

# PNEUMATIC GEAR CHANGER FOR FOUR WHEELERS

N.VENKATESH<sup>1</sup>, P.KARTHIKEYAN<sup>2</sup>, R.MATHU PRASATH<sup>3</sup>, P S SABARI GIRISH<sup>4</sup>,  
S.AZARUDIN<sup>5</sup>

<sup>(1)</sup>Assistant Professor, Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu, India

<sup>(2, 3, 4)</sup> Student, Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu, India

## Abstract

*Pneumatic Gear Changer can be used in four wheelers easily because the availability of compressor is there. So we don't need extra support. In this we used principles of Mechatronics in developing this project work. The standing mechanism is achieved by reciprocating the double acting cylinders which controlled by single solenoid operated 5/2 way Directional control valve. This is actuated through the dashboard panel in front of the driver through the buttons. The operating pressure required for this system is 5 to 6 bar. The maintenance required for this system is less than the other systems. It is used to reducing the gear shifting time without losing the break power and the efficiency is improved. The main advantages of our project are elimination of wear and tear, simple in operation, fast movement in control and less space by elimination of linkages. Our project is a gear changing device, in which gear is changed using pneumatic power so that it avoids wear and tear.*

**Key Words:** efficiency, wear and tear, pneumatic

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## 1. INTRODUCTION

Automation is nowadays followed because shortage skilled labor and also to increase the accuracy, faster production through machines. So companies prefer automation considerably but it leads the moderate people to buy it difficult for their regular use. Our project deals with one of the automation to afford it for a low cost and it is a Pneumatic Gear Changer which is used to avoid wear and tear with faster shifting of gear. In this we are using solenoid operated AC valve which is a 2 position and 5 ports so it is used to shift gears as it is in four wheelers and double acting cylinders are used in this setup with air as a working fluid it is carried out by an air compressor. In this setup when the button is operated the air enters in to the cylinder based on the operation of solenoid so gear is shifted to front and back. When the second button is operated the gear shifted to third and fourth position. Even though automatic gear transmission is introduced but it is not cost efficient. It is used in cars more 4.5 lakhs so normal operated old cars can utilize this project to make transmission of gears easier.

### 1.1 PNEUMATICS

The word "pneuma" comes from Greek and means wind. The word pneumatics is the study of air movement and its phenomena is derived from the word "pneuma". Today pneumatics is mainly understood to means the application of air as a working medium in industry

especially the driving and controlling of machines and equipment. Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system.

When the pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

### 1.2 PNEUMATIC POWER

Pneumatic systems use pressurized gases to transmit and control power. Pneumatic systems typically use air as the fluid medium because air is safe, low cost and readily available.

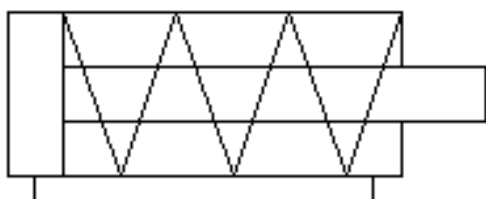


Fig 1

**ADVANTAGES OF PNEUMATICS:**

1. Air used in pneumatic systems can be directly exhausted back in to the surrounding environment and hence the need of special reservoirs and no-leak system designs are eliminated.
2. Pneumatic systems are simple and economical.
3. Control of pneumatic systems is easier.
4. The air could move at speed that can be adjusted from low to high. When using the pneumatic cylinder actuator, the piston speed can reach 3m/s.

**DISADVANTAGES OF PNEUMATICS:**

1. Pneumatic systems exhibit spongy characteristics due to Compressibility of air.
2. Pneumatic pressures are quite low due to compressor design limitations(less that 250 psi).

**2. PROBLEM IDENTIFICATION**

Automation is nowadays carried out in because less skilled labor, more time lag to complete process and also to increase the accuracy, faster production of machines.so companies prefer automation but it leads the moderate people to buy it difficult for their regular use. Most of the researches in automobile is being automated so it made the manual transmission to make it as automated one it will be easier for transmission. We used some simple components to make it simple and affordable.

**3. COMPONENTS USED**

Table 1

S.NO	COMPONENTS	QUANTITY
1	DOUBLE ACTING CYLINDERS	2
2	5/2 WAY SOLENOID OPERATED AC VALVE	2
3	VALVE CONNECTORS	5
4	HOUSING UNIT	1
5	GEAR LEVER	1
6	COMPRESSOR	1
7	GEAR ARRANGEMENT	1

**4. COMPONENTS DESCRIPTION**

In this pneumatic gear changer for four wheelers we use some electronics as well as with mechanical components. The components we used here are

- Double Acting Cylinder
- 5/2 Way solenoid operated AC valve
- Air compressors
- Gear Lever
- Pneumatic fittings
  - Bulk head union
  - Flexible hoses

**4.1 DOUBLE ACTING CYLINDER**

It consists of a piston inside a cylindrical housing called a barrel. Attached to one end of the piston is a rod which the rod end has one port. This rod end port is used for entrance of air and extends outside one end of the cylinder. At another end is a port for exit of air. Double acting cylinder can be extended and retracted pneumatically. The smallest bore size of a double acting cylinder is 1 1/8 inch. The piston, which is made of ductile Iron, contains u-cup packing to seal against leakage between the piston and

barrel. The ports are located in the end caps, which are secured to the barrel by bolts and nuts.

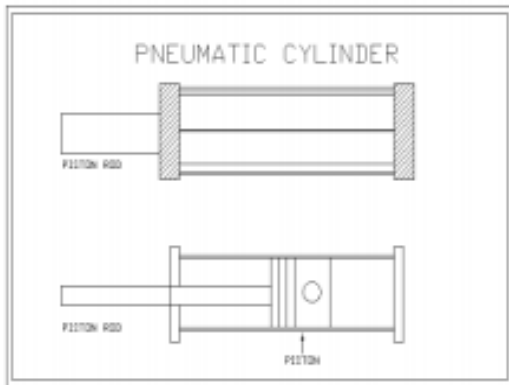


Fig 2

## 4.2 SPOOL VALVE

The spool is rod in 5/2 valves, so that 5/2 valve is called "Spool Valve". It used to change the path of flow of air.

### 4.2.1 DIRECTION CONTROL VALVES

A direction control valve is used to change the direction of airflow as and when required by the system for reversing the machine tool devices. A direction control valve may be classified, according to the construction of the internal moving parts, as

1. Rotary spool Type.
2. Sliding Spool Type.
3. Solenoid operated valve.

### 4.2.2 SOLENOID OPERATED VALVES

Solenoid valves are electromechanical devices like relays and contractors. A solenoid valve is used to obtain mechanical movement in machinery by utilizing fluid or air pressure. The fluid or air pressure is applied to the cylinder piston through a valve operated by a cylindrical electrical coil. The electrical coil along with its frame and plunger is known as the solenoid and the assembly of solenoid and mechanical valve is known as solenoid valve. The solenoid valve is thus another important electromechanical device used in control of machines. Solenoid valves are of two types,

1. Single solenoid spring return operating valve,(5/2)
2. Double solenoid operating valve

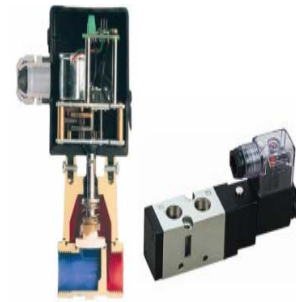


Fig 3

## 4.2.3 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 (i.e., compressed 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 upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. 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, the air compressor turns on again and re-pressurizes the tank.

### 4.2.3.1 COMPRESSOR MAY BE CLASSIFIED IN TWO GENERAL TYPES.

1. Positive displacement compressor
  2. Turbo compressor
- Positive displacement compressors are most frequently employed for Compressed air plant and have proved highly successful and supply air for pneumatic control application. The types of positive compressor

1. Reciprocating type compressor
2. Rotary type compressor



Fig 4

## 4.2.4 GEAR LEVER

It is component used to shift gears in an automobile so it can be easily shift between gears at ease. In this setup we have used the gear rod of maruthi Omni so that it is of less cost and affordable one. A gear stick or gear lever or gearshift is a metal lever attached to the shift assembly in a manual transmission-equipped automobile and is used to change gears.

In an automatic transmission-equipped vehicle, a similar device is known as a gear selector. A gear stick will normally be used to change gear whilst depressing the clutch pedal with the left foot to disengage the engine from the drivetrain and wheels. Automatic transmission vehicles, semi-automatic transmissions, and those with continuously variable transmission gear boxes do not require a clutch pedal.



Fig 5

#### 4.2.5 PNEUMATIC FITTINGS

There are no nuts to tighten the tube to the fittings as in the conventional type of metallic fittings. The tube is connected to the fitting by a simple bush ensuring leak proof connection and can be released by pressing the cap and does not require any special tooling like spanner to connect (or) disconnect the tube from the fitting.

#### 4.2.6 FLEXIBLE HOUSES

The Pneumatic hoses, which is used when pneumatic components such as actuators are subjected to movement. Hose is fabricated in layer of Elastomer or synthetic rubber, which permits operation at high pressure. The standard outside diameter of tubing is 1/16 inch. If the hose is subjected to rubbing, it should be encased in a protective sleeve.

### 5. BLOCK DIAGRAM

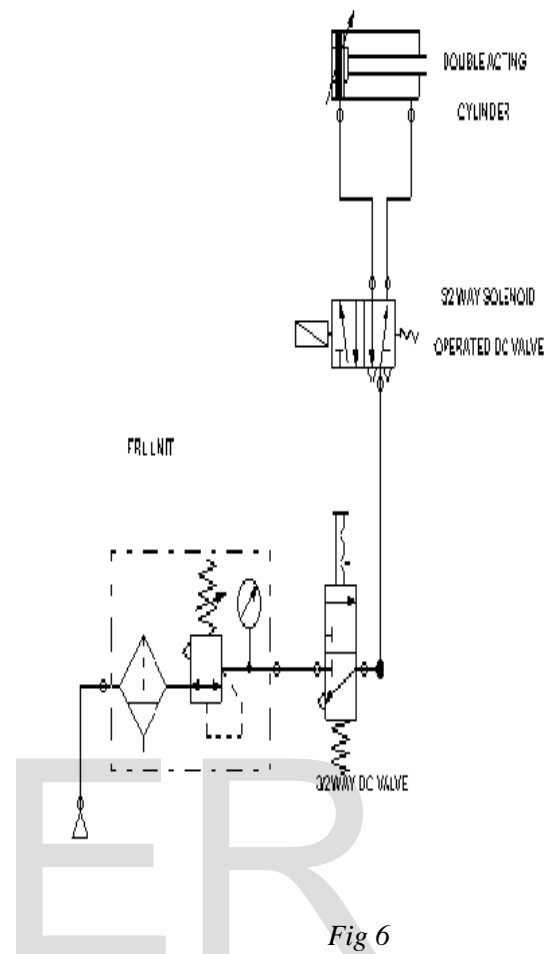


Fig 6

### 6. WORKING METHODOLOGY

The gear shifting operation is start when lever is turned in the control valve. When the hand lever is turned, the 5/2 way directional controlled solenoid valve supplies pressurized air to the air cylinder in the pneumatic cylinder unit. The piston rod pushes the yoke in the gear changer .thus gear drive changes to next speed. The cylinder in 'A-(MINUS) position the middle gear connects the bottom shaft gears and in A+ position the middle gear connects the top shaft gears. Then the gear shifting operation is performed in ease so the devise works perfectly using the principle followed. In this construction there are two pneumatic cylinders consisting of pistons on either side of the vehicle pedal for engaging the gear. The cylinders are operated with the help of a pressurized air coming from compressor and it is controlled by a control unit (micro controller). This microcontroller (chip) is pre-programmed for working of the system. The role of two pneumatic cylinders is one for increasing the gear speed and for decreasing the gear speed. For the forward motion one cylinder is actuated & for the reverse motion second cylinder is actuated.

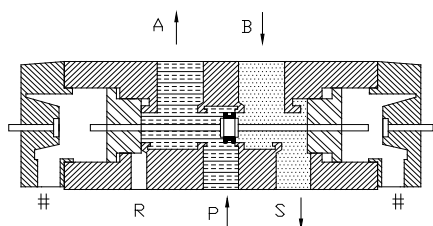


Fig 7

## 7. FABRICATED MODEL



Fig 8

## 8. ADVANTAGES

- It requires simple maintenance cares.
- The moving parts of this system are cooled by the oil itself used. Thus this project does not require any cooling arrangements.
- The safety system for automobile.

- Checking and cleaning are easy because of the main parts are screwed
- Easy to handle.

## 9. DISADVANTAGES

- Initial cost is high.

## 10. APPLICATION

It is very much useful for car Owners & Auto-garages. This automatic gear shifting system is used for smooth engagement of gear selecting for the vehicles. Thus it can be useful for the following type of vehicles.

- 1) MARUTHI
- 2) AMBASSADOR
- 3) FIAT
- 4) MAHINDRA
- 5) TATA

## 11. CONCLUSION

With more automation is one the way to make life easier but it must be affordable to live a life in a sustainable way so this product gives some of the glimpses of automation at a low cost which is easier to handle as well as gives more smooth operation than normal system. In the past years the pneumatic is used in this gear shifting process is utilized in Two Wheelers but it is not been tested in four wheelers our project gives the best solution for it than in Two Wheelers. Conventionally, the automatic transmission are being used in cars of high end models. So our project gives way for old cars as well as car owners who can't afford a new car they can use this system which is affordable one than other automated works used in cars. Another important thing is it doesn't require more power consumption. On further developments we can also implement this system in high end cars also it provides more advantages than the current one.

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