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Fabrication and Modification of Hand Brake and Clutch Assemblies to avoid unnecessary wear and tear of Brake Liners

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Abstract - *The technological advancements in automobile sector has paved the way to some innovations related to safety and braking of an automobile. But such system when employed in any automobile, costs up to some extent. Hence, a system which works with less operating and input cost is needed. This research is based on developing such system which helps in improving brake liner's life using simple and manipulating arrangements. Mechanical input used while applying hand brake, the clutch is disengaged from the flywheel. This would not allow the automobile to move forward until the hand brake is disengaged. Hand brake disengagement will engage the clutch with flywheel and the vehicle will move forward. This process is carried out using as simple arrangement which is the proposed work of the project.*

Key Words: Hand brake, brake liners wear, Clutch plate

1.INTRODUCTION

Parking Brake is the lever brake arrangement in a vehicle used to hold the vehicle in stationary position when parked. At times, due to human error, this lever is not disengaged before driving. This leads to the continuous brakes' engagement inside the brake drum while the vehicle being driven. Continuous engagement of brake liner with the brake drum while the drum constantly rotating with the wheels, causes friction between the liners and the drum. The friction causes large temperature increase and wear of the brake liner surface. This could've been avoided if the parking brake lever was disengaged before the vehicle being driven.

Clutch of a vehicle is a friction material used in transmission system to engage and disengage engine from the gearbox. It is operated by an actuation lever provided over bell housing. This actuation lever can be actuated using hand levers (in two wheelers) and foot pedals (in four wheelers).

The following paper is an attempt to avoid temperature increase and wear of the brake liners. It is a demonstration of a linkage connected from brake liner to the clutch engagement lever. This linkage will disengage the clutch from the flywheel whenever parking brake is engaged. This will not let the vehicle move forward when the parking brake is in engaged position, as any power produced by the engine will not be transmitted to the gearbox, as the clutch will be disengaged from the engine.

1.1 Parking brake: It is a latching brake used to hold the vehicle stationary when the vehicle is not in use. It is engaged/disengaged using a hand lever. When the lever is pulled up, the brakes

1.2 Clutch: A Clutch is a machine member used to connect the driving shaft to a driven shaft, so that the driven shaft may be started or stopped at any time, without stopping the driving shaft. A clutch thus provides an interruptible connection between two rotating shafts. Clutches allow a high inertia load to be started with a small power. Clutches are also used extensively in production machinery of all types.

1.3 Parking Brake: It is a latching brake usually used to keep the vehicle stationary. It can also be used as an emergency brake in case of a failure of primary brakes.

1.4 Hand Brake Equalizer: It is a component which is used to divide the single hand brake lever motion towards two rear wheels brakes.

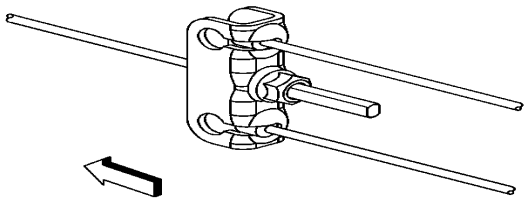

Fig 1. Hand Brake Equalizer.

1.5 Clutch: While clutch assembly is a system which is used to disengage the power/torque from engine to gearbox/transmission system.

1.6 Proposed System: Using the above two systems, the proposed system is fabricated. This system will disengage the clutch from the flywheel and the vehicle will not move forward and will subsequently increase liner's life if vehicle is not driven forward when parking brake is engaged.

2. Literature Review:

Heinz Heisler [1] in his book explaining various advanced system employed in any automobile has provided some information about hand brake system. When the hand brake lever is applied, the cable pulls the hand lever inward, causing it to react against the strut. As it tilts it forces the trailing shoe outwards to the drum. At the same time the strut is forced in the opposite direction against the sector lever.

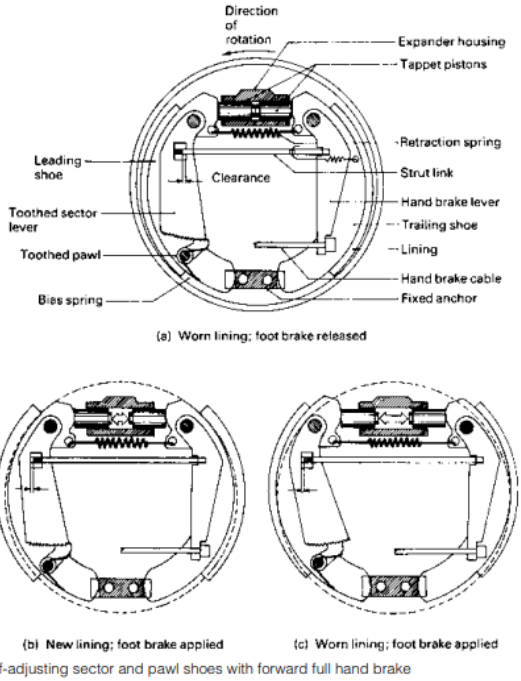

Fig 2. Linkage from Hand Brake lever to the Brakes [2]

V.B. Bhandari (2008) [2] explained in his experiment that Diaphragm spring is a flat, spring-steel disc compressed between the cover and pressure plate that, when pushed by the release bearing, engages and disengages the clutch.

Prof. K. Gopinath et. al[3], has stated some useful calculations formulae for calculation of temperature rise in the brake liners during parking condition. This transaction also includes solved examples of such calculations of temperature rise in the liners.

2. CONSTRUCTION & WORKING

Construction:

L- angle beams are welded together to construct a rectangular frame of (1000x600x600) mm. It is provided with reinforcement angles to support the load at 450mm from the top. Bell housing which consists of the clutch assembly (Flywheel-Clutch Plate-Diaphragm Spring) is mounted on the frame. Hand brake lever is mounted on the corner or the frame. One end of the clutch cable is connected to the hand brake and the other is connected to the clutch actuation lever, alongside the primary clutch cable on the bell housing. A MS rod of 22mm is connected to the clutch assembly which acts as the output shaft.

A 0.375W, 1375 rpm DC motor is mounted at the lower part of the frame using supports from the reinforcement angles. A solid MS rod is welded to the flywheel and mounted on the top reinforcements of the frame and the end of shaft is supported using a 22/62 ball bearing. This MS rod is mounted with a pulley of ID 22 mm and OD 50.8 mm at 150mm from the bearing end. This rod acts as the input shaft connected to the flywheel. The pulley on this shaft will be connected to the motor shaft using a V-belt. Construction layout of the demonstration is shown.

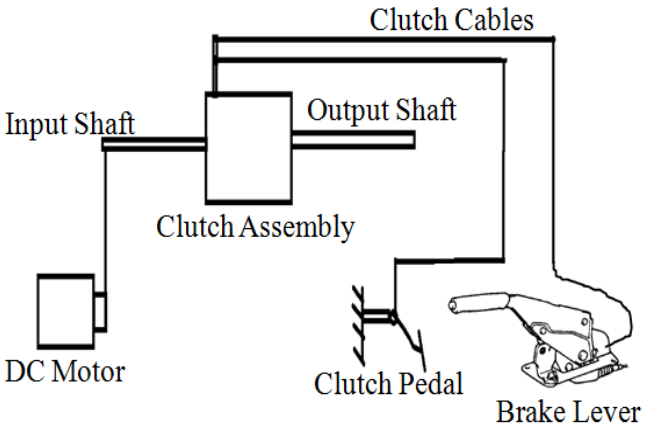

Fig 2. Demonstration Layout.

Working:

The proposed idea is demonstrated by mounting hand brake and clutch assemblies on a frame and linking both the assemblies using a simple four-wheeler clutch cable. It demonstrates the process when the hand brake is engaged (pulled up), it will disengage the flywheel from rest of the transmission.

The motor is run and the rotary output from the motor is transmitted to the input shaft and it rotates, the clutch assembly rotates along with it as the flywheel being connected to the shaft. As soon as the hand brake lever is engaged (pulled up), the clutch is disengaged from the flywheel and the output shaft from the clutch assembly stops rotating. In short, the DC motor acts as the engine of the vehicle and the shaft connected to the flywheel acts as the crank shaft.

Fig 3. Actual demonstrating model.

3. EQUALIZER PROBLEM

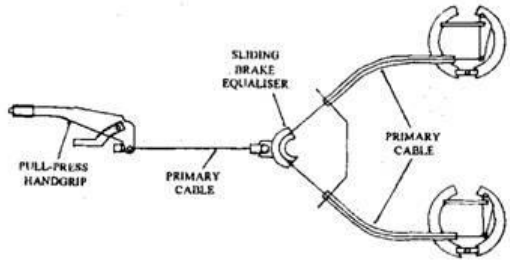

Fig 3. Actual hand brake system

Above illustration shows the hand brake system in actual. When the hand brake is pulled up the motion is transmitted to the brakes through a component called the equalizer. But the equalizer has two one input and two outputs. In the proposed system, there is a need for a third output, which is to be connected to the clutch.

In order to overcome this problem, there are two options viz.,

1. To design an equalizer which has one input and three outputs
2. The manipulation shown below:

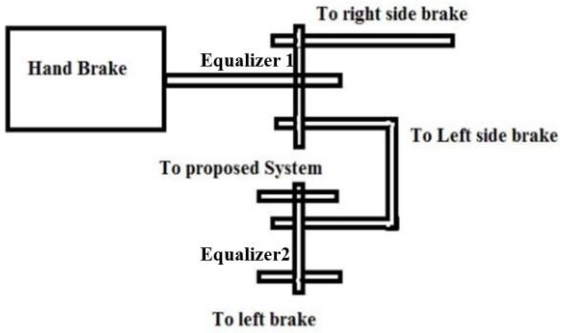

Fig 4. Equalizer adjustment.

The above figure shows an adjustment in real practice which helps obtain three outputs. Two equalizers are used in above adjustment. Input from hand brake is transmitted from Equalizer 1 to two cables (outputs), the right-side brake and left side brake, (in usual practice). Another equalizer, Equalizer 2 is connected to the left side brake cable. Equalizer 2, then transmits the input in two more outputs, one can be used in order to carry out the proposed system and the other will be connected to the left side brake. One input and requirement of three outputs can thus be fulfilled, when, the proposed idea is taken up for actual use.

4. CONCLUSIONS

Using the demonstrative model, it was concluded that the clutch is properly and completely disengaged from the flywheel, using hand brake actuations. There are no problems in primary workings of the clutch and hand brake. This disengagement does not allow the vehicle to move forward until the hand brake is disengaged. In actual practice, there will be a need of connecting just a clutch cable from the hand brake to the clutch actuation lever and a slight modification of hand brake equalizer connections.

Advantages:

1. The unnecessary wear and tear of brake liners is avoided, when engaged while the vehicle is driven.
2. Cost effective method to save brake lining materials from wearing out quickly.
3. Saves the brake liners from temperature rise due constant friction with the brake drum.

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