

Pneumatic Gear Shifting using Vehicle Suspension

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Abstract: The main objective of this paper is to do gear shifting pneumatically using vehicle suspension. For pneumatic gear shifting compressed air is needed. This compressed air can be produced by vehicle suspension system. Vehicle suspension system consists of shock absorber, non return valve and compressed air tank. The suspension system used in vehicle to reduce road shocks & vibrations due to irregularity of road surface. The vehicle undergoes in vibration which also cause discomfort to the rider. In order to provide comfort & safety suspension system is used in vehicle. Shock absorbers isolate the wheel of vehicle from the vehicle body so when the vehicle undergoes in vibrations, these vibrations get absorbed by shock absorbers. Thus during suspension kinetic energy is generated by using this kinetic energy we can produce compressed air & further can do gear shifting using this compressed air.

Keywords: Pneumatic System, Suspension system, Gear shifting.

1. INTRODUCTION

In pneumatic gear shifting, compressor sends the pressurized air to the lever operated direction control valve. Whereas the DCV acts as temporary storage of air & acts as passage. The air from direction control valve enters into pneumatic cylinders. Pneumatic cylinder is the main working medium in pneumatic gear shifting. These pneumatic actuators/pneumatic cylinders undergoes reciprocation that is extension & retraction during. During these working stroke gear shifting is takes place for this pneumatic gear shifting, the compressed air is needed which is produced by suspension of vehicle. Practically it is not possible to produce much pressurized air for gear shifting using suspension. Because suspension system only works when the vehicle undergoes in vibrations in order to do gear shifting, it is necessary to produce high pressurized air. So in order to make whole system reliable allied system/arrangement can be used. Battery operated compressor can be work as allied system for producing compressed air, also if cylinder is connect to shock absorber via bearing the reciprocatory motion of shock absorber also leads to reciprocation in cylinder attach to shock absorber. which can also produce compressed air. Thus, the system is somewhat hybrid type. system can be run in any condition if there is no any road disturbance then the battery operated compressor can be used. the compressed air from cylinder is stored in compressed air tank. non return valve is provided in order to avoid back flow. for making gear shifting more efficient electro pneumatic system can be used. these system intends to avoid wastage of kinetic energy during suspension and making gear shifting less destructible.

2. PROBLEM STATEMENT

While driving the vehicle, due to suspension system in vehicle energy is generated this is normally a kinetic energy. This energy is previously wasted but in our project we are converting that kinetic energy into compressed air by using piston-cylinder

arrangement in single acting cylinder. In this we are shifting gears using compressed air produced by suspension. Normally, manual method i.e. pedal operated arrangement is used for shifting of gears but in this arrangement most of the times their is chances of accident and also extra fuel consumption is there for gear shifting. But in case of gear shifting using pneumatics gear shifting is done automatically thus accidental chances are reduced & also fuel energy is being saved as we are using previously formed compressed air for pneumatic operation.

3. OBJECTIVE

1. Design development & analysis of mechanism for air compression using the suspension of vehicle.
2. Design development of pneumatically operated gear shifter which will be button operated for a single gear pair.
3. Combination of the air compression system & the Pneumatic gear shifter to effectively develop an autonomous & integrated system.

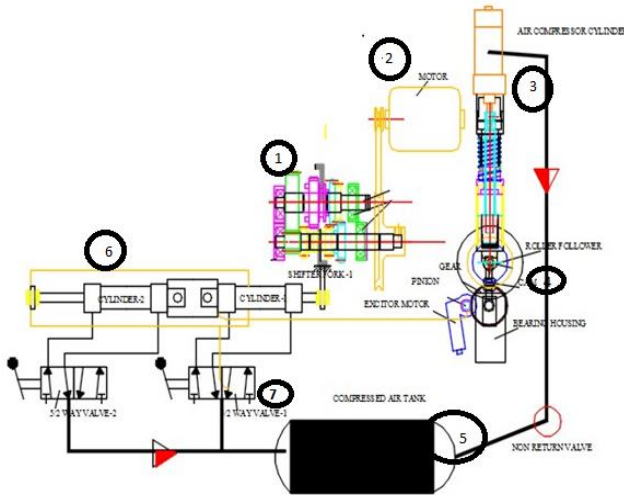
4. LITERATURE SURVEY

After careful study of the literature is come to the notice that although different researchers have individually studied the pneumatic gear shifter and the compressed air using suspension, no researcher is seen to combine both of the techniques. Considering that pneumatic gear shifter will need the compressed air and the compressed air using suspension system will only be useful with an application.. the combination of both techniques is a must for optimal use. Hence in our project we propose to fuse both the technologies so as to take maximum advantage of either methods and combine them to make an effective solution.

5.SCHEMATIC REPRESENTATION

D= 13.81 mm = 16 mm

Table no.6.1 Selection of Cylinder



Sr.No	Description
1	Gearbox
2	Electric Motor
3	Shock Absorber
4	Cam & Follower
5	Compressed air tank
6	Pneumatic Actuators/Cylinders
7	5/2 Direction control valve

Criterion	Feature
Piston Diameter	16
Piston rod thread	M6
Cushioning	Pneumatic cushioning ,adjustable at both ends(PPV)
Assembly Position	Any
Comforms to standards	ISO 6431
Cushioning Length	30mm
Theoretical Force at 2bar,return stroke	30N
Theoretical Force at 2bar,advance stroke	50N
Mounting type	With accessories
Material information for cylinder barrel	Anodized
Material information for piston rod	High alloy steel

6.SELECTION OF PNEUMATIC CYLINDER

7.COMPRESSOR SELECTION CRITERIA



Fig.6.1.Pneumatic cylinder

Specifications
 Working Voltage: 12V DC
 Maximum Amps. 15Amps
 Minimum Amps. 10Amps
 Rated Power – 120 Watt

Air Flow: 35 L/Min

+Maximum Working Pressure: 150 PSI

LED Flashlight: Bright Torch
 Display Units: PSI, KPA, Bar
 Continuous Operating Time: 30 Minute Maximum.

Selection of components:
 Selection criteria is how much amount of force a cylinder can be generates.determine this with the help of air pressure & bore size.). A general rule of thumb states that for vertical & high friction applications , The required force should be twice the load to be moved.In some cases additional force is necessary to compensate for friction. Designer can calculate cylinder force by multiplying the effective piston area by the working pressure .the effective piston area by the working pressure .

8.MOTOR SELECTION

Thus selecting a motor of the following specifications
 Single phase AC motor
 Commutator motor
 TEFC construction
 Power = 1/15hp= 50 watt
 Speed= 0-6000 RPM (Variable)
 The power from motor is transmitted from the motor shaft to input shaft of gearbox via belt drive using gear motor pulley ,Reduction pulley & belt.

9.SCOPE

- 1.Making gear shifting more efficient & automatic using Programmable logic controller, timers, proximity sensors we can make gear shifting process more reliable.
- 2.Use of non-conventional energy sources for energy generation.
- 3.We also operate braking system in two wheelers using pneumatics

$$F = \frac{\pi}{4} \times D^2 \times P$$

Where ,

F= Force

D= Diameter in mm

Pull force is

$$F = \pi \left(\frac{D^2}{4} - \frac{d^2}{4} \right) * P$$

$$30 = \pi \left(\frac{D^2}{4} \right) * (2 * 10^5)$$

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