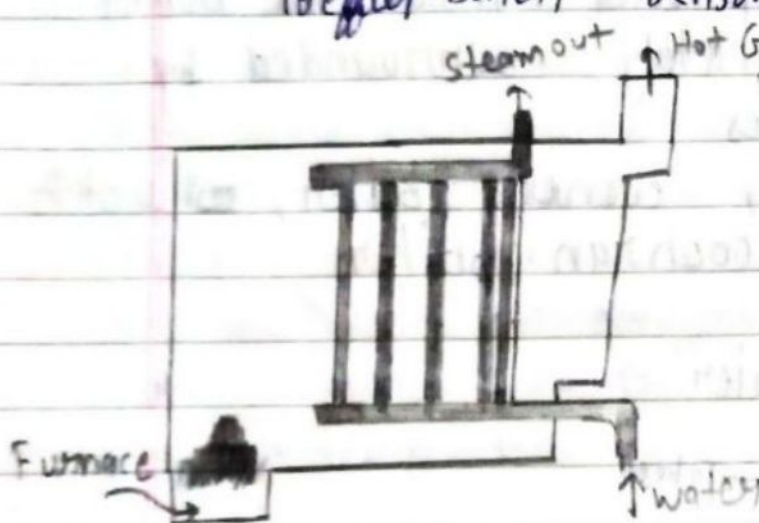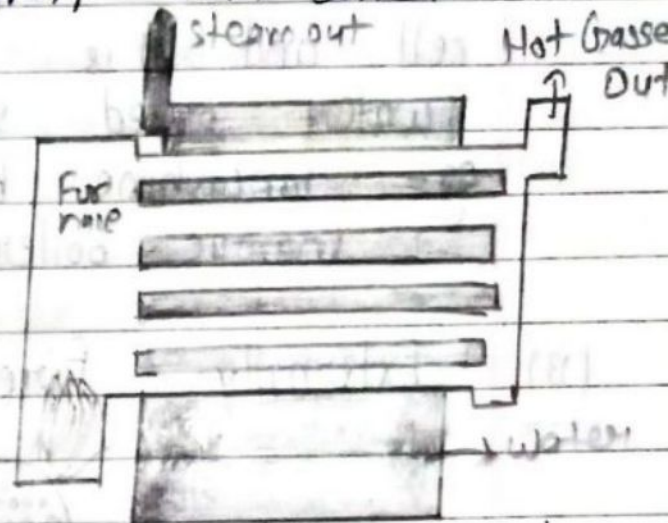A bank of water tube is connected with steam water drum through two set of header. The hot fuel gases from the furnace are made to flow around the water tube a sufficient no. of times. The gases thus give up their heat get cold & are discharged to the chemney.
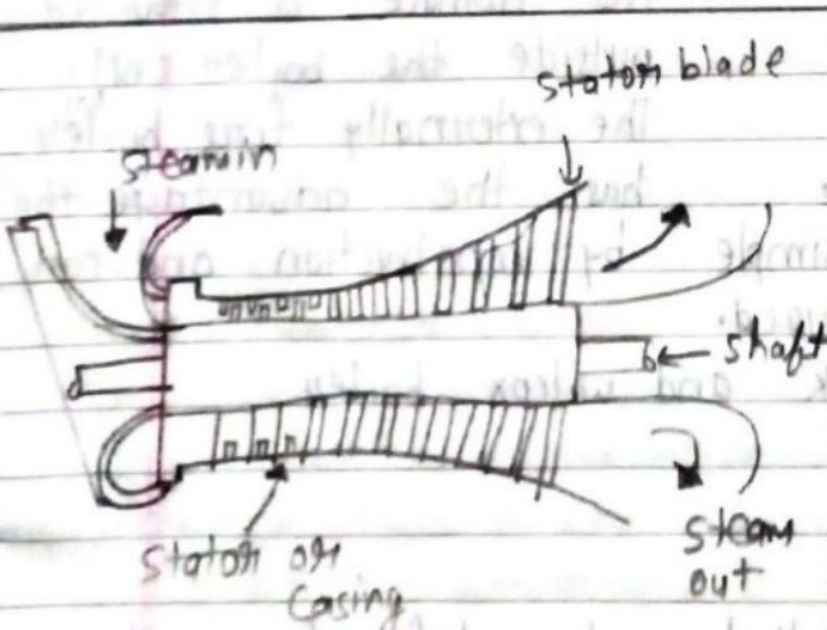
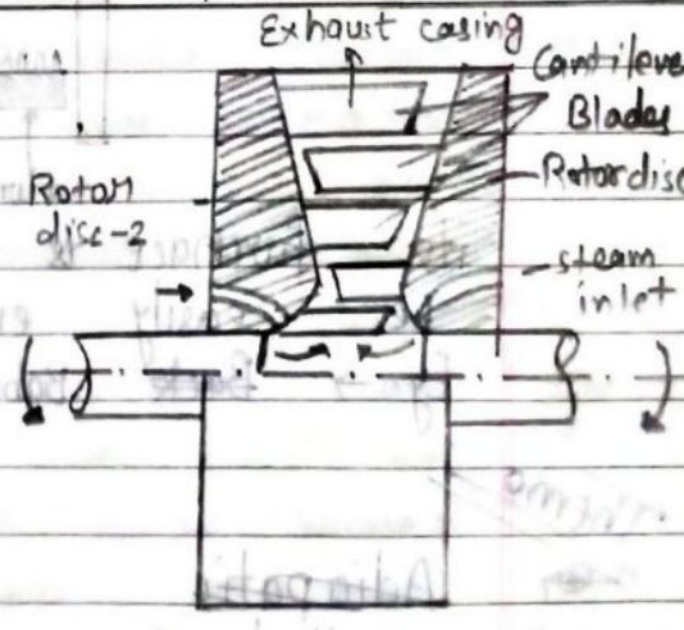eg - Babcock and wilcox boiler, stirling boiler, lamont boiler, loeffler boiler, benson boiler, velox boiler.

Water tube boiler | Fire tube Boiler

Axial flow turbine | Radial Turbine (Ljungstrom turbine)

Centrifugal Pumps (2)

Centrifugal pump:—
Components of C.P. ⇒

(i) Impeller (ii) Casing (iii) Suction pipe
(iv) Delivery pipe. Csteran &

A Hydrolic machine which converts the mechanical energy into hydrolic energy is called pump. The hydrolic energy of pump is available in the form of pressure energy.

Different type of pumps are used for industrial purposes, irrigation system, domestic uses, sewage extertion. When mechnical energy is converted in hydrolic energy by mean of centrifugal force then that this type of pump is called centrifugal pump. (~~idith~~ ~~are~~)

(i) Impeller :— It is rotating part of the centrifugal pump. A set of curve blades are mounted on the shaft. And shaft is collected to the rotating shaft of the electric motor.

Application of centrifugal PUMP :—

Explain

(i) For domestic water supply →
(ii) For waste water management
(iii) In fire protection system
(iv) For irrigation system
(v) Other than there centrifugal pump is widely used in dairying form, food processing and in production line
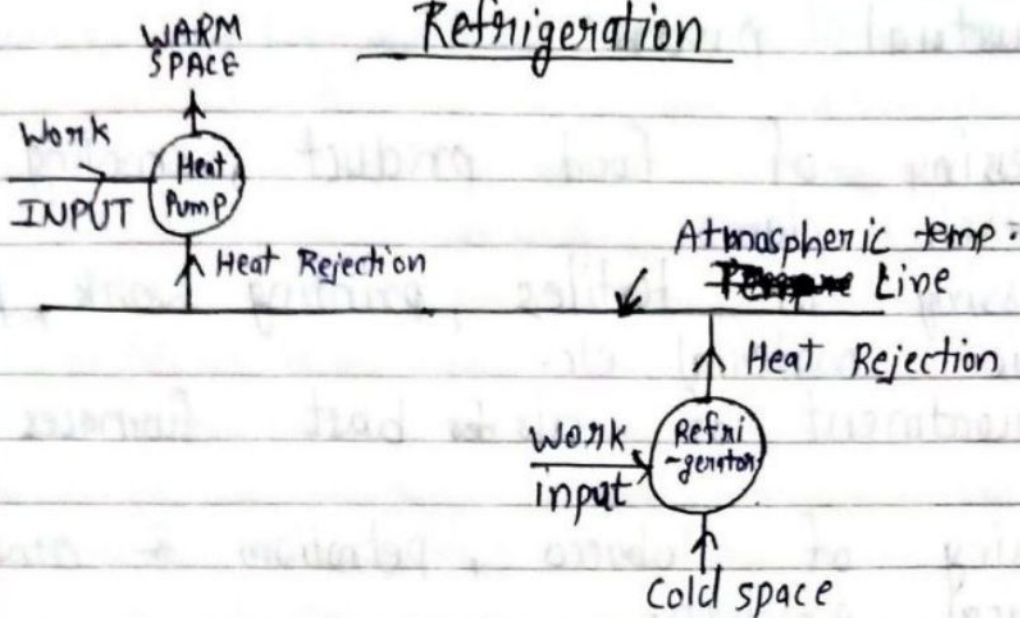
Reciprocating pump ⇒ ★
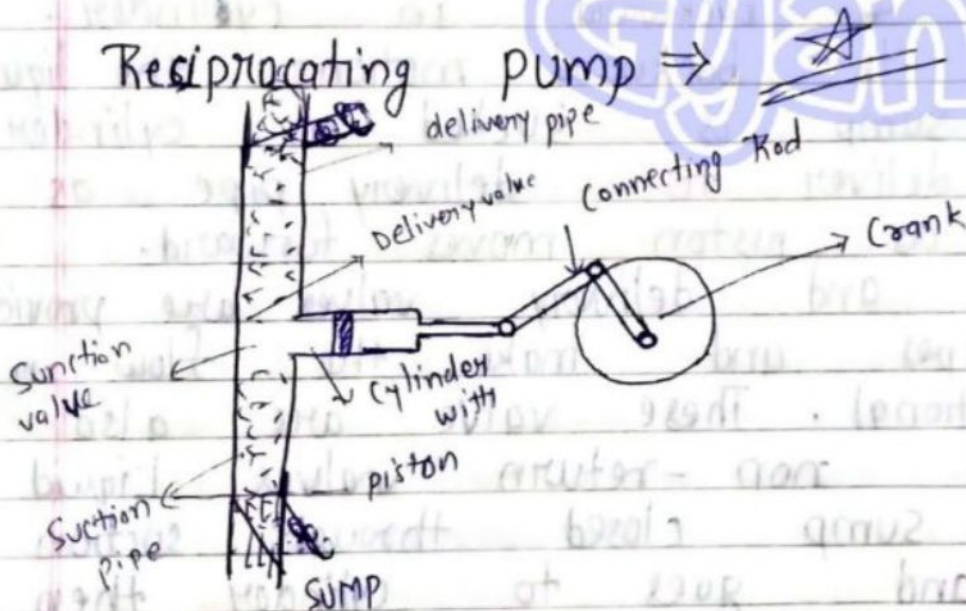
A singal acting reciprocating pump

When a pump converts mechanical energy into hydrolic energy by means of reciprocating (backward & forward) motion of piston in a fluid chamber then it is called reciprocating pump. Main part of reciprocating pump a

(i) Suction pipe
(ii) Suction valve
(iii) Reciprocating parts (piston, rod & connecting

Refrigeration

WARM SPACE

Work INPUT → (Heat Pump)

↑ Heat Rejection

Atmospheric temp. Pressure Line

↑ Heat Rejection

Work input → (Refri-gerator)

↑ Cold space

Symmetric Diagram of Heat pump & Refrigeration System

→ Refrigeration is defined as maintenance of a system at the temp. lower than that of it surrounding by continuous removal of heat from it.

Application of Refrigeration :— It is mainly classified into 3 main category.

(i) Preservation parishable items ⇒

→ For making ice & ice plant

→ For cold storage & refrigerator, in which perishable force like dairy products, fruits, vegetables, juices, fish, meat etc. can be stored.

→ For preservation of photographic films, arculogical documents etc.

Refrigeration

```
        WARM
        SPACE
         ↑
Work     ⊙ Heat
 →       ⊙ Pump
INPUT       
         ↑ Heat Rejection
```

```
                    Atmospheric temp:
                    Temp Line
                         ↑ Heat Rejection
            Work    ⊙ Refri
             →      ⊙ -gerator
           input       ↑
                    Cold space
```

Symmetric Diagram of Heat pump & Refrigeration System

→ Refrigeration is defined as maintenance of a syste at the temp. lower than that of it surrounding by continuous removal of heat from it.

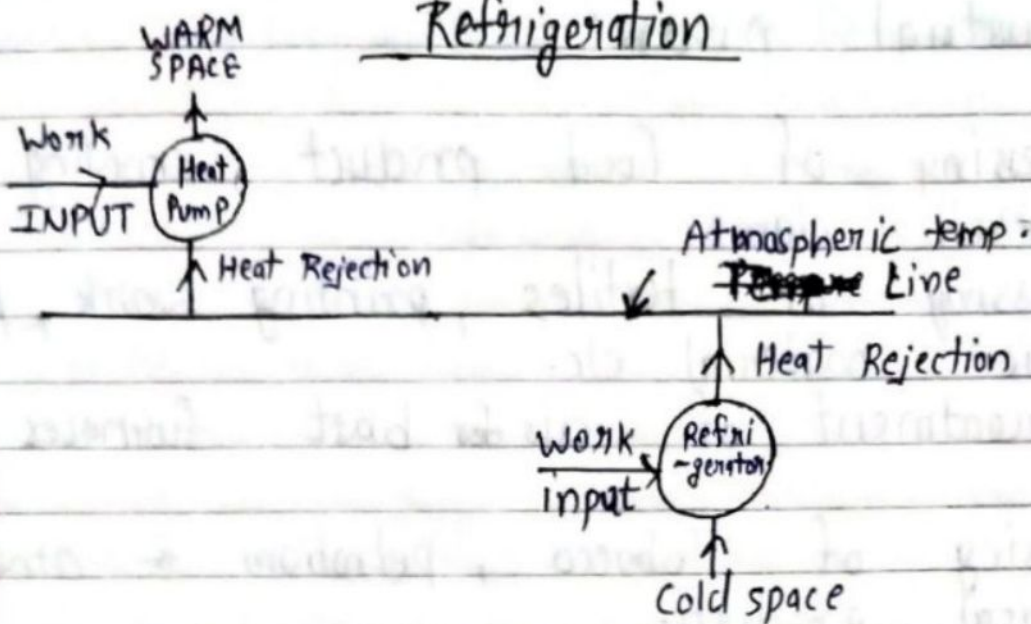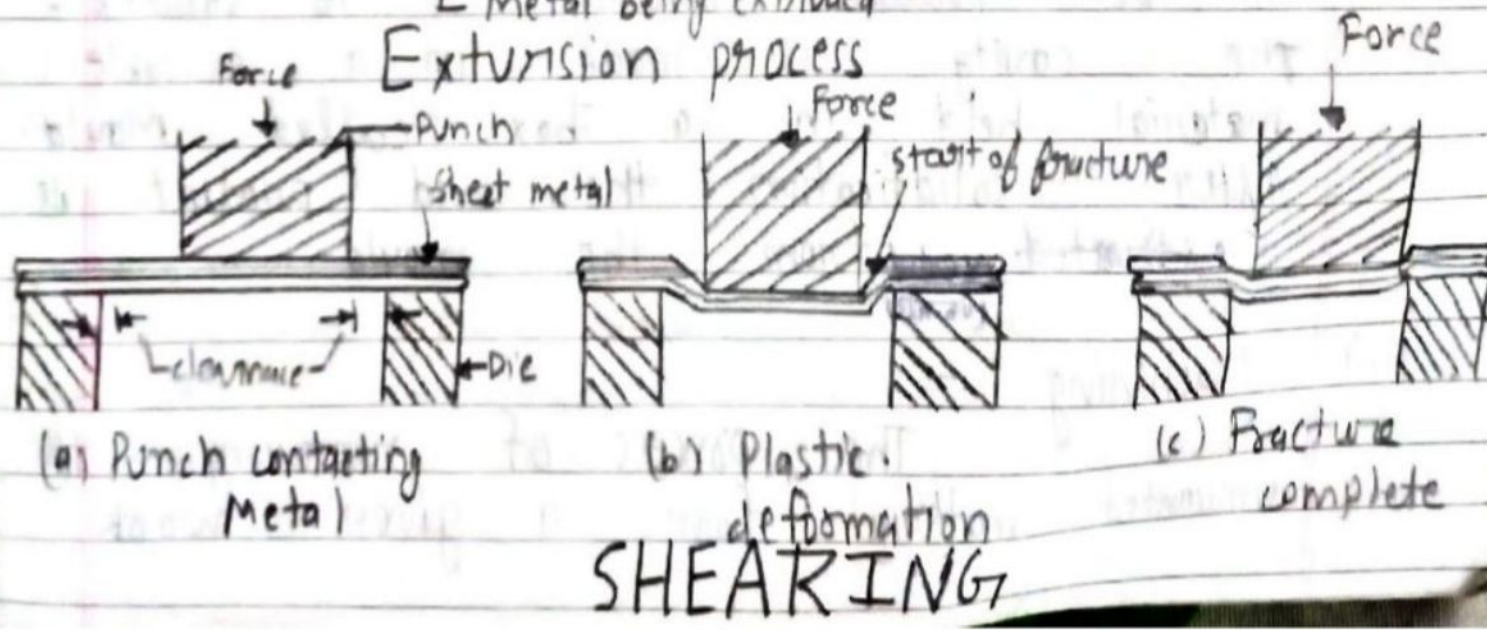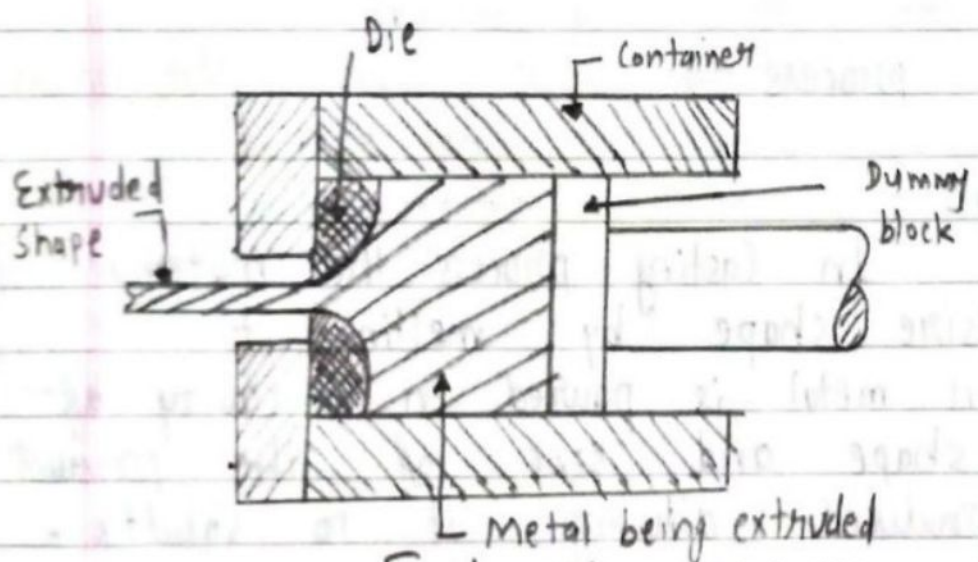Application of Refrigeration :— It is mainly classified into 3 main categeory.
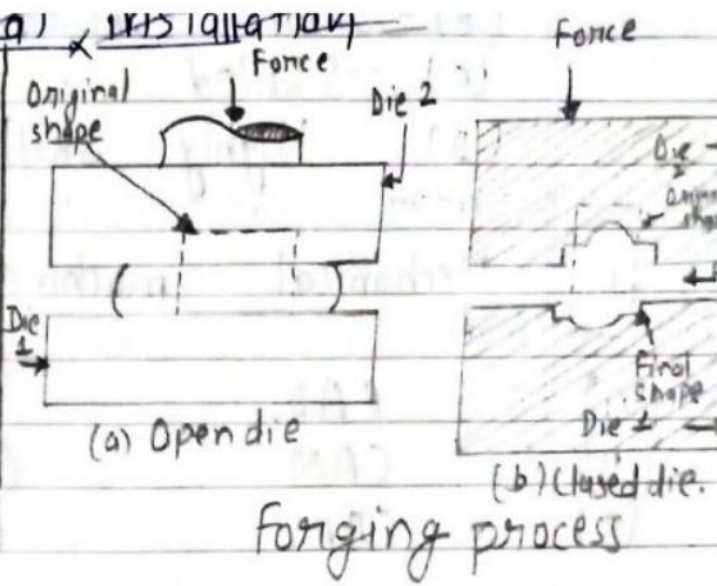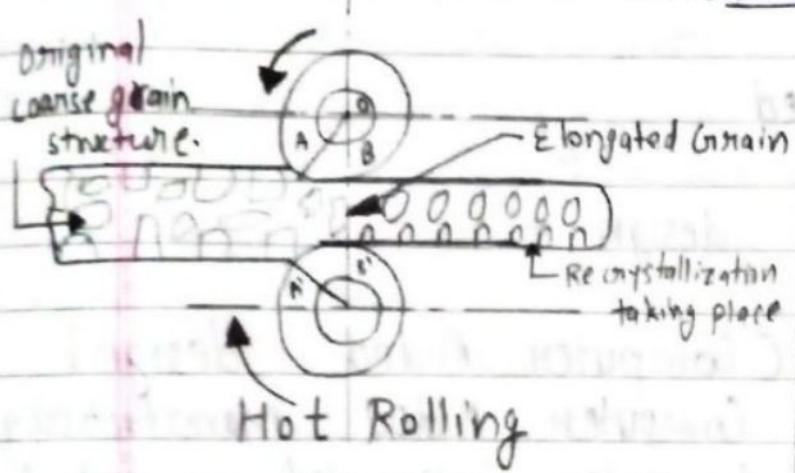
(i) Preservation parishable items ⇒
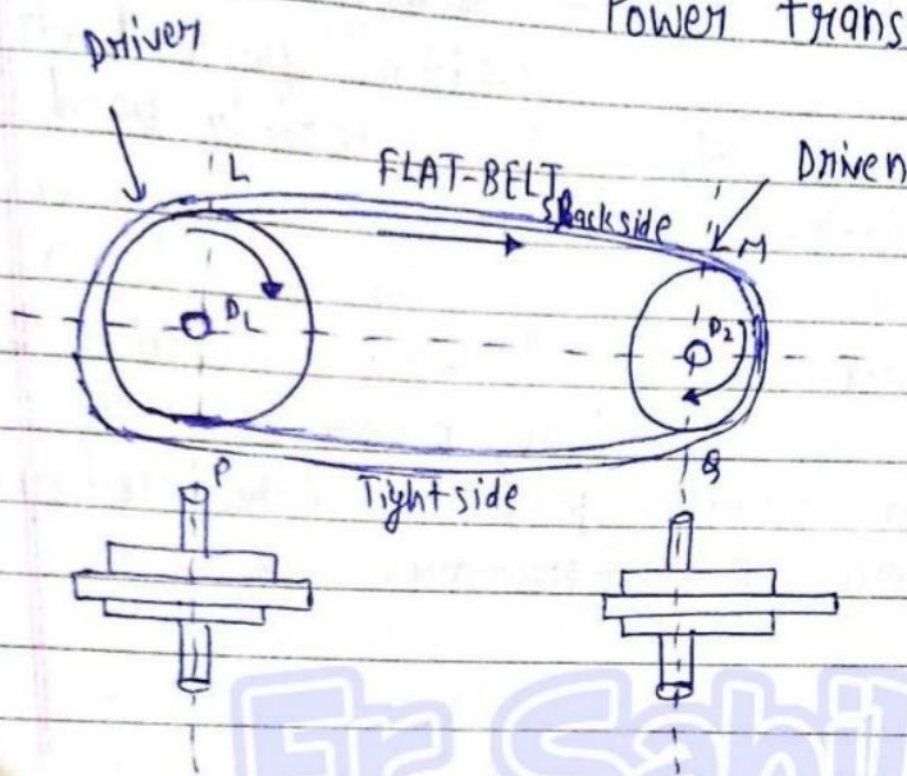
→ for making ice & ice plant

→ For cold storage & refrigerator in which perishable force like dairy products, fruits, vegetables, juices, fish, meat etc. can be stored.

→ for preservation of photographic films, arculogical documents etc.

original
coarse grain
structure.

Elongated Grain

Re crystallization
taking place

Hot Rolling

Original
shape

Force

Die 2

Die 1

(a) Open die

Force

Die

original shape

Final shape

Die 1

(b) Closed die.

forging process

Die

Container

Extruded
Shape

Dummy
block

Metal being extruded

Extrusion process

Force

Punch

Sheet metal

clearance

Die

(a) Punch contacting
Metal

Force

start of fracture

(b) Plastic
deformation

Force

(c) Fracture
complete

SHEARING

Driver

'L   FLAT-BELT
                    Slackside   Driven
                                    'M

D_1 D_2

P   Tightside   Q

Belt - drives :- The belt drive is used to transmit power
            from one shaft to another by means
of pullys. The belt & ropes are wrapped round
to two pully and the end are then connected to
form an endless connector.
The belts or ropes must be intension so that motion
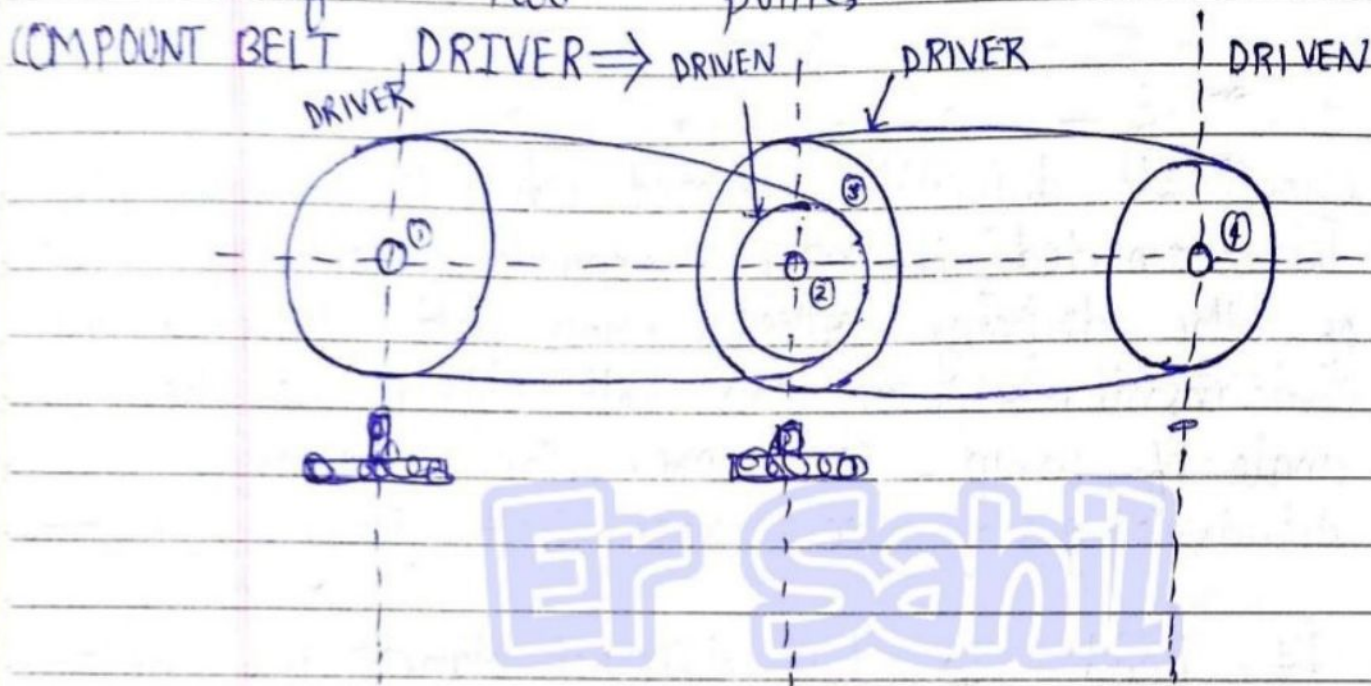is transmitted from one shaft to another without
slit.

Classification of Belts :-

(i) Light Drives Belt
(ii) Medium Drives Belt
(iii) High Drives Belt
     Heavy

(i) Light Drives Belt :- These type of belt used to
                    transmit small power at belt
speed upto 10m/s. It is mainly used in repulsion
                                    machine.

power one side of belt is more tightened (known as tight side) than the other side (known as a slack side).

In case of horizontal drive it is always desired that tight side is that the lower side of two pullies.

COMPOUNT BELT DRIVER ⟹ DRIVEN , DRIVER | DRIVEN

DRIVER

When it is required to have large velocity ratio, ordinary the size of the driver pulley is quite big. The compount and belt drive is used when power is transmitted through one shaft to another shaft by using no. of intermediate pullies.
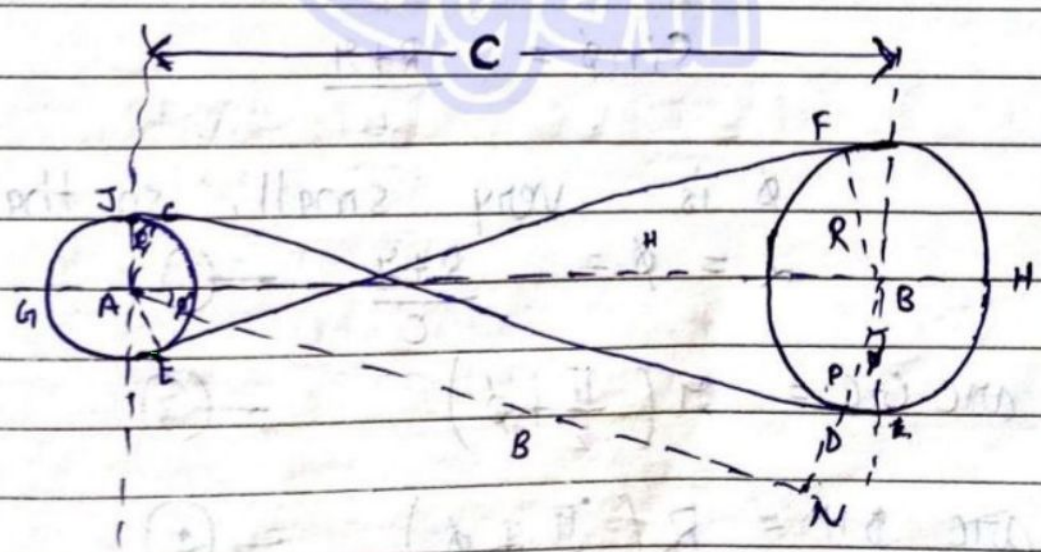
Velocity ratio :— It is the ratio of speed of driven pullies to and that of driving pullies.

let N_1 & N_2 = rotational speed of driver and driven pullies in RPM respectively.

Total length $L = 2\left[r\left(\dfrac{\pi}{2} - \phi\right) + c\left(1 - \dfrac{1}{2}\left[\dfrac{R-r}{c}\right]^2\right) \right.$

$$\left. + R\left(\dfrac{\pi}{2} + \phi\right)\right]$$

$$= 2\left[\dfrac{\pi}{2}(r+R) + \phi(R-r) + c - \dfrac{1}{2}\dfrac{(R-r)^2}{c} \right]$$

$$= \pi(r+R) + 2\phi(R-r) + 2c - \dfrac{(R-r)^2}{c}$$

$$= \pi(r+R) + 2\cdot\dfrac{(R-r)^2}{c} + 2c - \dfrac{(R-r)^2}{c}$$

Total length $L = \pi(r+R) + 2c + \dfrac{(R-r)^2}{c}$

LENGTH OF CROSS BELT :—

We know that in cross belt, both pully rotate in opposite direction.

Let $A \& B$ with the pully center & CD & EF are common tangent to the (cross) 2 pully circle.

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