

Lecture

Automobile engineering

- Advantages of overdrive:
 1. It allows a lower engine speed to maintain the car at highway speed.
 2. It does not require as much as power to keep it moving. Therefore, the engine can turn more slowly, produce less power and still maintain car speed.
 3. This system saves fuel.
 4. Wear on the engine and accessories are reduced.
 5. A typical overdrive transmission can maintain a car speed of 88 kmlhr while allowing the engine to tum at the equivalent of only 70 km/hr.
- 3.10.1. Operation
- The shift to overdrive can be obtained when the car is running above a predetermined cut-in speed from 32 to 51 kmlhr by lifting the foot momentarily from the accelerator.
- The action of the overdrive is controlled by a centrifugally operated switch.
- As the car slows down below another predetermined speed (slightly lower than the cut-in speed), it is returned to third speed automatically in most designs.
- Greater power and acceleration are needed through the overdrive gear ratio when a car runs on the road.
- So, the car gear is shifted back to direct gear when an overdrive is depressed by the accelerator to the full-throttle position.

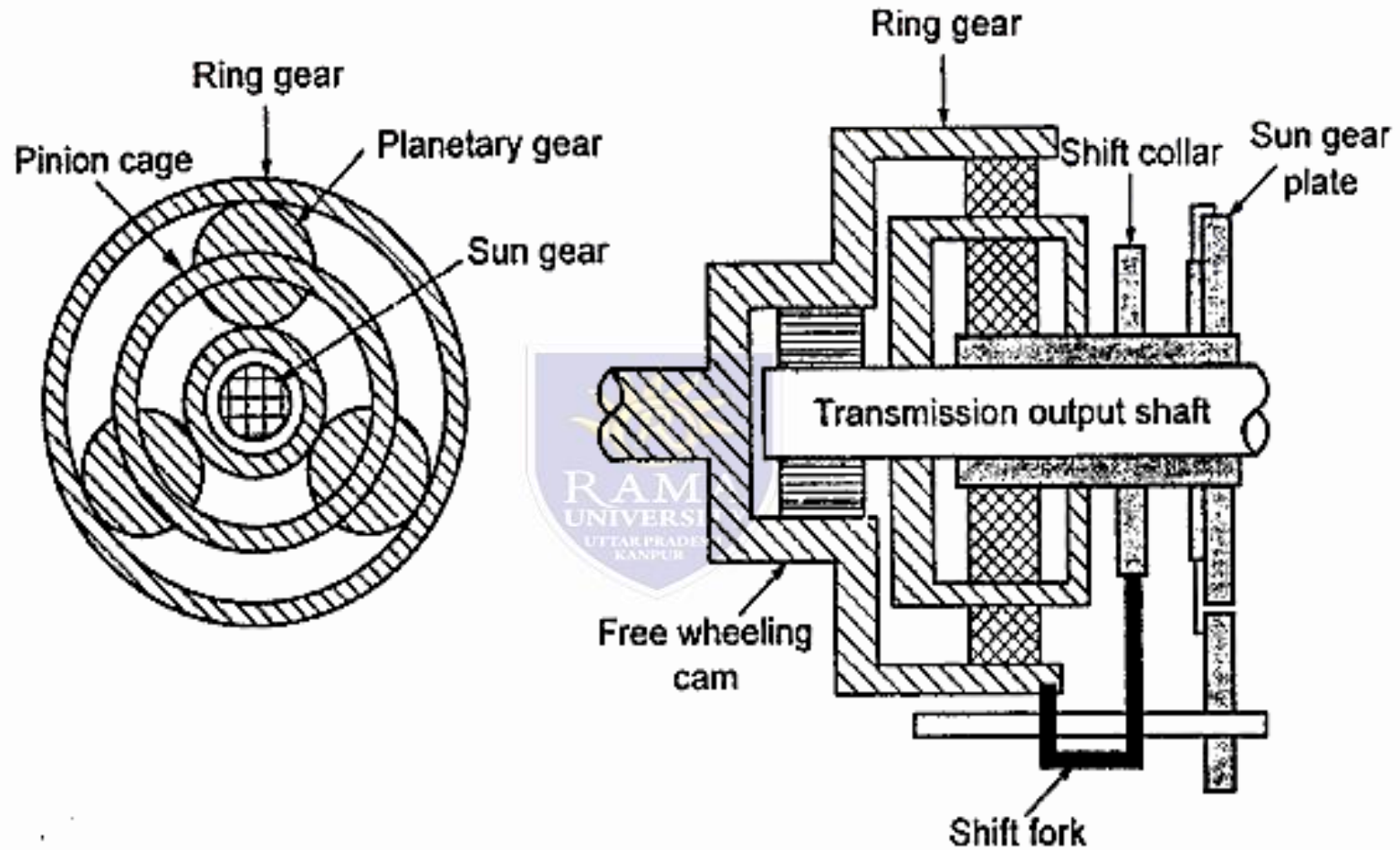


Figure 3.33 Planetary gear set arrangement of overdrive mechanism

Lecture

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- Construction
- A design of overdrive used in late-model American passenger cars is shown in Figure 3.33.
- This arrangement has a planetary gear set, a solenoid and pawl arrangement to lock the sun gear, a rail and fork assembly which is linked to a dash-control knob.
 - It is used for disconnecting the overdrive when it is not in use.
- On that time, a freewheel assembly or overrunning clutch drives the main shaft below the cut-in- speed
- The planetary gears are used to increase the speed. It is done by arranging the ring gear driven with the planet-pinion cage. At the same time, the sun gear is locked.
- Due to this, the speed of the main shaft increases with decrease in power available to driving wheels. The minimum speed of the engine varies with different models called cut-in speed.
- If the engine runs below this speed, the drive is made direct by unlocking the sun gear through the solenoid. This solenoid withdraws the pawl held to the gear plate.
- The operation of solenoid is controlled by an electrical circuit. When the engine speed is above the cut-in speed, the electrical controls having the solenoid move the pawl to engage with the gear plate. Thus, the sun gear is locked.
- The power is transmitted from the transmission main shaft to the planet-pinion cage, to the ring gear and to the overdrive main shaft. When the pinions rotate around the stationary sun gear, the ring gear is driven at increased speed.
- Generally, the gear ratio is about 0.7: 1.
- The ring gear is splined to the outer case of the freewheel assembly.
 - It is a part of the overdrive main shaft. If the pawl is not engaged in the gear plate, the sun gear is unlocked.
- Due to this, the planetary gears will not transmit power.
- When the unit is in direct drive, the power will flow from the transmission main shaft to the freewheel assembly and to the overdrive main shaft.

Lecture

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- Freewheel Assembly or Overrunning clutch
- Freewheel assembly or overrunning clutch, sprang clutch or one-way clutch are essential parts of every overdrive.
- This mechanism transmits the rotational motion only in one direction but not in reverse direction.
- It is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft.
- The unit runs free whenever the power is transmitted through the planetary gears. Otherwise, whenever the engine slows down, the transmission main shaft is started to drive the output shaft.
- The construction and principles of operation of a typical freewheel unit are shown in Figure 3.34.
- It consists of cam, rollers and outer race.
- One part of the free wheel unit consists of a hub having internal splines.
- These internal splines connect the transmission shaft to freewheel unit.
- The outside surface of the hub is splined with cam and it has four cam profiles to hold twelve rollers in a cage between them and outer race. The outer race is splined for connecting with the overdrive output shaft.
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- When the transmission output shaft rotates faster than the overdrive main shaft as shown in Figure 3.34, the rollers are shifted into narrow parts between cam and outer race to perform the locking action.
- By this, the transmission output shaft rotations are transmitted through cam to rollers and to outer race and then to drive the propeller shaft.
- It is the method to drive the output shaft in direct drive.
- When the outer race turns faster than cam, the outer race becomes the driving member.
- Now, rollers are dropped into valley parts of the cam to unlock the connection between transmission output shaft and overdrive main shaft.
- Thus, the free wheel is moved independent of the hub. So, the entire assembly acts as a roller bearing.
- The torque is not transferred from the outer race to cam.

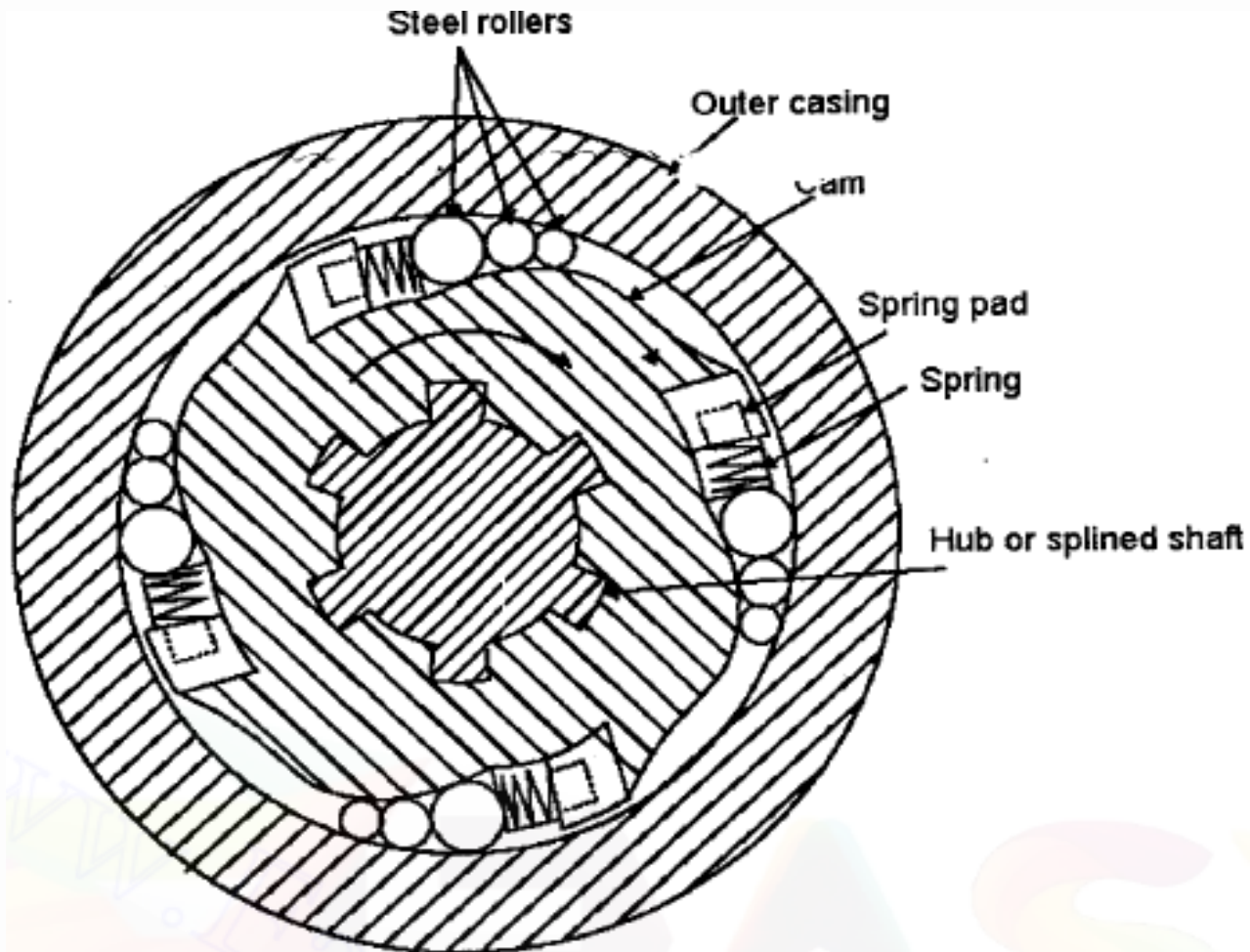


Figure 3.34 Freewheeling assembly