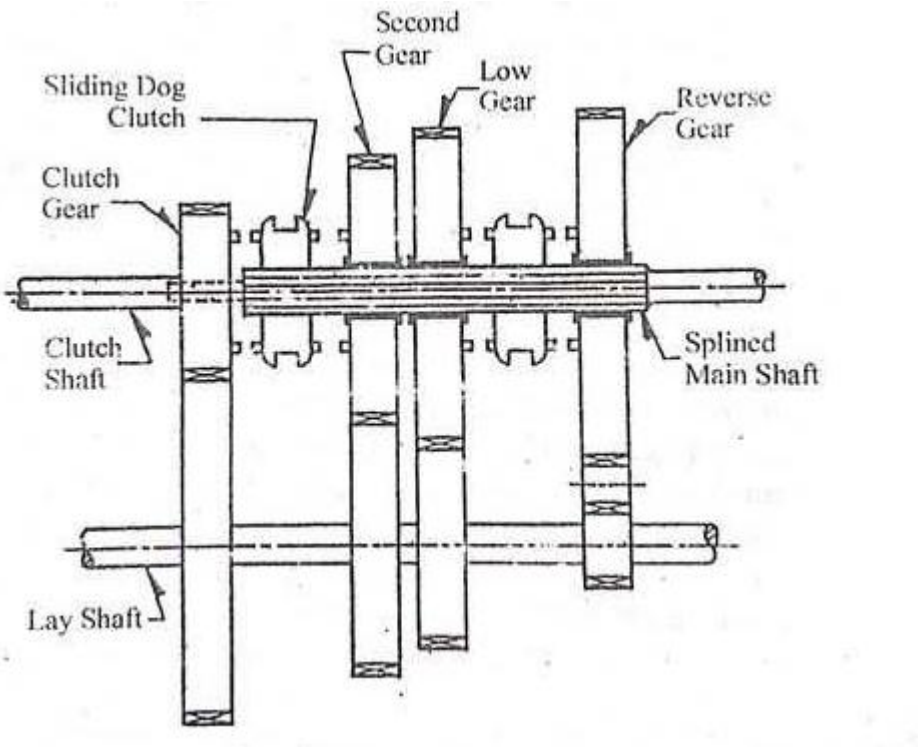
LAYOUT OF CONSTANT MESH GEARBOX

INTRODUCTION

Constant Mesh Gearbox was invented to overcome the limitations of the sliding mesh gearbox. In this gearbox, all the gears are always in mesh. The gear remains fixed and not slide like the sliding mesh gearbox. In this gearbox, the sliding mesh was replaced with constantly meshed pairs of gears and the new shifting devices named dog clutches were introduced. A constant mesh gearbox usually comes with 4-speed 1-reverse manual transmission configuration.

This gearbox has different parts like counter shaft, main shaft, clutch shaft, gears and dog clutch. Gears on the counter shaft are fixed to it and the gears on the main shaft are free to rotate. Helical and herringbone gears are usually used in this gearbox, so it is quitter than sliding mesh gearbox which uses spur gears.

In this gearbox all the gears in the main shaft and the counter shaft are always engaged with each other. Different transmission ratio or speed ratio are obtained by using the **dog clutch. Dog clutches** engage with gears on the main shaft to obtain desired speed or torque.



MAIN PARTS

1. Shafts – There are 3 shafts present in this gearbox which are

- **Main Shaft**: It is also known as output shaft. It is the splined shaft over which the dog clutches along with gears are mounted. Gears on this shaft are free to rotate.

- **Lay Shaft or Counter Shaft:** It is an intermediate shaft between the Main Shaft and Clutch Shaft. The gears of counter shaft are in constant mesh with gears of main shaft. Also the gears of counter are shaft are not free to rotate as they are directly connected to the Counter Shaft.
- **Clutch Shaft:** The clutch shaft carries the engine output to the gearbox but act as input for the gearbox. It is also known as input shaft.

2 Dog Clutch:

The dog clutch couples the lay shaft and main shaft by interference and not by friction. Dog clutches are used to transmit appropriate gear ratio to the main shaft or output shaft by coming in interference with pair of gears with suitable gear ratio. There are usually two dog clutches in a Constant Mesh Gear Box.

3) Gears:

Gears of constant mesh gearbox come in pairs. All gears of lay shaft or counter shaft are always paired with gears of main shaft or output shaft. This paired gears of counter shaft and main shaft provide different gear ratio which can be transmitted to main shaft by engaging dog clutch with appropriate gear ratio required.

Two type of gears are used in constant mesh gearbox:-

- **Helical Gears:** These gears have angular cut teeth over cylindrical cross-section metal body.
- **Bevel Gears:** These gears have angular cut teeth over conical cross-section metal body.

CONSTRUCTION

- The output of the engine is carried by clutch shaft. The gear in clutch shaft is in constant mesh with the gear of lay shaft.
- There are 5 gears in lay shaft, one of which is connected to gear of clutch shaft and the other 4 are connected with gears of main shaft.
- All four gears are of different sizes to obtain different gear ratios.
- An idler gear is present between the gear of lay shaft and gear of main shaft to form reverse gear.

WORKING

- When the **dog clutch** is engaged with different gears of main shaft different gear ratios are obtained as gears of main shaft are always paired with gears of counter shaft to form different gear ratios.
- If the dog clutch is not in contact with any gear of main shaft the gears of main shaft rotates freely and does not rotates the main shaft as they are connected with main shaft using bearings.
- The main shaft rotates only when one of the dog clutch is engaged with any of the gear of the main shaft.
- Reverse gear is obtained in this gearbox using the same technique that was in sliding gearbox i.e using the idle gear between main shaft gear and counter shaft gear.
- First gear is obtained in constant mesh gearbox when dog clutch gets engage by interference with the largest gear of main shaft which is in constant mesh with smallest gear of main shaft. This gear provides maximum torque and minimum speed to the main shaft.
- Second Gear is obtained when dog clutch gets engage with second largest gear of main shaft which is in a constant mesh with second smallest gear of lay shaft. This gear provides higher speed and lower torque than first gear.
- Third gear provides the highest or maximum speed in a vehicle using constant mesh gearbox. This gear is obtained when dog clutch engages with smallest gear of main shaft which is in constant mesh with largest gear of lay shaft.
- In Reverse gear the vehicle goes in reverse direction. Like sliding mesh gearbox, an idler gear is also used in constant mesh gearbox between the main shaft gear and lay shaft gear to form reverse gear. Reverse gear is obtained when dog clutch engages with gear in main shaft which is paired with idler gear.

ADVANTAGES

- Constant Mesh Gearbox are quiter because helical or herringbone gears can be used in this gearbox instead of spur gears.
- Since the gears are engaged by dog clutches, if any damage occurs while engaging the gears, the dog unit members get damaged and not the gear wheels.