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Working of hydraulic clutch pedal assembly

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Abstract

Instead of a mechanical connection, a hydraulic clutch pedal mechanism utilizes a hydraulic line to transmit pedal movement. At the clutch operation on the gearbox, a piston on the master cylinder at the pedal transmits pressure to the slave cylinder piston through the use of a fluid. Hydraulic clutch pedal mechanism they are much smoother and comfortable to the users than Cable clutch or Linkage clutch paddle mechanism.

Keywords: Clutch, hydraulic system, pedal mechanism, fluid, hydraulic

1. Introduction

1.1 Clutch pedal mechanism

The clutch pedal is used to disconnect drive from the engine to the transmission. The pedal converts a conical clutch pedal swing into a linear movement.

1.2 Lever mechanism

A lever mechanism is a rigid beam that can rotate around a pivot, which is a fixed point. A weight will be moved at the other end of the beam if an effort is exerted to one end. You can raise a huge load with very little effort by bringing the pivot closer to the load. There are 3 types of lever mechanism.

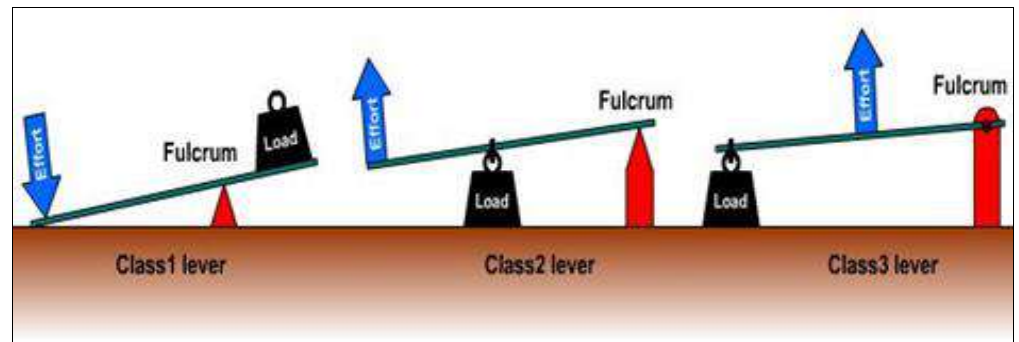


Fig 1: Types of lever

Class 1 lever has the fulcrum between the load and the effort force.

Class 2 lever has the load between the fulcrum and the effort force.

Class 3 has the effort force between the load and the fulcrum.

For clutch pedal mechanism Class 2 lever mechanism is used.

1.3 Types of clutch pedal mechanism

1.3.1 Cable clutch pedal mechanism: A cable clutch is operated by pushing and pulling a cable from the clutch pedal to the clutch fork, which engages and disengages the clutch assembly.

1.3.2 Linkage clutch pedal mechanism: The clutch fork and the clutch pedal are connected to each other with the help of linkages and rods. The driver's leg force is transmitted and multiplied by the linkage to the clutch fork, which engages and disengages the clutch assembly.

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1.3.3 Hydraulic clutch pedal mechanism: The master cylinder is connected to the clutch pedal. The master cylinder's function is to compress the fluid in the reservoir to a high pressure using the piston inside. The hydraulic line sent highly pressurized fluid from the master cylinder to the slave cylinder. The clutch fork is attached to the slave cylinder rod. This forces the clutch release bearing on the clutch shaft to push or pull.

2. Product Details

Hydraulic pedal mechanism

Hydraulic Clutch pedal Assembly plays very important role in the manual transmission (gear-box). In manual transmission it has a diaphragm spring which helps in push and pulls the pressure plate. The diaphragm spring requires lots of force to engage and disengage.

So, we use hydraulic system which consists of master cylinder, Slave cylinder and hydraulic line.

2.1 Master Cylinder



Fig 2: Master cylinder

A cylinder in a hydraulic system in which a piston compresses the fluid, allowing it to drive a slave cylinder

2.2 Slave cylinder



Fig 3: Slave cylinder

A short cylinder that carries a piston and controls the clutch fork in manual transmission.

2.3 Hydraulic line



Fig 4: Hydraulic line

Hydraulic hoses are specialized hoses that can be found in a variety of commercial and industrial environments. Hydraulic hoses are usually made of flexible rubber or wire, and they have a sequence of layers that give them strength and longevity.

3. Working principle

The function of a clutch is to generate and stop the flow of power from the engine to the transmission, allowing for seamless gear shifting. The linkage between the flywheel and the pressure plate is separated to accomplish this. In this process clutch assembly requires high amount of force to engage and disengage. This is where our hydraulic pedal Assembly comes in use when the clutch pedal is pushed, the Hydraulic Clutch uses the fluid contained in the reservoir. The clutch pedal is pushing force pushes the piston inside the master cylinder, compressing the fluid to high pressure. The high-pressure fluid is transferred from the master cylinder to the slave cylinder through hydraulic line.

4. Working

3.1 Clutch disengagement

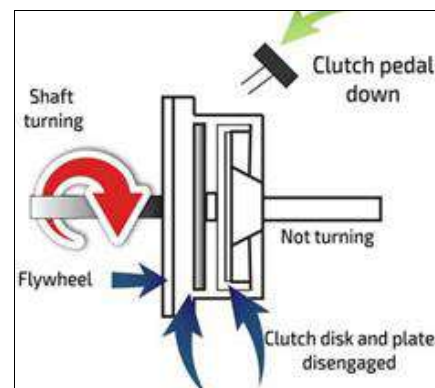


Fig 5: Clutch disengagement

When the engine and transmission are both rotating at the same time, the clutch is engaged. In simpler terms, a clutch is engaged when the flywheel and clutch plate rotate at the same speed under pressure. For smooth gear changes, the transmission must be separated from the engine. Clutch disengagement is the term for this process. When the driver depresses the clutch pedal, the disengagement procedure begins. The master cylinder is connected to the clutch pedal. The master cylinder's function is to compress the fluid in the reservoir to a high pressure using the piston inside. The hydraulic line transports this highly pressurized fluid from the master cylinder to the slave cylinder. The clutch fork is attached to the clutch shaft and is actuated by the slave cylinder rod. This forces the clutch release bearing on the clutch shaft to move. The clutch release bearing is attached to the diaphragm spring's midsection. A diaphragm spring is used to contract and extend the pressure plate's surface. When the release fork pushes the release bearing, the pressure plate is pulled away by the centre of the diaphragm. The pressure plate pulls the splined sleeves away from the clutch plate, releasing the pressure. Frictional force between the clutch plate and the flywheel is lost in this process. The power flow is interrupted when there is no frictional connection between the plates and the flywheel because it is caused by friction. As a result, the clutch disengages, allowing you to change gears.

3.2 clutch engagement

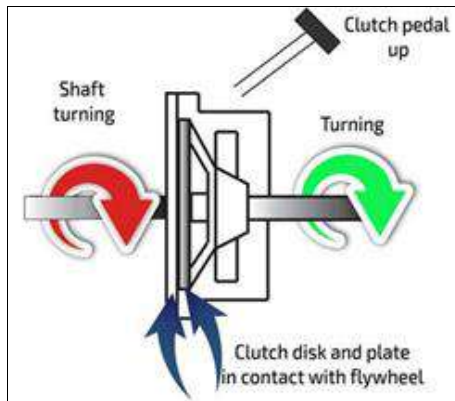


Fig 6: Clutch engagement

When power passes between the engine and the transmission, the clutch engages. When the driver lets go of the clutch pedal after changing gears, this happens. When you let go of the clutch pedal the fluid in cylinder releases the pressure. The fork, bearing, and diaphragm spring are all returned to their normal locations. Splined sleeves return to their previous positions as the diaphragm returns to its original position, bringing the pressure plate into contact with the clutch plate. The clutch plate is pressed against the flywheel by the pressure plate, generating friction. This causes the plates to rotate at the same rate as the flywheel. As a result, power is transferred from the engine to the transmission.

5. Analyses

Analysis on hydraulic pedal mechanism it is based on liver mechanism expression which is $F_1 \times A = F_2 \times B$

Where F_1 stand for force 1, F_2 stand for force 2, A stands for distance from pivoted point to pedal and B stands for distance from pivoted point to master cylinder point.

$A = 30\text{cm}$

$B = 5\text{cm}$

$F_1 = 60\text{N}$

$F_2 = ?$

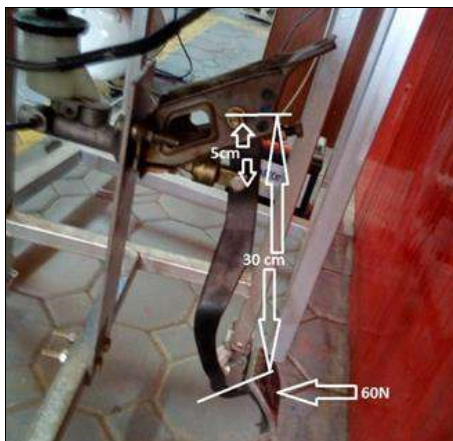


Fig 7: Analysis on hydraulic pedal mechanism

$$F_1 \times A = F_2 \times B$$

$$60 \times 30 = F_2 \times 5$$

$$1800 = F_2 \times 5$$

$$F_2 = 1800 / 5$$

$$F_2 = 360\text{N}$$

6. Result

It is possible to drive away smoothly from a stop.

The clutch master cylinder responds to the force applied by the clutch pedal.

The hydraulic fluid's force can be used to engage and release the clutch.

The hydraulic line must transmit the pressurized fluid between the cylinders without leaking, as this could cause air to become trapped in the system, causing the clutch mechanism to fail.

There is no air in the system between the master and slave cylinders because it is a closed system.

7. Acknowledgment

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