- 1. The main shaft or output gears are freely rotated on bushes of the output shaft.
- They are internally placed by splined thrust washers. Generally, single or double helical gears are used in constant mesh with the long shaft gears.
- 2. When their speed is equalized or synchronized by their cones, the output gears will be locked to their shaft by the dog clutch.
- Figure 3.26 shows the synchromesh unit. The synchromesh unit helps to synchronize the speed of two gears to be engaged without necessity of faster running gear to slow down. Quick shift is possible and noise is reduced by eliminating any clashing of gears.
- The clutch brake of unit is engaged with the faster running gear of these two gears.
- The speed of the faster running gear has to be quickly slowed down to the slow turning gears before putting into operation. It is done for intermediate and high-speed gears.
- In an Ambassador car, this system is incorporated on second, third and fourth gears. A synchronizing unit has a set of sleeves. These sleeves slide endwise.

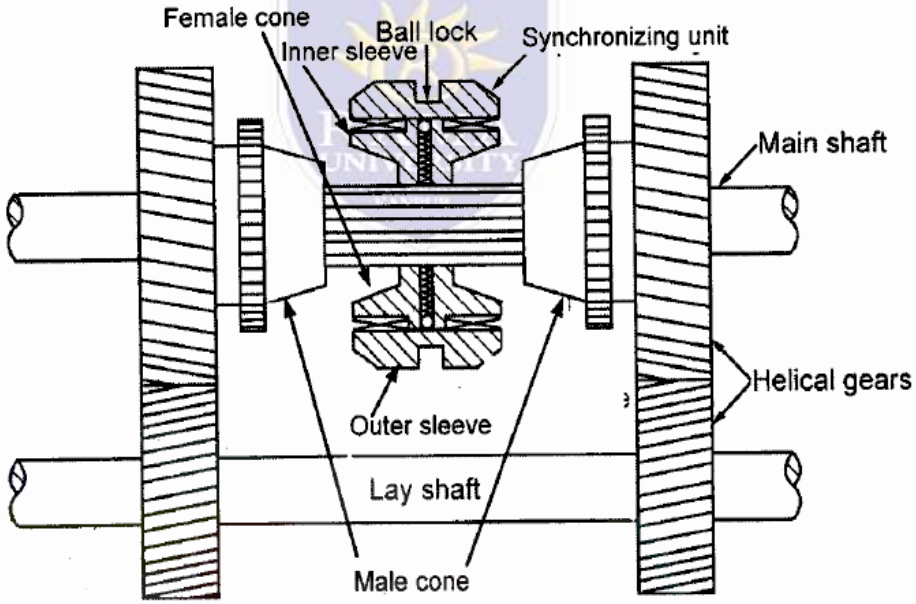

Figure 3.26 Synchromesh unit

- The inner sleeve is splined on the main shaft. It contains gunmetal faced female cones on both ends.
- These cones are mounted over male cones integrated with each main gear having secondary toothed wheel.
- The inner sleeve is fitted over the outer sleeve which contains internal teeth to engage with the teeth of secondary wheel.
- The outer sleeve is locked at different positions
- The synchronizing unit slides on the splines of the main shaft to engage the cones and then the outer sleeve slides over the inner sleeve or hub to engage the gears through a dog clutch.
- when the synchronizing unit is moved to either left or right, the female cone in the inner s
- leeve is mounted over the male cone. This female cone is an integrated with the gear which is moving free over the main shaft. The friction of the cones helps to revolve the main shaft with the main gear. Also, it speeds up or slows down as required until the speed of the main shaft and gear is same.
- The clutch is easier to the gear with the main shaft through the synchronizing unit when the speed is synchronized.
- 'The synchronization of speed obtained with a partial movement of the gear shift lever. Further movement of the gear lever causes the outer toothed sleeve to slide relative to cones. It tends to engage with the secondary wheel in the form of a dog clutch. It results the driving member of main shaft rotate with the main gear.

- Advantages:
- 1. Gear changing is very much simplified.
- 2. Less wear in gears.
- 3. It allows the usage of helical gears that run quietly.
- Disadvantages:
- 1. The design is very much complex.
- 2. Initial cost is high.
- 3. Quick change of gears occurs due to noise of crashing.

- Epicyclic Gearbox
- In ordinary gearing, the axes of various gears are fixed. These gears are simply rotated I about their axes. In the case of epicyclic gearing, at least one of the gears not only rotates about its own axis but also rotates about some other axes. The two arrangements of the epicyclic gear trains are shown in Figure 3.27. In Figure 3.27 (a) arrangements, a spur pinion called sun wheel is an integral part of shaft which is made to rotate freely about its own axis XsX. The pinion shaft is mounted on bearings in the frame. Also, 11crankshaft or carrier arm is also made to rotate freely about the same axis x-x. This arm is connected with a spur pinion called planet wheel by crankpin. The planet wheel is freely to revolve about its own axis y-Y. When the carrier arm is rotated on its bearings, the planet wheel will also rotate bodily about the axis XsX. The planet wheel is meshed with the spur pinion and also meshed with an internally toothed ring called annulus. The annulus is one part of the frame as a fixed unit. The annulus is circular and concentric with the axis X-X. It is an epicyclic train of gearing. It provides a definite and fixed speed or gear ratio between the shaft attached to the sun wheel and the shaft of the carrier arm.

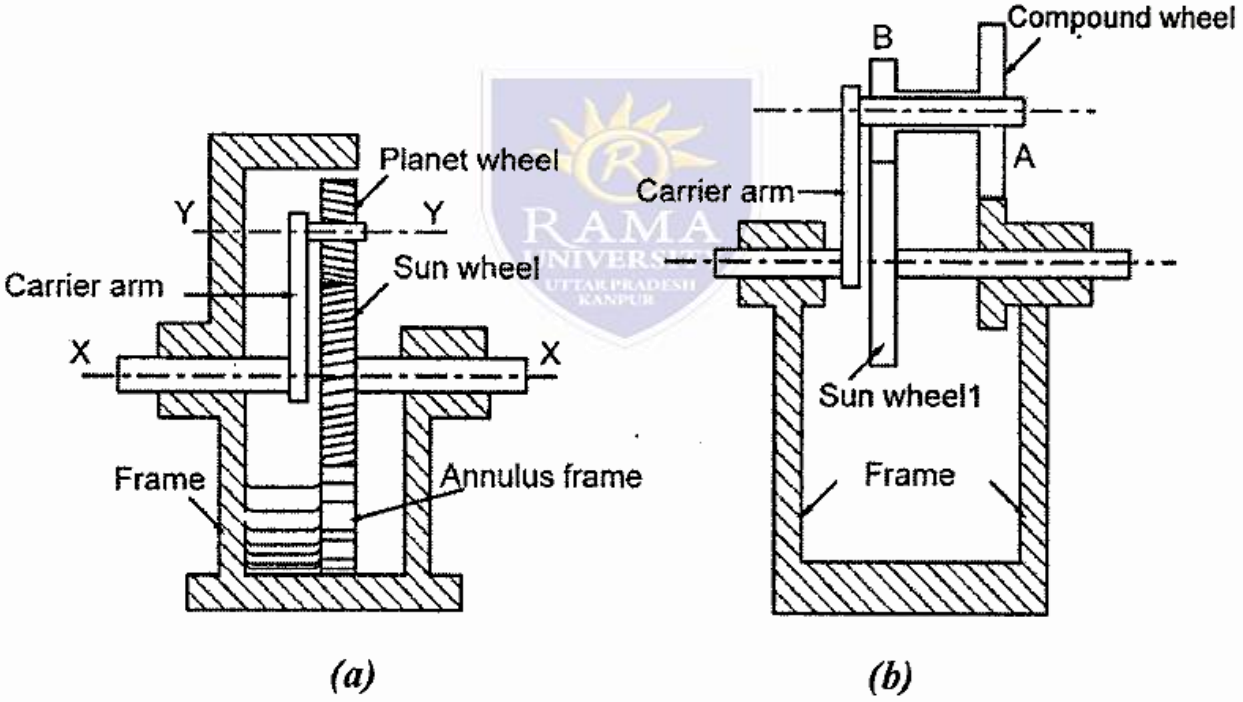

Figure 3.27 Epicyclic gear box

- In Figure 3.27 (b), the sun wheel (1) is a part of integral shaft which is freely to rotate about its axis in the frame.
- This sun wheel is meshed with the teeth A of the compound planet wheel. Now, the compound wheel freely revolves on the pin of the carrier arm. The carrier arm called shaft is mounted in the frame. It is free to revolve about the sun wheel.
- The portion B of the compound planet wheel is meshed with the sun wheel (1). When the carrier arm shaft is turned, the shaft attached to the sun wheel (1) will also be driven in the same direction as the carrier arm rotates. But its speed is low.
- The epicyclic or sun and planet type gearbox have no sliding dogs or gears to engage.
- But different gear speeds can be obtained by tightening brake bands on the gear drum. Hence, gear changing is simplified.

- Figure 3:28 shows an epicyclic gearbox. The compound gear 1, 3, 5 is located to a pinfixed on a wheel A. The compound gear is freely rotated on the pin. Gears 1, 3 and 5 are shed with three different gears 2, 4 and 6 respectively. They are connected in turn to drums 7, 8 and 9. The drums 7 and 8 have brakes in their outer circumference and a number of clutch plates are provided on drum 9. A hub is attached to the flywheel spigot shaft N in which a number of clutch plates are fitted. For obtaining top speed, the member of is pressed against clutch plates. It will engage the clutch by connecting the shaft N to the output shaft P directly. Thus, the top speed gear is obtained

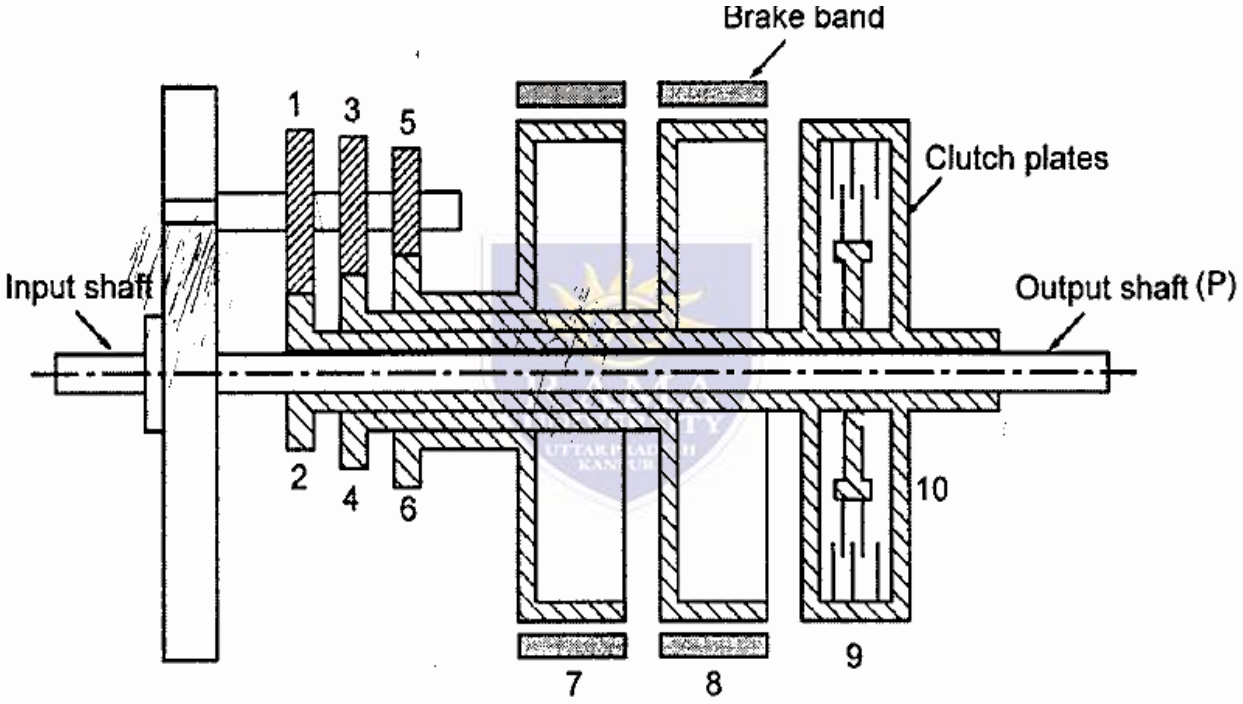

Figure 3.28 Epicyclic gearbox