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IMPROVE GEAR SHIFTING PROCESS USING DEVICES AS AUTO PNEUMATIC GEAR SHIFTER

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Abstract - In this study, a gear shifting mechanism was designed and applied to make the shifting process faster and less destructible for the driver. The new device must be reliable, has a small dimensions, low construction and maintenance cost. This paper aims to improve gear shifting process using devices as: a manual four speed gear box, two pneumatic double acting cylinders, Programmable Logic Controller (PLC), an electrical motor, limit switches, push buttons, bulbs, a table (holder) and power supply. According to suggested gear_ shifting method the control unit chooses optimum gear shifting ratio for an automobile without operating it manually (using relays). Using this method leaves to the driver the excitement of choosing the shifting moment.

***Key Words*: Control Unit (Relays) - Programmable, Pneumatic Cylinders, Solenoid Valves, Gear Box, Gear Shifting Mechanism, Pneumatic linear actuator.**

1. INTRODUCTION

At present due to the extended difficulties in manual operations, the technology has shifted from manual to automatic; few of them include ABS system, active steering system e.t.c., in order to increase passenger safety and comfort. Increasing demands on performance, quality and cost are the main challenge for today's automotive industry, in an environment where movement, component and every assembly operation must be immediately and automatically recorded, checked and documented for maximum efficiency. One of the automatic applications includes pneumatic gear changer. This study describes in detail in an understandable way to how to convert the traditional manually gear shifting mechanism by using microcontroller (control unit- relays).

A method of controlling a gear change of an automobile, said automobile comprising an internal combustion engine; an automatic transmission connected to an output rotation shaft of said engine so as to transmit the rotational output of said engine to drive wheels of said automobile through any selected one of a plurality of gear ratios; a load device selectively connectable to said output rotation shaft of said engine via selectively-connecting means; and means for generating a gear change control signal for selecting one of said gear ratios of said automatic transmission in accordance with one of operational conditions of said automobile and said engine said method comprising the steps of controlling said selectively-connecting means when said gear change signal-generating means generates the control signal for shifting up the gear in said automatic transmission, in such a manner that said selectively-connecting means connects said load device to said output rotation shaft of said engine.

For some drivers, the gear shifting can cause some confusing at driving especially 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 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. CONSTRUCTION

1) List of Components:

1. Base Frame: The base frame is an 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.

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

Single phase AC motor

Commutator motor

TEFC construction

Power = 1/15hp=50 watt

Speed= 0-6000 rpm (variable)

3. 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 an appropriate filter-regulator-lubricator (FRL) unit.

This linear actuator is used in the following positions,

a. 1st gear

b. 2nd gear

c. 3rd gear

d. 4th gear

4. 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.

5. Position control system: The position system comprises of the following components;

a. 5/2 way , hand operated valves, centre off , detent type

b. Pneumatic cylinder DPNC connectors.

The details of this relay system are given in the circuit diagram of the pneumatic .

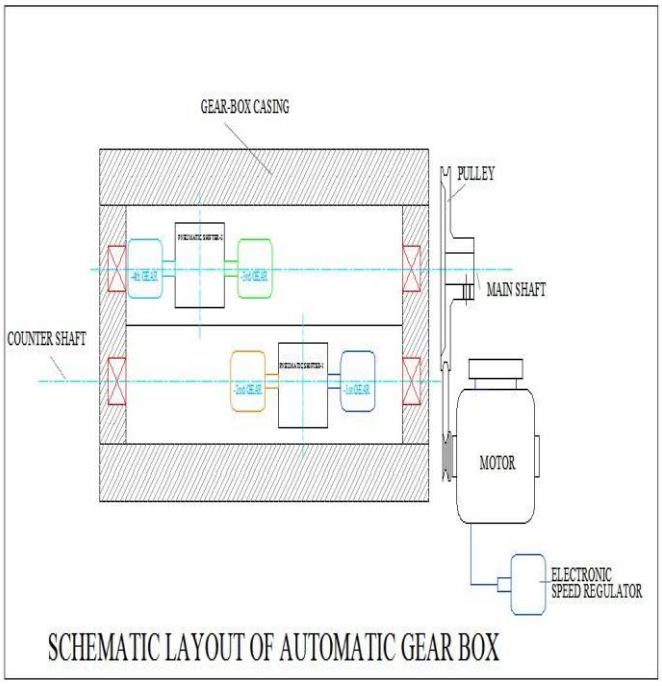

Fig 1-Schematic Layout of Automatic Gear Box.

3. Methodology

Design of Automatic Gear Box

In our attempt to design a **AUTOMATIC GEAR BOX** we have adopted a very careful a AGBoach, the total design work has been divided into two parts mainly;

- System design
- Mechanical design

System design mainly concerns with the various physical constraints and ergonomics, space requirements, arrangement of various components on the main frame of machine no of controls position of these controls ease of maintenance scope of further improvement; height of m/c from ground etc.

In Mechanical design the components are categories in two parts.

- Design parts
- Parts to be purchased.

For design parts detail design is done and dimensions thus obtained are compared to next highest dimension which are readily available in market this simplifies the assembly as well as post production servicing work.

The various tolerances on work pieces are specified in the manufacturing drawings. The process charts are prepared & passed on to the manufacturing stage .The parts are to be purchased directly are specified &selected from standard catalogues.

- **System Design:-**

In system design we mainly concentrate on the following parameter

1.System selection based on physical constraints:-

While selecting any m/c it must be checked whether it is going to be used in large scale or small scale industry In our case it is to be used in small scale industry So space is a major constrain .The system is to be very compact. The mechanical design has direct norms with the system design hence the foremost job is to control the physical parameters.

2. Arrangement of various components:-

Keeping into view the space restriction the components should be laid such that their easy removal or servicing is possible moreover every component should be easily seen & none should be hidden every possible space is utilized in component arrangement.

3. Components of system:-

As already stated system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact A compact system gives a better look & structure. Following are some example of this section

- Design of machine height

- Energy expenditure in hand operation
- Lighting condition of m/c

4. Chances of failure:-

The losses incurred by owner in case of failure of a component are important criteria of design. Factor of safety while doing the mechanical design is kept high so that there are less chances of failure. Periodic maintenance is required to keep the m/c trouble free.

5. Servicing facility:-

The layout of components should be such that easy servicing is possible especially those components which required frequent servicing can be easily dismantled.

6. Height of m/c from ground:-

For ease and comfort of operator the height of m/c should be properly decided so that he may not get tired during operation. The m/c should be slightly higher than that the level also enough clearance be provided from ground for cleaning purpose.

7. Weight of machine:-

The total wt of m/c depends upon the selection of material components as well as dimension of components. A higher weighted m/c is difficult for transportation & in case of major break down it becomes difficult to repair.

Input to the automatic gear box is to be given similar to engine drive hence the aAGBoach is to utilize an variable speed AC motor with the facility to vary input power and there by the input speed by use of an electronic variation.

4. Working Principle

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 preprogrammed 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.

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 doesnot 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 thereby bringing the 3rd gear into engagement, and thus the output shaft starts to rotate therby transmitting power fron 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 -2 is operated the cylinder -2 operates towards left 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 1st gear into engament .

Note : If both the valves ie , 5/2 way direction control valve -1&2 are operated simultaneously, the system is arranged such that neutral position will be achieved, hence the system beacomes fool proof,

Similarly the circuit works for the 2nd and 4th gear.

5. Advantages

- Semi-automated gear shifting mechanism.
- Gear shifting mechanism is easy to use and workable, these demands are very important especially for small cars used by special needs people.
- Gearbox becomes much smoother and produces less noise.
- Gear shifting less confusing.
- Easy 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.
- It reduces the time needed to engage the required reduction ratio, which increases the vehicles' response.

6. Disadvantages

- The system is bulky in construction
- The cost of setup is more.
- The system required compressor for operation.
- Adequate amount of air is required to change the gears.

7. Applications

- It is used to change the gear in crusher machine
- Used in automobiles
- Used for shift the gear in press machine

8. CONCLUSIONS

The application of this mechanism leads to make the driving process easier, reduces the risk of destabilizing the car, the lap/stage time, and the chance of miss shifting. 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 and as well as smooth shifting of gears in various applications.

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