

## Electro-Pneumatic Gear Shifter

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**Abstract**— gear shifting mechanism was designed & applied to make the shifting process faster and less destructible for the driver. The new device must be reliable and has a small dimensions, low construction & maintenance cost. This project aims to improve gear shifting process using devices such as a manual four speed gear box, single pneumatic double acting cylinders, single pneumatic two position five ways directional control valves, an electrical motor, a belt, two pulleys, push button, compressor, power supply. According to gear shifting method, the driver can select transmission gear ratio without moving his/her hands from the steering wheel by putting the gear shifting push buttons on the steering wheel. Using this method, leaves to the driver the excitement of choosing the shifting moment.

**Key words:** Gear Shifter, pneumatic gear

### I. INTRODUCTION

The gear shifter is the part of the gearbox which has the shift forks & allows the contact from the driver to the synchronization. They make it possible to choose the gear and to switch this in or out. The invention of the gear shift is attributed to Karl Benz.

This is the part for which it is possible to make an automation. Further these parts can be designed so compact so that it is possible to build a very modular transmission with less weight. The benefit of the compact build of the shifting is not only the gain of modulation and less weight but also the time during the production and space in the whole drivetrain. Depending on the space around the total drivetrain and type of car, for automation a hydraulic, pneumatic or electric actuator can be used. For private cars, a hydraulic or electric actuator is most often used. Further, such a system also needs an electronic application. Currently started designing electro pneumatic gear shift system for formula student racing car. The objective was to modify the existing mechanical shifting arrangement on the Pacific Motorsports Formula SAE vehicle to an electro-pneumatic system such that the shift sequence is executed in the shortest time possible.

According to suggested gear shifting method, the driver can select the transmission gear ratio without moving his hands from the steering wheel by pushing the gear shifting push buttons on the steering wheel. Using this method, leaves to the driver the option of choosing the shifting moment.

### II. LITERATURE SURVEY

Manual transmission is most popular among passenger cars, in which gear can be selected according to road load and driving conditions. It requires human effort, accuracy and skill to select particular gear under different conditions. Under city driving condition, it is difficult to shift the gear frequently while negotiating traffic. The shifting effort and

shifting frequency differs with different age group and genders. It may lead to higher fuel consumption and wear and tear of the gear if it is not properly operated. To overcome these difficulties alternative arrangement is essential and one such option is the push button operated gear shifting mechanism. This kind of gear shifting mechanism is very in two wheelers for special purpose vehicles.

Working prototype of the push button operated gear shifting mechanism has been tested for its functionality for the entire range of gear shifting. It can be easily incorporated to four wheelers for shifting gears with minimum alternations and the gear position can be displayed. As further improvement, the output speed of the gear box can be measured and used as an input for transmission control.

### III. ELECTRO PNEUMATIC GEAR SHIFTING METHOD

Instead of using clutch as in case of conventional Gear Shifting Mechanism, we used Compressed Air. With the help of compressed air, we actuate double acting cylinder which in turn helps to shift the gears by using DCV (Direction Control Valve).

The operation becomes quite easy and requires less time to operate. Driver does not need to remove his hand from steering in order to operate the lever as in case of conventional gear shifting mechanism.

### IV. BLOCK DIAGRAM & DESCRIPTION

#### Pneumatic auto gear changer

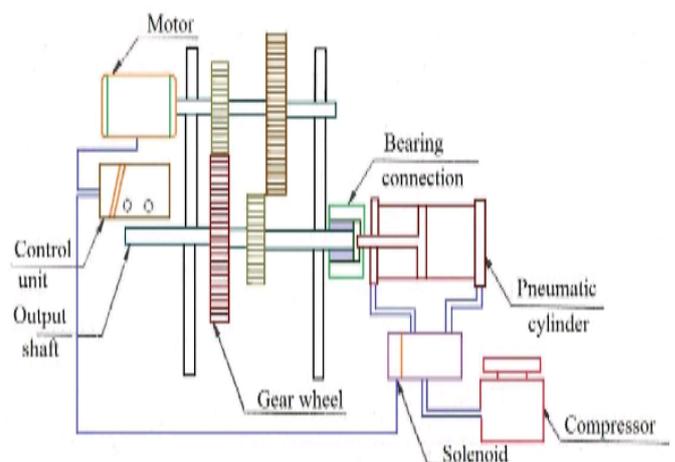


Fig.1 Block diag of pneumatic gear changer

The construction of the Automatic gear box comprises of the following parts.

#### A. Base Frame

The base frame is a structural element that supports the entire gear box system. The frame carries the drive system at its lower end which comprises of the LH and RH rear bearing housings. The drive motor is mounted on the base frame.

#### B. Drive system:

Drive system comprises of the single phase AC commutator motor with following specifications

Single phase AC motor

Commutator motor

Power = 1/15hp=50 watt

Speed= 0-6000 rpm (variable)

#### C. Pneumatic linear actuator

The Pneumatic Linear Actuator is an standard cylinder DNU-16-25-PPV-A. This cylinder is an double acting cylinder that is operated by an pneumatic valve 5/2 way. The valve is supplied compressed air from the compressor by means of filter-regulator-lubricator (FRL) unit.

This linear actuator is used in the following positions,

- 1) 1st gear
- 2) 2nd gear
- 3) 3rd gear
- 4) 4th gear

#### D. Shifter mechanism

The shifter mechanism is an assemblage of levers actuated by the linear actuator as mentioned above. This shifter is normally in neutral condition, it shifts the gears at start of cycle and releases it at end of cycle.

#### E. Position control system

The position system comprises of the following components;

- 1) 5/2 way, hand operated valves, center off, detent type
- 2) Pneumatic cylinder DPNC connectors.

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 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.

The two solenoid valves are connected to a compressor with the help of hoses of  $\varnothing 6$ mm from which pressurized air is extracted. The solenoid valves are followed by two pneumatic cylinders with the help of air hoses. The cylinders are followed by a clutch pedal. Next to the clutch pedal gear box and a motor arrangement is present. The construction also includes a proximity sensor which senses the speed of the wheel. The precise signals are sent to the solenoid valves by the control unit through the relays. Therefore the input is speed of the wheel sensed by a sensor and the output is shifting of gear accordingly. The power to the control unit is supplied from the 12V battery. On the other hand the shifting of gear can be monitored on an LCD. It also consists of DC motor, ATMEGA

Development board, speed regulator (accelerator), transformer etc.

#### V. CONCLUSION

The project presented has involved the development and implementation of automatic transmissions for bikes. The motivation of this work is to implement this idea in clutch featured bikes with a suitable clutch control. The automatic transmission can be also used in 5 and 6 speed versions by altering few changes in the program. Therefore from the above calculations it is evident that the forces exerted by the cylinders are optimum to move the shifting levers (pedals). According to the achieved results, the suggested mechanism is realizable & workable. Using the simplest PLC and required hardware enables to convert the old traditional gear shifting mechanism to semiautomatic one. The application of this mechanism leads to make the driving process simple and reduces the risk of destabilizing the car, the lap/stage time, and the chance of miss shifting.

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