

BASIC TECHNOLOGY

BELT AND CHAIN DRIVES

(Applications of Belt and Chain Drives).

Chain

A **chain** is a power transmission element made as a series of pin-connected links, the design provides for flexibility while enabling the chain to transmit large tensile forces when transmitting power between rotating shafts. Chain drive is a way of transmitting mechanical power from one place to another. It consists of chain running over a sprocket wheels. Most often the power is converted by a roller chain known as the driver chain or transmission chain passing over a sprocket gear, with teeth of the gear meshing with the holes in the links of the chain. The gear is turned and this pulls the chain putting mechanical force into the system. Chain drives are used where slip is not allowed and where there is need to transmit an exact velocity to another shaft or system.

Examples of chain drives.

1. Bicycle chain.
2. Motorcycle chain.
3. Hydraulic lift.

Belt

A **belt** is a looped strip of flexible material used to mechanically link two or more rotating shafts. Belt drive consist of a pair of pulleys over which is looped an endless belt. The edges of the pulleys are grooved so as to fully adapt the V-shape belt.

An example is in the car's cooling system, where a belt transmits power from the engine to the radiator.

Examples of belt drives.

1. Motor fan belt.
2. Drilling machine belt.
3. Grinding machine belt.
4. Sewing machine belt.

Principles of belt and chain drives.

Chain drive normally transmit power from one rotating shaft to another. Chain drive maintain a positive speed ratio between driver and driven sprockets. The driver and the driven sprockets will rotate in the same direction on typical chain drives.

Advantages and Disadvantages of belt and chain drives.

Advantages of chain drives.

1. It transmits exact velocity.
2. There is no slip.
3. It is more reliable.
4. It has higher efficiency.

Disadvantages of chain drives.

1. It requires steady maintenance.
2. It is more expensive than belt
3. It does not allow slip to balance motion.
4. It causes vibration.

Advantages of belt drive.

1. It is easy to install.
2. It is easy to maintain.
3. It is easy to stop when in motion.
4. It causes less noise and vibration.

Disadvantages of belt drive.

1. There is slip.
2. It generates heat.
3. It results in loss of motion and power.

HYDRAULIC AND PNEUMATIC MACHINES

Pneumatic is a branch of technology which deals with the study and application of use pressurized gas to affect mechanical motion. Pneumatic systems are extensively used in industries where factories are commonly plumbed with compressed air or compressed inner gasses. Pneumatic devices are power systems using compressed air as a working medium for the power transmission.

Examples of pneumatic devices.

1. Air brakes on buses and trucks.
2. Vacuum pump.
3. Centrifugal pump.
4. Compressed air engines.

Components of the pneumatic machines.

1. Pneumatic valves.
2. Air pressure regulator.
3. Pneumatic relays and volume.
4. Vacuum pumps and vacuum generators.

Uses of pneumatic devices

1. Pneumatic systems are used in controlling twin doors.
2. They are used in controlling automatic production lines and mechanical lamp
3. Force pump is used to lift up gas from lower level to higher level.

HYDRAULIC DEVICES

Hydraulic device is a device that uses liquid to transmit pressure equally from one point to another. Hydraulic machines consist of a column of confined fluid with a piston at each end.

Examples of hydraulic machines.

1. Hydraulic cylinders.
2. Hydraulic jacks.
3. Hydraulic motors.
4. Hydraulic pumps.
5. Hydraulic clutches.
6. Hydraulic regulators.
7. Hydraulic ram. Etc.

Components of the hydraulic devices.

1. **Reservoir:** - holds the fluid, transfer heat from the system.
2. **Pump:** - transmits mechanical energy into hydraulic energy.
3. **Valves:** - they are used in a system to start, stop and direct the flow of fluid.
4. **Actuators:** - it is where the hydraulic energy is converted back to mechanical energy.

Operations and uses of hydraulic machines.

1. They are used during operations, blanking and punching, riveting, stamping and pressing.
2. They are used in compression moulding of parts from rubber, plastics, ceramics and composites.
3. They are used in car brakes.
4. They are used in Jet planes for adjusting wings, putting out or bringing in the landing gear and opening and closing doors.

PASCAL'S LAW OF HYDRAULICS

Pascal's law of hydraulics states that the pressure applied to a confined fluid is transmitted equally to other parts of the fluid.

GEARS

A gear is a wheel with toothed edges fixed in machines for the transmission of power or motion from one shaft to another. They are found in the following:

1. Clocks
2. Cars
3. Motorcycles
4. Bicycles
5. Odometer
6. Scales
7. Conveyor system
8. Meters
9. VCD
10. VCR. Etc.

Types of gears

1. Rack and pinion gear.
2. Spur gear.
3. Planetary gear.
4. Worm gear.
5. Bevel gear.
6. Helical gear.
7. Internal gear. Etc.

Uses of Gear

1. They are used to transmit power or motion.
2. They are used to change speed.
3. They are used to change direction of rotation.

CALCULATION OF GEAR SPEED AND RATIO

N_a = number of teeth of gear A (driver).

N_b = number of teeth of gear B (follower).

S_a = speed of gear A.

S_b = speed of gear B.

Speed ratio = $\frac{\text{number of teeth of gear A}}{\text{number of teeth of gear B}} = \frac{\text{Speed of gear A.}}{\text{Speed of gear B}}$

Speed ratio = $\frac{N_a}{N_b} = \frac{S_b}{S_a}$

Example: Two gears mesh in an automobile. The driver and driven have 150 and 50 teeth respectively. What is the speed of the driven gear if the input speed is 9rev/s?

Solution:

$$\text{Speed ratio} = \frac{N_a}{N_b} = \frac{S_b}{S_a}$$

N_b

S_a

$$N_a = 150 \text{ teeth}$$

$$N_b = 50 \text{ teeth}$$

$$S_a = 9 \text{ rev/s}$$

$$S_b = ?$$

$$S_b = \frac{N_a S_a}{N_b}$$

$$N_b$$

$$S_b = \frac{150 \times 9}{50}$$

$$50$$

$$S_b = 27 \text{ rev/s.}$$

LUBRICANTS

Lubricants are substances used to reduce friction between objects or moving surfaces.

Lubrication is the application of a substance (lubricants) between moving surfaces in order to reduce friction and minimize heating.

Effective lubrication is necessary for the moving parts of the machine to avoid friction.

Properties of lubricants.

A good lubricant must possess the following properties:

1. Ability to wet surfaces.
2. Should be able to resist flow.
3. Should be stable under any condition.
4. Should not evaporate excessively when in use, i.e., should be non-volatile.

Importance of lubricants.

Lubrication of the parts of machine is necessary for the following reasons:

1. It helps to overcome friction.
2. It prevents excessive wear and tear of moving parts due to friction.
3. It prevents surfaces from rusting.

4. It acts as a coolant to reduce heat.