New Clutch Actuated System for Two-Wheeler

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Abstract

The new design is basically combined of Clutch and gear operating system for two wheelers. Pedal operated clutch operating system is a method in which clutch of a two wheeler is actuated using pedal is pressed. In the conventional clutch operating system it is operated by hand. Adopting this into two wheelers it reduces more than one operation which means hand operation (pressing clutch lever by hand). When the rider is facilitated to do drive then doing of that work is made easy. In today's competitive business world, time & cost are the major deciding key factors to get succeed in the market. This project is aiming at modular type of combined Clutch and gear pedal unit which will ultimately reduce the development time of the new product. This type of combined Clutch and gear pedal system is suitable for any two wheelers. This will enhance the design & development process considerably.

Keywords: Two wheelers clutch pedal, Wrist injury, Human fatigue, physically challenged.

1. Introduction

The purpose of the clutch actuation system is to convert clutch pedal travel and force into a travel and force acting on the clutch release lever. The clutch pedal is the input into this actuation system of foot travel and force. This enables the vehicle operator to disengage or engage the torque from the engine to wheels of the vehicle. The output of this actuation is a travel and force of the clutch release bearing assembly acting on the clutch release lever. The required travel and force to actuate the clutch release lever.

Clutch and gear shift lever system is a method in which clutch of a two wheelers are actuated by using pedal is pressed. In this method rider can easily operate the motor cycle by pressing the clutch pedal. Clutch pedal connected with gear pedal by shaft. In the conventional clutch operating systems, clutch engages or disengages by hand. When continuously press the clutch lever it cause damage to the clutch cable. Reduce the human fatigue in a two wheeler system by the use of combined Clutch and gear pedal system in a single pedal. Adopting this into two wheelers will reduce human fatigue particularly wrist injury. Physical therapists deal with two main types of wrist injuries: traumatic injuries and repetitive motion injuries. Traumatic injuries, such as fractures, are usually the result of a single traumatic event. Unlike traumatic injuries, repetitive motion injuries develop over time and are often the result of repetitive use of the arms and

hands. In the conventional clutch operation system is operated by hand.

In conventional two wheelers clutch operation system by cable, in the new design is clutch operation system by linkages. This will increase the life of clutch operation system. Clutch operation system by pedal is basically operated by mechanical operation. Mechanical operation is by means of number of links are use to operate that particular system. Mechanically linked Clutch pedal is fixed under the two wheeler frame. One end of clutch link is connected with end of clutch pedal and anther end of link is connected with clutch

This paper covers few areas of design calculations for design validation of the proposed clutch operation system

2. Clutch pedal travel and effort

Considering existing data from independent and Indian government sources, the recommended maximum clutch pedal travel should not exceed 175 mm. In general current passenger car clutch travels around 150 mm. This distance appears to be adequate for the normal range of vehicle operation. But in the two wheelers new pedal travel distance is 80 mm. This is the half of normal passenger car pedal travel.

The maximum force require depress the clutch pedal is referred to as pedal effort. In general for passenger cars and light trucks, a pedal effort below 100N would be considered a light pedal effort and a pedal effort in the

130 N ranges and above would be considered heavy.

3. Conventional clutch lever - force distribution
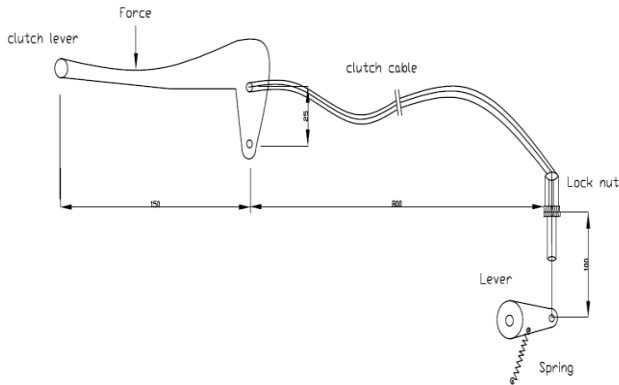
Fig.1 Typical conventional clutch operating system

Force = Max. Allowable force 100 N for clutch operation.
Momentum $\sum m = 0$

$$P_{pivot} = P_{in} (R_{in} + R_{out}) / R_{out}$$
$$= 100(0 + 0.025)/0.025$$
$$P_{pivot} = 100 \text{ N}$$
$$P_{out} = P_{in} \times \text{Cable length}$$
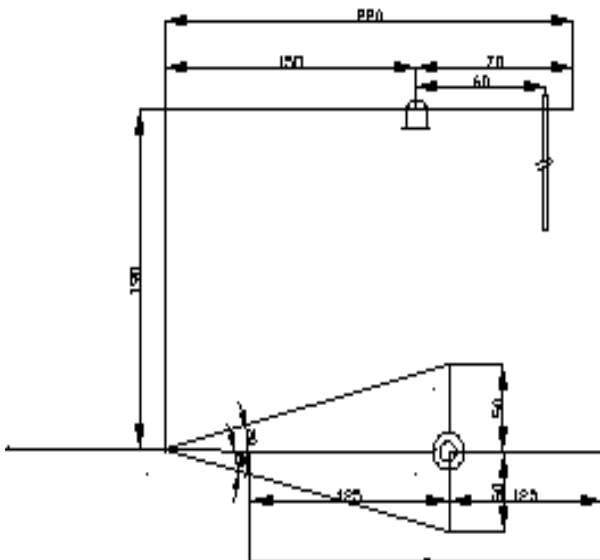$$= 100 \times 0.80$$
$$= 80 \text{ Nm}$$
$$= 80 / 0.75$$
$$P_{out} = 106 \text{ N}$$

Max. Force 106 N acting at output of the clutch pedal. It is maximum force than input force. Output force is more or less related to input force. It is 1.06 times more than input force.

4. Force distribution calculation of new clutch pedal

Fig.2 Free body diagram – new clutch pedal

Max. Clutch force at top of the pedal   = 100N

$$F = \text{Max. Allowable pedal force}$$
$$= 100 \text{ N for two wheelers Clutch}$$

Moment at point '0' due to pedal force = 500 x 0.125
$$= 65 \text{ Nm}$$

Axial force along the link rod   **=** 65/.05
$$= 1083.3/500$$

Pedal produce force   = 2.16 time more than given force

$$= 500/2.16$$
$$= 230N$$

Find force Distribution at link rod (1)
$$F_{xi} = 230\cos2$$

$$= 216.12 \text{ N}$$
$$F_{yi} = 230\sin20$$
$$= 78.66 \text{ N}$$

Find force Distribution at link rod (2)
$$F_{xi} = 230\cos20$$
$$= 216.12 \text{ N}$$

$$F_{yi} = 230\sin20$$
$$= -78.66 \text{ N}$$

Resultant force at 'L' Rod

$$R = \sqrt{((\sum F_{xi})^2 + (\sum F_{yi})^2)}$$
$$R = \sqrt{((216.12)^2 + (78.66)^2)}$$
$$R = 229.87 \text{ N}$$

Find momentum at 'L' type link Rod
$$= 229.87 \times 0.190$$

$$P_{in} = 43.67N$$

$$P_{out} = P_{in} \times C_{pedal}$$

$$C_{pedal} = R_{in} / R_{ou}$$
$$= 15/6$$
$$= 2.5$$
$$P_{out} = 46.67 \times 2.5$$

Max. Force '116.675'N acting at output of the clutch pedal. It is maximum force than input force. Out put force is more or less related to input force. It is '1.1667' times more than input force.

5. Vehicle with new model clutch system

Newly designed clutch pedal is located on the top of gear pedal above '30'mm. When it is required to change the gears or disengaging the clutch, just press the clutch pedal that will do both the gear change and disengage of clutch. Clutch pedal toe rest is above the gear toe rest,

while we press the clutch pedal that moves downward first disengage the clutch then clutch toe rest will press the gear toe rest. This will change the gears.

Fig.3 3D model – New clutch pedal

When it requires a clutch operation alone, clutch pedal moves freely without contacting gear pedal. The distance between the gear pedal and a clutch pedal is '8'mm. There is no need to panic about clutch operation alone. This same setup is for gear release it located rear side. Two separate levers are connected for this operation.

6. Result and discussion

Table 1 Clutch pedal Force analysis

Input Force in 'N'	Output Force in 'N'	
	By Conventional Design	By New Design
100	106	116.67

Conventional clutch lever provide 1.06 times of force to pull the clutch lever. But the new design will provide 1.167 times of force.

Conclusion

Clutch operating system by pedal means when we will press the pedal the link pulls along linearly. Conventional two wheeler clutch lever pulls clutch cable in linear movement and it causes damage of clutch cable, hence cable life will reduce. Clutch by pedal prevent the sudden damage of cable hence improve life of Clutch.

Pedal length is 12.5cm it is smaller than the conventional brake pedal length of two wheelers. So it will help easy pedal operation. When we implement this system in two-wheeler it will improve the operation of clutch engaging and disengaging.

Another prominent advantage of this new clutch actuated system in two-wheeler is that, it would be widely helpful for the physically challenged people particularly a single handed.

The merits of installing Pedal clutch operating system are,

- Reduce wrist injury
- Reduces the Human Fatigue
- Reduce the design complexity
- Easy to travel for long distance without any troubles.

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