



Experiment Details

Department Name	MECHANICAL
Class	B.TECH
Semester	VII
Subject Name	AUTOMOBILE LAB
Experiment No.	02
Experiment Name	STUDY OF DEMONSTRATION OF FINAL DRIVE AND DIFFERENTIAL

Version History

Sr. No.	Version Number	Created By	Approved By	Date
1	v1.0	BA Name	Faculty Name	DD/MM/YYYY
1	V1.0	SANDESH ANIL KAMBLE	PROF.SOURABH PATIL SIRTO	



AIM: To study the various components of Final Drive and Differential

THEORY:

Differential Unit - Construction and Working:

The purpose of the differential assembly is to allow the two drive wheels to turn at different speeds when the car goes around a corner. This is necessary because when cornering, the wheel on the inside of the turn goes through a smaller arc or corner than the wheels on the outside. If the wheels were not allowed to turn at different speeds, they would tend to skip around the corner and steering would be very difficult.

Differentials are used in:

- i) The rear drive axle of front engine, rear wheel drives vehicles.
- ii) The transaxles of front engine, front wheel drive and rear engine, rear wheel drive vehicles.
- iii) The front drive axle and rear drive axle of four wheel drive vehicles.
- iv) The transfer case of some four wheel drive vehicles.

Construction of Differential Gear: Differential is an arrangement of gears which work together and allow the vehicle to take a turn smoothly. In the differential, bevel pinion gear is fixed to the propeller shaft which rotates the crown wheel. The crown wheel has another unit called the differential unit. It consists of two bevel gears (sun gear) and two bevel gears (planet gear). The bevel gears are in contact with the half shaft of the rear axle. When the crown wheel is rotating, it rotates the differential unit. The bevel (sun) gears of the differential rotate the two shafts.

Working of Differential Gear: When the car is on a straight road, the ring gear, differential case, differential pinion gears, and two differential side gears all turn as a unit. The two differential pinion gears do not rotate on the pinion shaft. This is because they exert equal force on the two differential side gears. As a result the side gears turn at the same speed as the ring gear, which causes both drive wheels to turn at the same speed also. However, when the car begins to round a curve, the differential pinion gears rotate on the pinion shaft. This permits the outer wheel to turn faster than the inner wheel

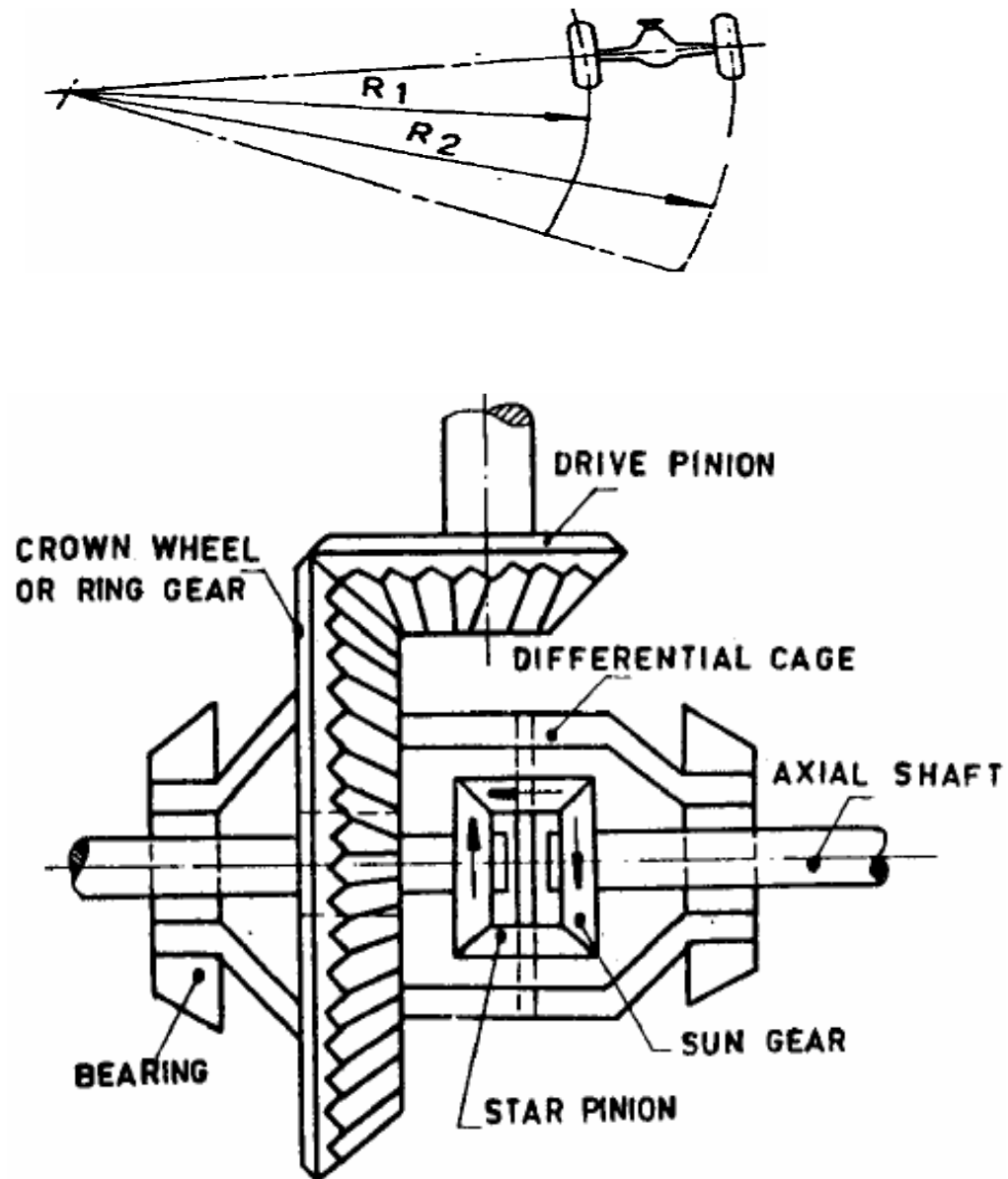


Fig. Differential Unit

Final Drive:

The functions of the final drive are to provide a permanent speed reduction and also to turn the drive round through 90° . The reduction provided is about 4:1 in cars and 10:1 in heavier vehicles. This is done either in one or two stages. For lesser reduction, say up to about 7:1 single reduction is used, while higher reductions are achieved in two steps.

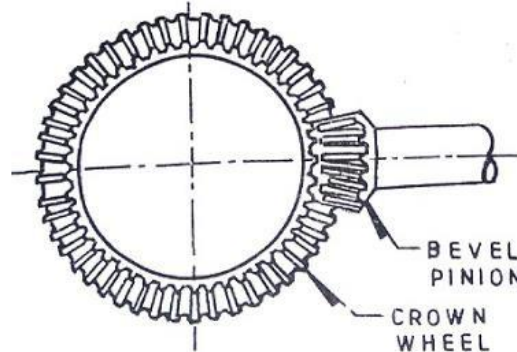
The final drive in practice consists of a bevel pinion and a crown wheel or alternatively, worm and wheel arrangement. The bevel pinion is mounted on a shaft which is connected to the propeller shaft generally through a universal joint. From the crown wheel the drive goes to the differential.

Three types of gears are used for the final drive gearing.

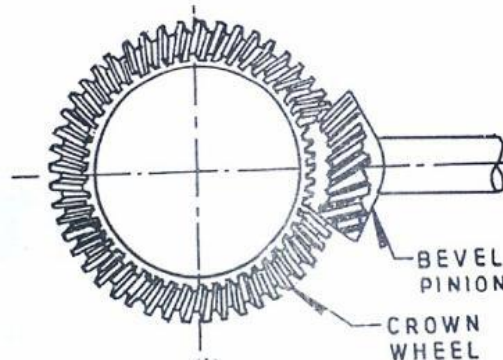
1. Straight Bevel Gears
2. Spiral Bevel Gears
3. Hypoid Gears

FINAL DRIVE GEARING

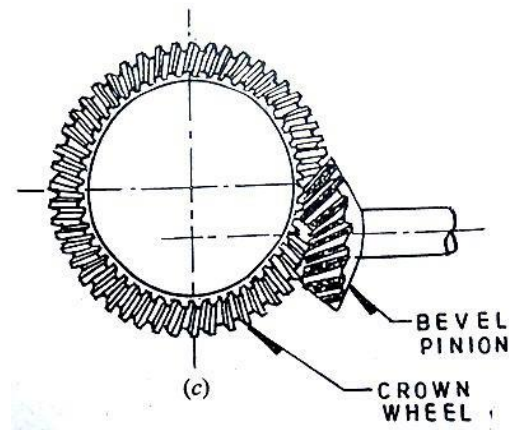
1. Straight Bevel Gears: These contain the straight teeth. They are the simplest and the cheapest of all types. However, with straight bevel gears, at one instant only one pair of teeth of pinion and the crown wheel will be in contact. As a result an uneven transmission of motion will take place as the load is transferred from one pair of teeth to the next. Thus these gears are noisy and suffer from high wear.



2. Spiral Bevel Gears: The spiral bevel gears have curved teeth which result in greater contact of the teeth. Because of this spiral bevel gears are silent in running and stronger than the straight bevel gears.



3. Hypoid Gears: These types of gears are widely used for final drive these days. In this the pinion shaft is placed below the axis of the crown wheel. This permits a lower position of the propeller shaft, thus allowing low chassis height. The name 'hypoid' is derived from the 'hyperboloid of revolution'. The basic surface on which the teeth are cut in their case, is hyperboloid, which is a solid obtained by rotating a hyperbola about an offset axis.



PRE TEST:

1. When might an open differential be a problem?
 1. Driving on hot asphalt
 2. Making a turn
 3. **Driving on ice (correct)**
2. How many differential do all-wheel-drive vehicles?
 1. One
 2. **Two (correct)**
 3. Three

POST TEST:

1. Which of the following is one of the jobs of the differential?
 1. To allow the wheels to rotate at exactly the same speed
 2. To maintain torque
 3. To aim the engine power at the wheels
 4. **All of the above (correct)**

2. When a wheel slips, what types of differential allows more torque to be transferred to the non-slipping wheel?
 1. Stable differential
 2. Limited slip differentials
 3. **Closed differential (correct)**

REFERENCES:

1. Kripal singh ,Automobile Engineering Vol II, Standard Publishers Distributers, Tenth Edition, 2007