Mechanical Engineering Fundamentals

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Mechanical Engineering Fundamentals

(MEC103)

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Content

1) Fundamental Concepts of Thermodynamics
2) Laws of Thermodynamics
3) Pressure and its Measurement
4) Heat Transfer
5) **Power Absorbing Devices**
6) Power Producing Devices
7) Principles of Design
8) Power Transmission Devices and Machine Elements

Lecture No. - 1

- Power Absorbing Devices
- Difference between Hydraulic pump, Air compressor, Fan, Blower,
- Pump (Function, Selection, Applications)
- Classification of Pump
- Positive displacement and Dynamic Pumps

Power Absorbing Devices

The equipment's or devices that consume power for the working are called power absorbing devices.

Examples: Pumps, Compressor, Refrigerators etc.

Pump / Air Compressor / Blower / Fan

These devices are used to increase the pressure of the fluid.

Pump: The hydraulic machine which convert mechanical energy into hydraulic energy are called as pumps.

Pumps are driven by some prime mover which can be an IC engine, steam engine or an electric motor.

Hydraulic energy is in form of pressure energy.

Pump / Air Compressor / Blower / Fan

Air Compressor: Air compressors are used to compress the atmospheric air to higher pressure. The pressure rise is 7-8 bar.

Fan: A fan increases the pressure of air or gas slightly and it is mainly used to move a gas around.

Blower: The pressure rise is 1-2 bar.

Use of Compressed Air

- To operate lift, reams and pump.
- To inject drill, hammer, air brake for locomotive and water sprays.
- Air Tools, Sand Blasting, Pneumatic Control Systems.
- Paint Spraying, Powder Coating, Packing Machines.
- Indoor Applications, Food Industry, Dairy Industry, Laboratories.
- Compressed air is used for cooling in welding equipment's.
- Compressed air is used for cleaning processes in manufacturing facilities.

Functions of Pump

- Lifting the Liquid
- Circulation of Liquid
- Increasing pressure of Liquid
- Imparting K.E.
- Extracting Liquid

Selection of Pump

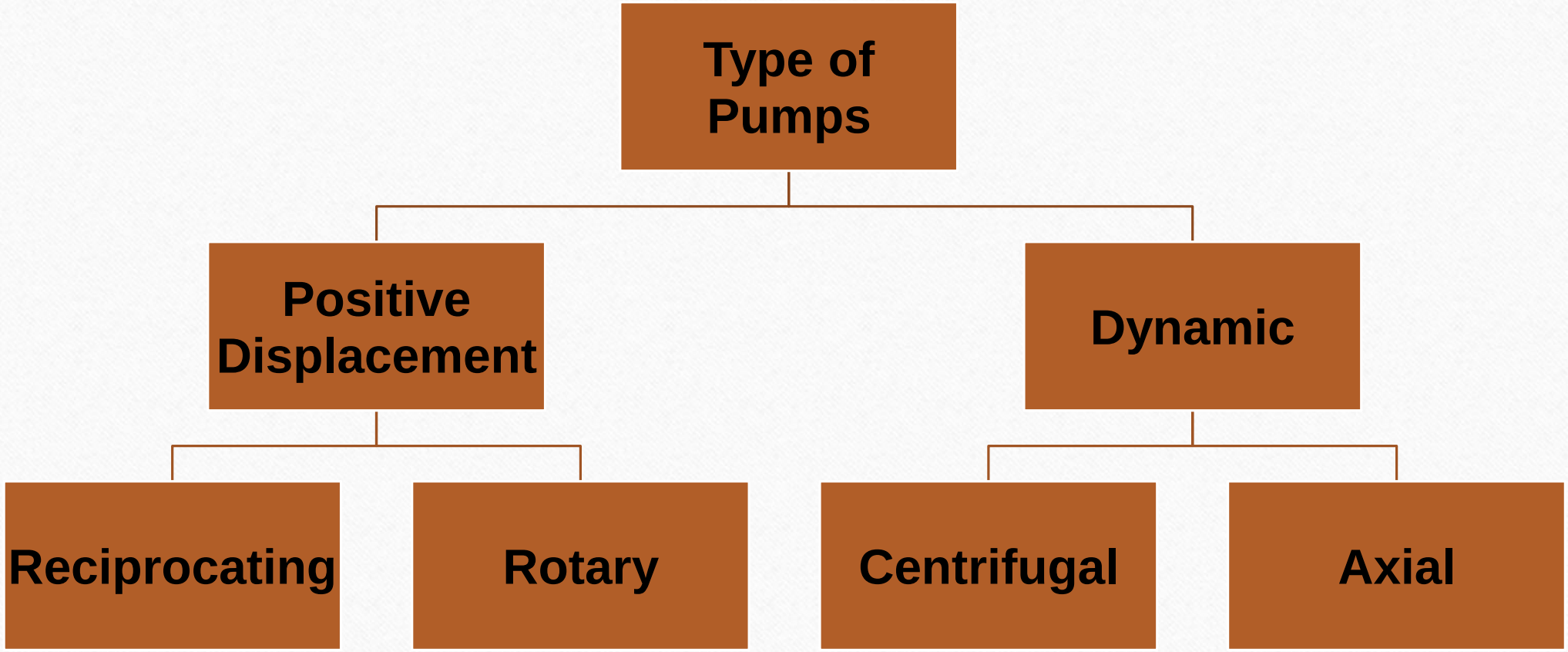
Pump selection is determined by:

- Capacity requirement
- Requirement of Installment
- Expenses for purchase, installation and maintenance
- Availability of Parts and service
- Characteristics of liquid to be pumped

Applications of Pump

- Agriculture and Irrigation Purposes
- Oil Pumping
- Municipals Water Works
- Boilers and refrigerator Units
- Transfer of materials in industry for manufacturing etc.

Classification of Pumps



Positive Displacement

- A positive displacement pump makes a **fluid move by** trapping a fixed amount and forcing (displacing) that trapped volume into the discharge pipe.
- Positive Displacement Pumps are also called "**constant flow machines**" because the volume is constant through each cycle of operation i.e. the energy is added periodically to the fluid.
- Reciprocating and rotary pump are the examples of positive displacement pump.

Positive Displacement

- The pump does not rely on raising the velocity and flow rate of the fluid as the dynamic pump but they are capable of producing much higher pressures.
- Positive Displacement pumps are generally used for specialist applications such as for pumping viscous liquids or liquids that contain suspended or fragile solids.

Dynamic Pumps

- In dynamic pumps, energy is added to the fluid continuously through the rotary motion of the blades.
- Centrifugal and Axial flow pump are the examples of dynamic pump.

Dynamic Pumps

- Dynamic pumps impart velocity energy to continuously flowing fluid by means of impellers rotating at very high speeds.
- Dynamic pumps usually have lower efficiencies than positive displacement pumps, but also have lower maintenance requirements. Dynamic pumps are also able to operate at fairly high speeds and high fluid flow rates.

Positive Displacement vs Dynamic Pumps

S. No.	Parameter	Positive Displacement Pumps	Dynamic Pumps
1	Flow Rate	Low flow rate	High flow rate
2	Pressure	High	Moderate
3	Priming	Very Rarely	Always
4	Viscosity	Virtually No effect	Strong effect
5	Energy added to fluid	In positive displacement pumps, the energy is added periodically to the fluid.	In dynamic pumps, energy is added to the fluid continuously through the rotary motion of the blades.

Question

Pump or Compressor?

There is a pressure gauge on it and the pressure increases as the pump works, technically it's also working as a compressor. With the foot pump, as air is inflated in the car tires, pumping and compressing is done at the same time.

Even so, we wouldn't really describe this as an air compressor, because its job is really to move air from the atmosphere into tires. A compressor is normally designed to **make use of compressed air** in some way, for example, by powering a jackhammer (pneumatic air drill).

Learning Outcome

- Power Absorbing Devices
- Difference between Hydraulic pump, Air compressor, Fan, Blower,
- Pump (Function, Selection, Applications)
- Positive displacement and Dynamic Pumps

THANK YOU