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Semi-automatic pneumatic gear shifting

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Abstract - *In this project, a gear shifting mechanism is designed and applied to make the shifting process faster and less destructible for the driver. The new device must be reliable, with small dimensions, low construction and maintenance cost. This project aims to improve gear shifting process using devices as: a manual four speed gear box, two pneumatic double acting cylinders, two pneumatic two position five ways directional control valves, , an electrical motor, a belt, two pulleys, limit switches, push buttons, bulbs, a table (holder) and power supply. According-to suggested gear_ shifting method the driver can select the transmission gear ratio without moving his 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 Mechanism, Gear Box, buttons, pneumatic, control valves.

1.INTRODUCTION

This study describes in detail in an understandable way to how to convert the traditional manually gear shifting mechanism to a semi-automated gear shifting mechanism. The development has concluded also the gearbox, which became much smoother and produces less noise. Gear shifting mechanism must be easy to use and workable, these demands are very important especially for small cars used by special needs people.
For some drivers, the gear shifting can cause some confusing at driving specially at critical situations. A crowded road on a hill or a sudden detour makes a lot of tension on the driver. One of the difficulties in this situation is to choose the right reduction ratio and engaging it at the right time. This design helps the driver to increase his focusing on the road. Also reduces the time needed to engage the required reduction ratio, which increases the vehicles response.

2.PROBLEM STATEMENT

Now a day, in modern vehicles, such type of gear shifting mechanism is used for power transmission. 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 alternation and the gear position can be displayed. As further improvement, the output speed of the gearbox can be measured and used as an input for transmission control.

3. SCOPE

In future Use composite material to reduce weight of material and increase life of machine.

4.OBJECTIVE

In manual transmission gear can be selected according to road load and driving conditions. It requires human efforts, accuracy and skills to select particular-gear under different conditions. Under city driving condition, it is difficult to shift the gear frequently while negotiating traffic. 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 is the push button operated gear shifting mechanism. This kind of gear shifting mechanism is very useful in four wheelers for special purpose vehicles.

4.CONSTRUCTION

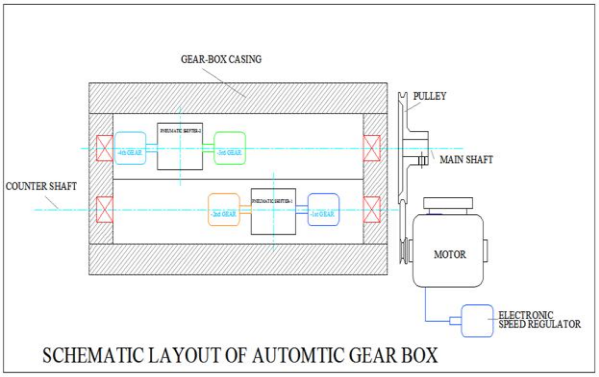

Fig 1: layout of automatic gear box

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

1.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 is consists of LH and RH rear bearing housings. The drive motor is mounted on the base frame.

2. Drive System
Drive system consists of the single phase AC commutator with following specifications:
Single phase AC motor
Commutator motor
TEFC construction
Power = 1/15 HP + 50 Watt
Speed= 0-6000 rpm (variable)

3. Pneumatic linear Actuator
The pneumatic linear actuator is a standard cylinder DNU-16-25-PPV-A.
This cylinder is a double acting cylinder that is operated by the 5/2 way pneumatic valves. 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. 2^{nd} gear
2. 4^{th} gear

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

5. Position Control System
The position system consists of the following components:
a. 5/2way, hand lever operated valves, center off, and detent type.
b. Pneumatic cylinder DPNC connectors.

5.WORKING

The pneumatic circuit is as shown, the motor is started to drive the main shaft by means of belt and pulley arrangement, initially the gear box is in neutral ie, the output shaft does not rotate. When the 5/2 way direction control valve -1 is operated the cylinder -1 operates the piston to move in the right hand direction (Cylinder extends) thereby bringing the 4th gear into engagement, and thus the output shaft starts to rotate thereby transmitting power from the input (motor/engine) to the output (differential).
The flow control valve in the circuit governs the pressure which is of the order of 1.5 to 2 bar, hence the governed pressure causes the gradual push provided to the piston rod which brings about gradual engagement of the gears hence, (effect of gradual clutch release for smooth engagement is not required). When the 5/2 way direction control valve -1 is operated the cylinder -1 operates towards left (Cylinder Retracts) as the piston rod is locked for movement left, hence first the fork shifter moves towards left bringing on the neutral position and then slides farther left to bring the 2nd gear into engagement.

5. CONCLUSIONS

1. According to the achieved results, the suggested mechanism is reliable and workable.
2. Hardware enables to convert the old traditional gear shifting mechanism to semi-automated one.
3. The application of this mechanism leads to make the driving process easier, reduces the risk of destabilizing the car, the lap/stage time and chances of miss-shifting.
4. The gear shifting mechanism is designed and applied to make the shifting process faster and less destructible for the driver.
5. We redesign the gear shifter to change the gear without removing hand from steering and not spending time in operating the lever.

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