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# Development and Optimization of Compressed Air Vehicle

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**ABSTRACT**: This research outlines the design and development of an innovative pneumatic vehicle that utilizes a chain drive system for propulsion. The pneumatic propulsion system of the vehicle provides numerous benefits, such as being environmentally friendly, straightforward, and cost-effective. The incorporation of a chain drive mechanism improves the vehicle's efficiency and overall performance. The design process encompasses conceptualization, modeling, simulation, and the construction of a prototype. Performance assessments conducted through experimental testing validate the practicality and effectiveness of the proposed pneumatic vehicle with a chain drive system. The findings suggest significant potential for future applications in sustainable transportation.

This study explores the innovative creation of a pneumatic vehicle equipped with a state-of-the-art chain drive system, with the objective of transforming sustainable transportation. Utilizing compressed air for propulsion, the vehicle exemplifies environmental sustainability and operational effectiveness. The carefully designed chain drive mechanism enhances power transmission, improving the vehicle's performance and agility. This research thoroughly details the iterative design process, which includes conceptualization, computer-aided modeling, comprehensive simulation, and prototype development. Extensive experimental validation confirms the viability and effectiveness of the pneumatic vehicle, highlighting its potential to redefine the future of transportation while minimizing environmental impact.

KEYWORDS: Pneumatic Propulsion System, Chain Drive Mechanism, Suspension Systems, Wheels, Control System.

### I. INTRODUCTION

In contemporary times, the demand for electricity is expected to rise; however, traditional energy sources are limited due to the continuous increase in the cost of petroleum and gasoline. To meet our energy requirements, a transition from gasoline to electricity is necessary. When considering alternatives to gasoline, several factors must be taken into account, such as availability and environmental impact. Furthermore, the emissions produced from these fuels play a significant role in contributing to global issues, including the greenhouse effect, depletion of the ozone layer, acid rain, and pollutants that pose a serious threat to the environment and, ultimately, to life on Earth. It is crucial to address these issues at their inception. Consequently, leading automobile manufacturers are compelled to expand their offerings of vehicles powered by alternative energy sources. Hybrid cars, fuel cell vehicles, and hydrogen-powered cars are becoming increasingly available in the market as a result. One potential alternative is the air-powered vehicle.

### **II. LITERATURE SURVEY**

### PRAMOD KUMAR. J - AIR POWERED ENGINE

The environmental pollutants within the metropolitan towns is increasing swiftly on the whole because of the expanded number of fossil fuel powered cars. Many alternative options at the moment are being studied at some stage in the arena. One of the alternative answers may be a compressed air powered car. Main advantage of this engine is that no hydrocarbon gasoline is required which means that no combustion technique is taking place. In this venture, an SI engine is transformed into a compressed air engine. A four stroke single cylinder SI engine is converted to 2 stroke engine which operates using compressed air due to its design simplicity. As we transformed the already current



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conventional engine into an air powered one, this new generation is easy to adapt. Another benefit is that it makes use of air as gas that's available abundantly in atmosphere.

### VISHWAJEET SINGH - COMPRESSED AIR ENGINE

Mankind is continually searching out green and pollutant-loose way of powering their machine. Resent improvement in light and robust fabric has aided us to attain those simpler ways. In gift take a look at a four stroke engine become changed into 2 stroke engine, and become used to run on compressed air generation. Some take a look at was completed on the modified engine to observe the effectiveness of the engine.

## SAURABH PATHAK, KONTHAM SWETHA, V. SREEDHAR, V.S.V PRABHAKAR - COMPRESSED AIR VEHICLE: A REVIEW

The state-of-the-art fashion in the automotive enterprise is to broaden light weight vehicles. Every car industry is seeking to lessen the weight of the vehicle because it helps within the higher managing of the car and increases the efficiency of the vehicle. Today, the heavy cars are acknowledged for generating a big amount of dangerous gases like CO2, SO2 etc. Which act as the main source for global warming. So studies are going on to find a light weight vehicle which does no longer pollute the surroundings. One of the options is the usage of compressed air to generate power to run a car. Due to the unique and environmental pleasant residences of air, it is considered as one of the destiny fuels so that you can run the motors. So on this paper an effort is made to take a look at the extent of research done and the ability blessings and drawbacks of the compressed air generation.

#### QIHUI YU, MAOLIN CAI - EXPERIMENTAL ANALYSIS OF A COMPRESSED AIR ENGINE

Nowadays, automobiles consume a large number of fossil fuels. However, the consumption of fossil fuels has brought many serious environmental problems, such as global warming, ozone layer depletion and fine particulate matter. To avoid such environmental problems, renewable energy has been applied to automobiles. In this paper, an airpowered engine of a renewable energy vehicle is introduced. To lay a foundation for the optimization of compressed air engine (CAE), a physical model of compressed air engine (CAE) is established with cam which controls compressed air charge or discharge cylinder. To obtain performance of the CAE, a prototype CAE system is set up. The output torque, power and efficiency are obtained through experimental study. The results show that the prototype of CAE has a good economic performance under low speed and when the supply pressure is 2 MPa, the maximum output power is 1.92 kW; the maximum output torque is 56.55 N·m; and the maximum efficiency is 25%. This research can be referred to in the optimization of airpowered engine.

# SHUBHAM KUMAR, PANKAJ KUMAR PRADHAN, ZAKEER HUSSAIN KHAN, B. ANIL KUMAR, M. CHAITHANYA - DESIGN AND DEVELOPING OF COMPRESSED AIR ENGINE

Internal combustion engine produces a large amount of harmful gases like CO2, SO2 etc. which pollute the environment and causes global warming and it consumes enormous non-renewable energy. So today every country is in search of alternative source of energy and there are couple of alternate source of energy such as solar power, tidal power, geo-thermal power, etc. and one of them is compressed air. The air engine runs on air only, no fossil fuel. The compressed air engine is a modified 100cc conventional engine. The engine is modified from 4-stroke to a 2-stroke engine (suction and exhaust) by modification of cam-gear system. The maximum pressure used is 8 bar. The project was successfully carried out and tested. This technology is cheaper in cost and maintenance and it does not cause any kind of harm to the environment. Thus the compressed air engine will play vital role in reducing air pollution and also in reducing temperature of earth. Compressed air engine uses air as fuel which is available abundantly in atmosphere.

### **III. METHODOLOGY**

#### Working principle

A pneumatic engine is a type of engine that performs mechanical work by utilizing the expansion of compressed air. Typically, pneumatic engines convert the energy stored in compressed air into mechanical work, which can manifest as either linear or rotary motion. When compressed air is directed into an onboard storage tank, it is gradually released to drive the pistons of the transport vehicle. Subsequently, the motor transforms this air power into mechanical power. This project employs a slider crank mechanism, which operates based on the principles of a pneumatic cylinder. In this system, gas is compressed within the compressor's cylinder to elevate the pressure. The pneumatic cylinder consists of several components, including a cylinder, end cover, piston, piston rod, and seal. During operation, the piston is



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lubricated by an oil mist present in the compressed air. The lever control valve facilitates the flow of compressed air from the compressor to the pneumatic cylinder, enabling its extension. The resulting linear motion is then converted into a half rotation of the crankshaft, with the subsequent half rotation achieved through the retraction of the pneumatic cylinder.



#### WORKING OF PNEUMATIC ENGINE



**IV. EXPERIMENTAL RESULTS** 

### FABRICATION MODEL ASSEMBLE





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CAD MODEL



### V. CONCLUSION

The model we have developed is a compact operational prototype of a compressed air engine. When enhanced to a larger scale, it has the potential to power vehicles either independently or in conjunction with other types of engines, such as internal combustion engines. The primary benefits of the Compressed Air Engine (C.A.E.) include:

- 1. Zero emissions
- 2. Utilization of renewable fuel
- 3. No fuel costs (expenses are incurred solely for air compression).

It is crucial to acknowledge that while the concept of vehicles powered exclusively by compressed air may appear to be a far-off reality, they continue to garner public interest due to their environmentally friendly characteristics. The use of compressed air for vehicle propulsion is currently under investigation, and air-powered vehicles are being developed as a more fuel-efficient alternative for transportation. This paper, titled 'International Compressed Air Vehicle: A Review,' examines the practical application of pneumatic power. Pneumatic vehicles are expected to supplant battery-operated vehicles in various industries, as they require significantly less time for refueling compared to their battery-operated counterparts..

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