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HYDRAULIC RETARDER BASED BRAKING SYSTEM

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***Abstract*—**Through this paper an initiative is taken to put focus on a special technique of retarder mechanism which is used in automobile industries. In this technique retarder device is used to augment or replace some of the functions of primary friction-based braking systems, usually on heavy vehicles. Friction-based braking systems are susceptible to 'brake fade' when used extensively for continuous periods, which can be dangerous if braking performance drops below what is required to stop the vehicle-for instance if a truck or bus is descending a long decline. For this reason, such heavy vehicles are frequently fitted with a supplementary system that is not friction based.

Keywords—retarder; braking system; viscous force;

I. INTRODUCTION

A retarder is an additional supporting braking mechanism to service brake or foundation brake. As the name suggest, they work on the principle of hydraulics. Primary principle being the Pascals law. "Pressure applied to any part of a confined fluid transmit to every other part with no loss.The pressure act with equal force on all equal areas of the confining walls and perpendicular to the walls". Hydraulic retarder is basically a vaned flywheel in the transmission housing. The transmission directs oil in to the retarder housing to absorb the vehicles energy through drive shaft. More oil in the housing means stronger braking and since there is no mechanical friction or wear there is a better control of maintenance cost.Retarders serve to slow vehicles or maintain a steady speed while traveling down a hill and help to prevent vehicle from running away by accelerating down the hill. Hydraulic retarders are extremely quite and inaudibly over the sound of a running engine.

II. PROBLEM DEFINITION

While using ordinary braking system along the slopes the service life of it may get reduced. Due to the over heating of these brakes, there may be chance for its failure. While moving down from slopes, it may decrease the braking efficiency due to continuous application. So if we are using this retarder based braking system along with conventional braking, these problems can be successfully solved.

III. WORKING PRINCIPLE

A hydraulic retarder uses vanes attached to a transmission drive shaft between clutch and rod wheel. The vanes are enclosed in a static chamber with small clearance to the chambers wall. When retardation is required fluid is pumped into the chamber and viscous drag induced will slow the vehicle. The working fluid will heat and is usually circulated through a cooling system. The degree of retardation can be varied by adjusting the fill the level of chamber.

The prop shaft driven rotor accelerates the oil being decelerated in the stator. The oil turbulence decelerates the rotor and thusbrakes the vehicle. The braking heat generated is being dissipated through the vehicle coolingsystem.

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Fig. no. 1

IV. FUNCTION AND INSTALLATION OF RETARDER

Retarders are highperformance brakes decelerating even heavy vehicles safely and effectively. The retarder braking power is approximately twice the value the vehicle engine power. By setting a speed retarders ensures that the heavy vehicles doesn't exceed the particular speed.This is called as down hill retardation and is most useful when driving down the hill. Partial braking as a feature can be used just to slow the vehicle a bit.This is a handy feature that can be used in traffic condition, that doesn't require full braking and requires deceleration may be negotiate a turn or to slow in view of on coming traffic.

V. COMPONENTS SPECIFICATION

RPM of motor	1440RPM
Diameter of shaft	20mm
Length of shaft	1m
Sump head	1.5m
Hydraulic pipe	4m
Hydraulic valve	0.5 inch

Hydraulic gear pump

Fig. no. 2

Gear pump is a positive displacement rotary pump that transports fluid using rotating gears. Gear pumps are compact, high pressure pump which provide a steady fluid flow.The gear pump has an efficiency of 90%.

Mechanical Pulleys

Fig. no. 3

A pulley has a circular crosssection which drives the power from one shaft to another. The diameter of pulley selected according to the need.

V-belts

Fig. no. 4

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Belt used is a loop of flexible material used to connect to pulleys on each shaft. They have high efficiency (95%), high tolerance for misalignment.

VI. EXPERIMENTAL SET UP

Experimental procedure for the hydraulic retarder involves a motor of 1.5 HP. The motor runs at 1440 rpm. A pulley of suitable diameter is coupled to the rotating end of the shaft. By using a suitable V-belt the drive is transmitted to the other pulley which is connected to a 20mm diameter shaft. Now both the shafts rotating at same speed. The other end of the 20mm shaft is connected to an impeller which is rotating in a closed casing. The impeller is specially designed to produce maximum viscous force. A delivery valve is connected to the outlet of the impeller which will discharge the fluid back in to the sump which is placed particular head. For the normal working condition, fluid from the sump is flows to the hydraulic gear pump which will discharge the fluid at high pressure back in to the sump.

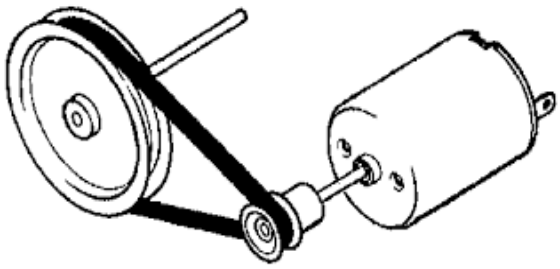

Fig. no. 5

Whenever the retardation effect is required, the valve which is connected to the impeller casing from the gear pump is opened. When this valve is opened, high pressure fluid from gear pump enters in to the closed impellor casing which will provide the required resistance to the rotating impeller inside the casing. By using a Tachometer, speed of the 20mm diameter rotating shaft is measured without the application of the fluid.The same procedure is repeated while the application of fluid. [4] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller.This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

VII. ANALYSIS AND TESTING

Analysis of the proposed model done under standard conditions of temperature and pressure. Speed of the shaft obtained in normal running is 1300 rpm. Hydraulic fluid was applied for few seconds. It may be noted that speed of the shaft decreases from 1300 rpm to 820 rpm. So it is clear that viscous force reduced the speed of shaft considerably.

Following graph shows the relationship between drum temperature and wear rate for vehicles on long down hill slopes by Telma a famous retarder manufacturing company.

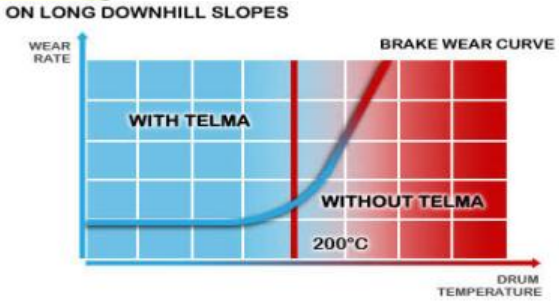

Fig. no. 6

It is clear that with out retarder based braking system the wear rate considerably increases. But by using retarders in the braking system the wear rate reduces considerably.

VIII. CONCLUSION

The retarder will normally make your rig a safer rig on the road and will extend your service brake life. There is a lot of arguing amongst drivers about whether or not to use the jake brake during shifting. During the shifting double clutch, the conditions are correct for jake brake activation. If your gear shifts are close together, then the jake brake will fight you on the engine RPM match while shifting. However, if the gear shift result in large RPM drops, or if the shift is on a steep grade which results in rapid truck speed loss, then use of
thejake brake may very well help you to grab that next gear quicker. In this situation, the truck speed is falling rapidly, and the engine RPMs are falling normally, so during the double clutch, the engine RPMs are yanked lower by the jake
brake. This might be helpful to get that next gear in place during a slow and steep grade climb.

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