

Hand Operated Pneumatic Clutch System

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Abstract— This research work is aiming to avoid the necessity of pressing the foot clutch paddle while changing gears. The semi-automatic clutch system comprises a switch mount on steering wheel. With this switch the driver controls the clutching operation. Hence the clutch operates semi-automatically by this mechanism. The retraction of pneumatic cylinder achieved smoothly. Instead of pressing the clutch manually.

Key words: Clutch, Pneumatic System, Heavy Vehicle

I. INTRODUCTION

A clutch is a form of a coupling. The clutch engages and disengages the engine crankshaft to or from the transmission and the rest of the power train. Engine power to the load must be applied slowly to allow a smooth engagement and to lessen shock on the driving and driven parts. After engagement, the clutch must transmit the engine power to the transmission without slipping. [12] Additionally, the engine must be disconnected from the power train in order to shift gears.[8] The working of a clutch is to initiate motion or raise the velocity of a body generally by changing kinetic energy from another moving body [13]. A Clutch is a machine member used to connect the driving shaft to a driven shaft, that the driven shaft may be started or stopped at any time, without ending the driving shaft.[7]

II. DEMERITS OF THE EXISTING SYSTEM

In tri-pedal clutch system driver has to manage all three pedals with his two legs, which is way too complicated. Most of the drivers who are driving heavy vehicles were unaware of the improper engaging of the clutches; due to this there can be occurrences of friction between the gears and the life time factor of gearbox and transmission system is affected badly. We can see a driver shifting the gears without engaging the clutch; one can normally see this practice in their surroundings. If the driver regularly does this the gear tooth may subject to damage.

The second system is a two pedal system which eliminates the clutch pedal system. This system is introduced based on the drawbacks of the first system but there were also some side effects created in the locomotive. The problem caused by the locking of clutch with the main shaft and that system is costly. These were considered to be de-merits of the existing system.

III. OBJECTIVE

Automation which is the pure sense reduces the human effort and increases the reliability and accuracy of the process. The objective of the project is to design and implement a semi-automatic clutch system for automobiles, which provides a simplistic remedy for physically challenged.

IV. COMPONENT DETAILS

A cylinder is a pneumatic actuator constructed of a piston or plunger that operates in a cylindrical housing by the air under pressure. Cylinder housing is a tube in which a piston operates. In a cylinder, a ram actuates a load directly. In a piston cylinder, a piston rod is connected to a piston to actuate a load. A cylinder in which air pressure may be alternately applied to the piston to drive it in either direction.

Technical Data and Specification

- 1) pneumatic cylinder type = double acting
- 2) diameter of cylinder = 25 mm
- 3) diameter of rod = 10mm
- 4) Stroke length = 25mm
- 5) Material =

The material used for a pneumatic cylinder is nickel-plated brass to aluminum and even steel and stainless steel depending upon the level of load, humidity temperature, and stroke length specified appropriate material selected.



Fig. 1: Double acting cylinder

To change the direction of airflow to and from the cylinder, we use a directional control valve. The moving part in a directional control valve will connect and disconnect internal flow passages within the valve body.[14]

In 5/2-Way single solenoid valve, in the normal position, port 1 is connected to port2; port 4 is connected to port5, and port 3 is blocked. When rated voltage is applied to the coil, the valve is actuated through an internal pilot valve. In this position, port 1 is connected to port 4, port 2 is connected to port 5 is blocked. The valve returns to the normal position when the voltage to the coil is removed.



Fig. 2: 5/2 solenoid valve

The Teflon tube having 8mm diameter is used for a pressure line or return line. The line is connected with valve with a knob or pneumatic connector. The air pressure line having 5/2 directional control valve which actuate the pneumatic cylinder.



Fig. 3: pneumatic wires

A push-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. [9] Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their-pushed state.



Fig. 4: push button

V. WORKING

Pneumatic source is the base of this project. A switch mount on the steering which is directly coupled to the 5/2 solenoid actuated valve. The signal from the switch 12 V supply connected to the directional control valve. A double acting cylinder is actuated by using the directional control valve. The compressor port available in the heavy vehicles for the usage of air conditioners and also for air brakes. It generates the total pressure of 13 bars but 5 bars are sufficient for the cylinder to retract and extend. During the forward stroke of cylinder the piston extends with normal speed, this in-turn presses the pedal and disengaging operation takes place. Whereas during the retraction of the cylinder flow control valve or needle valve is introduced in order to reduce the speed of the retraction stroke. Hence the smooth operation of the clutch takes place.

VI. CONSTRUCTION DIAGRAM

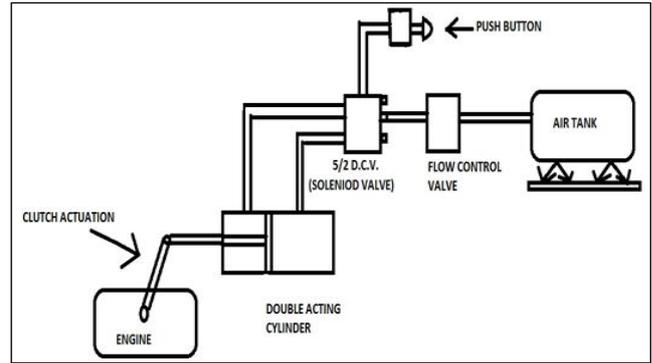


Fig. 5: experimental setup

VII. CALCULATION

Clutch actuation lever of economic cars & heavy vehicles moves within or less than 25 mm

Assumed standard data-
Piston diameter=25 mm

Stroke(S) =25mm

For above double acting cylinder (25*25)

Maximum pressure= 10 bar

Formula=

Force = pressure x area

Mode	Force required to operate clutch lever (N)	Pressure per stroke (bar)	Displacement of clutch lever (mm)
Economic cars	5.98	0.145	22
Heavy vehicle	6.51	0.158	24

Table. 1: calculation table

VIII. CONCLUSION

The project presented has involved the development and implementation of pneumatic clutch system for car, heavy vehicles. We mounted the pneumatic clutch in car engine. After mounting all parts and components we tested the car. We found that it has reduced effort required for disengagement of clutch as compare to pedal clutch. The effort required is very less because pedal or cable operated clutch requires more pressure for engagement and disengagement of clutch. So we finally conclude that pneumatic clutch is very efficient and easy to operate then pedal the clutch actuation assembly of the present subject matter is compact, efficient, and economical.

REFERENCES

- [1] Frank Zimmerman T., Brunswick M., Paulus heidemyor R., "Automatic clutch system for heavy vehicles using centrifugal clutches", 1981
- [2] N.Prasanth1, M.Arun1, R.Balagurubaran1, D.Sabarish1, Dr.R.Kirubashankar2," Semi-Automatic Clutch in Heavy Vehicles"
- [3] Design and Fabrication of Sequencing Circuit with Single Double Acting Cylinder V.G.Vijaya

- [4] Kirpal Singh, “Automobile Engineering volume – 1” – Centrifugal clutches, Page No. 29 onwards, 1969
- [5] <http://www.pneumaticsonline.com> for study on pneumatic components
- [6] <http://www.festo.com> for pneumatic control units
- [7] nptel.ac.in/courses/112106137/pdf/3_5.pdf
- [8] <http://www.tpub.com/eqopbas/18.htm>
- [9] <http://www.alinshra.com/switch-gear-control-panel-accessories.html>
- [10] <http://enginemechanics.tpub.com/14081/css/Chapter-2-Power-Train-51.htm>
- [11] www.sciencedirect.com/science/article/pii/S2211812814004283
- [12] wikipedia.moesalih.com/Pneumatic_cylinder

