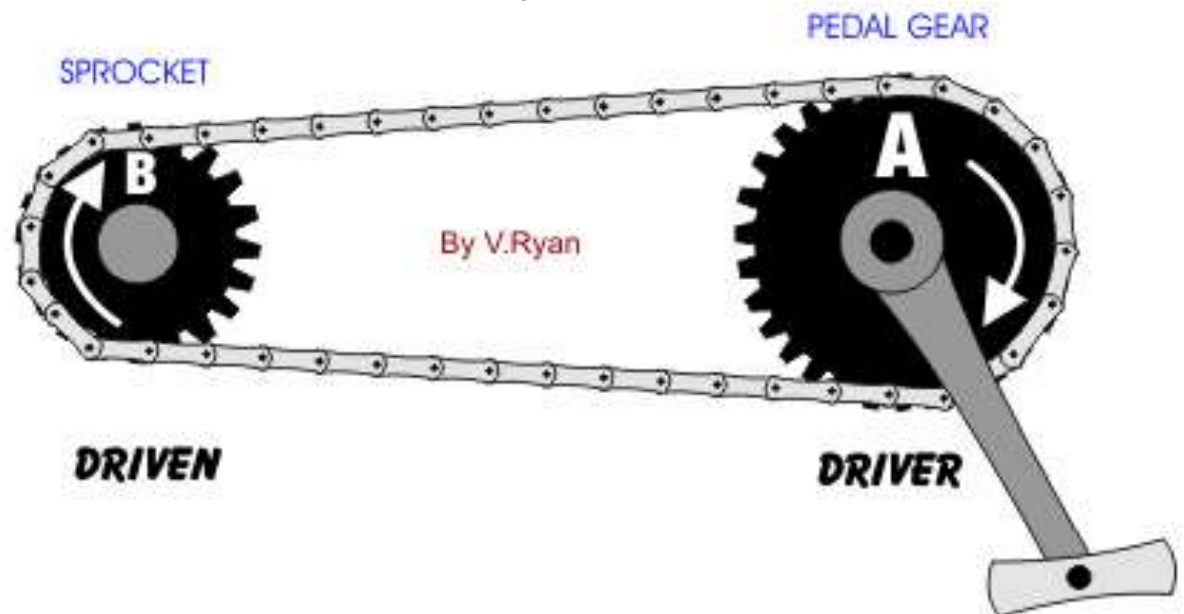


POWER TRANSMISSION

BY

M.WASIM RAJA

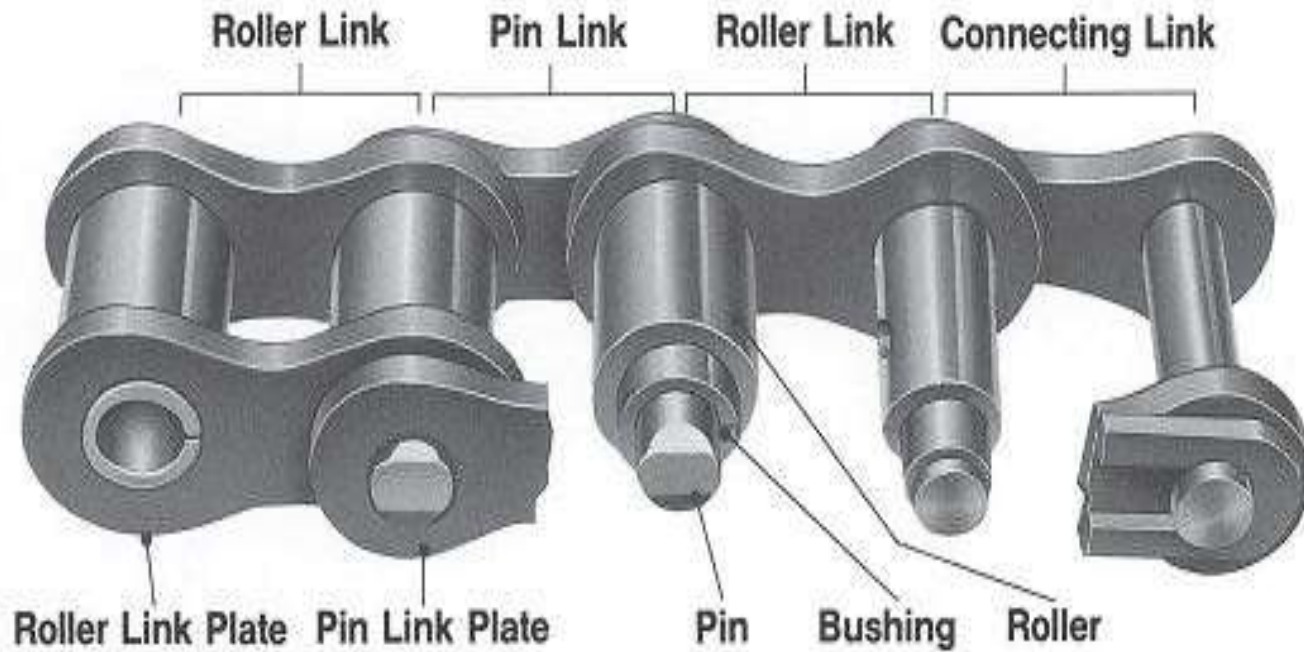
- Chain drives consist of endless chain links over sprockets.
- Sprockets are usually fitted on driving and driven shaft
- In printing industry chain is used for power transmission, speed conversion, and elevating and conveying system.
- A belt or a rope drive does not give a constant velocity ratio due to slip, which may occur due to overloads. In order to avoid slipping and to have a constant velocity ratio, steel chains are used.



TYPES OF CHAINS

- Roller chain
- Silent chain
- Ewart chain
- Bead Chain

Roller Chain



- A roller chain, the most common type of chain, is made up of side plates with alternating roller/bushing and pin-link assemblies.
- It is used for accurate and high-speed chain drives.
- The chains are made up of a number of rigid links, which are hinged together by pin joints in order to provide the necessary flexibility for wrapping round the driving and driven wheels.
- This type of chain is adaptable to widely varying needs, from small-stand drives for light applications to large multiple-strand chains for heavy-duty industrial applications.

Key components of a roller chain mechanism

- Roller chain, which consists of a finished steel roller, alternate assemblies roller, and pin links.
- Link, which is heat-treated strip stock steel that has been perforated and blanked.
- Pin, which is hardened alloy steel that has been ground to specific tolerances
- Bushings, which is a case-hardened core that prevents metal from rubbing metal
- Rollers made of heat-treated, high-carbon steel.

Silent Chain



- The silent chain, also known as an inverted-tooth chain, consists of a series of inverted-tooth links held together by joint pins to which washers have been riveted.
- The silent chain, while not exactly silent, is much quieter in operation than transmission chains
- Unlike a roller chain, the silent chain has a tooth engagement with gradual sliding action. This chain “rolls” on its sprockets rather than riding on them.
- The straight sides of the sprocket teeth mesh with the straight-sided working jaws of the chain links to move the chain along.
- The chain is constructed of precision-formed leaf links that are perforated and blanked from strip steel.
- Several different types of guide rails can be used to prevent lateral movement of silent chains

Ewart Chain Drive



- The Ewart chain is principally used for conveying and elevating equipment, although it sometimes used to transmit lightweight loads at speeds under 400ft./min.
- Ewart chains are generally constructed to malleable iron, though are made from steel

Bead Chain



- A Bead chain consists of beads that swivel and turn in metal link or pins.
- Because the beads are relatively delicate, the bead chain is used for light service.
- Sometimes special situations such as misaligned sprockets, skewed shafts or nonparallel planes call for the use of this type of chain.

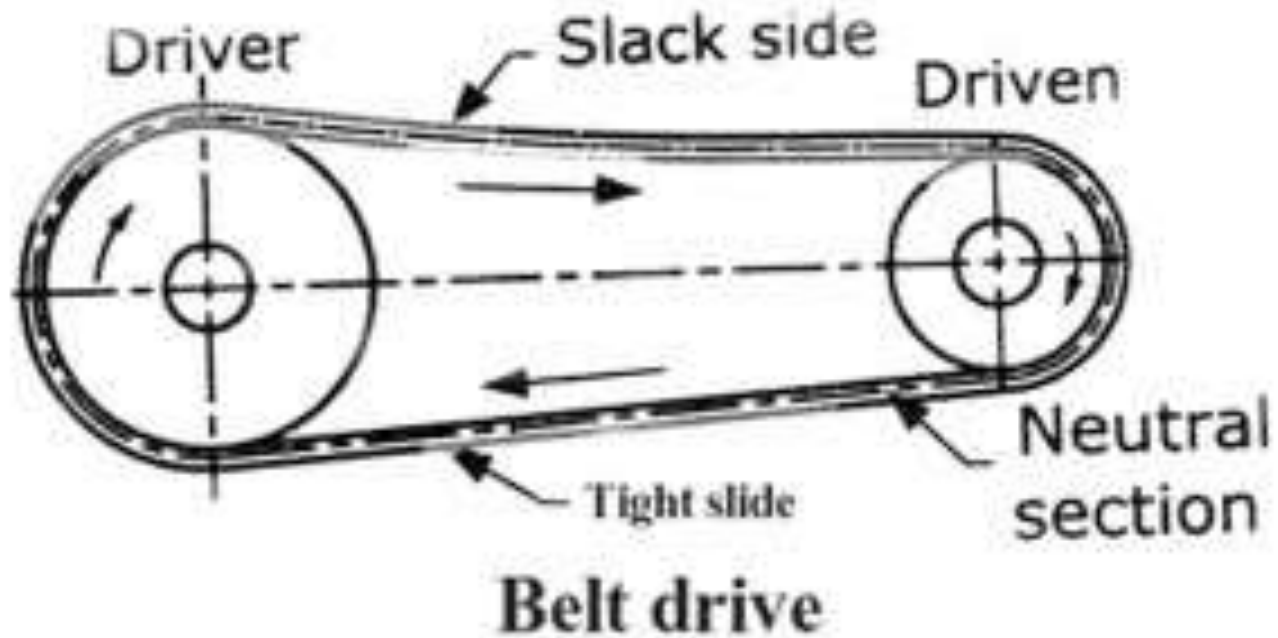
Advantages of Chain Drive

- Positive contact between the chain and the drive sprocket eliminates the possibility of slips.
- Chain drives are compact and occupy less space.
- Has a wide range of driving power.
- Useful for low speed and high torque transmissions.
- It can absorb shocks.
- It can be operated under adverse temperature and atmospheric conditions.
- It gives high transmission efficiency.
- Chain drives withstand heat, dirt and weather exposure when properly lubricated
- It can be used where there is considerably large distance between the driving and driven shafts.

Disadvantages of Chain Drive

- The Production cost of chain is relatively high.
- For better efficiency, lubrication of its parts is necessary.
- It is heavier as compared to the belt.
- There is gradual stretching which leads to velocity fluctuations.

BELT DRIVES

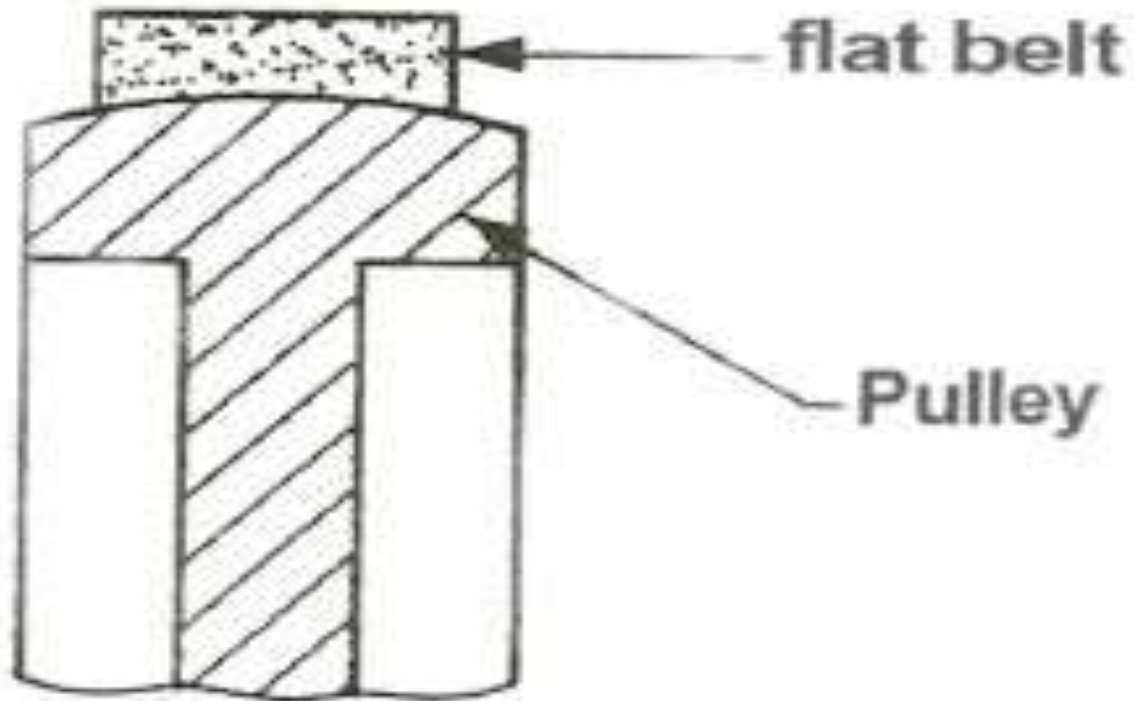


- The belt and rope drive system is widely used in power transmission system.
- The belts are used to transmit power from one shaft to another by means of pulleys which rotate at the same speed or at different speed.
- The belts are made from leather, cotton , rubber and synthetic materials.
- The pulley on the rotating shaft is called driver and the pulley on the shaft to be rotated called as driven or follower.
- Varying the diameters of the two pulleys can vary the speed of the driven shaft.

Type of belt

- Flat belt drive
- V-belt drive
- Circular belt or Rope drive
- Ribbed belt drive
- Toothed or timing Belt drive

Flat belt drive



- A belt may be of rectangular cross section known as flat belt.
- It is mostly used in the factories and workshops where a moderate amount of power is to be transmitted.
- In the case of flat drive, the rim of the pulleys is slightly crowned which helps to keep the belt centrally on the pulley rim.
- Generally the distance between the pulleys should not be more than 10 meters apart

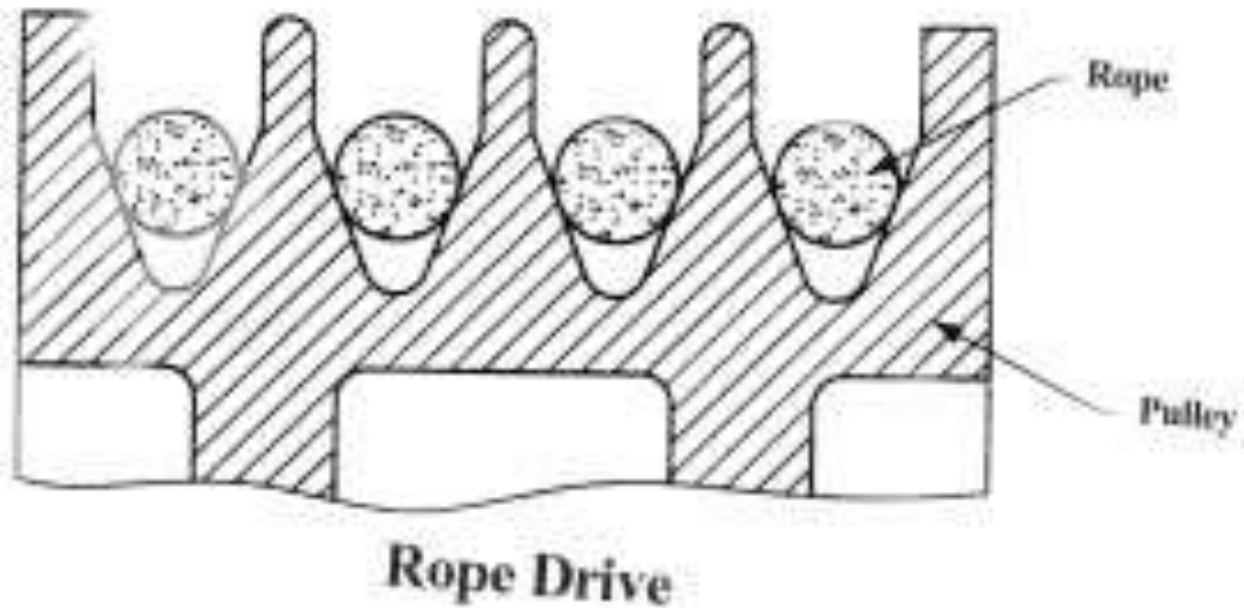
Advantages of Flat belts

- It is simple and cheap.
- It runs smoothly.
- It is suitable for any arrangement of shafts.
- It transmits power over considerable distance between driver and driven shafts.

Disadvantages of Flat belts:

- The life is very short.
- It requires comparatively large size.
- Slip of belt will occur frequently.

Rope Belt Drive

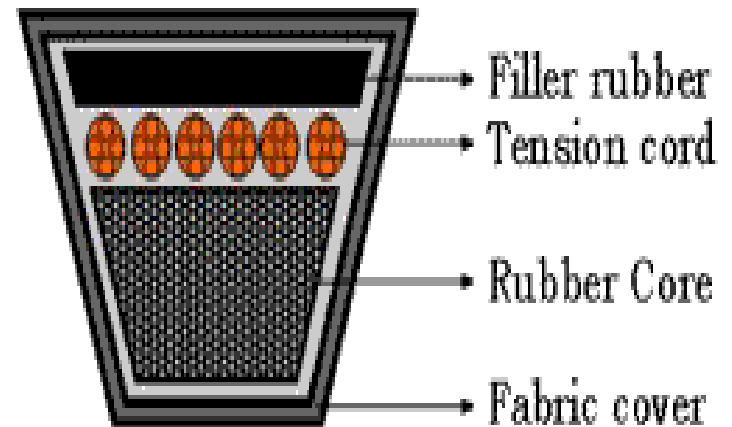
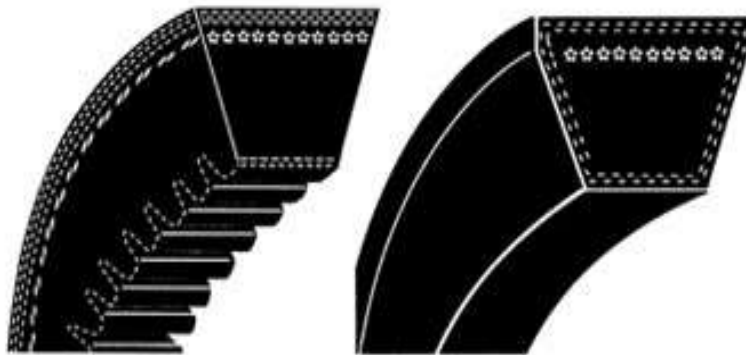


- The belt with circular cross section is known as rope or circular belt.
- It is widely used where greater amount of power is to be transmitted and the distance between the pulleys is more than 8 meters apart.
- One of the main advantages of rope drive is that is any number of separate drives may be taken from the one driving pulley.
- The rope drives are mainly employed in mining and textile industries.
- The commonly used rope drives are
- 1.Fiber ropes and 2. Wire ropes.

Advantages of Rope drives

- These are lighter weight.
- They give high mechanical efficiency.
- The cost is low.
- They are more durable and more reliable as compared with others.
- Frictional grip is more.
- They can withstand shock loads.
- It is more useful to transmit large amount of power over long distance from one pulley to another

V-belt drive



- V-belts are particularly suitable for short drives (i. e) the pulleys are nearer to each other.
- A belt with trapezoidal cross section is known as V- belt.
- They are made endless and it used in factories and workshops where greater amount of power is to be transmitted.
- Owing to the wedge action between the belt and the sides of groove in the pulley, the V- belt is less likely to slip.
- The V-belts are made of rubber impregnated fabric with angle V between 30 to 40 degrees.

Advantages of V- belts

- It is compact, so installation is possible in limited space.
- Less vibration and noise.
- Easy replacement and maintenance.
- They are suitable for transmission of power for short center distance.
- They transmit more power.
- Slip between the belt and pulley groove is negligible.
- Since the V- belts are made endless and there is no joint trouble. Hence the drive is smooth

Disadvantages of V- belts

- It is costlier.
- The V- belt are not as durable as flat belts.
- The construction of pulleys for V-belts is more complicated than flat belt pulleys.
- V-belt drive cannot be used for long distances due to weight per unit length is more.

Toothed or timing Belt drive



- A toothed belt; timing belt; cogged belt; ; or synchronous belt is a flexible belt with teeth molded onto its inner surface.
- It is designed to run over matching toothed pulleys or sprockets.
- Toothed belts are used where high-power transmission is desired.

GEAR DRIVES

- A gear is a mechanism that transmits mechanical rotary power from one shaft to another at shorter distance, smoothly and positively.
- Gear drives are used to transmit power from one shaft to another shaft where constant velocity ratio is essential

Purpose of Gears

The gear drives are used to transmit motion from the driving shaft to the driven shaft to

- Change the velocity ratio
- Change the direction of rotation
- Get a Positive Drive

TYPES OF GEARS

- Spur gear
- Helical gear
- Bevel gear
- Worm gear
- Herringbone gear
- Rack & Pinion gear

Advantages of Gear Drives

- It transmits exact velocity ratio
- It has high efficiency
- It transmits high power
- It has reliable service and compact layout

Disadvantages of Gear Drives

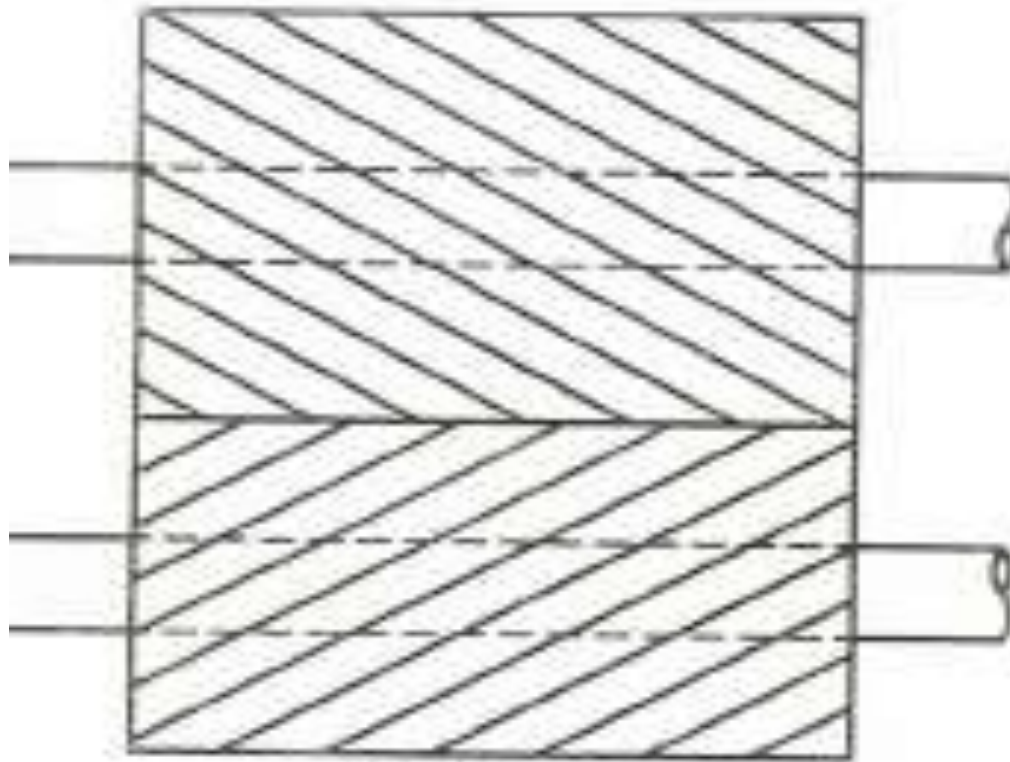
- It is costlier than others, as it requires special machine tools.
- It requires suitable and proper lubrication system, and hence maintenance cost is high.

Spur Gear

- It has teeth parallel to the shaft, and used to transmit power to only parallel shafts.
- Use of spur gears will eliminate the end thrust and axial displacement at moderate speeds



Helical Gear



Helical gear

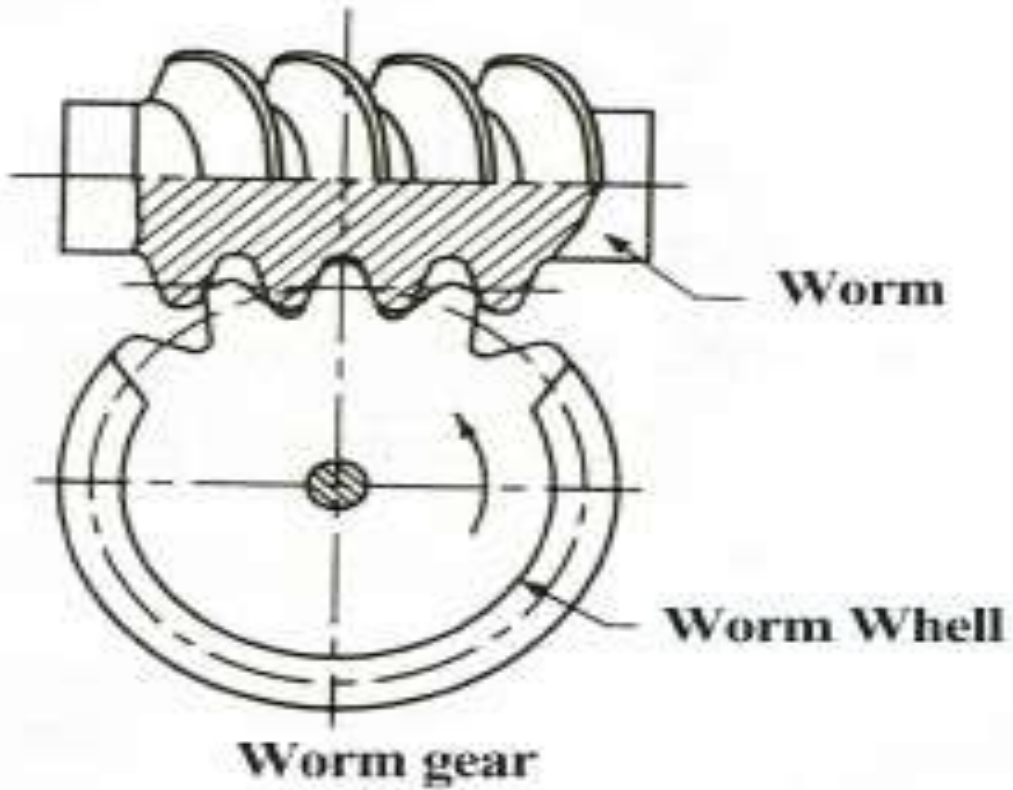
- Helical gear has teeth that form a helical angle around the center.
- Helical gears are most accurate and stronger than spur gears.
- This type of gears, eliminates the shock and jarring under heavy loads.
- As these gears provide axial thrust, it is recommended to use thrust bearings.

Bevel Gear



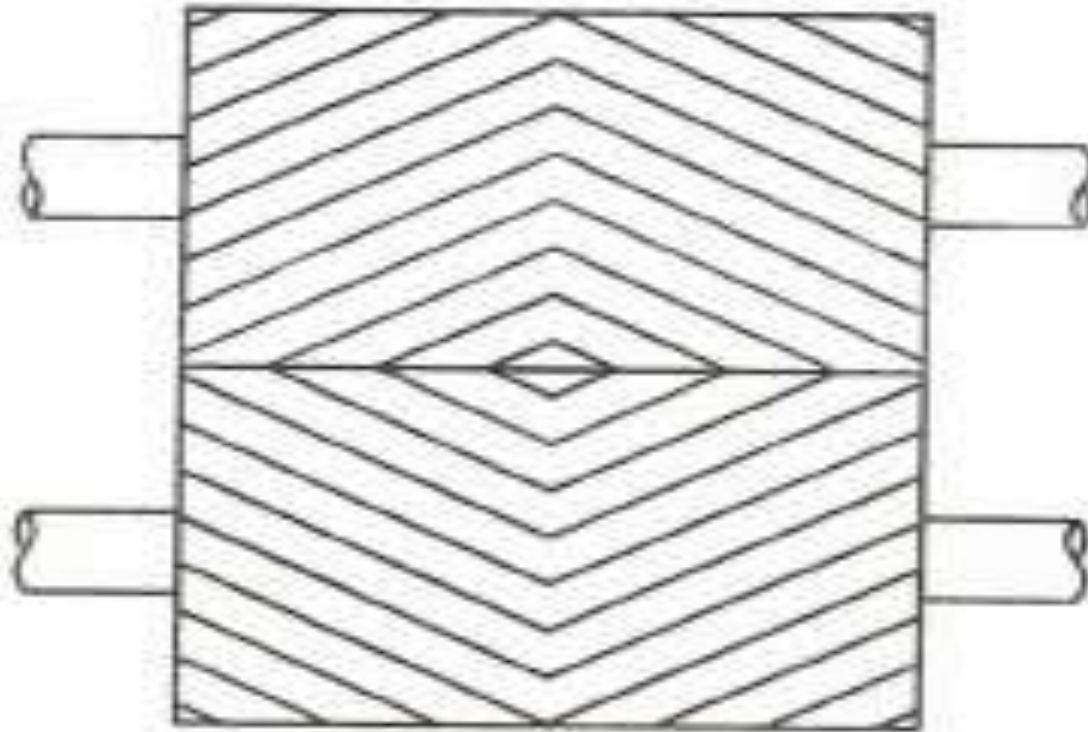
- It has teeth cut on an angular face for transmitting power between shafts that are at an angle to each other.
- Bevel gears are not as precise as spur gears. They are only suitable for shafts at right angles.

Worm Gear



- Worm gears combine worm wheel and gear. They are used to connect the shafts in parallel planes.
- Worm gears are used for high precision and high quality work.
- Worm gears produce less noise and vibration also they handle high loads

Herringbone Gear



Herringbone gear

- They are called as double-helical gear.
- There are opposite angle helixes on the two sides of gears.
- Sometime two opposite-angle helical gears are fastened together.
- These gears are used to transmit heavy loads with a minimum of noise and thrust.

MAINTENANCE OF CHAIN DRIVE

- Scheduled lubrication should be employed to restrict wear.
- It is advisable to adjust the alignment in regular intervals.
- Whenever you replace the chain by new one, you must change the sprocket also.
- Worn out sprocket sometime may be used in a reverse manner

MAINTENANCE OF BELT DRIVE

- Belt drive is covered at the top to protect the belt from ant dust, metal particles to enter.
- Excess load on belt should be avoided; otherwise it will stretch the belt.
- Slippage if any in the drive, should be checked periodically to ensure the transmission of the rated load.
- Belts of different bands should not be mixed. When replacing belts, total set of belts is to be replaced.
- New and used belts should not run together.
- Belts wear results by the contact of pulley walls groove. So groove must be checked periodically.

MAINTENANCE OF GEAR DRIVE

- Always use recommended lubricants and filter to avoid normal wearing.
- To avoid abrasive wear, gear teeth should be scrapped and cleaned, and care to be taken to use dust-free lubrication.
- Ridging appears on gear teeth as diagonal lines due to heavy load and inadequate lubrication use.
- Pitting (surface-fatigue) occur at initial stage should be avoided by gradual running. Sometime, grinding and polishing of tooth surface is done.
- Gears running in one direction may be reversed 180 degree to take the help of a non-worn surface for better operation.
- When a wear appears on both sides of the tooth surface, it may be seen that a smaller meshing gear will wear more. New one may replace this.

Direct Drive Technology

Conventional



+



+



+



Universal Motor

Pulley

Belt

Drum

- Rotation axis and central axis are not consistent
- Creates noise and abrasion
- Less stable balancing system

LG Inverter Direct Drive



+



DD Motor

Drum

- Motor directly attached to drum
- Less noise and vibration
- No loss of energy due to power directly transmitted onto drum



10 Year Warranty



VDE Certification

- The direct drive motor is brushless and gearless so it eliminates friction from its power transmission
- The motor contains precision bearings, magnetic components and integral feedback in a compact motor package.
- The motor is an outer rotor type, providing direct motion of the outside housing of the motor and thus the load.
- The cross roller bearings that support the rotor have high stiffness, to allow the motor to be connected directly to the load.
- In most cases, it is not necessary to use additional bearings or connecting shafts.

- DDT is dependent upon maintaining extreme accurate synchronization of each cylinder rotation.
- Traditionally, this has been accomplished by gearing. As press speed and printing quality requirements have increased, the inevitable inaccuracies in the gearing system have become a limiting factor on press print quality and speed.
- Recent advancements make it possible to synchronize them to a much higher level of precision without mechanical transmissions by using **closed loop control technology** and driving them directly with independent, Direct Drive Rotary (DDR) servo motors.
- The elimination of the mechanical transmission enables elimination of the gear backlash, thus providing for higher speeds and accuracies for improved print quality.

- A feedback device such as a high resolution sine encoder provides the servo motors with far more accurate position and velocity information that the controller compares to its programmed motion profile and based on this signal sends velocity command signals to the amplifier that drives the servo motor.
- A motion profile defines the operation of each servo motor in terms of time position and velocity.
- In practice, all cylinders are synchronized in both speed and phase.

Advantages

- **Increased efficiency:** The power is not wasted in friction
- **Reduced noise:** Being a simpler device, a direct-drive mechanism has fewer parts which could vibrate, and the overall noise emission of the system is usually lower.
- **Longer lifetime:** Having fewer moving parts also means having fewer parts prone to failure.
- Failures in other systems are usually produced by aging of the component (such as a stretched belt), or stress.
- High torque at low rpm.

- Faster and precise positioning-High torque and low inertia allows faster positioning times on permanent magnet synchronous servo drives.
- Feedback sensor directly on rotary part allows precise angular position sensing.
- **Drive stiffness**- Mechanical backlash, hysteresis and elasticity is removed avoiding use of gearbox or ball screw mechanisms.

Disadvantages

- The main disadvantage of the system is that it needs a special motor.
- The slow motor also needs to be physically larger than its faster counterpart.
- Also, direct-drive mechanisms need a more precise control mechanism.