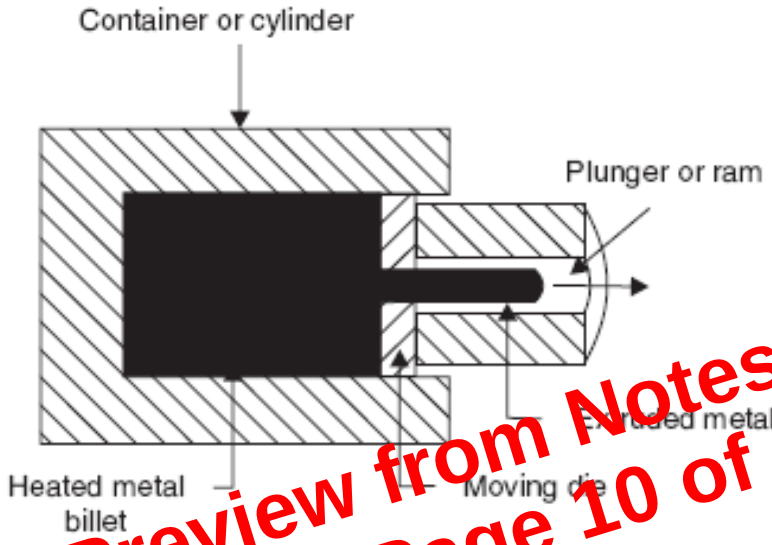
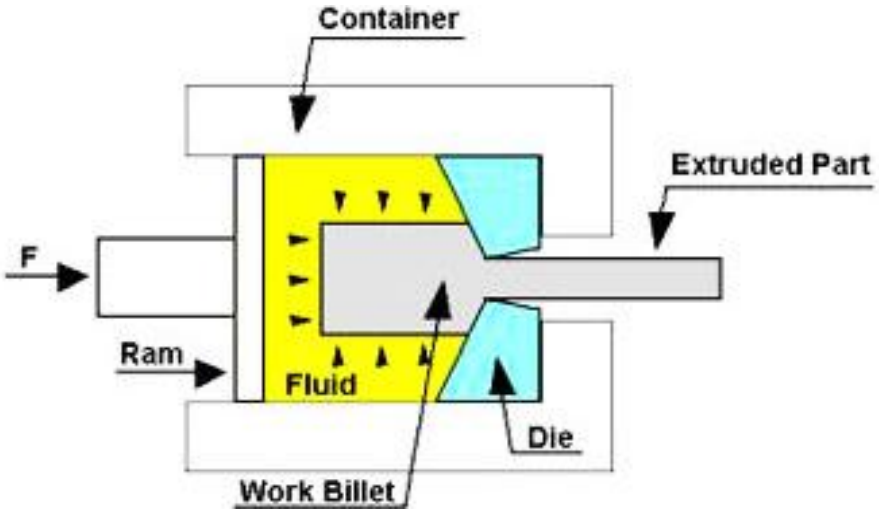
Backward or indirect extrusion:

The block of heated metal is inserted into the container/chamber. It is confined on all sides by the container walls except in front, where a ram with the die presses upon the material. As the ram presses backwards, the material has to flow forwards through the opening in the die. The ram is made hollow so that the bar of extruded metal may pass through it unhindered. This process is called backward extrusion process as the flow of material is in a direction opposite to the movement of the ram. In the forward extrusion process the flow of material and ram movement were both in the same direction.



Hydrostatic extrusion:

It is a type of cold extrusion process. In the hydrostatic extrusion process the billet is completely surrounded by a pressurized liquid, except where the billet contacts the die. The fluids commonly used are glycerin, ethyl glycol, mineral oils, castor oil mixed with alcohol etc. these fluids are helpful in reducing the friction between metal block and chamber surface. This is a direct extrusion process. Pressure is applied to the metal blank on all sides through the fluid medium.



The advantages of Hydrostatic extrusion process include:

- No friction between the container and the billet reduces force requirements. This ultimately allows for faster speeds, higher reduction ratios, and lower billet temperatures.
- Usually the ductility of the material increases when high pressures are applied.
- An even flow of material.
- Large billets and large cross-sections can be extruded.
- No billet residue is left on the container walls.

The disadvantages are

- The billets must be prepared by tapering one end to match the die entry angle. This is needed to form a seal at the beginning of the cycle.
- Handling the fluid under high pressures can be difficult.

Welding

Welding means the process of joining two metal parts together to give strong joint . The welding process is subdivided into two main classes.

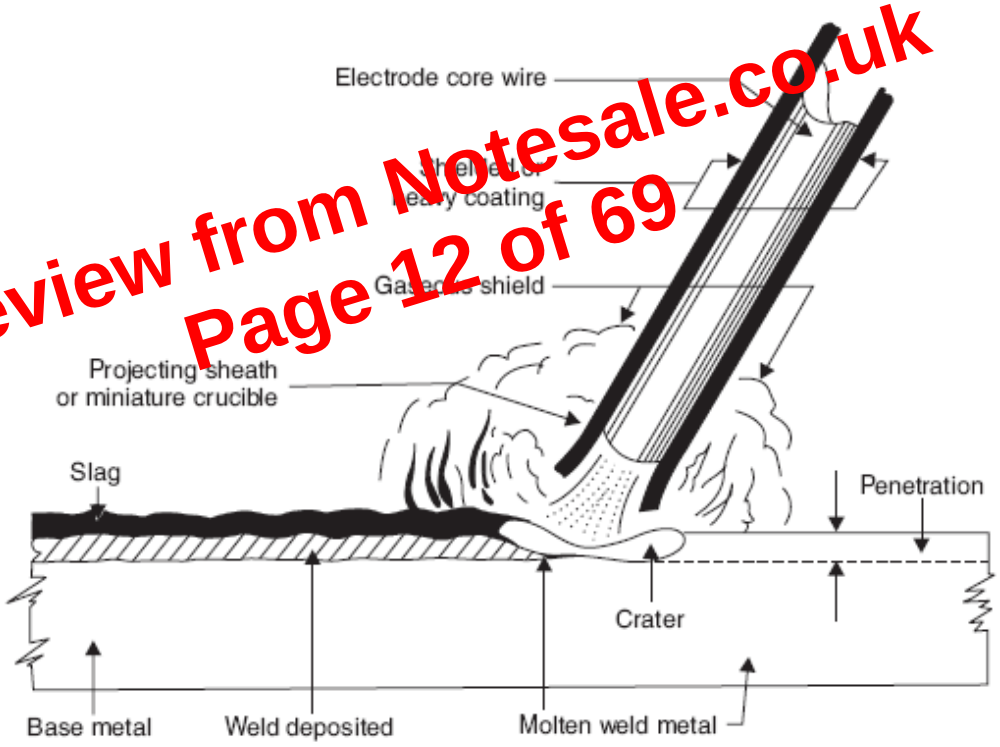
1. **Fusion welding:** which involves heating the ends of metal pieces to be joined to a temperature high enough to cause them to melt or fuse and then allowing the joint to cool. The joint, after the fused metal has solidified will result in a strong joint.

2. **Pressure welding:** which involves heating the ends of metal pieces to be joined to a high temperature, but lower than their melting point and then keeping the metal pieces joined together under pressure for some time. This results in the pieces welding together to produce a strong joint

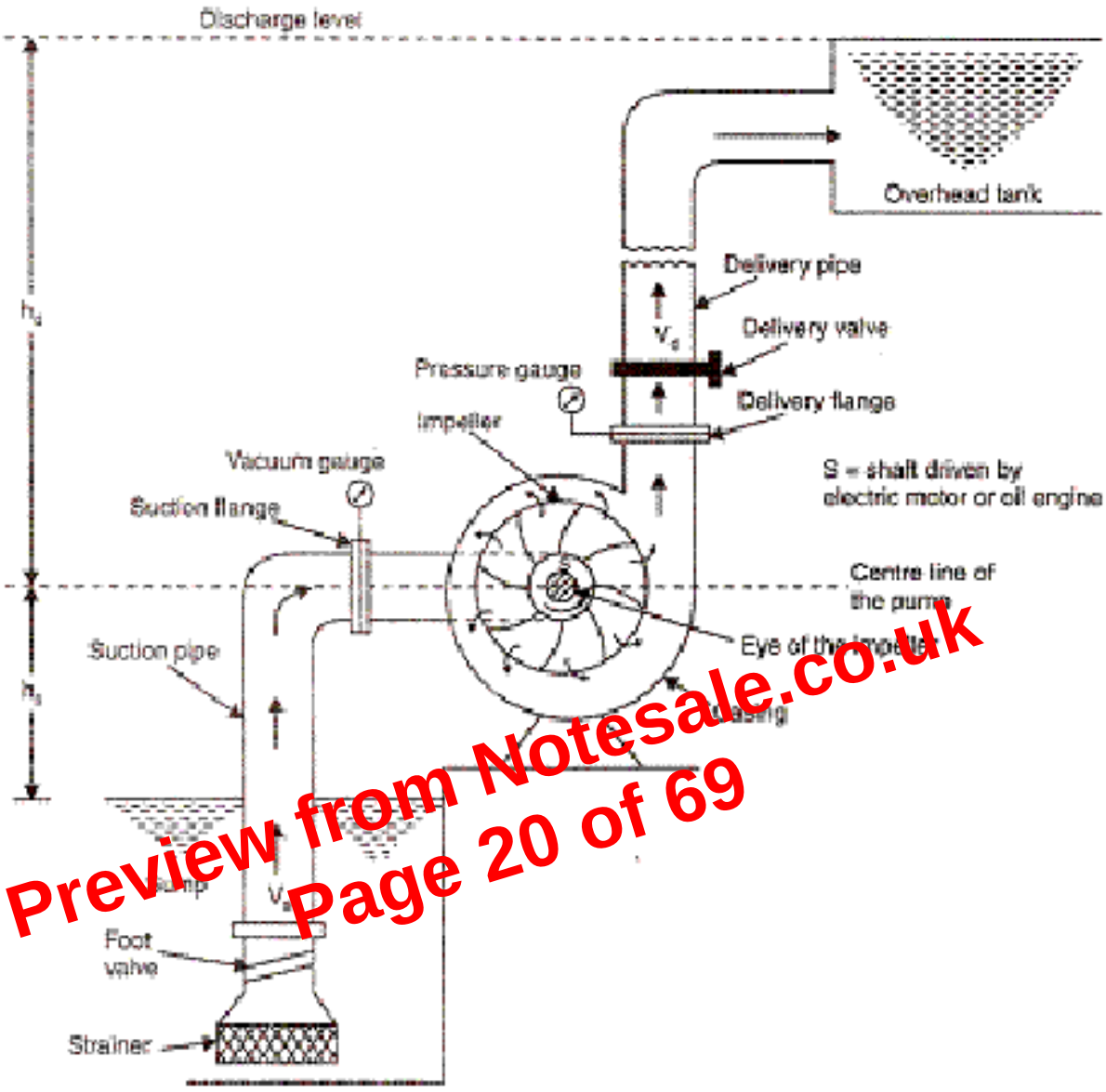
Based on the sources of heat, fusion welding is again classified to different type

- Electric arc welding: electric arc is the source of heat
- Gas welding: A burning gas is producing the heat. Normally acetylene is used.
- Electric resistance welding: heat produced from the electric resistance of material
- Thermite welding: chemical reaction is the source of heat. Etc
- Laser welding: heat produced using Laser.

SMAW (shielded metal arc welding)



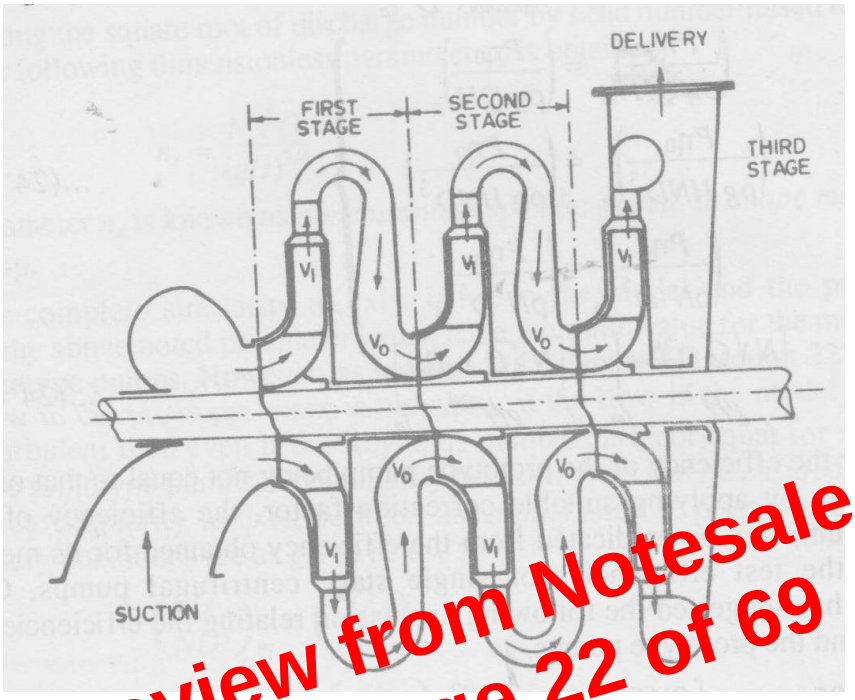
it is a manual arc welding process that uses a consumable electrode coated with flux. An electric current, welding power supply is used to form an electric arc between the electrode and the metal to be joined. As the weld is laid, the flux coating of the electrode disintegrates, giving off vapors that serve as a shielding gas and providing a layer of slag, both of which protect the weld area from atmospheric contamination



The basic principle on which a centrifugal pump work is that when a certain mass of liquid is made to rotate by an external force. It is thrown away from the central axis of rotation and a centrifugal head is developed which enables it to rise to higher levels may be ensured. Since in these pumps the lifting of the liquid is due to the centrifugal action, these pumps are called centrifugal pumps. In addition to centrifugal action, liquid passes through revolving impeller, its angular momentum changes which also results in increasing the pressure of the liquid

Components and construction

Normally a pump with a single impeller can be used to deliver the required discharge against a maximunhead of about 100m. but ifthe liquid is required to be delivered against a lrger head then it can be done by using two or more pums in series. This arrangement can be replaced by a multi stage pump.



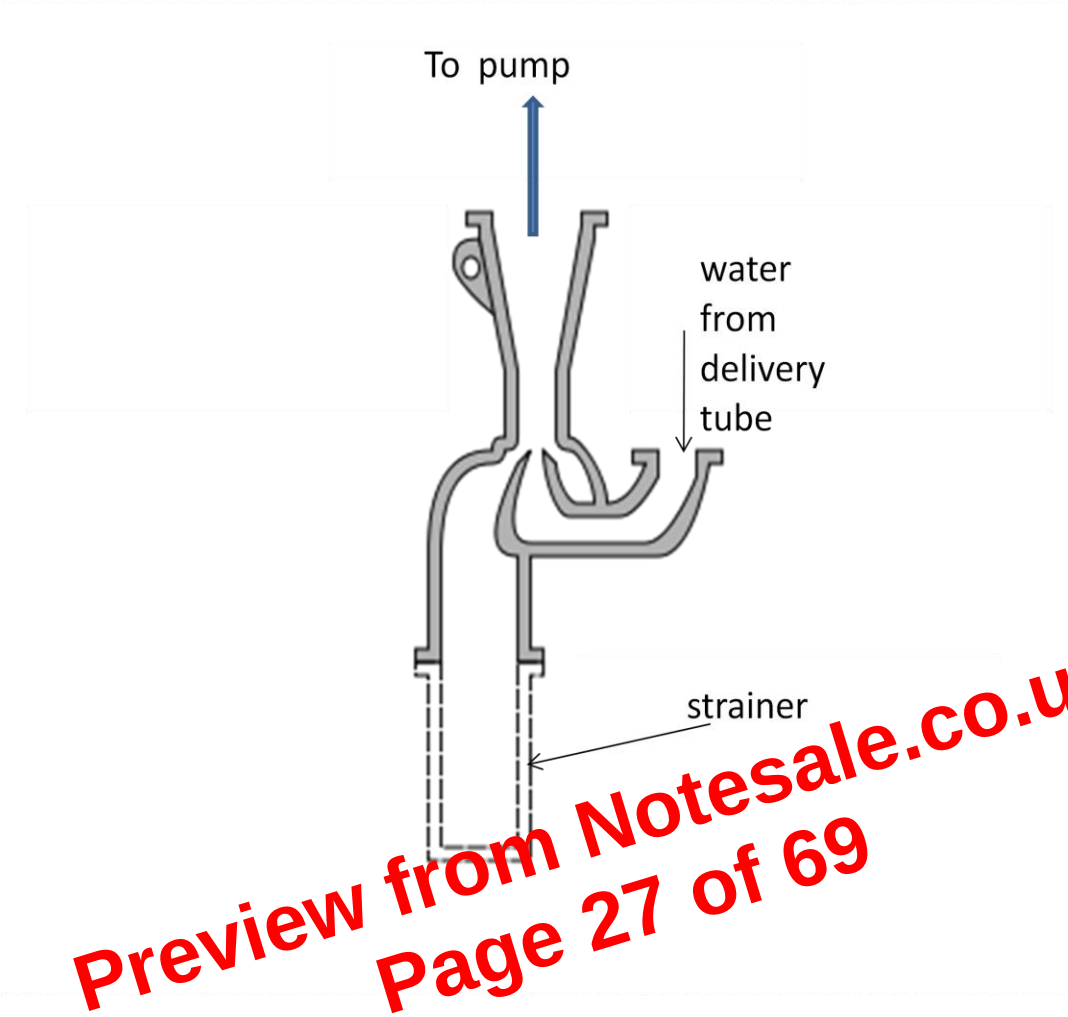
A multistage pump consist of two or more identical impellers mounted on the same shaft and enclosed in the same casing. All impellers are connected in series so that liquid discharged with increased pressure.

Total head developed H= n X Hm

Where n= no of stages and Hm= head developed in each stage

Advantages of centrifugal pumps over reciprocating pumps

- Greater discharging capacity
- Centrifugal pump can pump high viscous fluids but reciprocating pumps can handle water or low viscous fluid
- Operated at very high speed



Application

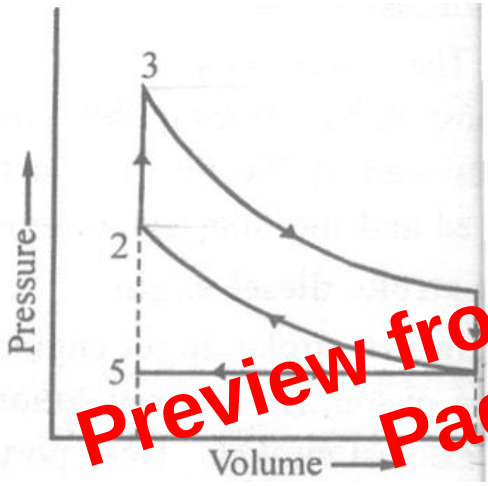
- In thermal power stations, they are used for the removal of the boiler bottom ash, the removal of fly ash the boiler flue gas, and for creating a vacuum pressure in steam turbine exhaust condensers.
- For use in producing a vacuum pressure in steam jet cooling systems.
- For the bulk handling of grains or other granular or powdered materials.
- The construction industry uses them for pumping turbid water and slurries.

The piston moves from BDC to TDC and the burnt gases escape through the exhaust valve. During this stroke the inlet valve remains closed. This stroke is represented by the line 1-5 in PV diagram. During this stroke the exhaust valve remains opened and the inlet valve remains closed. By this one cycle is completed.

2.5 Working principle of petrol engines (Spark Ignition Engines)

Petrol engines operate on the so called Otto cycle. These engines work based on either four stroke or two stroke cycle.

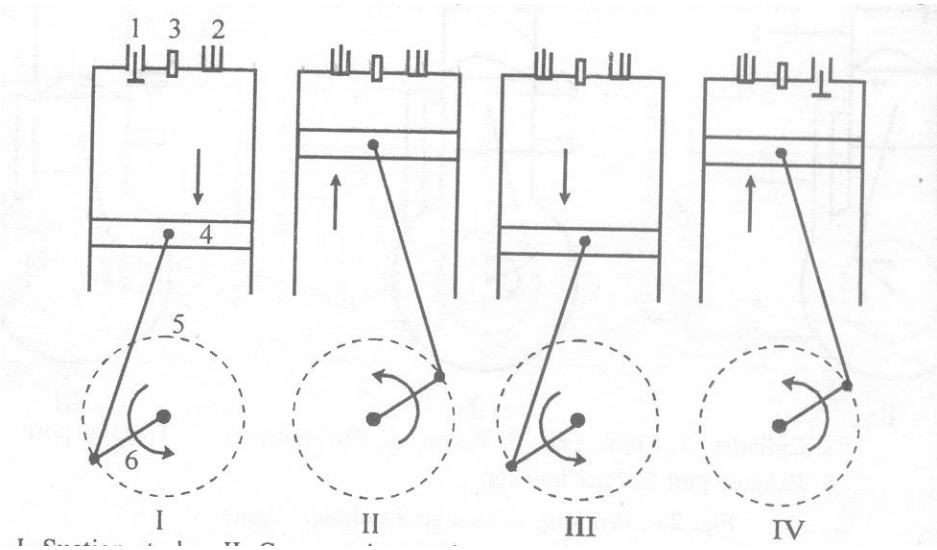
Otto cycle (Constant volume cycle)



In this cycle, heat is supplied at constant volume. A homogeneous mixture of air and petrol is supplied to the engine cylinder during the suction stroke. A carburettor provides a mixture of petrol and air in the required proportion. The fuel air mixture (charge) gets compressed during the compression stroke At the end of this stroke, fuel is ignited and combustion occurs at constant volume. The gas expands and moves the piston downwards, during work.

Four stroke petrol engines

The various strokes of a four stroke petrol engine are detailed below. Refer PV diagram



I Suction stroke II Compression stroke III Working stroke IV Exhaust stroke

1 Inlet valve 2 Exhaust valve 3 Fuel injector 4 Piston 5 Connecting rod 6 Crank

Fig: Working of four stroke petrol engine

1) Suction stroke

During this stroke the piston moves from top dead centre (TDC) to bottom dead centre (BDC). The inlet valve opens and the fuel air mixture is sucked into the engine cylinder. The exhaust valve remains closed throughout this stroke. This is represented by the line 5-1 in PV diagram.

2) Compression Stroke

The air fuel mixture is compressed as the piston moves from BDC to TDC. Just before the end of this stroke, the spark plug initiates a spark which ignites the mixture and combustion takes place at constant volume (line 2-3 in fig PV diagram). Both the inlet and exhaust valves remain closed throughout this stroke.

A system provide for supplying compressed air which used to start the engine.

Exhaust system: this include silencer and exhaust manifold. After combustion smoke and burned particles removed from engine through this exhaust system .silencer provided in order to reduce the noise

Fuel system: diesel fuel stored in a storage tank. This tank mainly located outside the power plant. fuel from this tank is pumped to an all day tank through a filter. the fuel from day tank flows under gravity to the engine. Fuel injector is used to inject the required amount of fuel into the cylinder.

Cooling and lubrication: proper cooling is required to extend the life of the plant. In small engine air cooling is sufficient. But in large engine water or oil cooling system is employed. Water the water is circulated through lubricating oil cooler and through water jackets is passes through a heat exchanger and is re-circulated again

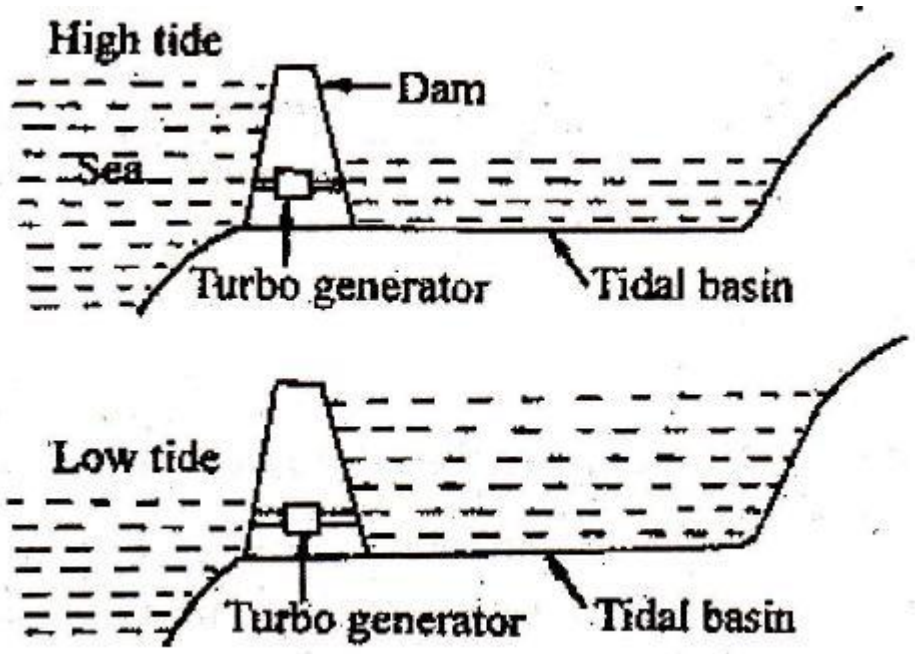
The function of this system is to reduce the friction between moving parts in order to reduce wear and tear of engine parts. lubrication system includes oil pump, oil tank, filter, and connecting tubes

Advantages and disadvantages of diesel power plant

It is more efficient than thermal power plant. Design and construction are easier and less expensive. It can start quickly. Compared to other plants, it is having less maintenance. Here fuel handling and waste removal is very simple. Space requirement is less. Also cooling water requirement is less than thermal or nuclear plant

Disadvantages

Life of diesel plant is comparatively less. Heavy noise generated from diesel engine. Lubrication cost is higher. It is not economical where fuel has to be imported.



OTEC

OTEC, or ocean thermal energy conversion, is an energy technology that converts solar radiation to electric power. OTEC systems use the ocean's natural thermal gradient—the fact that the ocean's layers of water have different temperatures

Ocean and sea constitute about 70% of earth and hence they act as large storage reservoir of solar energy. In ocean surface water temperature is about 25 degree celcius and 1 km directly below, the temperature is about 4 degree celcius. The concept of OTEC is based on this temperature gradient.

There are 2 different types of OTEC. Open cycle OTEC and closed cycle OTEC. In open cycle, sea water itself is used as working fluid. The warm sea water will enter into a low pressure evaporator, and it would vapourise. using this low pressure steam a turbine runs, from which power extracts.

In closed cycle instead of sea water , a working fluid such as ammonia or propane is used.see the fig. the ammonia vapourises at 21 degree celcius. This ammonia vapour send to the turbine for extracting energy from it. The vapour from turbine passsess through a condenser where it gets condensed using the cold deep sea water.then it is pumped back to the vaporator

Advantages : it is cheaper than other energies. It is a renewable energy source and hence non polluting. Energy is available throughout the year.

Disadvantages: drilling operation is noisy. The steam and hot water coming out may contain other poisonous gases like CO2, H2S, NH3 etc. so there is a chance for pollution. Overall efficiency of geothermal power plant is low.