

# Design & Working of Compressed Air Engine

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**Abstract** – In recent scenario of global warming the need of reducing the use of fossil fuels will be the most important topic to work on. The fossil fuels are non-renewable energy sources and it also pollutes the atmosphere and environment. But these fossil fuels are the most important energy sources for automobile industry in recent times. To decrease the use of these non-renewable energy resources researches are being going on for finding the alternatives of these sources in different fields. The use of renewable energy sources in power plants has helped the world to shift to better and sustainable energy generation. In automobile industry also hybrid vehicles have been developed like electric bikes which require electrical batteries to run the vehicle which is costly. To make a vehicle of low cost we are working on an engine which runs on air that is renewable source and which is endless source. Our project is related to a compressed air engine which is running on compressed air and produces no pollution in atmosphere, it is particularly an air powered engine and we explore our project towards development of this engine.

**Key Words:** Pneumatic Engine, Compressed Air, No Combustion Engine, Power Transmission, Environment-Friendly

## 1. INTRODUCTION

A Compressed Air Engine is basically a pneumatic actuator that produces work on expansion of compressed air. It uses the compressed air technology to generate useful work and to run a vehicle. The idea is to store compressed air inside a tank. Instead of mixing fuel with air and combustion of this mixture to produce hot gases whose expansion will lead to movement of piston the idea is to store the compressed air inside the tank which is at high pressure to drive the piston and by use of proper valve mechanism, to and fro motion of piston can be obtained which can be utilized to run the wheels and thus running a vehicle. The laws of physics dictate that uncontained gases will fill any given space. The easiest way is to see this in action by inflating a balloon. The elastic skin of the balloon holds the air tightly inside, but the moment you use a pin to create a hole in balloon the air expands outward with so much energy that balloon explodes. Compressing air into a small space is a way to store energy. When the air expands again, that energy is released to do work. Thus work output is obtained, this is the basic principle which runs a "Compressed Air Engine".

## 1.1 Problem Summary

Fossil fuel are widely used as a source of energy in most of the fields. But this source is limited and cannot be regenerated quickly. Nowadays the use of this fossil fuel has been increased at tremendous level which result into faster depletion of the fossil fuels and after some time the fossil fuel may deplete because the formation of fossil fuel takes thousands or millions of years thus it take large time to regenerate. Also the use of fossil fuels pollutes the environment and after industrialization, the use of fossil fuel has increased at a high rate which results into production of more and more amount of carbon dioxide in environment which led to increase in the temperature of the earth's atmosphere every year by 0.07°C per decade which is very harmful and dangerous as the more percentage of CO<sub>2</sub> lead to greenhouse effect which traps the radiation coming from sun and increases the temperature of earth. Due to which a major issue is being faced by the world which is "Global Warming". Nowadays the use of vehicles are increasing at faster rate and this vehicles are running on IC engines which produce work by combustion of fossil fuels and releasing exhaust gases like nitrogen, CO<sub>2</sub> etc. which are harmful gases that pollutes the environment and atmosphere. So to tackle problems like pollution and energy crisis, it is inevitable to develop alternative technologies to use the renewable energy resources, so that the use of fossil fuel will reduce which result into conservation of fossil fuels and also the protection of environment which result into sustainable development.

## 1.2 Aim and Objective of Project

The main aim is to create an engine which uses compressed air as a fuel called "Compressed Air Engine".

- To produce power by expansion of compressed air
- Reduction in pollution by no emission of harmful gases at exhaust
- To reduce the cost of engine as no cooling system is required
- To reduce the use of fossil fuels thus developing an alternative technology for vehicles.
- To decrease the maintenance cost
- To produce an engine which is non- flammable.
- Use of Renewable Source.

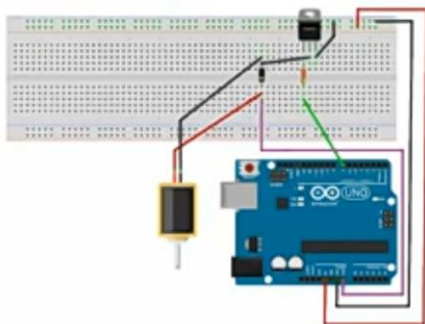
## 2. DESIGN METHODOLOGY

### 2.1 Components of Engine

- Pneumatic Cylinder
- Solenoid 5/2 Valve (12V)
- Pipes
- Air Compressor
- Transistor (TIP142T)
- Diode (1N5408)
- Arduino board
- Breadboard
- Battery (12V DC)
- Resistor (1K)
- Jumper Wires
- Connectors
- Wheel
- Rack and Pinion like arrangement for motion conversion
- Mufflers
- Frame

### 2.2 Design of Electric Circuit

Initially the solenoid is required, the solenoid requires larger voltage this voltage cannot be supplied by Arduino 5V pin thus transistor is required to switch on and off the solenoid by 5V supply from Arduino. A 1k resistor is required to attach the Arduino pin to the transistor. we're using an diode **1N5408** to prevent an electronic spike caused by the solenoid from going back into the electronics of the Arduino we'll also need six jumper wires for the connection between Arduino and breadboard.



### 2.3 Circuit Programming

For programming in ARDUINO we have used ARDUINO software

- Here we can change the timing of valve. For e.g. here we have given 250 milliseconds as input. Thus according to need program can be modified. The program is shown below

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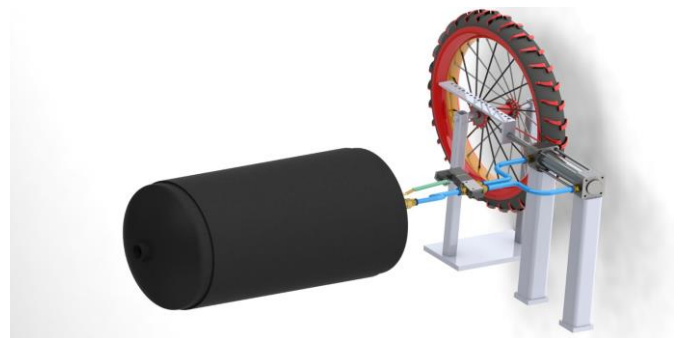
sketch_apr13a | Arduino 1.8.13
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sketch_apr13a
int signal_pin = 5; // Set signal pin
void setup() {
  pinMode(signal_pin, OUTPUT); // Set the signal pin as an output
}

void loop() {
  digitalWrite(signal_pin, HIGH); // Turn the signal on
  delay(250); // Pause
  digitalWrite(signal_pin, LOW); // Turn the signal off
  delay(250); // Pause
}

```

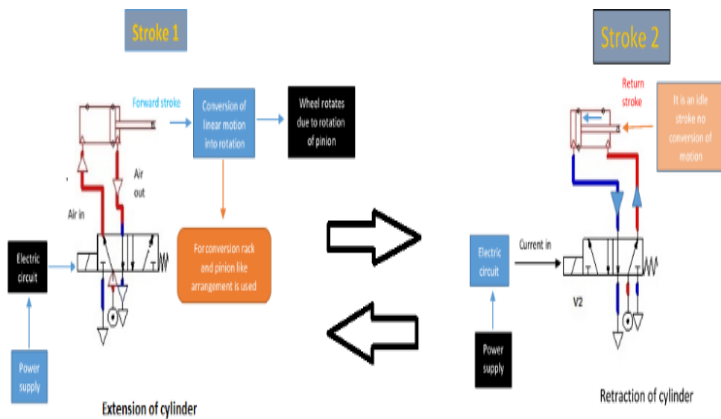
### 2.4 Design of Engine

The valves are connected to the storage tank by pipe at inlet and connectors are used for leak proofing in between. The outlet of valve is connected to the cylinder inlet port, the valves are controlled by electric circuit which controls the flow of compressed air and makes the piston reciprocate. The piston rod is connected to the rack like arrangement which is used to rotate the sprocket connected with wheel the entire system is being supported by supporting frame. The cylinder is connected to compressor which compresses the air.



### 2.5 Working of the Engine

The air is being compressed by Compressor, this compressed air is being admitted and stored in the storage tank. The compressed air flows through the inlet port of pneumatic cylinder through valve. This valve is being operated by electric circuit as described earlier as it acts as a timer mechanism. The compressed air is under high pressure thus it exerts a force on piston due to which the piston moves and this linear movement of piston is converted into rotary motion by help of rack and pinion (sprocket) like arrangement. This sprocket is mounted with wheel, the wheel is supported by frame, and thus the wheel rotates due to rotation of sprocket. This is the working of Engine where no combustion of fuel takes place thus it uses only compressed air to run an engine. The return stroke is idle.



Cycle Continues

### 3. CONCLUSION

The compressed air engine is the green technology engine that do not emit any harmful gases as no combustion process is involved thus this engine is the future technology in the development of vehicles with reducing the use of fossil fuels and using renewable source. The engine speed can be varied according to the need so speed variation can be achieved.

### ACKNOWLEDGEMENT

We are very thankful to our project guide **Prof. Miskin Hemendra**, in Mechanical Engineering Department, VGEC whose encouragement, guidance and support has helped us for building the concept from preliminary level to concluding level of the project. His guidance has help us to improve our project and in better understanding of the concept. His belief in us has helped us to perform better than we could. He has

been a great motivator and have encouraged us in our project work. We are also thankful to **Dr. D.M.Patel**, Head of Mechanical Engineering Department VGEC, Chandkheda and all other faculty members of VGEC for providing necessary permission and guidance to achieve what we are able to do in our project. Special regards to our colleagues for helping and supporting us during the project work. We are very thankful to our parents for supporting us financially and mentally. Lastly, we thanks who helped us in some or other way for carrying out this work.

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