# Air Engine By Using Air Compressor

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***Abstract-*** *The Air Engine is an eco-friendly engine which operates with compressed air. An Air Engine uses the expansion of compressed air to drive the pistons of an engine An Air Engine is a pneumatic actuator that creates useful work by expanding compressed air. There is no mixing of fuel with air as there is no combustion.*

*An Air Engine makes use of Compressed Air Technology for its operation The Compressed Air Technology is quite simple. If we compress normal air into a cylinder the air would hold some energy within it. This energy can be utilized for useful purposes. When this compressed air expands, the energy is released to do work. So, this energy in compressed air can also be utilized to displace a piston.*

*Global warming and pollution related problems are posing threat to our environment. The dependency on I.C engines has led to increase in air pollution due to harmful emissions in the environment.*

***Keywords***- Compressed Air, Crank, Compressor, Pneumatic, No-Combustion Engine, Environment Friendly

## I. INTRODUCTION

Compressed Air Technology is now widely preferred for research by different industries for developing different drives for different purposes. The Compressed Air Technology is quite simple. If we compress normal air into a cylinder the air would hold some energy within it. This energy can be utilized for useful purposes. When this compressed air expands, the energy is released to do work. So, this energy in compressed air can also be utilized to displace a piston. This is the basic working principle of the Air Engine. It uses the expansion of compressed air to drive the pistons of the engine. So, an Air Engine is basically a pneumatic actuator that creates useful work by expanding compressed air. 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 HISTORY

The first air powered vehicles were actually trains. The Mekarski air engine, the Robert Hardie air engine and the Hoadley-Knight pneumatic system were used in the 1800's to power locomotives.

From 1896 onward Charles B. Hodges invented air powered engines and made a profit selling hundreds of locomotives through the H. K. Porter Company. The inventor of the first air car, however, has been debated for years.

In 2007, Tata Motors introduced the MDI CityCat developed by Guy Nègre as the first commercial air car. As of 2009, two more models of MDI air cars have been showcased.

The pneumatic motor was first applied to the field of transportation in the mid-19th century. Though little is known about the first recorded compressed-air vehicle, it is said that the Frenchmen Andraud and Tessie of Motay ran a car powered by a pneumatic motor on a test track in Chaillot, France, on July 9, 1840. Although the car test was reported to have been successful, the pair didn't explore further expansion of the design.

### 1.2 WORKING

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 solenoid valve 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 connecting rod and crank like arrangement. This cranks shaft is mounted with wheel, rotates due to rotation of cranks. 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.

The slider crank mechanism is used in this project The working principle of pneumatic cylinder. The gas is compressed in the cylinder of the compressor to increase the pressure. Pneumatic cylinder is composed of cylinder, end

cover, piston, piston rod and seal. The piston is lubricated by the oil mist in the compressed air when the cylinder work.

## II. COMPONENT

- Pneumatic cylinder
- Air compressor
- 5/2 Solenoid Direction control valve
- Crank shaft
- Connecting rod
- Hoses
- Connecters
- Roller bearings
- F.R.L UNIT

### 2.1 Pneumatic cylinder

Double-acting cylinders (DAC) use the force of air to move in both extend and retract strokes. They have two ports to allow air in, one for outstroke and one for instroke. Stroke length for this design is not limited, however, the piston rod is more vulnerable to buckling and bending. Additional calculations should be performed as well.

Pneumatic actuators are the devices used for converting pressure energy of compressed air into the mechanical energy to perform useful work. In other words, Actuators are used to perform the task of exerting the required force at the end of the stroke or used to create displacement by the movement of the piston. The pressurized air from the compressor is supplied to reservoir. The pressurized air from storage is supplied to pneumatic actuator to do work.

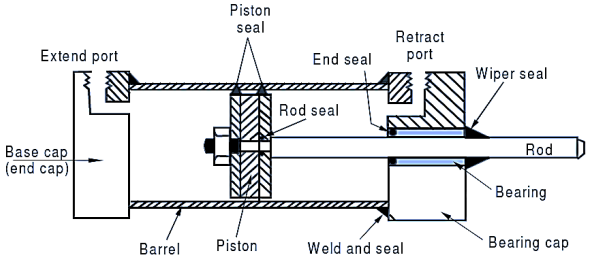


**Fig -1**: Double acting cylinder

### 2.2 Air compressor

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air by one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its engineered upper limit, the air compressor shuts off. The compressed air, then, is held in the tank until called into use.[1] The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit.

**Fig -2**: Air compressor

### 2.3. 5/2 Solenoid Direction control valve

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV; this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts. This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoid is one in which the plunger is pulled when the solenoid is energized.

### Working Of Solenoid Valve

The solenoid valve has 5 openings. These ensure easy exhausting of 5/2Valve.the spool of the 5/2 valve slide inside the main bore according to spool position: the ports get connected and disconnected.

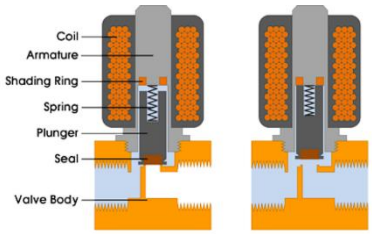


**Fig -3:** working of solenoid valve

The working principle is as follows:

**Position-1** When the spool is actuated towards outer direction port ‘P’ gets Connected to ‘B’ and ‘S’ remains closed while ‘A’ gets connected to ‘R’.

**Position-2** When the spool is pushed in the inner direction port ‘P’ and ‘A’ Gets connected to each other and ‘B’ to ‘S’ while port ‘R’ remains closed.

**2.4 F.R. L UNIT**

Filter, regulator, and lubricator (FRL) units in compressed air systems deliver clean air at a fixed pressure. They are lubricated, if necessary, to ensure proper pneumatic component operation, which increases their operational lifetime. The air supplied by compressors is often contaminated, over-pressurized, and non-lubricated, meaning an FRL unit is required to prevent damage to equipment. Filters, regulators, and lubricators can be bought individually or as a package depending on the need for components to meet the proper air specifications for downstream equipment.

**Fig -4:** F.R.L UNIT

**Install an FRL unit when:**

- Using pneumatic tools and equipment
- installing an HVAC system
- delivering clean air to the workplace
- requiring compliance with ISO, OSHA, ASHRA, or
- other air quality standards
- improving an air system's service life, safety, and reliability

**Filters:** Filters remove water, dirt, and other harmful debris from an air system, which is often the first step in improving air quality.

**Regulators:** The second step in an FRL system is a regulator. Regulators adjust and control the air pressure of a system to ensure that down-line components do not exceed their maximum operating pressures.

**Lubricators:** Lubricators reduce the internal friction in air tools by releasing a controlled oil mist into the compressed air. This is often done last and/or right before the component that needs lubrication

Filter, regulator, and lubricators are available individually or as a combined air filter-regulator (FR) or filter-regulator-lubricator (FRL) unit. Install an air compressor filter and regulator unit if the equipment is self-lubricating and an FRL unit if the equipment requires lubrication.

**OBECTIVES**

The main objective is to develop compressed air engine which can be run by the compressed air. Main advantage of compressed air engine is that no hydrocarbon fuel required means no combustion process.

The main objective is to develop compressed air engine which can be run by the compressed air. A four stroke single cylinder conventional engine can be run on compressed air with a few modifications. Main advantage of compressed air engine is that no hydrocarbon fuel required means no combustion process. Our environment must be protected against various contaminations produced by vehicles driven on I.C. engine which produces some of most adverse environment effects. For example, Nitrogen oxide (NOX) after oxidation forming nitric acid, contributes to acid rain which causes severe damage to environment. Nevertheless,

The compressed air technology will contribute to reduce air pollution and tend to zero pollution level and promoting great environment. This is because in compressed air engine air is used as fuel and exhaust is also in the form of air. There are several technical benefits of using this engine, like as no combustion inside cylinder, working temperature of engine is very close to ambient temperature. This in turn results in smooth working of engine, less wear and tear of engine components. There is one more technical benefit that there will not be any need for installing cooling system or complex fuel injection system, etc. These benefits result simple design, simple construction and less weight. Thus, compressed air technology satisfies present demand and can prove to be future transport medium

**2.5 ADVANTAGE OF AIR ENGINE:**

1. Less costly and more effective
2. The air engine is an emission-free piston engine that uses compressed air as a source of energy.
3. Simple in construction. The engine can be massively reduced in size

4. Easy to maintain and repair.
5. No fire hazard problem due to over loading. Air, on its own, is non-flammable.
6. Low manufacture and maintenance costs
7. Comparatively the operation cost is less.
8. Light in weight and easy to handle.
9. Compressed-air tanks can be disposed of or recycled with less pollution than batteries.
10. Compressed-air engines are unconstrained by the degradation problems associated with current battery systems.
11. The air tank may be refilled more often and, in less time, than batteries can be recharged, with re-filling rates comparable to liquid fuels.
12. Lighter vehicles cause less damage to roads.
13. The price of filling air tanks is significantly cheaper than petrol, diesel or biofuel. If electricity is cheap, then compressing air will also be relatively cheap.
14. The tank may be able to be refilled more often and, in less time, than batteries can be recharged, with refueling rates comparable to liquid fuels.

## III. CONCLUSIONS

We were able to successfully complete the design and fabrication of the Air Engine. By doing this project we gained the knowledge about pneumatic system and how automation can be effectively is done with the help of pneumatic system. We were also able to gain practical knowledge about the basics of the normal IC engine and solenoid valves.

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.

The Air Engine provides an effective method for power production and transmission. Even though its applications are limited currently, further research could provide wider applications.

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