Design and Fabrication of Hand Operated Gear Shifting Mechanism

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Abstract—The present automatic transmission is fully mechanically controlled and costs very high. In this study, a gear shifting mechanism was designed and applied on a clutch featured bike to make the gear transmission process faster and less destructible for the driver using push button System design. But the gear transmission mechanism designed makes driving easier and to achieve efficient driving. This new device must be reliable, has small dimensions, economical and low maintenance cost. This project aims to improve the gear shifting process with a suitable control mechanism to implement in clutch featured bikes. According to the suggested gear shifting method, the selects the transmission gear as per the speed of the vehicle without any human interference. A pneumatic shifter is a mechanical device that uses compressed air to shift a gear from the clutch near the driver to the engine of a vehicle. Pneumatic shifters should be viewed as a safety device. There is no lag time in a gear shift occurring at the clutch and taking hold in the rest of the vehicle.

Key words: Hose Pipes, Adapter, Pneumatic cylinder

I. INTRODUCTION

This invention relates to control mechanisms and more particularly to mechanisms for controlling the selection and establishment of various gear relations of automotive vehicle transmission gearing. Our invention relates to gear shift mechanisms particularly such as are used on automotive vehicles. It has for one of its principal objects to provide a gear shift mechanism pneumatically operated, through the instrumentality of which the various gears in the mechanism may be made operative.

Other objects are to provide a gear shift mechanism which is noiseless in its operation, which greatly relieves all strain on the parts with which it is connected, which has no parts easily broken or apt to get out of order, which may be operated with but slight skill on the part of the driver, which is suitable for all makes of automotive vehicles. And which can be manufactured at a relatively low cost.

As a rider when we have control over the gear shifter, typically with the rider’s left foot & to operate both the clutch and brake, drivers both hands & foot remains busy. To shift the control of gear, in hand from foot & to provide safety & comfort to driver is the need from the perspective of Ergonomics.

II. CONSTRUCTIONAL DETAILS

A. Pneumatic Cylinder:
Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

B. Compressor:
An air compressor is a device that converts power (usually from an electric motor, a diesel engine or a gasoline engine) into kinetic energy by compressing and pressurizing air, which, on command, can be released in quick bursts. There are numerous methods of air compression, divided into either positive-displacement or negative-displacement.

C. Hose Pipes:
A hose is a flexible hollow tube designed to carry fluids from one location to another. Hoses are also sometimes called pipes (the word pipe usually refers to a rigid tube, whereas a hose is usually a flexible one), or more generally tubing. The shape of a hose is usually cylindrical (having a circular cross section).

Hose design is based on a combination of application and performance. Common factors are Size, Pressure Rating, Weight, Length, Straight hose or Coil hose and Chemical Compatibility. Hoses are made from one or a combination of many different materials.

D. Adapter:
The adapter facilitates the connection of the crimping head to the pneumatics tooling assembly and provides the necessary straight line motion of the movable die when the pneumatics tooling assembly is actuated. The adapter features a switch, two quick pins, and a threaded SDE pin. The switch can be used to manually open and close the dies of the crimping head for insertion and removal of the product. The quick pins secure the outer housing tabs of the crimping head to the adapter, and the threaded SDE pin secures the movable die of the crimping head to the internal spring--loaded die holder and switch of the adapter.

E. Push Button:
A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, mash, and punch.
III. ACTUAL DESIGN

![Fig. 1:](image)

IV. WORKING PRINCIPLE

The main objective of this concept is to apply the gear by using automation system in automobile vehicles. This is the new innovative model mainly used for the vehicles to control the vehicle. Here we are concentrating to design the automatic gear changing mechanism in two wheeler vehicles by using the mechanical devices. This is very useful for the gear changing mechanism in automobile vehicles. By using this we can easily control the vehicle and improve the performance of the vehicle also we can avoid the wear and tear of the gear.

![Fig. 2:](image)

![Fig. 3: Top View](image)

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. 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 pneumatic cylinder is fixed at the end of the flat pedal rest. The plate rest has pivot at the centre. The cylinders are operated with the help of electric power supply and it is controlled by the control unit. One of the cylinders is used to apply the gear and another one for reducing the gears. The gears are applied on the vehicle depending up on the speed of the vehicle. When the vehicle speed increases automatically the clutch and the gear will change in the vehicles. The arrangement is clearly shown in the below diagram.

V. DESIGN CALCULATION

Following are the specification of the cylinder which are used in our system

- Single stroke cylinder
- Bore diameter=15.5mm
- Stroke length=50mm
- Piston diameter=12mm

<table>
<thead>
<tr>
<th>PRESSURE(BAR)</th>
<th>OBSERVATION</th>
<th>GEAR SHIFTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piston rod does not reach to gear lever</td>
<td>NO CHANGE</td>
</tr>
<tr>
<td>2</td>
<td>Piston rod does not reach to gear lever</td>
<td>NO CHANGE</td>
</tr>
<tr>
<td>3</td>
<td>Piston rod does not reach to gear lever</td>
<td>NO CHANGE</td>
</tr>
<tr>
<td>4</td>
<td>Piston rod does not reach to gear lever</td>
<td>NO CHANGE</td>
</tr>
<tr>
<td>5</td>
<td>Piston rod does not reach to gear lever</td>
<td>NO CHANGE</td>
</tr>
<tr>
<td>6</td>
<td>Piston rod reach gear lever</td>
<td>CHANGE</td>
</tr>
</tbody>
</table>

Table 1:

Therefore pressure \((p) = 6\) bar (max)

Piston area

\[ A = \pi x \left( \frac{12x10^{-3}}{2} \right)^2 / 4 \]

\[ = 1.13x10^{-4} \text{ m}^2 \]

1 bar = \(10^5\) Pascal

Force= pressure x area

\[ = 6 \times 10^5 \times 1.13x10^{-4} \]

\[ F= 67.8 \text{ N} \]

VI. RESULT

From the above calculation we get a 67.8N force which is required to shift the gear from initial position.

VII. RESULT AND CONCLUSION

The project presented has involved the development and implementation of pneumatic gear transmissions for bikes. The motivation of this work is to implement this idea in clutch featured bikes with a suitable clutch control. 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 and workable. Using the simplest pneumatic system and required hardware enables to convert the old traditional gear shifting mechanism to semi-automatic. The application of this mechanism leads to make the driving process easier, reduces the risk of destabilizing the bike, the lap/stage time, and the chance of miss shifting.
VIII. FUTURE SCOPE

In addition to the existing system, the digital display with a programmed logic circuit can be used in conjunction with shifting mechanism which will indicate the gear shifting status to the rider. The same idea can be extended for braking system in automobile. Thus reducing lot of efforts of driver and provide ease and comfort.

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