ABSTRACT:

The project consists of locking the reverse wheel such that it will control the reverse motion of the light commercial vehicle with the help of ratchet and pawl mechanism. The movement of the pawls will be controlled with the help of controlling mechanism. A push button will be provided on steering of the vehicle which will be operated by the driver on choice.

Keywords: CAD, Pawls, Wheel Mechanism.

I. INTRODUCTION

The land transport sector encompasses the commercial use of many different vehicles including lorries, light vans, taxis, buses, cars construction and agricultural machinery, emergency service vehicles, motorcycles, mopeds and bicycles. Road safety is a multi-sectoral and multidimensional issue.

The main types of transport accidents are:
- Vehicle crashes
- People being struck or run over by moving vehicles (e.g. during reversing or coupling)
- People falling from vehicles
- People struck by objects falling from vehicles, or vehicles overturning.

In addition to this, roads in hilly areas are more accident prone due to
- Inadequate sight distances
- Sharp curves
- Poor weather conditions
- Steep gradients etc.

Possible factors of defined problem are apparent
- Loss of braking effectiveness
- Pedal misapplication
- Mechanical and electrical failures etc.

Driving mistakes made by heavy goods vehicle drivers may be more serious because of the weight, size, shape, maneuvering abilities, braking abilities, etc., of the vehicle. Thus, improper handling and loss of control over vehicles may cause a severe threat to both the driver and the pedestrians. Unexpected reverse motion of vehicles in gradients and mountain roads is one of those problems which may cause disastrous accidents. Even though a modern vehicle has equipment like parking assistance system, hand brake, etc., driver’s apesemia will cause serious damages.

The objectives on which we have primarily focused are:
- To provide safety measure against unexpected reverse motion
- To provide a simple and economical solution
- To provide self locking provision without driver’s active involvement

To achieve this, we have prepared a model wherein a Freewheel sprocket is coupled to an additional differential pinion engaged with the existing differential system of the automobile vehicle. The project integrates locking mechanism with the differential. Locking mechanism involves the use of freewheel. A Freewheel is nothing but a mechanical device that allows continuous linear or rotary motion in only one direction while preventing motion in the opposite direction. With this equipment we can prevent the unwanted reverse motion of a vehicle during all situations. The attachment is engaged and coupled with the differential system. The project permits only the forward motion of vehicle due to the mechanism involved. The Freewheel resists the reverse motion of the vehicle by a locking solenoid valve actuator mechanism. Disengagement of the Freewheel permits the reverse motion. Reverse motion of the vehicle can be achieved only when the driver desires to do so.
The objectives on which we have primarily focused are:

- To provide safety measure against unexpected reverse motion
- To provide a simple and economical solution
- To provide self-locking provision without driver’s active involvement
- Working

The ratchet and the pawl arrangement is normally in the engaged position. For the engaged position the forward motion is freely running but the reverse motion of the vehicle is restricted.

**COMPONENTS USED:**

**Ratchet**

A ratchet (fig.1) consists of a round gear or linear rack with teeth, and a pivoting, spring-loaded finger called a pawl that engages the teeth. The teeth are uniform but asymmetrical, with each tooth having a moderate slope on one edge and a much steeper slope on the other edge.

![Fig(1)](image1.jpg)

**Pawl**

A pawl is a metal part shown in fig.2 that rests on the ratchet. As the ratchet rotates, the pawl drops onto each of the steps on the ratchet rim, preventing the ratchet from turning in the direction of the reverse light switch.

There are two main types of reversing light switch shown in fig(3).

On a manual gearbox the switch usually screws into the gearbox casing and may have a locknut to hold it in position. This type of switch has two terminals.

On an automatic gearbox the switch is similar in appearance but usually has four terminals instead of two. Two are for the reverse light circuit and two for the inhibitor switch circuit which prevents the car being started in any gear position other than 'N' or 'P'.

![Fig(3)](image2.jpg)

**Pneumatic actuator**

A pneumatic actuator is a device that is capable of converting energy from a pressurized gas into motion. There are several different types of pneumatic actuators and each of them are designed in a slightly different way. Pneumatic actuators can be used to produce both rotary and linear motion and are usually powered by an electric compressor. While motion can be created through other means, such as a hydraulic or electric motor, pneumatic actuators are safer, cheaper, more reliable, and often provide more power.

Pneumatic actuators (fig4) are generally relatively simplistic and depend on their own ability to convert potential energy into kinetic energy. Pneumatic actuators usually consist of a cylinder or chamber in which regular air, a pressurized gas, or
a mixture of the two, is contained and allowed to expand. As the gas expands, a pressure difference between the inside of the chamber and the natural atmospheric pressure causes the gas to build up energy. The gas is then allowed to leave the chamber in a controlled manner so that it is directed toward a piston, gear, or some other mechanical device. The piston is then used to perform the actual work to be done. Depending on how the gas is directed toward the piston and how the actuator is designed, the piston can be driven in a straight line or in a circle.

**Direct-acting solenoid valve**

With a direct-acting solenoid valve Fig(5), the seat seal is attached to the solenoid core. In the de-energized condition, a seat orifice is closed, which opens when the valve is energized.

**WORKING**

The device consists of Ratchet and pawl arrangement which will be mounted to the differential unit of the vehicle. The device is normally engaged position that means only the forward motion is achieved but the reverse motion of the vehicle is restricted. The device is disengaged when the reverse gear to be operated position only.

The reverse gear to be operated the reverse light switch to be operated that means the current flow is started. The reverse light switch to be connected with the solenoid valve. The current flow is started the solenoid valve to be actuated. The solenoid valve to control the pneumatic cylinder. The air supply is given to the solenoid valve inlet and the outlet to be given to the pneumatic cylinder.

The pneumatic cylinder is connected to the pawl. The reverse gear to be operated the solenoid valve to be actuated using power supply from the reverse light switch. The pawl to be disengaged from the ratchet the vehicle moves freely otherwise the ratchet and the pawl in the engaged position.

**CAD DIAGRAM**

Now, the reverse motion of the vehicle will be constraint i.e. the vehicle will not move in the reverse direction it will only move in forward direction. In this way the engagement and disengagement of Ratchet and Pawl will take place.
RESULTS AND DISCUSSION

Results

As we have already discussed earlier in the introduction, freewheel is the main component used for preventing the reverse motion of the heavy load vehicles. Hence we check if the freewheel used in the model sustains the load exerted on it.

Freewheel used: Standard I.R.F Sprocket A10A17. The torque induced on the Freewheel is 15.53 N-m. The nominal torque that the selected freewheel can sustain is 150 N-m. Hence the design comes safe and the selected freewheel can be used in the model up to the capacity of 150 N-m. If the load increases further, the Freewheel can be selected from the same table.

Merits

- Decrease in accidents on slopes by driver.
- Economical, affordable.
- Easily adoptable in the vehicle with minimum changes in the car parts
- Low maintenance cost & easily replaceable.
- The mechanism can work for a long time without any failure.
- No effect on the working of differential.

Demerits

- Freewheel design must be changed if the load increases.
- The cost of system increases slightly due to the additional parts.

Future scope

- A sensor can be put in the car to sense the inclination of the road.
- A single integrated mechanism can be used instead of bevel gear and freewheel sprocket.

CONCLUSION

Here we conclude that with the use of this system, the unwanted reverse motion of the vehicles can be prevented

It provides working vehicle with differential locking system to be capable of reliable straight running and excellent working performance.

Since engagement of freewheel will completely prevent the reverse motion of the vehicle, there is no need to specifically pay attention as it is paid while applying brakes and clutches.

This will lead to the considerable reduction in the accidents on mountain and hilly roads.

The system eliminates the problem of excessive wear of the brake shoe and increases brake life.

The system is of great use for all the drivers and especially for heavy load vehicles.

REFERENCES