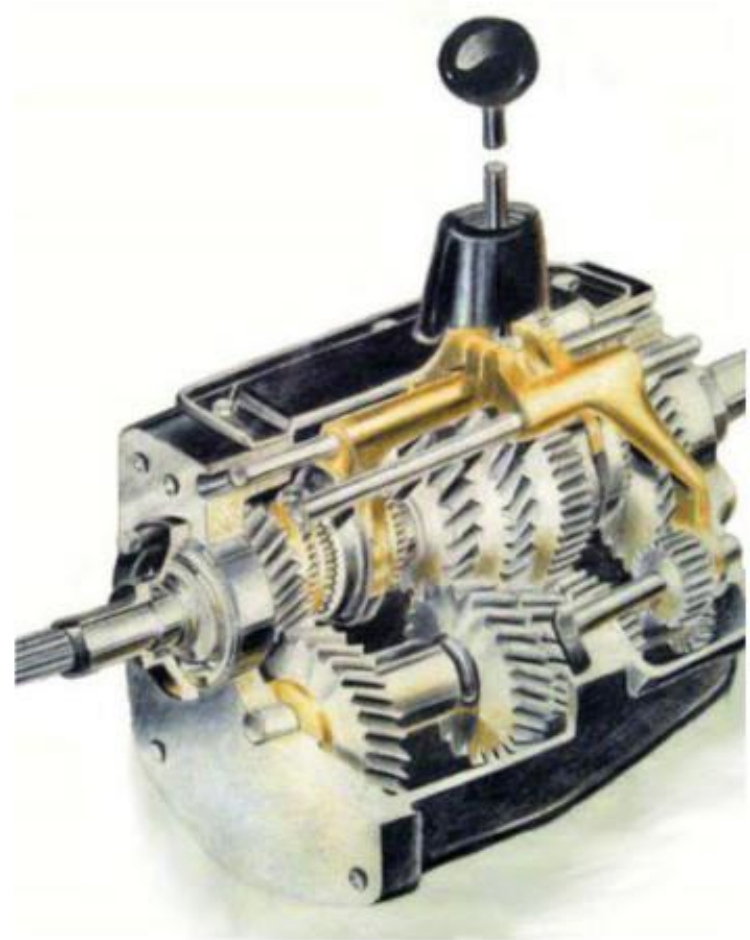


UNIT 2

TRANSMISSION SYSTEM-GEARBOX

Gear Box

- Gear box varies the leverage (speed ratio & hence torque ratio) between the engine & driving wheels.
- It is located between Clutch & Propeller shaft.
- It is provided with either 4 speed or 5 speed ratios or more depending on design.
- Gear ratio is varied by Gear shift lever.



Introduction and Purpose

- Provides speed and torque conversions because of the limitations of internal combustion engines.
- Also facilitates change of direction of output shaft for reversing
- Automotive gearboxes are used to reduce load on the engine by manipulating torque and speed. They have the option to select one of several different gear ratios.
- Once the engine has reached a number of revolutions per minute, it is advisable to increase the gear to reduce the engine rpm to **reduce wear** on the engine, allow **more control**, and **greater speeds, better acceleration, and better fuel economy**.
- Most gearboxes are used to increase torque & reduce the speed of a output shaft. This produces a **mechanical advantage**
- Automotive gearbox also have the provision to do the opposite ie provide an increase in output shaft speed with a reduction of torque (overdrive).

Basic Principle



- The most basic type of gear is a spur gear, and it has straight-cut teeth, where the teeth are cut parallel to the axis of the gear.



- Wider gears and those that are cut for smoother meshing are cut with the teeth at an angle. These are called helical gears.

Basic Principle

- Because of the angle of cut, helical gear teeth have a much more gradual engagement with each other, and they operate more smoothly and quietly than spur gears.
- Helical gears can transmit more torque because at any time, more number of teeth are in mesh
- Gearboxes for cars and motorbikes almost always use helical gears.
- However, helical gears also exert undesirable axial thrust
- To prevent axial thrust, double helical gears are used which cancel out the thrust. Double Helical gears are called Herringbone gears.

- ***Classification of Gear Boxes:-***

1. Manual Transmission

- a. Sliding Mesh Gear-box
- b. Constant Mesh Gear-box
- c. Synchro Mesh Gear-box

2. Automatic Transmission

3. Epicyclic Gear-box

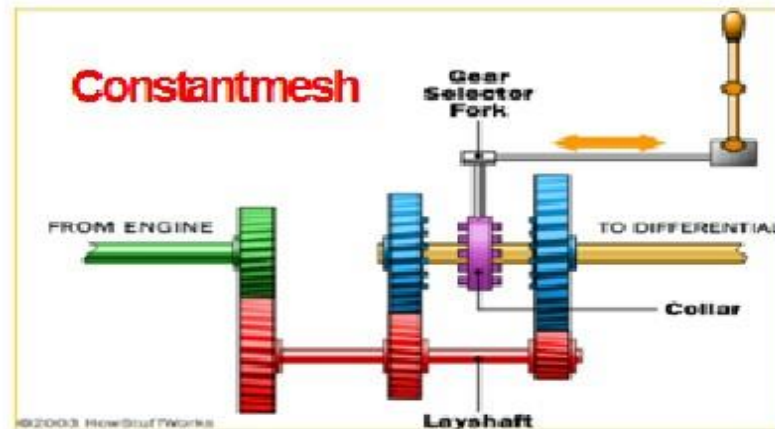
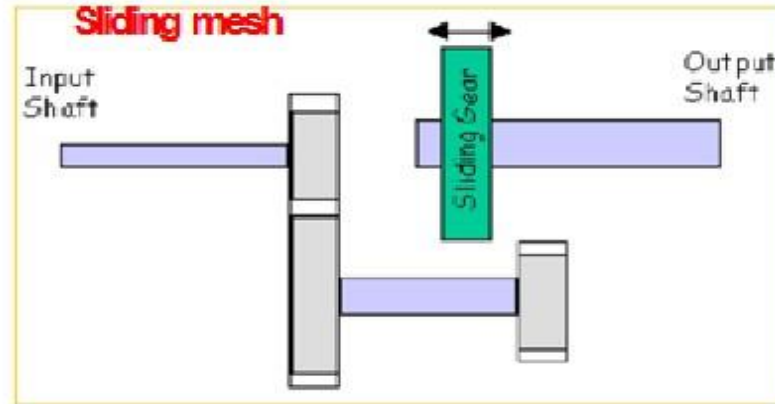
4. Auxiliary Gear –box

5. Pre-selective Gear-box

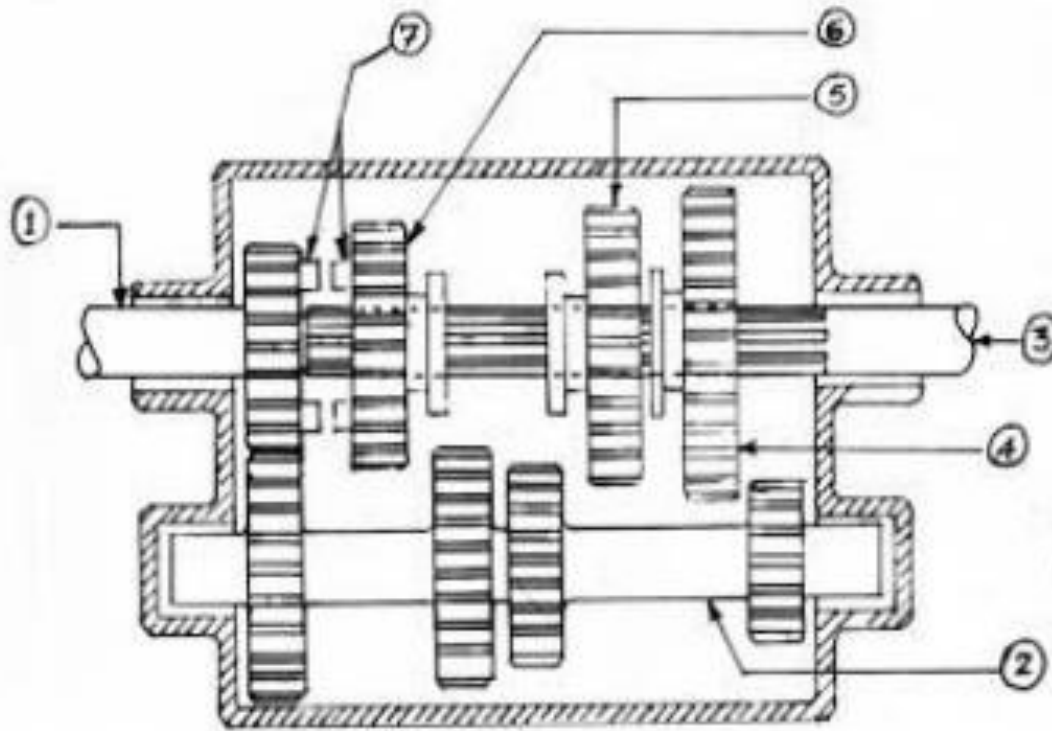
Types of Gearboxes

- Sliding Mesh Gear box
- Constant Mesh Gear Box
- Synchromesh Gear Box
- Transaxle Gear Box
- Sequential gear box
- Automatic Gear Box

Manual Transmission - Types



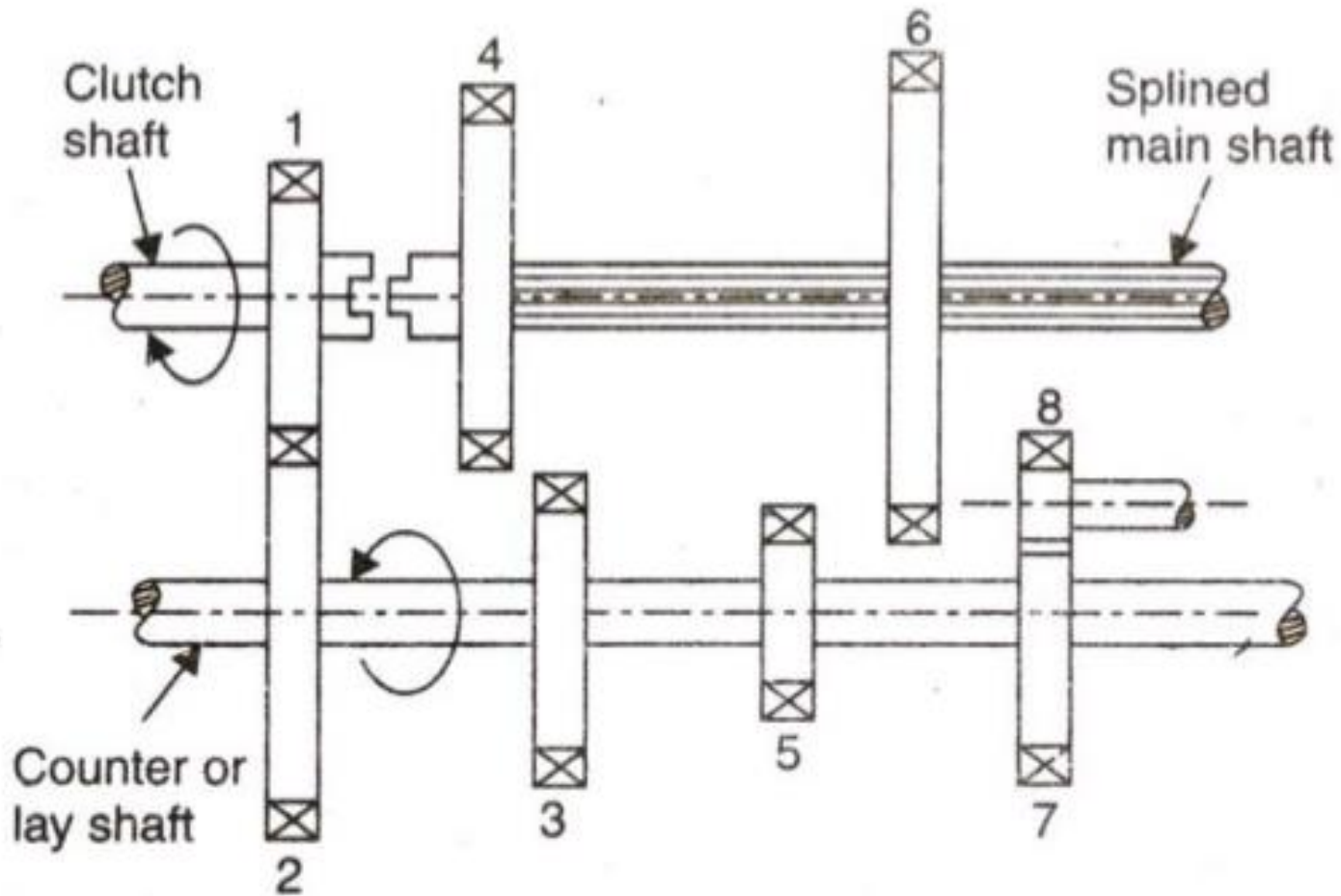
Sliding Mesh Gearbox



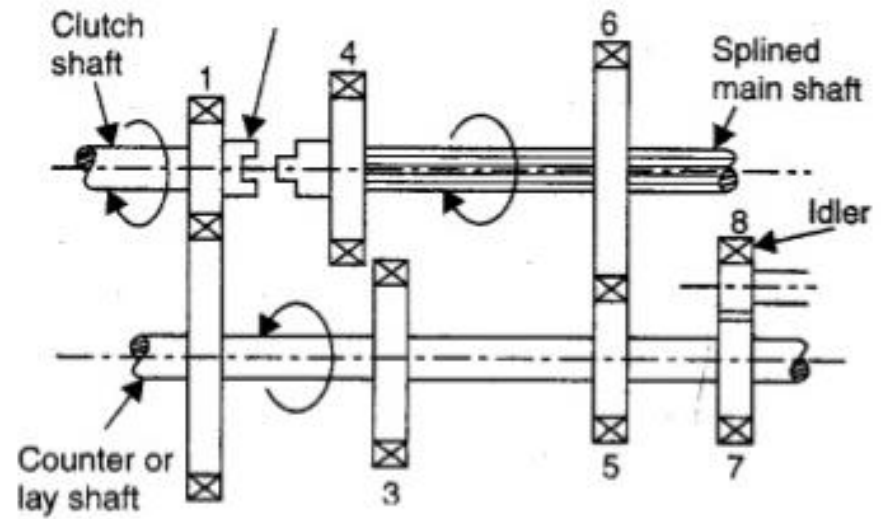
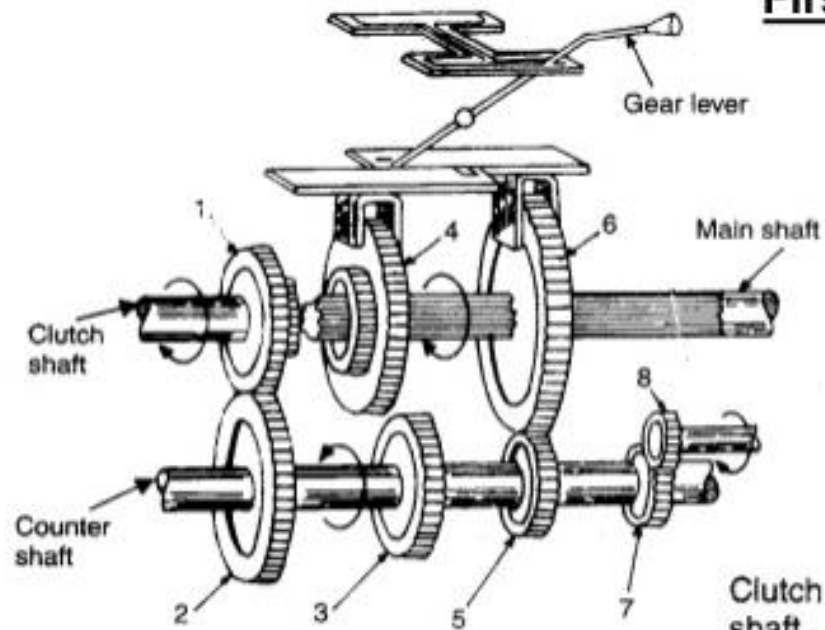
- 1. main drive gear
- 2. counter shaft
- 3. main shaft
- 4. I gear
- 5. II gear
- 6. III gear
- 7. top speed engaging dogs

- Normally 3 forward and 1 reverse gear ratios
- Spur gears are used
- Gear wheels on the main shaft engage with gear wheels on the lay shaft (counter shaft) by sliding themselves.
- Not used in automobiles now

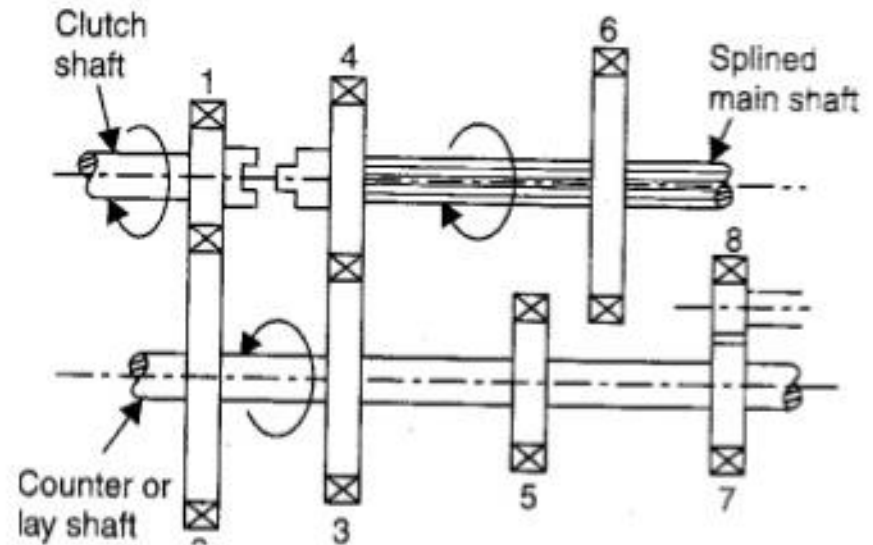
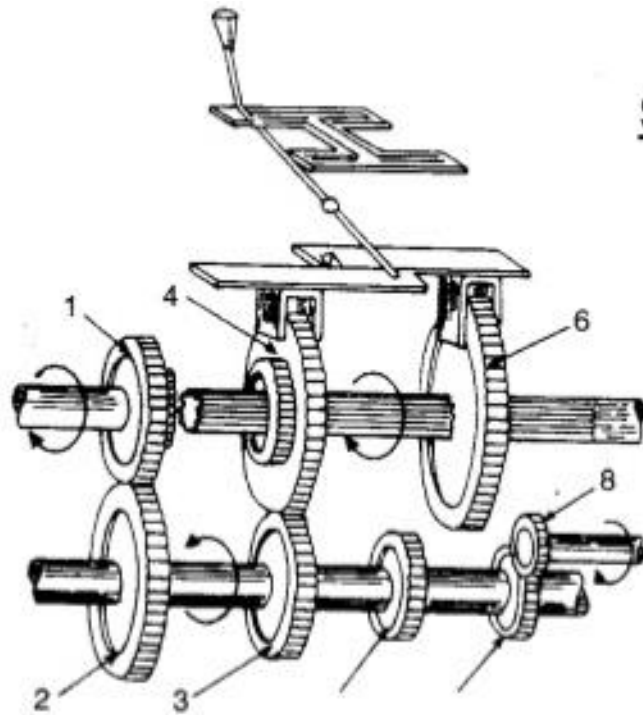
Sliding Mesh Gearbox



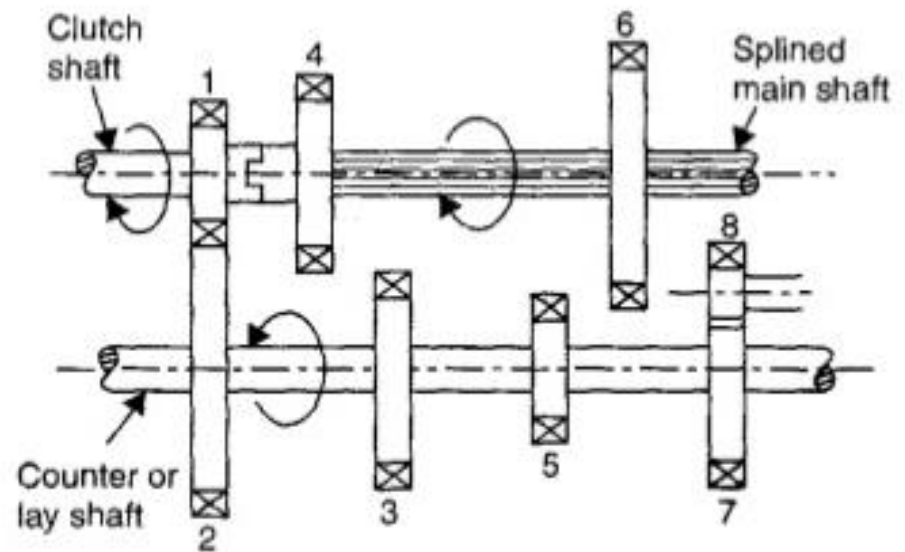
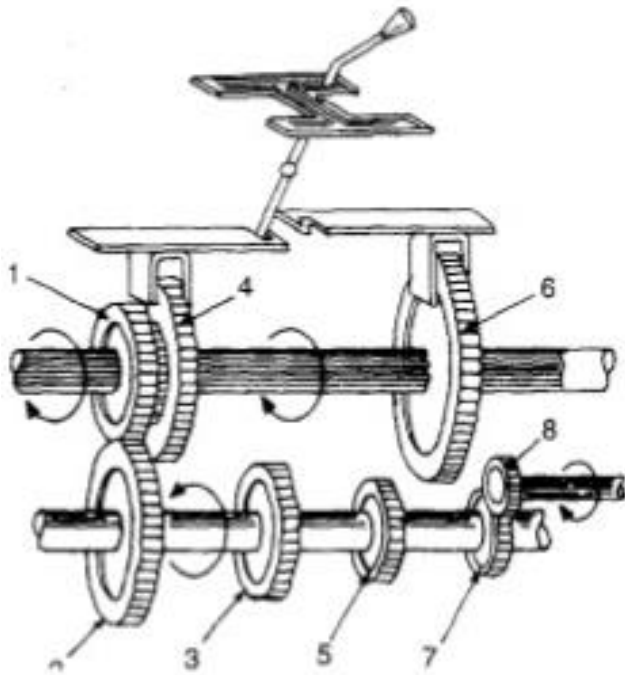
First gear position



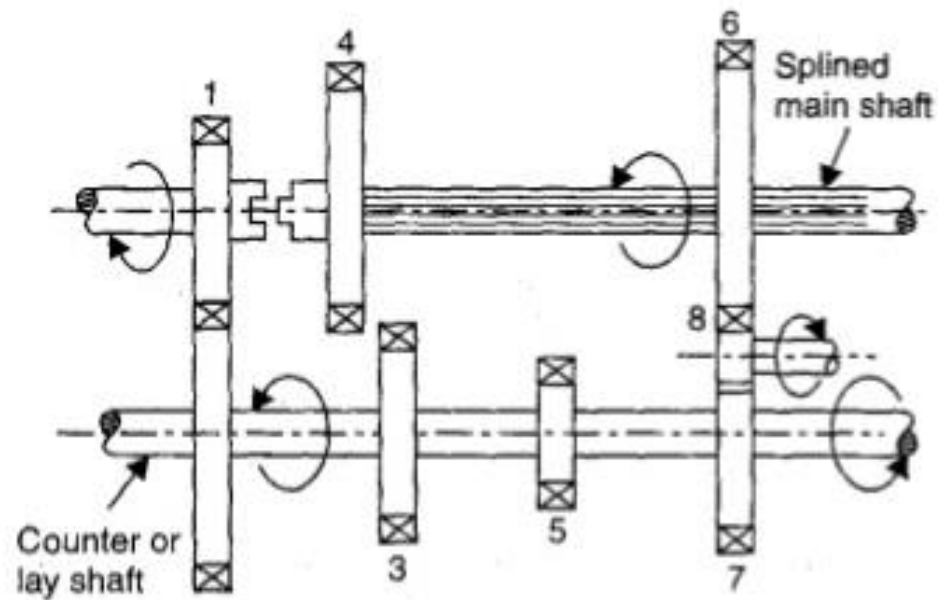
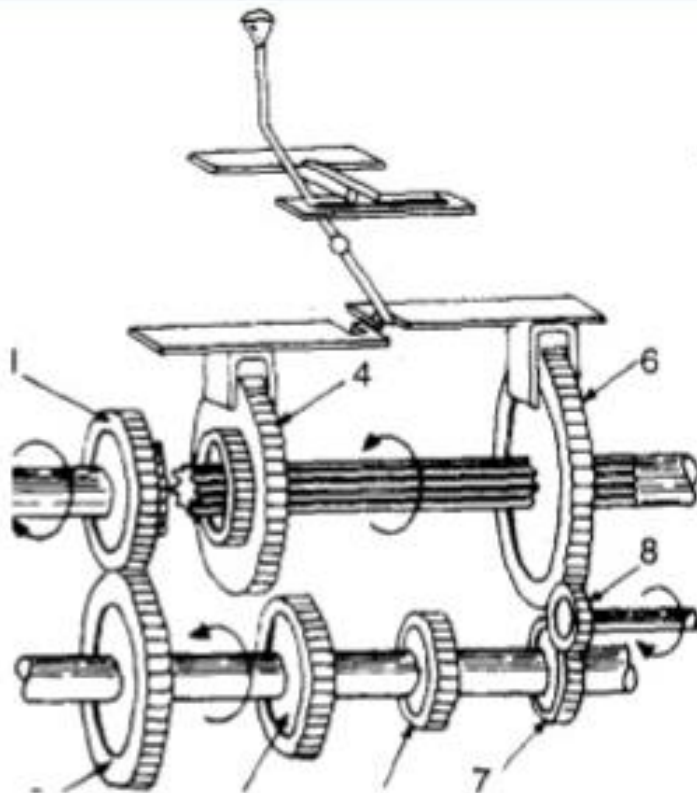
Second gear position



Third gear position



Reverse gear position



➤ Oldest and simplest form of gear-box, in which to mesh gears on the splined main shaft with appropriate gears on the lay shaft for obtaining different speeds, they are moved to the right or to the left and hence, meshing of gears takes place by sliding of gears on each other.

➤ Splines are provided on the main shaft. For meshing the pinions with the mating gears on the lay shaft, the pinions are slid along the spline .

➤ When the main shaft is driven from the lay shaft, the gear reduction is provided by the first pair of gears which are always in mesh. They are usually known as constant mesh gears.

1. **First Gear:-** Largest gear on the main shaft is driven by smallest gear on the lay shaft. With corresponding increase in torque, the speed reduction is quite low.
2. **Second Gear:-** Less speed reduction and smaller torque increase.
3. **Third Gear or Top Gear:-** The clutch shaft and main shaft are directly connected to revolve both shaft at the speed without any change in torque.
4. **Reverse Gear:-** Direction of rotation of the main shaft is reversed by introducing an idler in it.

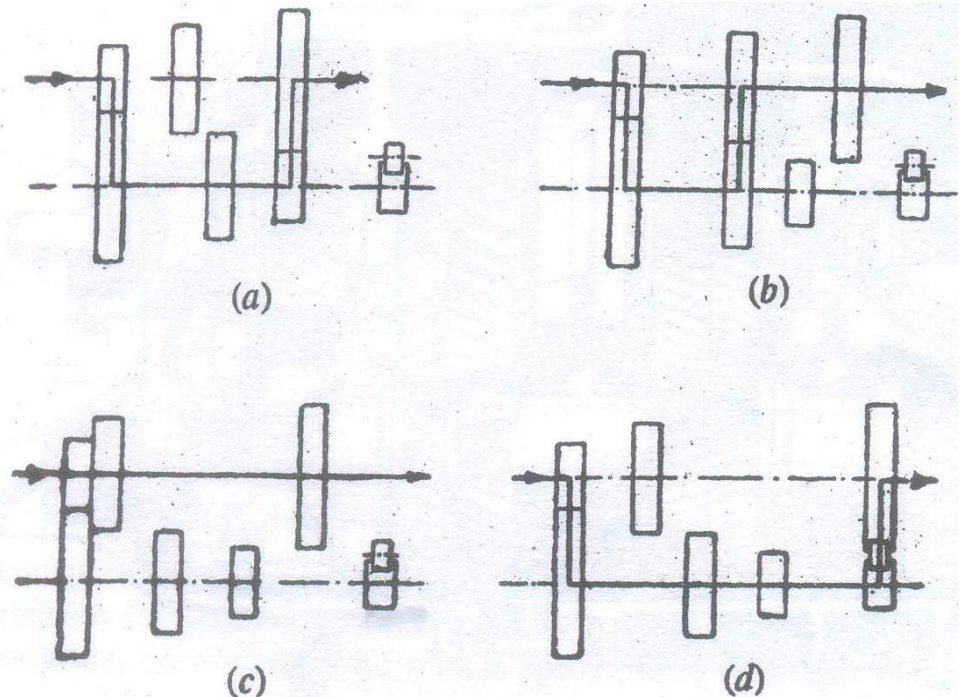
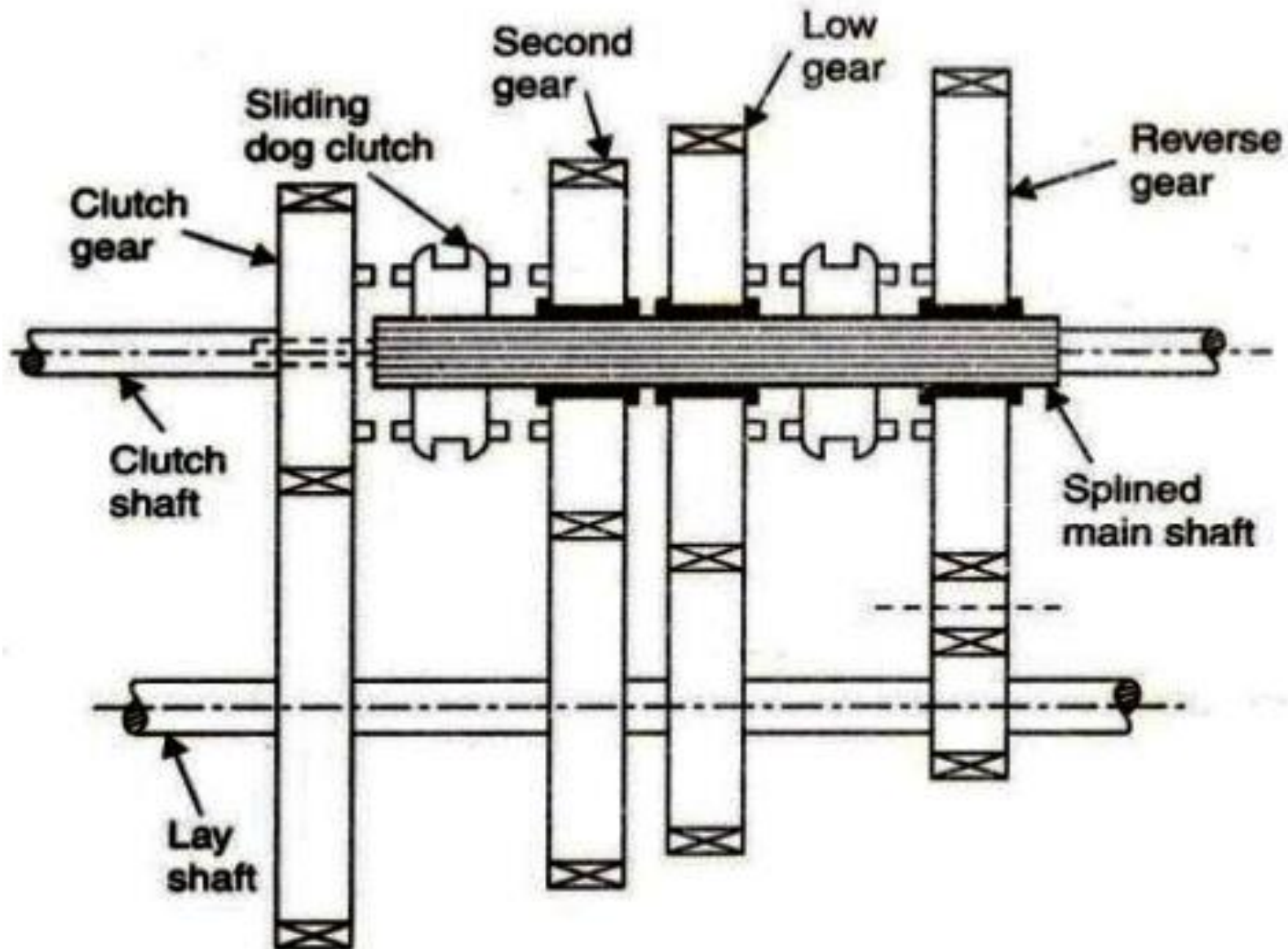


Fig. 4.7. Various Gear Positions in a Sliding Mesh Gear Box.
(a) First Gear, (b) Second Gear, (c) Top Gear, (d) Reverse Gear

• *Constant Mesh Gear-box:-*



➤ In this type of gear box, all the gears are in constant mesh with the corresponding gears on the lay shaft. It is also known as silent or quiet gear box.

➤ The gears on the main shaft which is splined are free and the dog clutches are provided which are free to slide on the main shaft. The gears on the lay shaft are fixed.

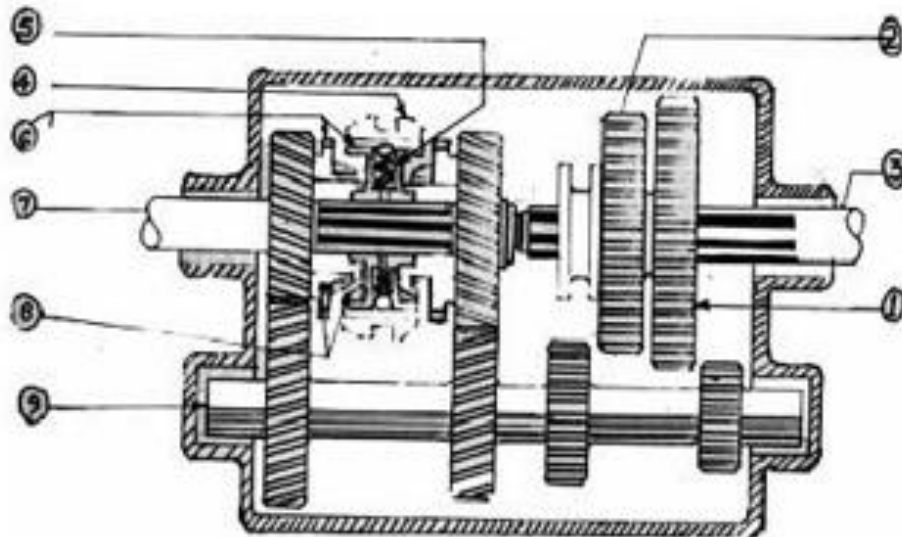
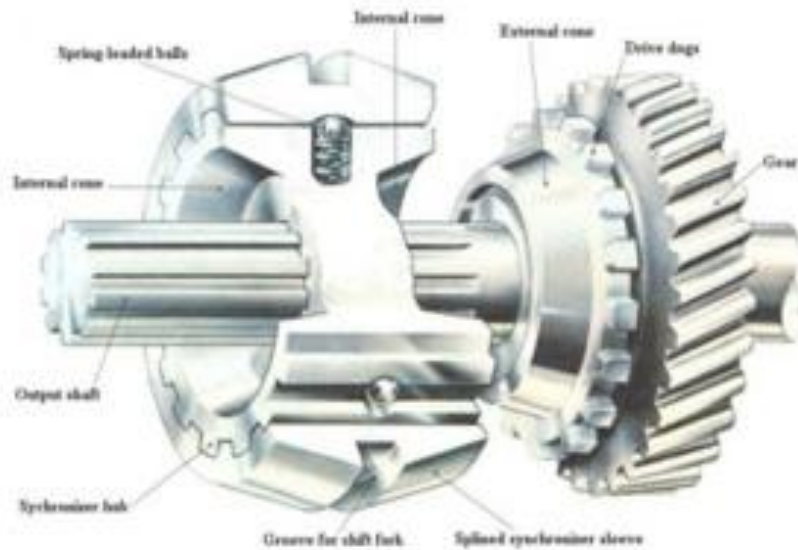
➤ When the left dog clutch is slid to the left by means of the selector mechanism, its teeth are engaged with those on the clutch gear to get direct gear. Similarly, when the same dog clutch, when slid to right, makes contact with the second gear and second gear is obtained.

➤ The movement of right dog clutch to left results in low gear and towards right in reverse gear.

• *Advantages:-*

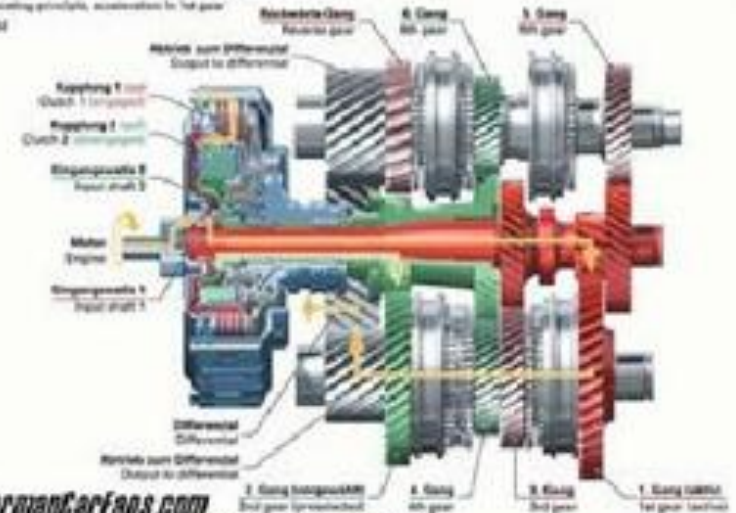
1. No necessary to use straight spur gears and replaced by helical gears which are quieter in operation .
2. Wear of dog teeth is reduced when engaging and disengaging.

Synchromesh Gearbox



Audi TT 3.2 quattro

mit vollwertiger automatischer Sperrgetriebe (DSG)
 Performance: Beschleunigung in 5. Gang
 with the new automatic sports transmission (DSG)
 Operating principle: acceleration in 1st gear
 11.0s



GermanCarfans.com

1.1 speed gear

2.II speed gear

3.main shaft

4.outer engaging unit

5.inner engaging unit

6.top gear engaging teeth

7.main drive gear

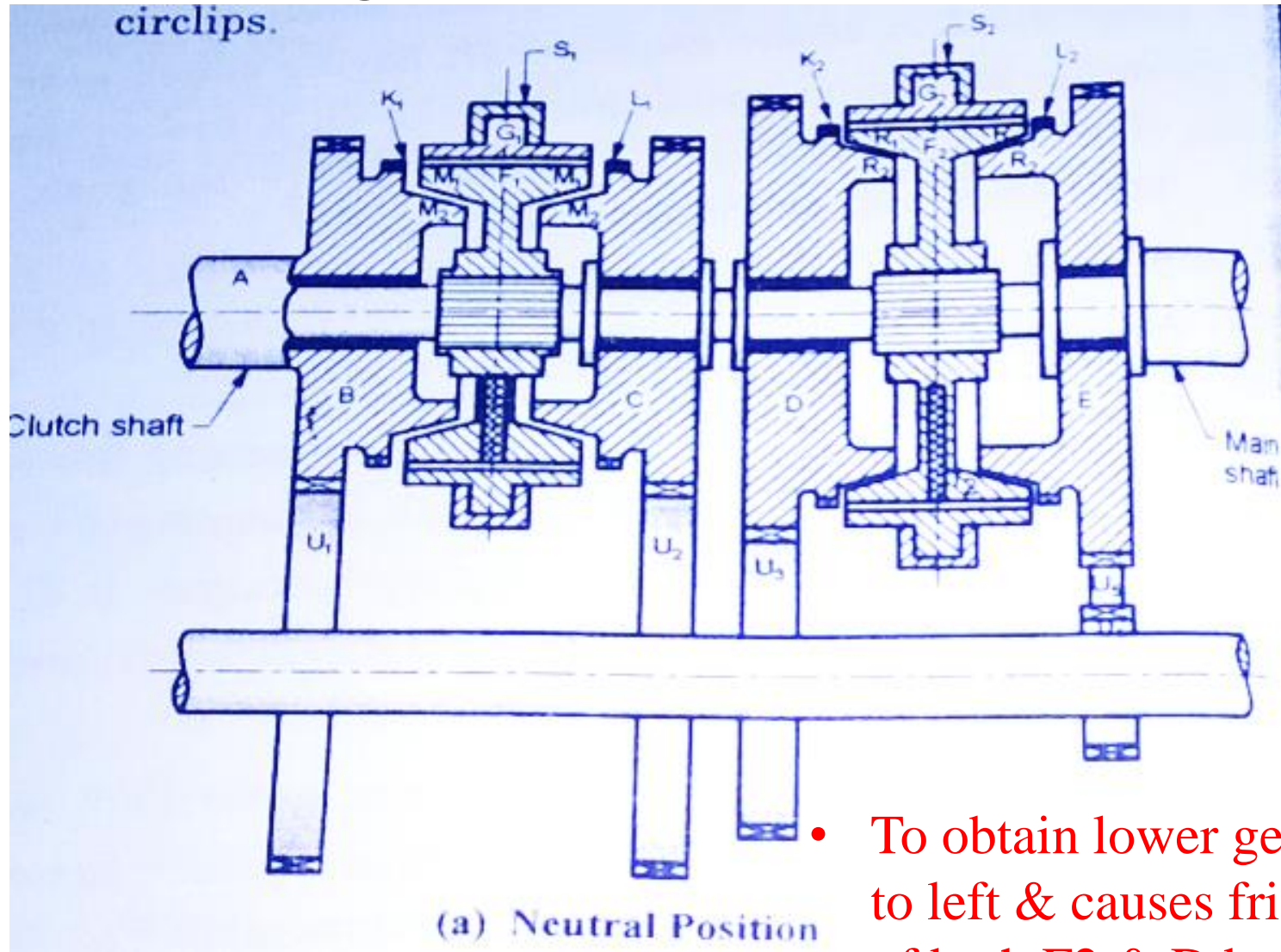
8.top gear synchronizing cones

9.counter shaft

Synchromesh Gearbox

- In order to simplify operation of changing gear this can be done by every operator (skilled/unskilled driver) without occurrence of teeth clashes and damage.
- In this a synchromesh device is used instead of dog, which equalises the speed by friction after which these may be engaged smoothly.
 - B,C,D,E are gears on main shaft
 - F1, F2 are synchromesh members
 - G1, G2 are ring shape members having internal teeth.
 - K1, K2, L1, L2 are dog teeth on gear B,C,D,E
 - T1 & T2 are ball supported by spring.
 - S1 & S2 are the fork.

Synchromesh Gearbox



- To obtain lower gear, F2 moves to left & causes friction & speed of both F2 & D becomes same then G2 override to left to engage with K2

Synchromesh Gearbox

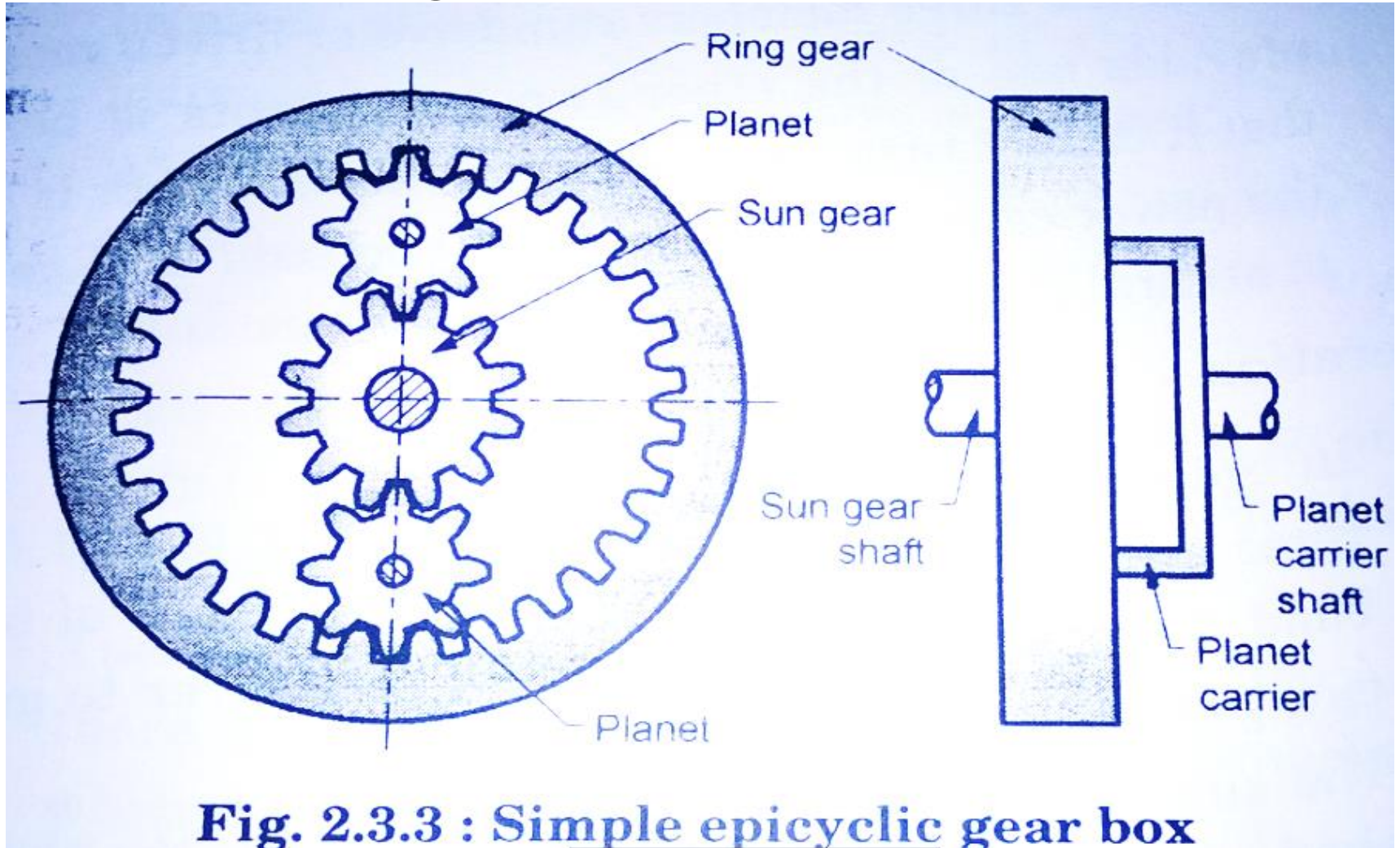
Advantages

- Power transmission capacity is more.
- Unskilled driver can change gear very easily.
- No need of double declutching.

Disadvantages

- Gear box is more expensive.
- It is more bulky due to additional component.

Epicyclic Gearbox



- This is an essential part of the overdrive.
- There is no dog or sliding member to engage.

Epicyclic Gearbox

- To obtain different speeds any one of these three units can be held by rotation by means of brake band.
- The brake band is operated by a lever to grip a ring gear and hold its movement.
- Different speed ratios are obtained by making any one of the part, (Sun gear, planet gear and the annular gear) are stationary.
- By locking two parts with each other a solid drive or direct gear is obtained.

Applications-

1. Cars that having automatic transmission.
2. Army trucks.
3. Watches/ wall clocks.

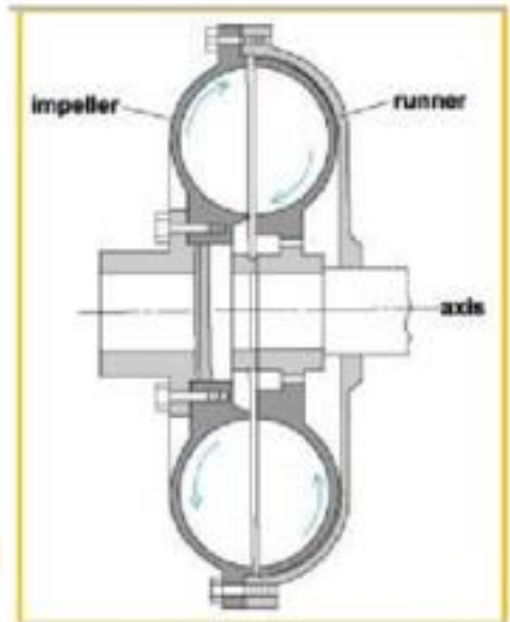
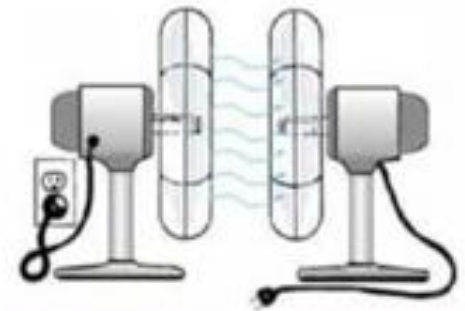
Automatic Transmission (AT)

Conventional Definition

- **Moving away from rest - Torque converter**
- **Achieving ratio change - Planetary gear sets**
- **No power interruption**
- **Mechanism for ratio change**
 - **Wet plate clutches and brakes**
- **Control of ratio change**
 - **Normally automatic timing and actuation**

Fluid Coupling

- **Converts or transmits rotating mechanical energy or power.**
- **Basic components.**
 - outer shell or housing,
 - impeller or pump and turbine or runner
- **Both of these units are contained within the housing via oil-tight seals.**
- **The input turbine is connected to the power supply, typically an electric or ICE.**
- **The output turbine is connected to the drive train of the vehicle or the drive system of a machine.**
- **Mineral oil is used**



Automatic Transmission (AT)

Automatic Transmission (AT)

Automatic Transmission (AT)

Automatic Transmission (AT)

Automatic Transmission (AT)