UNIT-2

POWER TRANSMISSION

INTRODUCTION TO POWER TRANSMISSION

Power transmission is the movement of energy from its place of generation to a location where it is applied to perform useful work.

Power is defined as units of energy per unit time. In SI units

Watt = joule / second = Newton x meter / second.

Mechanical power transmission is used for short distances. Mechanical power may be transmitted directly using solid structures such as drive shaft, transmission gears etc. The transmission gears can adjust the amount of torque or force v/s speed.

A shaft is a rotating machine member usually having a circular cross section much smaller in diameter than its length. Power transmitting elements namely, pulleys, belts, ropes, chains, gears etc. are mounted on the shafts.

TYPES OF POWER TRANSMITTING DRIVES

1. Belt drive
2. Rope drive
3. Chain drive
4. Gear drive

BELT DRIVE

Belts are used to transmit power between two parallel shafts. A belt drive consists of two pulleys on which belt is passed. One of the pulleys called the 'driver' is mounted on the driving shaft, while the other, which is mounted on the shaft to which power is transmitted is called the 'driven'.

The diameters of the driving and driven pulleys on the 'speed ratio' of the drive. The power is transmitted from the driver pulley to the driven pulley by the frictional grip between the belt and the surfaces of the pulleys.

Based on the cross section of the belts, the belt drives are divided as follows:

Flat belt: It is used in factories, workshops and flour mills for transmitting a moderate amount ofpower.

V-belt: It is used for transmitting a moderate amount of power, when the centre distance between the driver and driven is very less.

TYPES OF BELT DRIVE

a. Open Belt Drive:

The open belt drive is used when two parallel shafts of the driver and

driven rotate at the same direction.

The power transmitting capacity of belt drive depends on the tensions in the tight and slack sides, angle of contact of the smaller pulley (è) and the coefficient of friction (μ)between the belt and the pulley materials.

Velocity Ratio: The velocity radio (i) is defined as the ratio of the speed of the driving pulley (N1 in rpm) to the speed of the driven pulley (N2 in rpm).Assuming no slip between the belt and the pulleys, the speed at every point in the belt is same. Therefore the linear squad of the belt and the circumferential speeds of the driving and driven pulleys are equal.

π d1 N1 = π d2 N2

i = N1 / N2 = d1 / d2

where d1 = diameter of driver pulley d2 = diameter of driven pulley.

Tight side

Assume clockwise rotation of the driver pulley. The driver pulley pulls the belt from the lower side and delivers to the upper side. Thus the tension in the lower side belt will be more than that of the upper side belt. Because of the higher tension, the lower side belt is known as tight side.

T1 = Tension in the tight side.

Slack Side

Because of less tension, the upper side is known as 'Slack side'.

T2 = Tension of the slack side.

b. Crossed Belt Drive

It is used when two parallel shafts of the driver and the driven rotate in the opposite directions. At the point when the belt crosses, it runs against itself causing excessive wear. To avoid this, the shafts should be placed at maximum distance '20w',where w is the width of the belt and operated at velocities less than 15m/ sec.

Belt Slip

In flat belt drive, the difference between tensions in tight and slack sides of the belt is equal to force of friction between belt and pulley. When the frictional grip becomes insufficient, the belt begins to slide over the surface of the pulley.This sliding of the belt which causes relative motion between pulley and belt is called 'slip' of the belt.

c. **V-Belt drive:** When a belt is trapezoidal in section, designed to run in a 'V-shaped groove', it is known as V-belt. The V-belt runs is 30° to 40° veegrooves in the pulleys. The effect of the groove is to increase the frictional grip of the V-belt on the pulley and thus reduce the tendency of slipping.

ROPE DRIVE

Rope drive are widely used where the power to be transmitted is more than 150 KW and centre distance is more than 10m. In spinning mills, where number of driving pulleys are more, these drives are used. Steel wired ropes are used in hoisting equipment, craves, elevators, conveyors and other material handling equipment.

CHAN DRIVE

Chains are made up of rigid links hinged together. Chain drives are positive drives with no slipping. Hence velocity ratio remains constant. Power transmitted is as high as 100 KW. Wheels having teeth especially designed for chain are known as 'Chain Sprockets'. Chan drive is used when the centre distance is less as in bicycles, motor cycles, road rollers, agricultural machinery etc.

GEAR DRIVE

Gears are defined as toothed wheels which transmit power from one shaft to another by means by successive engagement of teeth.

Gear drives are used to transmit moderate or large amount of power positively over a short distance with a 'constant velocity ratio'.

GEARTRAINS

Any combination of gear wheels by means of which power is transmitted from one shaft to another shaft is called 'Gear Train'. Usually the 'train' is applied only to combinations, in which there are more than one pair.

TYPES OF GEARDRIVE

a. Simple gear drive
b. Compound gear drive
c. Reverted gear drive
d. Epicyclic gear drive

a. Simple gear drive

A simple gear drive train is one which each shaft carries one gear only. These are employed where a small velocity ratio is required. When distance between two shafts is small, gears 1 and 2 are in mesh with each other to transmit motion from one shaft to the other.

Velocity Ratio = N1 / N2 = T2 / T1

Where N1 and N2 are speeds of drive and driven gears in rlm T1 and T2 are number of driving and driven gears.

b. Compound Gear Drive

In a gear train, when the intermediate shaft carries two gears, it is known as compound gear drive. The compound gear drive is used when the velocity ratio is so high that one of the gears in the simple gear drive is very small.

BELT FASTENER

There are different types of belt fasteners. Some of them are:

a. Plate grip fasteners: These can be used on belts of any width and varying thickness.

b. Riv-Nail fasteners: These can be used as synthetic high strength belt fabrics.

c. Staple grip fasteners: These fasteners are very strong. It's hinged plates are held in compression with 'high tensile stainless steel staples'.

d. **Steel grip fasteners:** These are having combined toughness and with ease of installation.

e. **Flex grip round belt couplings:** These are smooth in operation with tough grip in multidirectional turns.

JACKEY PULLEY

Jackey Pulley is used to maintain tension in a chain or belt by using Jackey wheel. These wheels are used in causes and other pulley equipments.

Short Answer Questions

1. Define power transmission.
2. Explain rope drive.
3. Write types of gear drives.
4. Explain flat belt and V-belt.

Long Answer Questions

1. Explain types of belt drives.
2. Explain belt fasteners.