create a hole through pin into it .
- Then the air expands in the outward direction with so much energy that the baloon explodes
- Compressing the gas into a small space is a way to store energy
- If again the gas expands ,that's mean energy is released to do work
- That's the basicprinciple behind it to makes the engine go.

V. Advantages Of Cae

Compressed air is a safe and reliable power source that is widely used throughout industry. In fact, approximately 70% of all companies use compressed air for some aspect of their operations. Compressed air vehicle engine offers higher efficiency than most electric vehicle.Its only emission are cold air. The feature and the multiple example of use are as follow

- **Construction trade –** drill and demolition hammers, conveyor system for stone factory.
- **Steel mills –** carbon reduction in steel production.
- **Chemical industry –** raw material for oxidation processes, process control.
- **Energy industry –** inserting and withdrawing reactor rods, ventilation system for boiler houses.
- **Environmental technology –** forming oil barriers in the water, enriching water with oxygen slide actuation in sewage plants.

VI. Disadvantages Of Cae

As it the CAE has many advantages but at other hand it has also many drawbacks. An air Compressed air is an extremely versatile source of power, if someone knowwhat they want before they buy it. Compressed

air can offers a lot of benefits, but at the same time they should take care of it while choosing one to make sure they get exactly whatthey need. Some points which don't like about CAE are :

- **Noise** – air compressors are very loud. This is an major downside if you live in an apartment or duplex and don't have the privacy to run loud equipment.
- **Size**– the bigger the air compressor tankis, the more power it provides. However, if someone need more power and they don't have the space to store a large air compressor tank, this can be a downside.
- **Maintenance**– repair work should be done if the compressor malfunctions.

VII. Possible Improvements Of Pressure Air Engine For Third World Use

Imagine an engine which is powered by compressed air with upto 94% efficiency and zero % polluting emissions. A unique rotary piston concept whichvirtually eliminates vibration, internal wear and friction. Wind, solar and hydro power which can be used to compressed the air.

As the thermodynamic process is used to operate vehicle of compressed air engine because air cools down when expanding and heats up during compression. Since it is not practical, usingtheoretically ideal process because losses occur and improvements may also involve to reduce these.

India's largest manufacturing company TATA also working on compressed air technology and their first upcoming Mini CAT cars which is operated by compressed air concept Fig: is shown below

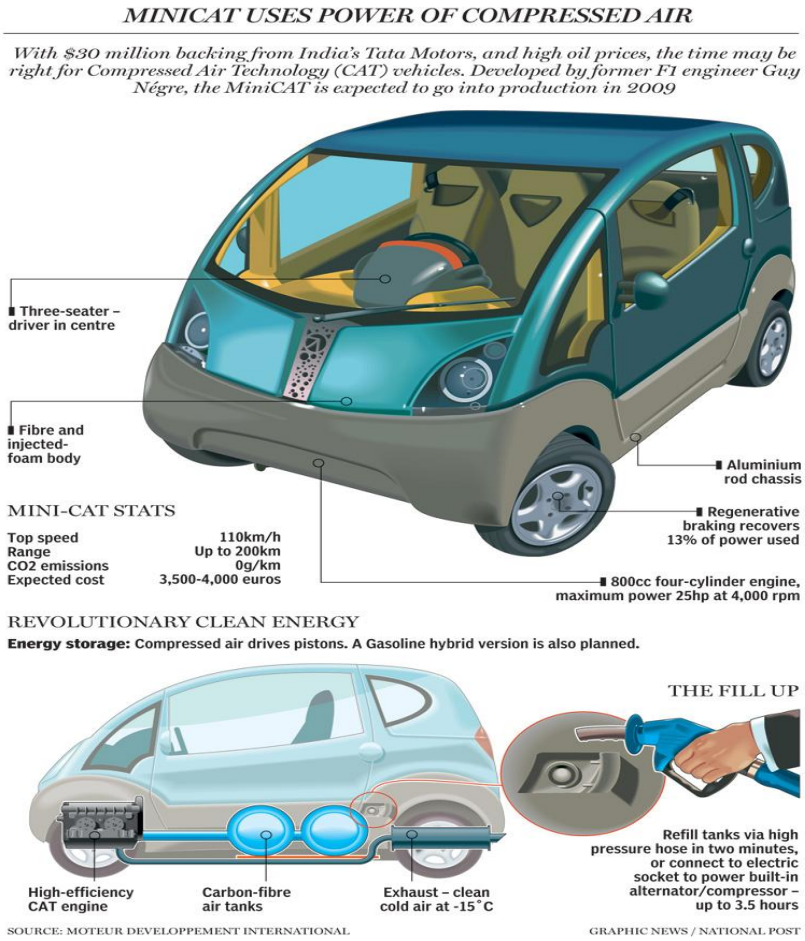

Fig5:MINI-CAT Uses Power Pf Compressed Air

VIII. Conclusion

Nowadays the need of energy is increases, but basically conventional source of energy is limited due to that price of petroleum or gasoline iscontinuously rising. To satisfy our need alternate fuelor energy is required. But while considering alternate fuel some factors be considered as like availability, eco-friendly etc. Since Compressed Air Technology(CAT) isbest technology which tend engine to zero pollutions and through this we can power our cars, ships, train anything except aeroplane. If further improvement is carried out with stress analysis, thermodynamic analysis, minimize compressed energy loss and other losses then efficiency of CAE may be further increases.After that we get every answers which we expect from our Environment as like, By this technology its possible to solve the environment problem what we're facing today? Of course we can! We

can do anything and everything what we want. Now We have been to the moon. We also have been into space. If we have damaged something whatever it should be now easily it should be fixed up.

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