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## Fabrication of Compressed Air Engine using Double Acting Cylinder

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### ABSTRACT

*The environmental pollution in the metropolitan cities is increasing rapidly mostly because of the increased number of fossil fuel powered vehicles. Many alternative options are now being studied throughout the world. One of the alternative solutions can be a compressed air powered engine. The main advantage of this engine is that no hydrocarbon fuel is required which means no combustion process is taking place. In this work, a pneumatic cylinder activation is used as a linear source and with the help of crank shaft, the rotational movement is obtained. The flow of air inside the pneumatic cylinder is controlled by means of a solenoid valve which is actuated periodically by an electronic control unit. As we completely changed the usage of existing conventional engine to a simplified air powered one, this new technology is easy to adapt. Another benefit is that it uses air as fuel which is available abundantly in the atmosphere. With the use of these technological advances this small concept of using compressed-air could really make a difference. The use of pneumatics could help save the fuel costs to a great extent. This concept mainly focuses on the non-usage of the conventional style fuels that have been used for centuries in automobiles and as a result, there has been a tremendous growth in the pollution sector especially in the busiest countries. Also, the anti-pollution measures taken by humans are very less so that means we are the verge of global warming which inflicts a great deal of disaster on a large scale human as well as other living population. Future modifications could render some major design revolutions that could let us use this in many sectors.*

**Keywords:** *Pneumatics, Engine, Unconventional, Crankshaft, Microcontroller, Double Acting etc.*

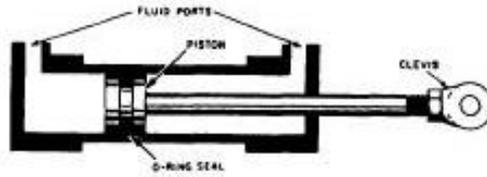
### 1. INTRODUCTION

The rate depletion of conventional sources of energy is much faster than the new ones are made, which puts us in place to consider and identify the other sources of energy to drive the needs of the world. This study presents the methodology towards design and fabrication of a compressed air engine equipped with pneumatic energy support. Gasoline, which has been the main source of fuel for the history of cars, is becoming more and more expensive and impractical (especially from an environmental standpoint). But the cost is not only the problem with using gasoline as our primary fuel. It is also affecting the environment, and since it is not a renewable resource, it will eventually run out. So this calls for a new age of fuel which does not involve the conventional fuels.

### 2. KEY COMPONENTS

#### 2.1 Double Acting Cylinder

Double Acting Cylinders are equipped with two working ports- one on the piston side and the other on the rod side. To achieve forward motion of the cylinder, compressed air is admitted on the piston side and the rod side is connected to exhaust. During return motion, supply air admitted at the rod side while the piston side volume is connected to the exhaust. Force is exerted by the piston both during forward and return motion of cylinder. Double acting cylinders are available in diameters from few mm to around 300 mm and stroke lengths of few 150 mm up to 2 meters.



**Fig -1 Double Acting Cylinder**

### 2.2 Crankshaft

The crankshaft is an engine component that converts the linear (reciprocating) motion of the piston into rotary motion. The crankshaft is the main rotating component of an engine and is commonly made of ductile iron. Features of a crankshaft include the crankpin journal, throw, bearing journals, counterweights, crank gear, and a power take-off (PTO). A crankpin journal is a precision ground surface that provides a rotating pivot point to attach the connecting rod to the crankshaft. The throw is the measurement from the center of the crankshaft to the center of the crankpin journal, which is used to determine the stroke of an engine. The throw is equal to one-half the stroke. The longer the throw, the greater the stroke, or distance, a piston travels.



**Fig -2 Crankshaft**

### 2.3 Coupling

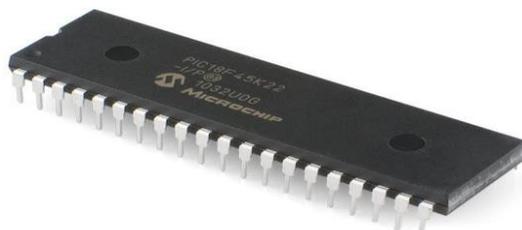
Couplings are mechanical devices used to connect together two shafts to transmit power. The coupling can have many functions, but their primary purpose is to connect shafts of units that are manufactured separately and rotating such as motor and generator. They, however, do permit some end movement or misalignment for flexibility and also provide easy disconnection of the two separate devices for repairs or modifications. They also reduce the shock that is transmitted from one shaft to another, protect against overloads and can alter the amount of vibration a rotating unit experiences.



**Fig -3 Coupling**

### 2.3 Microcontroller

The term PIC, or Peripheral Interface Controller, is the name given by Microchip Technologies to its single-chip microcontrollers. These devices have been phenomenally successful in the market for many reasons, the most significant ones are mentioned below. PIC micros have grown in steadily in popularity over the last decade, ever since their inception into the market in the 90's. These PIC's have been found to be quite useful especially in the field of automation and in this case the actuation of the double acting cylinder.



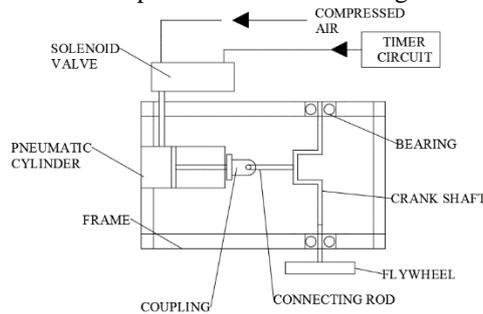
**Fig -2 Microcontroller**

### 2.3 Electronic Solenoid Valve

A solenoid valve is an electromechanical device used for controlling liquid or gas flow. The solenoid valve is controlled by electrical current, which is run through a coil. When the coil is energized, a magnetic field is created, causing a plunger inside the coil to move. Depending on the design of the valve, the plunger will either open or close the valve. When electrical current is removed from the coil, the valve will return to its de-energized state.

### 3. CONSTRUCTION

The base frame for mounting overall arrangement is fabricated with the help of square tubes and channels with the help of metal cutting and metal joining process called welding. The pneumatic cylinder is rigidly mounted on the base frame whose end of the piston rod is coupled to the crank shaft which is coupled to the base frame with the help of bearing at its end for attaining free rotation, for converting the linear translation to rotational motion connecting rod couples piston and crankshaft. The pneumatic cylinder is connected to the solenoid valve with the help of hoses for controlling it timer circuit is paired with it.



### 4. WORKING PRINCIPLE

When the timer circuit get turned on it functions the pneumatic cylinder to extend and retract based on the programmed time control. The solenoid valve allows the compressed air from the compressor to the pneumatic cylinder to extend it. This linear activation obtained is converted into half the rotation of crank shaft and its next half rotation is obtained by retraction of the pneumatic cylinder. Due to its continuous activation, a rotational movement is obtained which is stabilized with the help of flywheel arrangement and it is utilized for commercial applications.

### 5. SCOPE

This concept has great potential to be developed into the main product in upcoming years, where a permanent solution of a usage of an Air tank to be used along with the construction's setup. Just like filling up the conventional vehicles i.e. like petrol or diesel etc. The same ideology could be applied to this concept of a product. Separate booth with compressors for filling-up of the air tank could be done like any other petrol or gas stations. With proper care and calculated steps of hard work, these air vehicles could be the next stage of revolution in the automobile industry.



### 6. CONCLUSION

Compressed air technology is the best technology for emission of harmful gases because in this no combustion or burning of fuel takes place. It is eco-friendly and pollution free and economical and also gives a solution to fuel crisis and environment problems. If further research and improvement are carried out with it stress analysis, thermodynamic analysis and to minimize the losses to increase the efficiency. This technology of air driven engine in modern days will become boon to our future generation. By using more techniques, they can be modified and developed according to the applications. It's important to remember that while vehicles running on only compressed air might seem like a distant dream, but they still have public interest due to their environmentally friendly nature.

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