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Automatic Gear Shifting Mechanism

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ABSTRACT:

This research is based on the solution for gear shifting for the cars. The passenger cars that now ply on the road have transmission either of manual or automatic type of gear changing. The manual type of transmission is preferred for the perfect performance without a loss in power but a compromise for comfort ness. In this type automatic system of power transmission there is easiness of gear shifting but there is a definite loss of power and mileage.

The main objective of this research is to create a mechanism to reduce the inconvenience caused when changing gears in the car. The gear shifting here is by mere pressing of feather touch buttons present on the dash board. The gear shifting is by hydraulic force achieved by a simple modification to the gear box. The setup consists of power steering pump, piston cylinder assembly and a set of fluid valves. This project if implemented is a clear alternative for the Automatic transmission because of its low cost and ease of use. Moreover the whole set up is small and requires a very small space. This can sure be a standard fitment if proper marketing strategy is carried out. Further, automatic clutch can be incorporated with this unit to make it fully automatic.

INTRODUCTION:

The earliest description of gears was written in the 4th century B.C. by Aristotle. He wrote that the “direction of rotation is reversed when one gear wheel drives another gear wheel” (Hellenic World encyclopedia). In the 3rd century B.C., various Greek Inventors used gears in water wheels and clocks, and sketches of various types of gears of around this time were found in Leonardo da Vinci’s notebooks later on. For a long period after these discoveries, there were no major development concerning wheels until the 17th century, when the first attempts to provide constant velocity ratios (conjugate profiles) was recorded and there was mention of the utilization of the involute curve. The 19th century saw the

first use of form cutters and rotating cutters and in 1835 English inventor Whitworth patented the first gear hobbing process. Various other patents followed until 1897 when Herman Pfauter of Germany invented the first hobbing machine capable of cutting both spur and helical gears. Through the 20th century various types of machines developed. But, the next major step came in 1975 when the Pfauter Company in Germany introduced the first NC hobbing machine and in 1982 the Full 6 axis machine was introduced. Gears have existed since the invention of rotating machinery. Because of their force-multiplying properties, early engineers used them for hoisting heavy loads such as building materials. The mechanical advantage of gears was also used for ship anchor hoists and catapult pre- tensioning. Early gears were made from wood with cylindrical pegs for cogs and were often lubricated with animal fat grease. Gears were also used in wind and water wheel machinery for decreasing or increasing the provided rotational speed for application to pumps and other powered machines. An early gear arrangement used to power textile machinery is illustrated in the following figure. The rotational speed of a water or horse drawn wheel was typically too slow to use, so a set of wooden gears needed to be used to increase the speed to a usable level. The industrial revolution in Britain in the eighteenth century saw an explosion in the use of metal gearing. A science of gear design and manufacture rapidly developed through the nineteenth century. Today, the most significant new gear developments are in the area of materials. Modern metallurgy has greatly increased the useful life of industrial and automotive gears, and consumer electronics has driven plastic gearing to new levels of lubricant-free reliability and quiet operation.

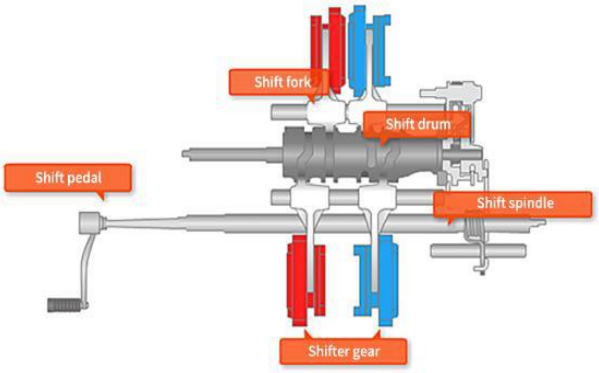


Fig. – 1

This research is aimed at giving driver the convenience for gear shifting. The car will have a series of buttons in the format of 4 forward, a reverse and a neutral. The clutch operation may or may not be put in the car depending on the user. The whole setup which is done on experimentation purpose proves to be a promising one. The power for gear shifting is got from hydraulic fluid. The power for fluid is from the power steering pump. So, a car with a power steering fitment can be easily adaptable.

PROBLEM DEFINITION:

Whenever research is carried out there is a reason behind it. The existing cars now pose some problems for the drivers. In the Manual Transmission cars the main problem for the drivers is the gear shifting. But the engineering concept behind this type of transmission paves way for higher power transmission efficiency. More over the mileage of the car and life is also more. These cars do not give much of comfort ness for the drivers in the terms of using the gear lever

and the clutch. Also it occupies a major area in the cabin resulting in the space congestion. These are the problems in the Manual Transmission cars.

In the Automatic Transmission type of cars, the gear shifting is easy. We just have to select the drive band, which is already pre-set. This selection may be either of lever type or a set of buttons. This is easy for the drivers as they don't have to use clutch during gear shift. But there is a compromise for power transmission and mileage. As the gear selection is by a fluid, power is required to drive it, so the engine performance is reduced. So the problem here is mileage drop, power loss and also it is costly.

The need of the hour, combining the position of both MT and AT a mechanism has to be created for better mileage and comfortable gear shifting. This is the objective of the project. So a car with this project provides ease of gear shift as in AT without a compromise in box.

METHODOLOGY:

Now here we calculate the range of speed of gear box output power and range of all minimum and
maximum rpm of the gear box shaft in every gear mashing condition…

If we consider the speed for first gear is 0km /h to 20km/h

For second 20km/h to

30km/h for third 30km/h to

45km/h and for greater than

45km/h

Take for the gear mashing. Here, we have the range in term of speed in km/h now converting the vehicle speed in rpm for that use the equation, as given below.

$$N=V*60/3.14\ D;$$

Where, N=speed in

rpm V=speed in m/s

D=tire diameter in m

Take, D=0.80 meter tire diameter. Thus by using this equation we can find the our speedometer speed km/h can convert in revolution per minute (rpm).

The torque converter is also in charge of driving the transmission fluid pump. The fluid pressure is what activates clutches and brakes in the planetary gear set. The pump is often a geroter type pump (a gear pump) meaning that a rotor spins in a pump housing and as it spins, it "meshes"

with the housing. This "meshing" creates chambers that change in volume. When the volume increases, a vacuum is created- this is the pump inlet. When the volume decreases, the fluid is compressed or pumped by the meshing of the gears- this is the pump exit. A hydraulic control unit sends hydraulic signals to change gears (via band brakes and clutches) and to lock the torque converter.

DESIGN OF A SYSTEM:

The project design comprises of designing the following parts,

1. Hydraulic circuit
2. Electronic circuit
3. Mechanical components

HYDRAULIC CIRCUIT:

Hydraulic motion is selected for gear shifting owing to its large load acceptance and ease of adaptability in the car. Also the gear shift should be quick. The basic components design is explained in detail.

SELECTION OF PUMP:

Selection of pump is based on following characteristics:

1. Select the actuator that is appropriate based on loads encountered.

2. Determine the flow rate requirements. This involves the calculation of the flow rate necessary to drive the actuator to move the load through a specified distance within the given time.

4. Select the pump based on application

5. Select the system pressure. These involves in with the actuator size and magnitude of the resistive force produced by the external load on the system. Also involved here is the total amount of power to be delivered by the pump.

6. Select the reservoir and associated plumping, including piping, valving, hydraulic cylinders, motors and other miscellaneous components.

7. Calculate the overall cost of the system.

8. Consider factors such as noise levels, horse power loss, need for a heat exchanger due to heat generated, pump wear, scheduled maintenance service to provide a desired life of the total system.

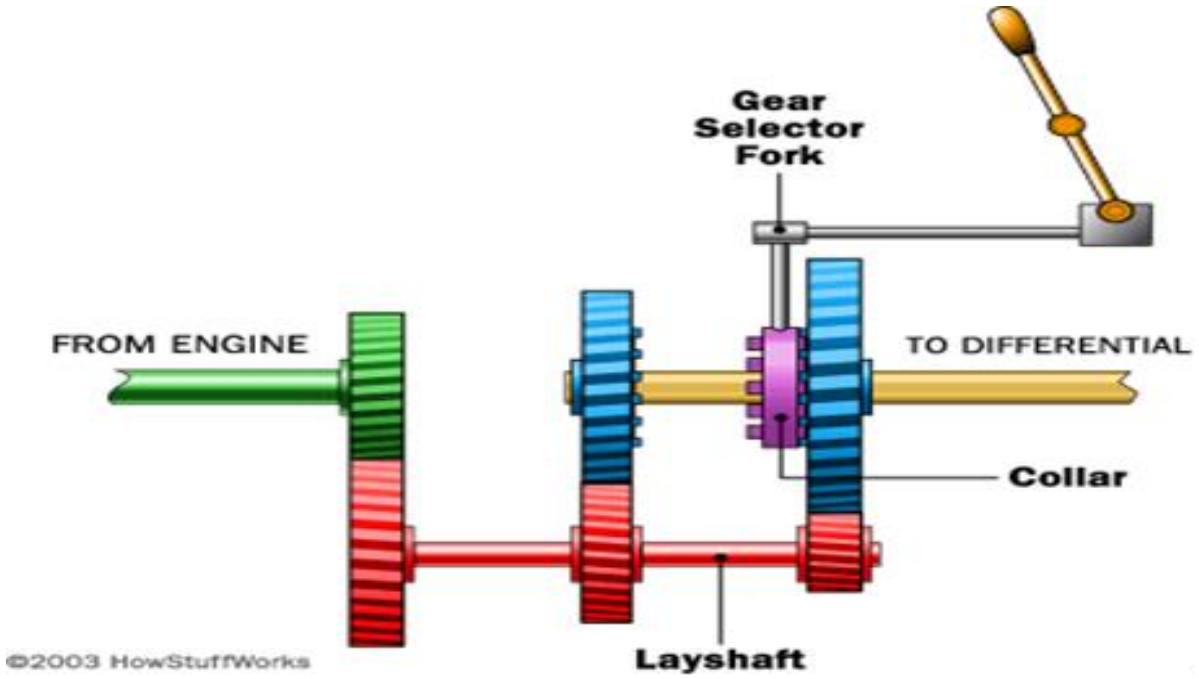

Gear
Selector
Fork
FROM ENGINE
TO DIFFERENTIAL
Collar
Layshaft
©2003 HowStuffWorks

Fig. – 2

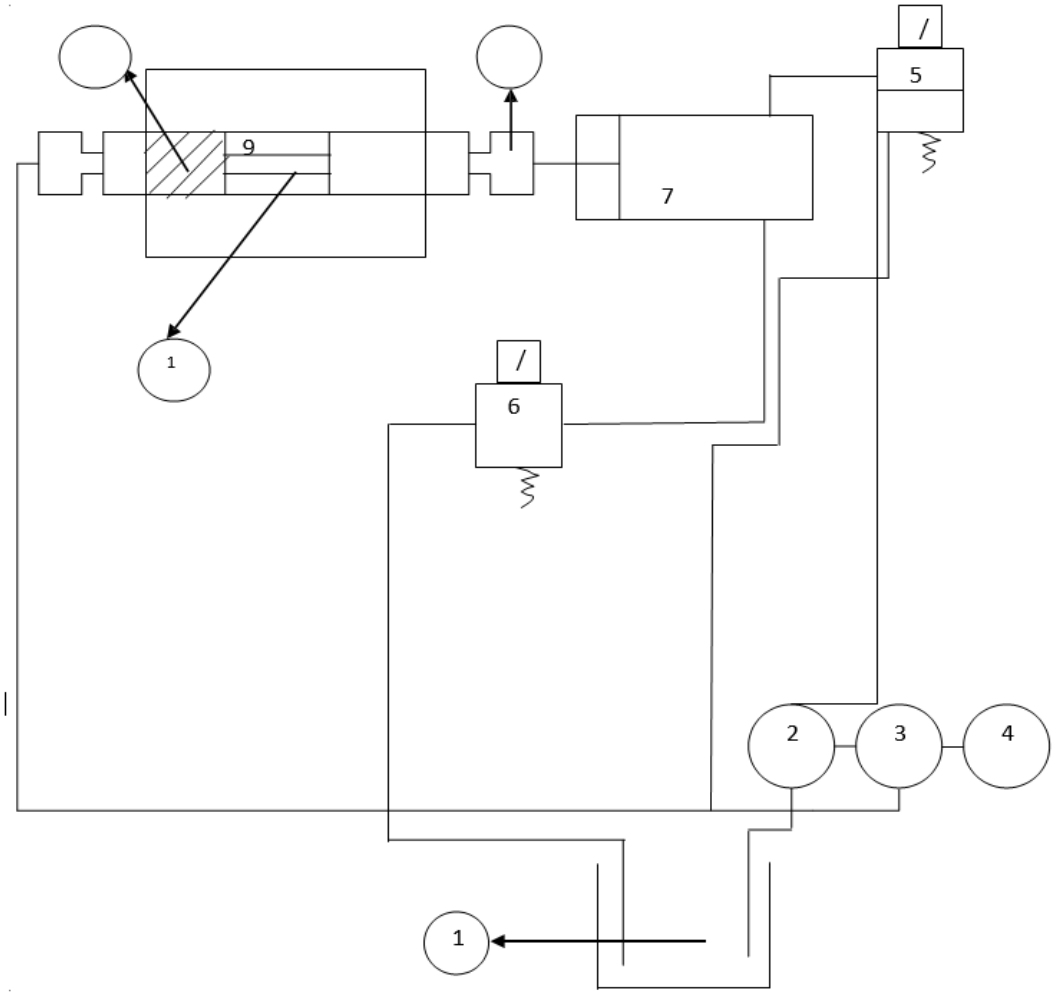

9
7
5
1
6
2
3
4
1

Fig:3

Hydraulic circuit diagram of the project

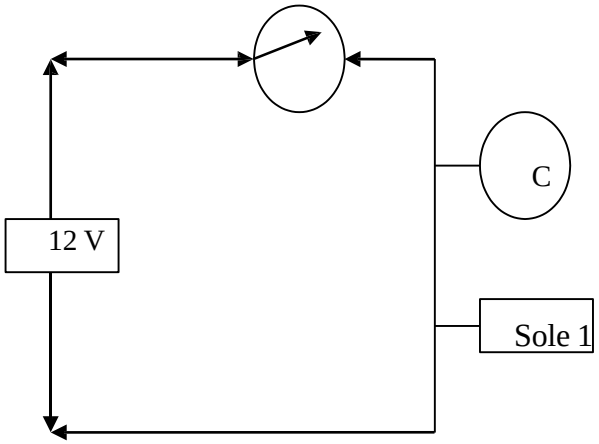
1. Reservoir
2. Pump
3. Clutch
4. Engine
5. Inlet Solenoid Valve
6. Outlet Solenoid Valve
7. Cylinder piston assembly
8. Limit Switch
9. Gear Box
10. Gear selector rod
11. Spring

ELECTRONIC CIRCUIT:

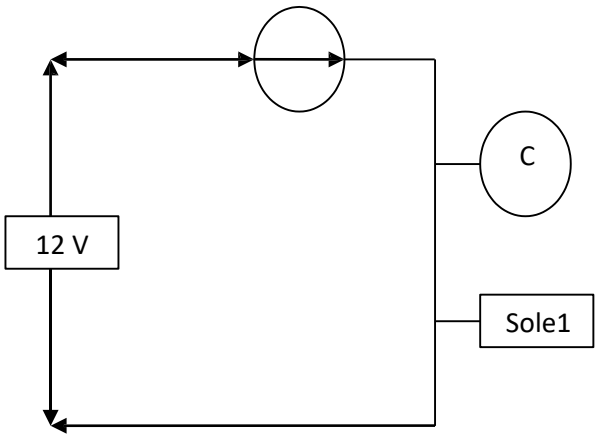
The electronic circuit is used for governing the hydraulic operation. For this purpose we have used two solenoid valves (inlet and outlet) for each gear to be shifted. The supply voltage is from battery which is 12V. There will be six buttons 1, 2, 3, 4, R, N for gear shifting. Each actuates the gear corresponding when pressed.

The diagram below shows the electronic circuit for various operation of the gear shifter.

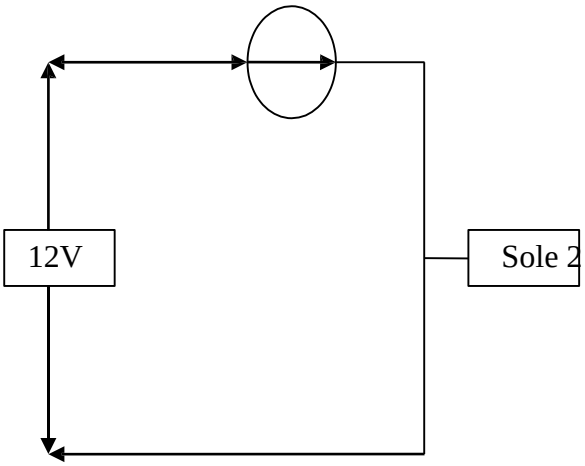
i. Engaging first gear



ii. Maintaining gear position



iii. Releasing gear-neutral position



MECHANICAL COMPONENTS:

The main mechanical component for the project is the spring. The spring is used to counter balance the force exerted by the piston. Moreover it is useful in the return motion of the gear selector rod during gear disengagement. Presence of spring on the gear selector rod helps in the quick action that is required during the gear shift.

WORKING PRINCIPLE:

The main driving force for the gear shifting is by the hydraulic fluid. The gear shifting along with the clutch operation works with the pressing of buttons. On pressing the button corresponding to the gear, three operations take place,

1. Engine rotation
2. Clutch engagement
3. Pump rotation

When the car is switched on the engine rotates, on pressing the button clutch engages. Now electromagnetic clutch engages the pump. Due to the pump rotation the hydraulic fluid is pumped from reservoir to the inlet solenoid valve. Through this valve the fluid pushes the piston in the cylinder. This motion causes the gear shifter rod to engage the gear which is fitted to the piston. In order to avoid slippage of gear a limit switch is used to sense the position of selector rod and cut off the supply.

To bring the car to neutral position we press the N button. Now the outlet solenoid valve energizes so the fluid in the cylinder rushes back to the sump with the aid of spring tension. If the next higher gear has to be selected, the same operation takes place on pressing the next button.

MERITS:

A clear alternative for Auto Transmission. This is much cheaper and user friendly with more features. Leg room for passengers at front is increased more since the removal of gear rod. Ease of operation, by the use of feather touch buttons. A boon for the handicapped, the car can be driven even with only one hand since buttons are used for changing gears. No loss in mileage of the car as the load required for gear shift is meagre. Gear shift is sequential, so no problem of wrong gear selection.

DEMERITS:

Since the project is custom made, it requires a skilled technician to assemble the set up in the car, considering the space constraints. Moreover the driver should be well trained in using the system to avoid malfunction. If there is any misbehavior of a person who is near to the driver, it will create an automatic change of gear.so it must be considered.

CONCLUSION:

This project is an innovative concept. It is a new dimension in the transmission system of a car. This is a simple and versatile pack that may be fitted to any cars existing with power steering. By implementing this smart gear shifter in cars, we can achieve more space, smooth operation, more user friendly, less effort to change the gear and no play. Also the project is a boon for physically challenged persons. The present condition of the project is promising for further developments. Lots of inputs are also got from the car specialists and academicians for its improvement. The concept can be transformed to a real time fitment on further development.

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