Automatically Engaging Mechanical Hill Start Assist
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1. Problem Description

Most of the drivers experience this embarrassing situation when they try to start the vehicle on a slope.

Effect of gravity
The vehicle experiences a force $W \sin \theta$ along the inclined plane
Need to overcome this force for the vehicle to move forward

2. Existing Solutions

1. Conventional Hand Brake Technique (Manual Transmission)
2. Hill Hold Control: This is the current technology which is predominantly used in the Automatic transmission

Sensors detect the slope of the road. HHC-On
Holds the vehicle for 2 additional sec after the brake pedal is released
Driver gets enough time to step on the accelerator

3. Drawbacks of the existing systems

1. The hand brake technique is not a fool proof solution and it requires experience and skill to master it.
2. The Hill Hold Control is mainly used in the automotive transmission and is hardly used in the manual one as again the driver needs to control his clutch and accelerator within 2 sec.
3. Cost of an electronic system such as the hill hold is high to be installed in an economic segment car.

4. The need for a new Solution

To Device a mechanism that
- Works efficiently for the manual transmission.
- Is Cost Effective (Mechanical Solution)
- Is fool proof

5. Brain Storming

The Main Challenges were
- To find a suitable mechanism to stop the rotation of the wheels in the undesired direction while climbing hills.
- To device an auto engagement mechanism which would always engage the hill start assist system while climbing slopes without the use of electronics.

6. Conceptual Solution

1. The system engages itself when the vehicle is switched to its first gear. The spur gear connects the auxiliary shaft and the propeller shaft. The Spur Gear is connected on bearings onto the auxiliary shaft, hence power is not always transmitted to the auxiliary shaft.
2. A dog clutch/synchroniser is fitted on the shaft by a key. The gear lever engages the dog clutch with the spur gear on the auxiliary shaft. Now the power on the propeller shaft is transmitted on to the auxiliary.
3. The presence of ratchet gears allows the rotation of the shaft in just one direction, which means in 1st gear, reverse motion is arrested.
4. When the vehicle is on slopes, and the first gear engaged, the vehicles thus will propel only in the forward direction, the rotation in the other direction is resisted by the ratchet gears.
5. When the gear is changed from 1st to 2nd, the gear lever disengages the dog clutch from the spur gear on the auxiliary shaft. This means that the spur gear will rotate on bearings alone, hence not transmitting power to the auxiliary shaft.

7. Working Principle

1. The system engages itself when the vehicle is switched to its first gear. The spur gear connects the auxiliary shaft and the propeller shaft. The Spur Gear is connected on bearings onto the auxiliary shaft, hence power is not always transmitted to the auxiliary shaft.

8. Prototype

1. Prevents accidents while starting the vehicles on slopes.
2. Cost effective solution
3. Stress free Driving
4. Longer clutch life
5. Its an advantage for heavily loaded vehicles

9. Advantages

The Same principle can be applied in heavy duty vehicles with a scaled up model. This could include trucks, trailers, tractors etc.

10. Extended Applications

By devising a mechanism of this sort we could make driving more easier and most importantly this sort of technology could reach the common man who form the majority in any economy.