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IIT(BHU) ,VARANASI STUDENT'S NOTES

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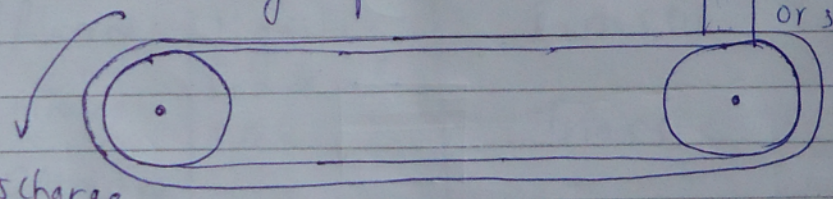
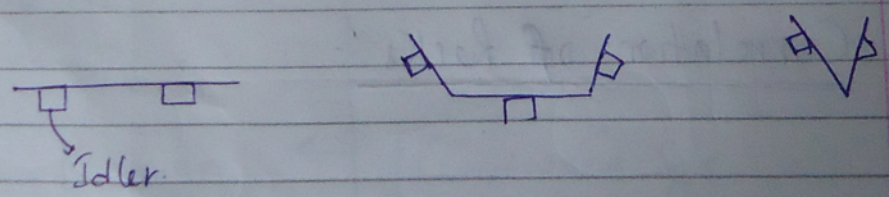
(RR) Mine Machinery

* **Conveyor System** → Belt conveyor
  → Chain conveyor

Why?

* Environmental advantages and adaptability.
* Continous transportation.
* Can be used in narrow passages.
* Energy saving.
* No need of tracks
* Derailment low. and high safety
* Management is easy.
* Low noise level.
* Can be extended
* Large carrying capacity.
* Good time management
* Adaptability to path of travel
* Provides inventory & process control like sorting, weighing or spraying of materials.



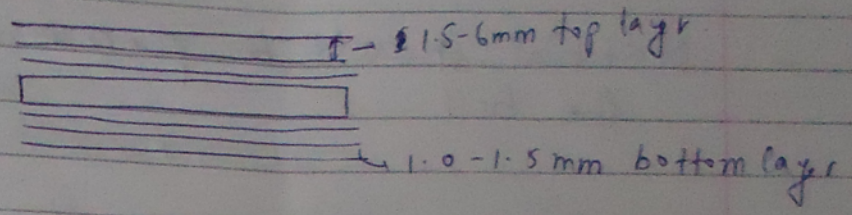


Belt → Rubber (Provides good friction)
→ PVC (Slipping occurs)

The belt consists of layers of plies of cotton duct impregnated with rubber and protected by rubber on both sides.

Horizontal curve Conveyor :- Conveying following natural terrain.

Cotton duck provides strength & rubber provides friction & flexibility.

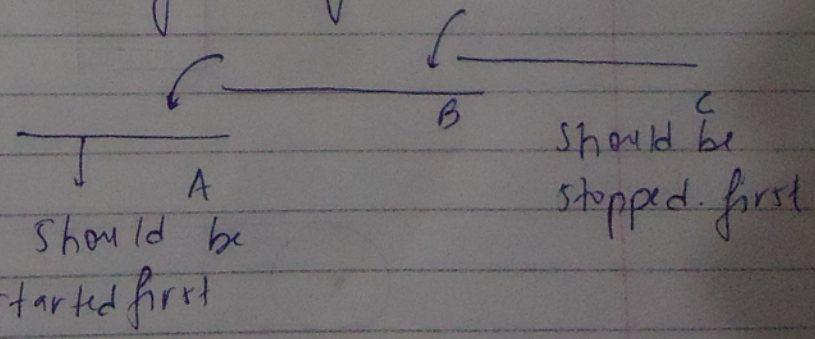


Safety Devices

* When inclination of seam is greater than 1 in 5, then driving gear is placed on the top ~~of the~~ end of the phase with a automatic power brake to prevent conveyor running away when power is cut off.

- Driving pulley should be on top.
- Belt can be stopped from anywhere.

* Sequence control in a system of belts



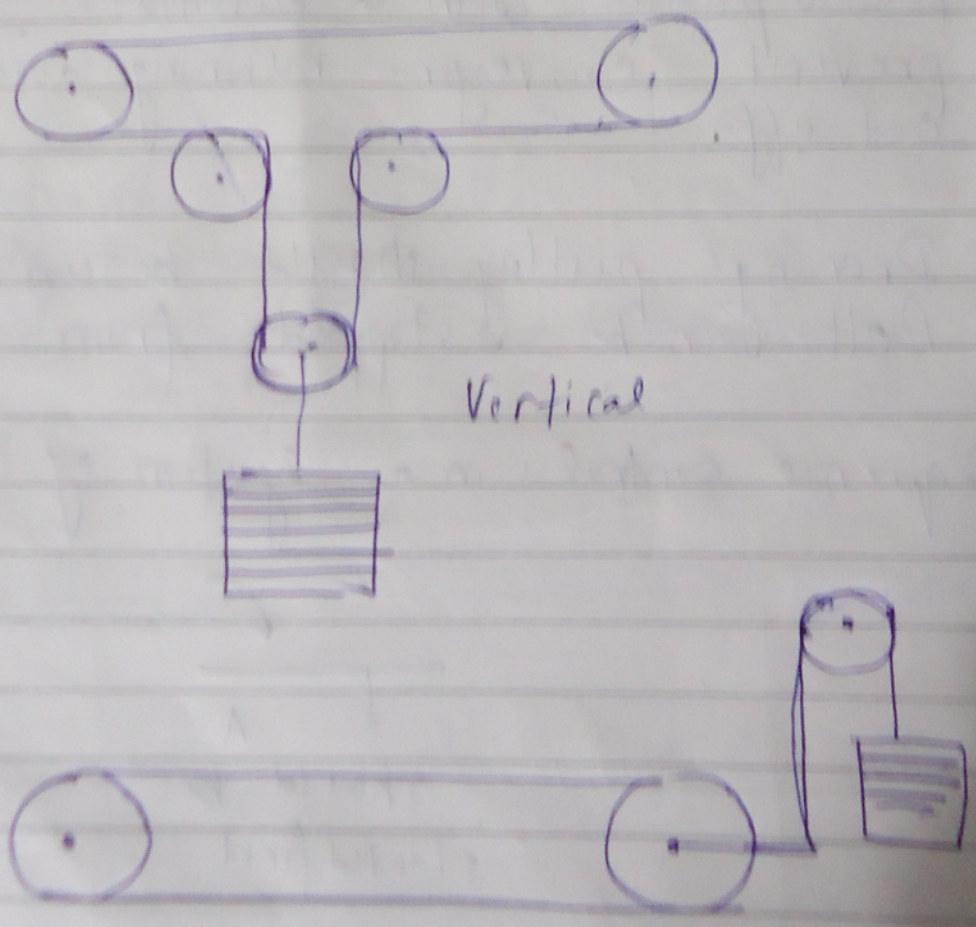
Loading & Unloading arrangement

Material should be deposited in the dir^n of mov^t of belt.

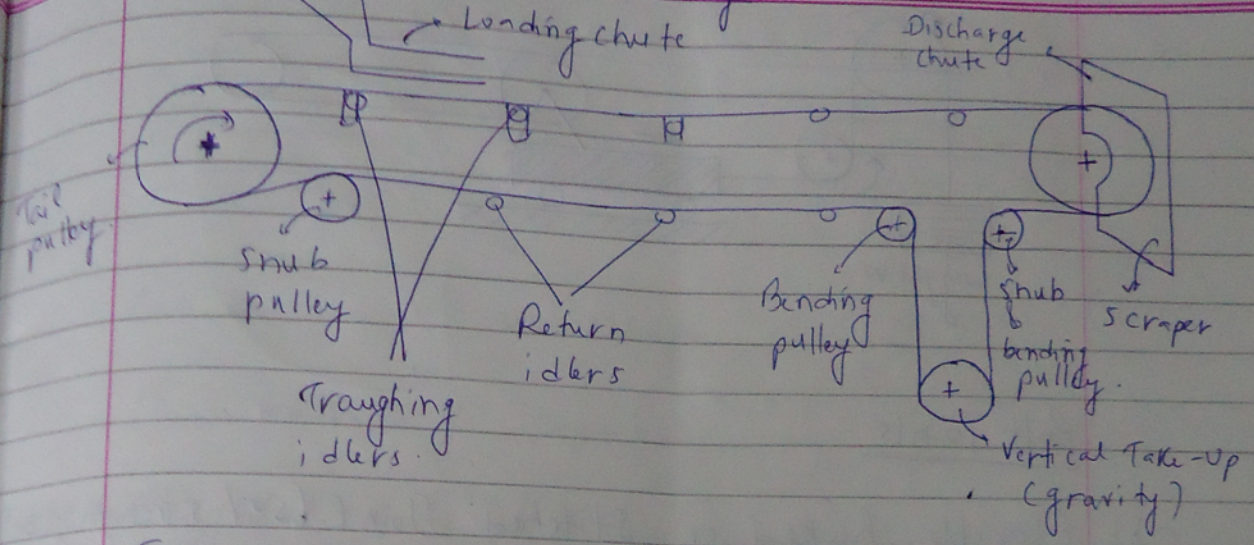
- Material coming on the belt should move in the same dirn as the belt at the same speed
- Material should be placed in the middle of the belt.

Loop Take Up Arrangement

Belt Tension Devices.



(RR) Mine Machinery

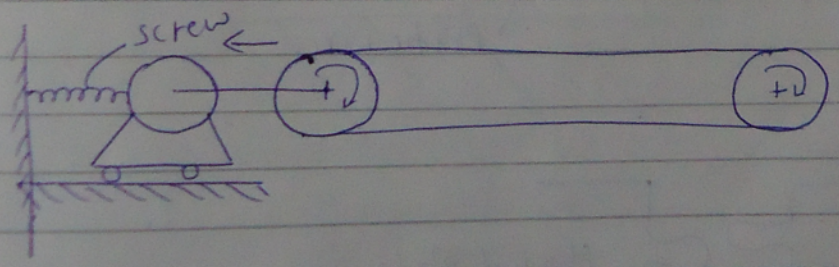


To provide proper tension to the belt

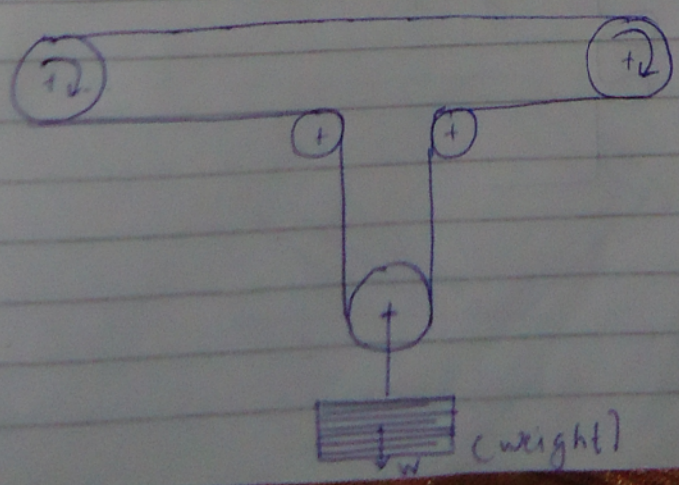
Loop Take-Up Arrangments

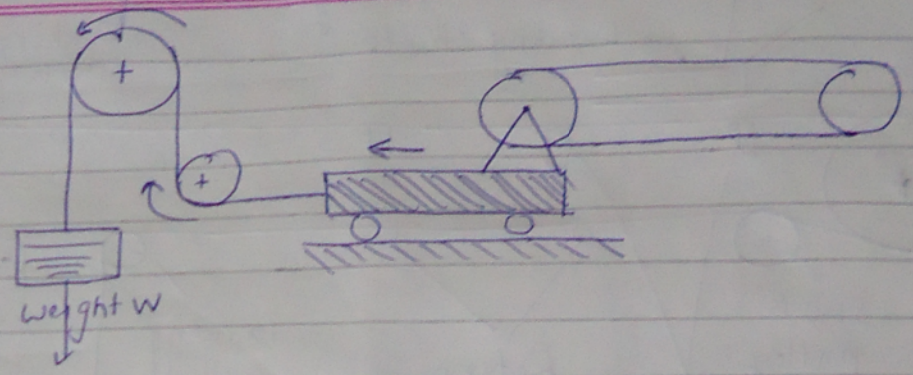
(i) Horizontal
(ii) Vertical
(iii) Horizontal & Vertical.

(i)



(ii)

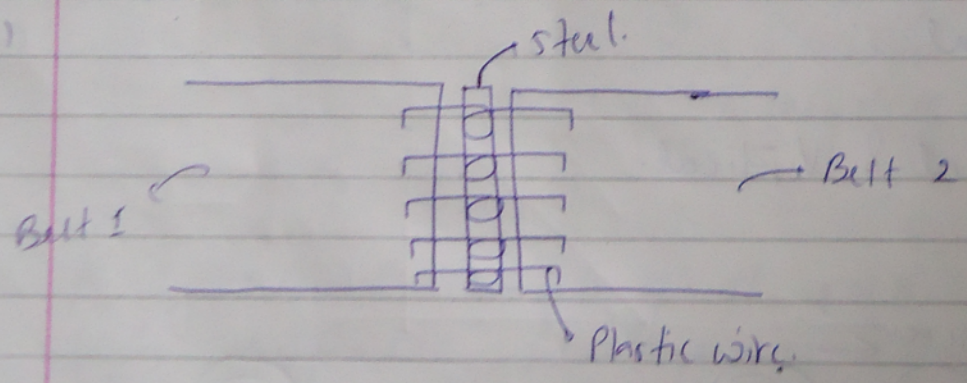




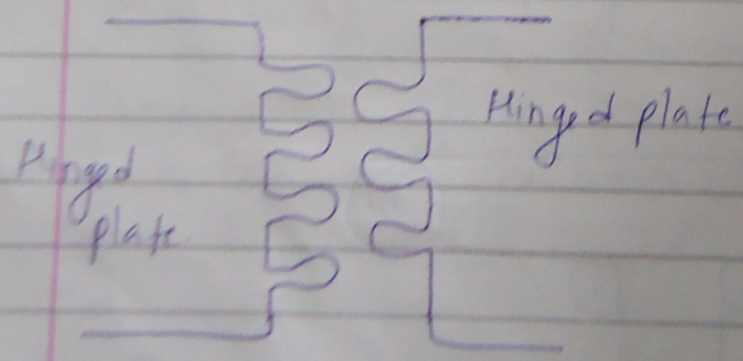
Belt Joints

(i) Flexible hooked or Stitched Joint (50% strength of belt)
(ii) Hinged Joint.
(iii) Vulcanized Joint. (Strength 100%)

(i)



(ii)



* Design of Belt Conveyor

It depends on :-

(i) Purpose of belt.

(ii) Transportation requirement.

(iii) Budget.

(iv) Motive of power.

(v) Layout of mine.

Selections of belt

(i) Suitability of belt conveyor.

(ii) PVC or rubber belt.

(iii) Inclination of belt.

(iv) Speed of belt conveyor.

(v) Width of belt. (~~1-3.2~~ m) (600 mm - 3200

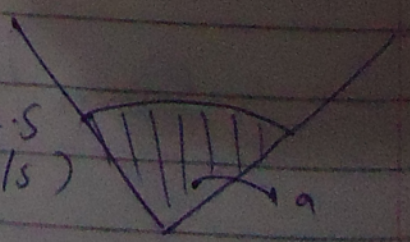
$T = a b v$

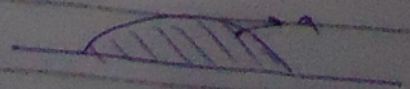
T → Total transportation.

a → Cross section are

b → Bulk density of material.

v → velocity of belt (1-2.5 m/s)





(vi) Material should be

→ Advantages

(i) Sensitive to power requirement

(ii) Less labour req

(iii) Environment-friendly

(iv) Low initial cost

(v) More reliable.

(vi) Less maintenance.

(vii) 90% efficiency

→ Disadvantages

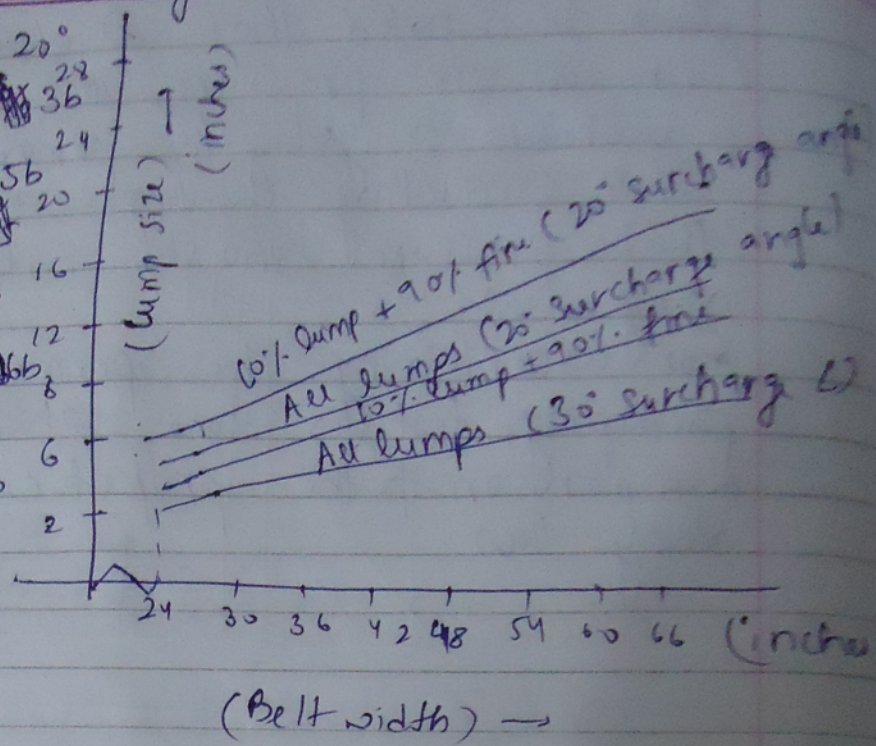
(i) Flexibility is not proper.

(ii) Inclination can't be greater than 30°.

Mine Machinery (RP)

1. Surcharge ∠ = 20°
(10% lumps + 90% fine) · Width of belt = 36
(All lumps) " " = 56

2. Surcharge ∠ = 30°
(10% lump + 90% fine) Width of belt = 66
" " = 106

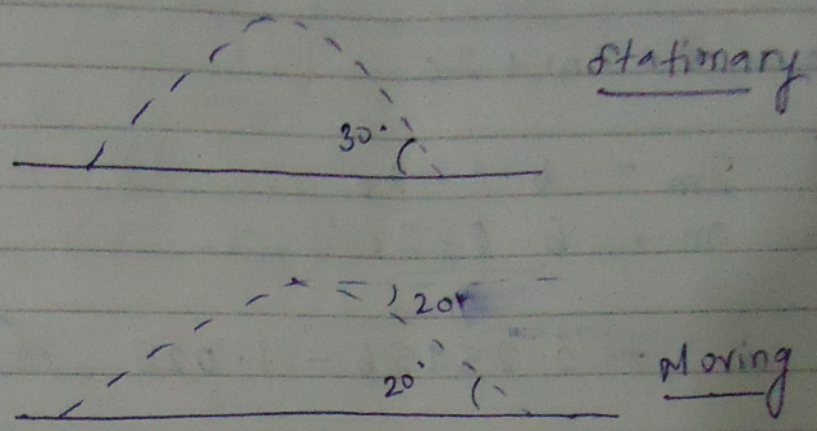


Care of Belt

* Distance b/w loading point and belt should not be very high.
* Prevent the belt from rubbing
* During storage, belt should be kept away from direct sunlight, heat, moisture.
* Drum size should be adequate
* Sticky material should be removed by using scrappers.
* Flexibility should be adequate.

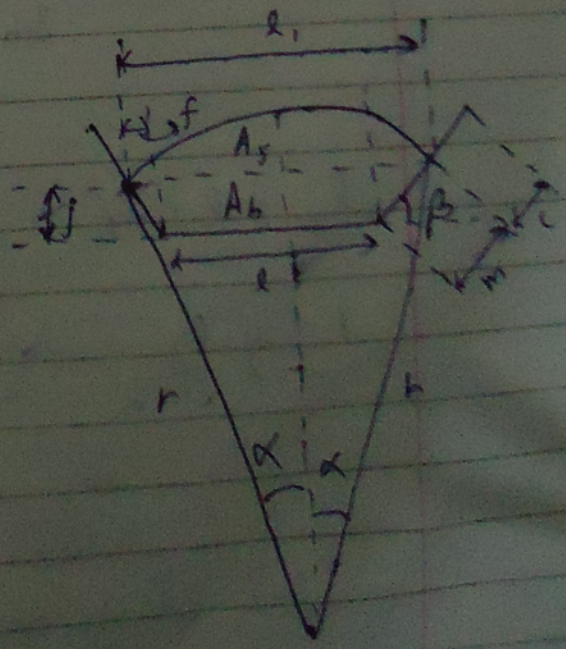
Surcharge Angle :-

The angle of repose when belt is in motion



Angle of repose (in degrees)	Surcharge Angle (in degrees)	Materials
0-19	5°-15°	Fine
20-30	15°-25°	Coarser sand
30-40	25°-35°	Large size material

* Area Calculation :-



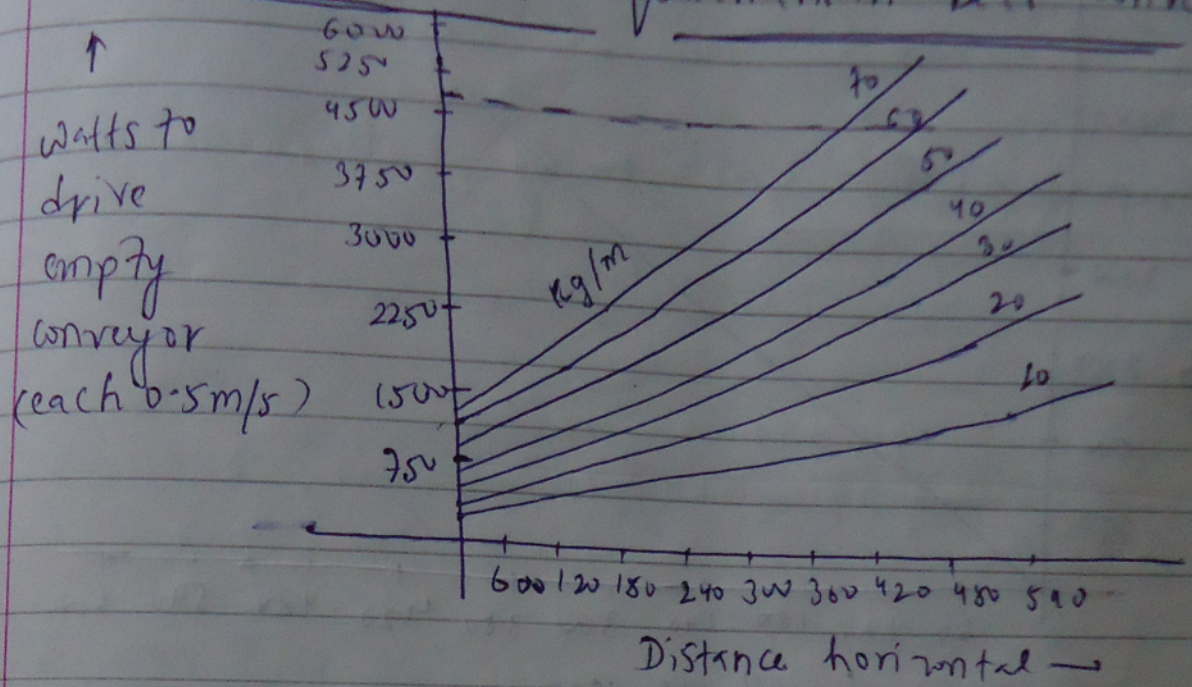
$l = 0.3716 + 0.25$

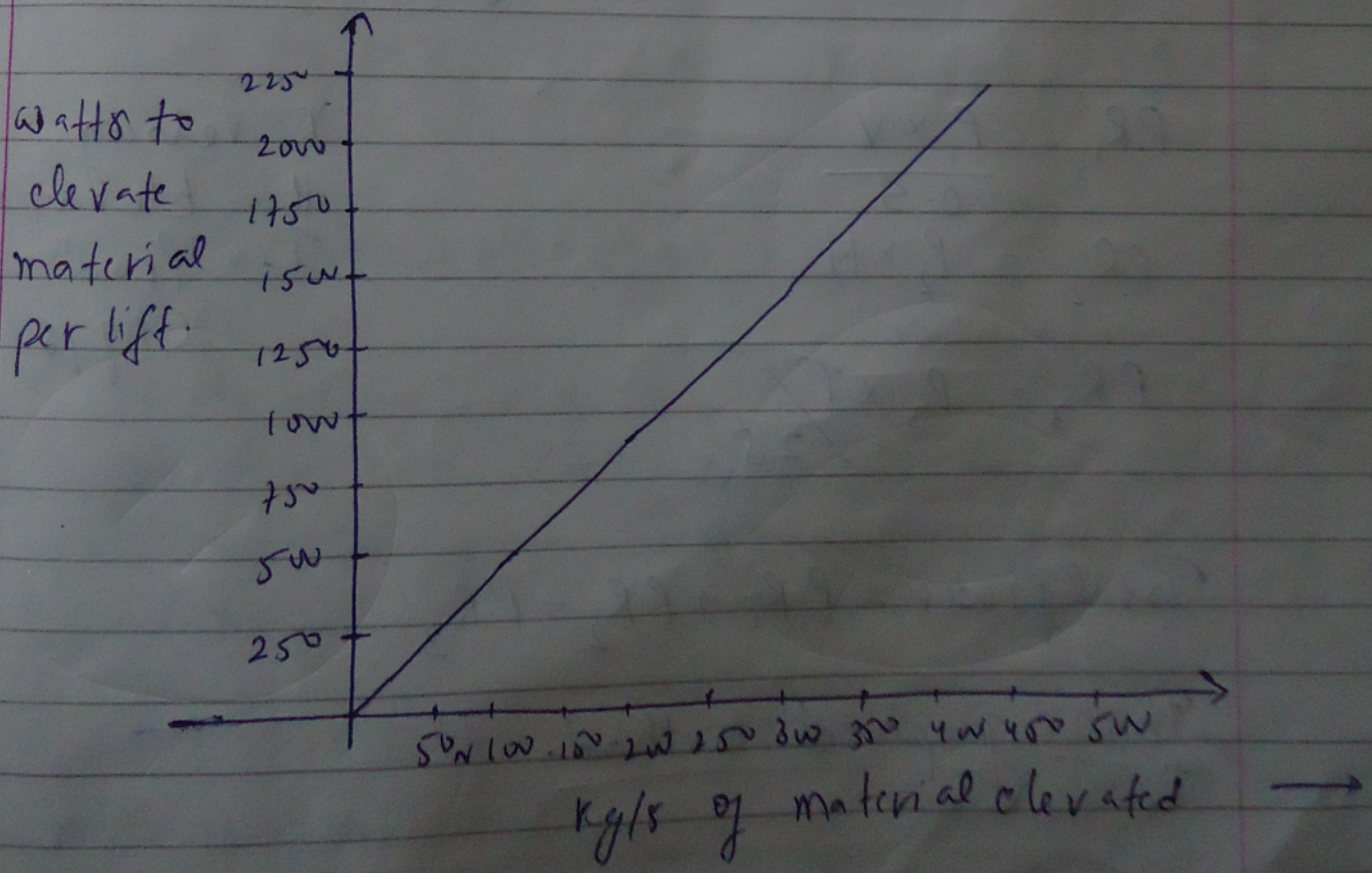
$c = 0.0556 + 0.9$

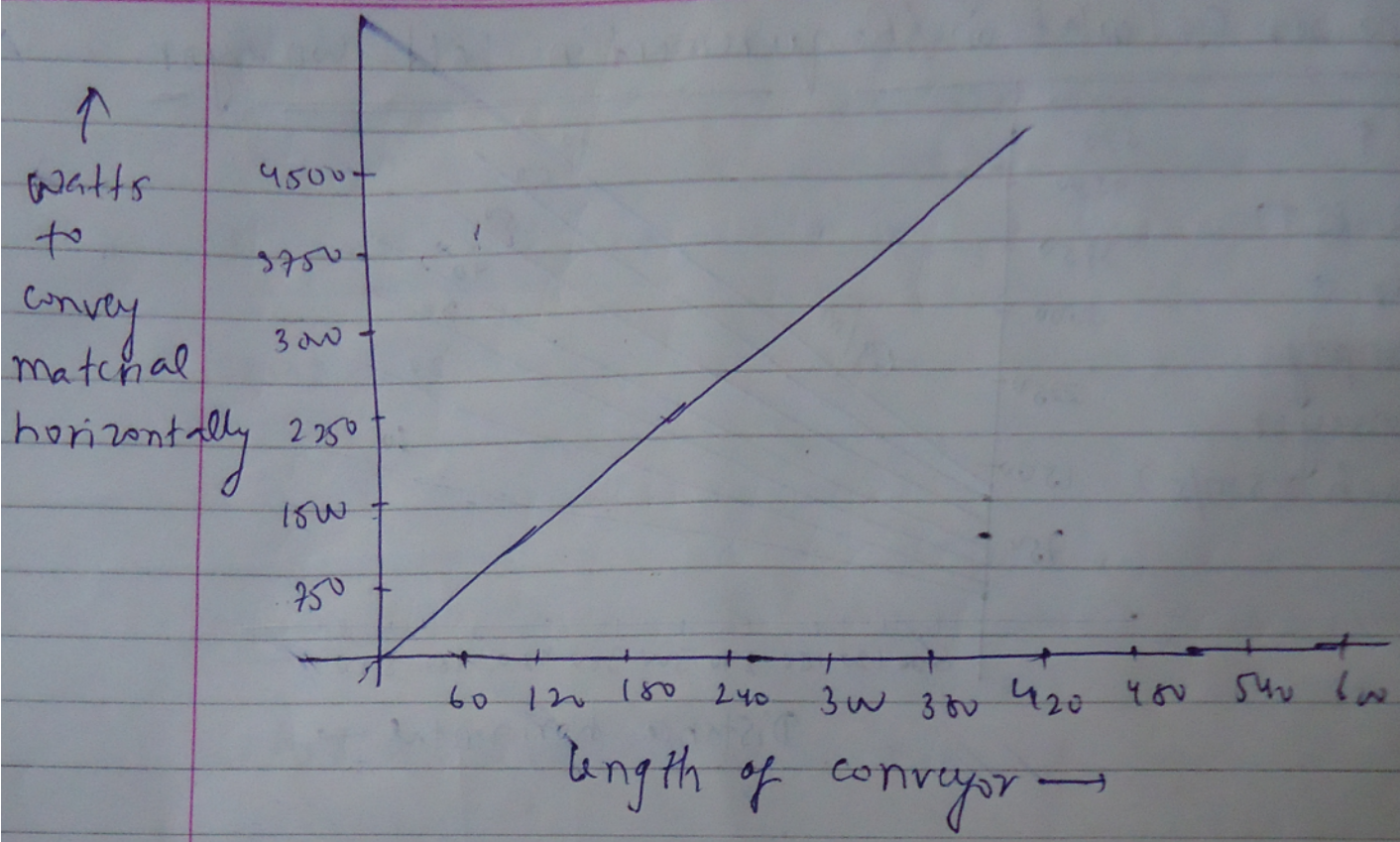
(b = width of belt)

Mira Machinery (RR Sir)

Power Calculation / Requirement in belt conveyor







$$PR_1 = \frac{P_1 \times V}{0.5}$$

$$PR_2 = P_2 \times H$$

$$PR_3 = P_3 \times T/2S$$

V = velocity
H = Elevation
T = Prodn capacity (kg/s)

Total power = $PR_1 + PR_2 + PR_3$

This is graphical method.

m_B = mass of belt in kg/m
m_L = mass of load in kg/m

m_{R_o} = mass of rotating drums, idlers, rollers, per meter length of top belt.

m_{R_U} = ——— ———

C = frictional factor for secondary resistance
B is the inclination of conveyor.

Total force = $F_o + F_u = F_e$

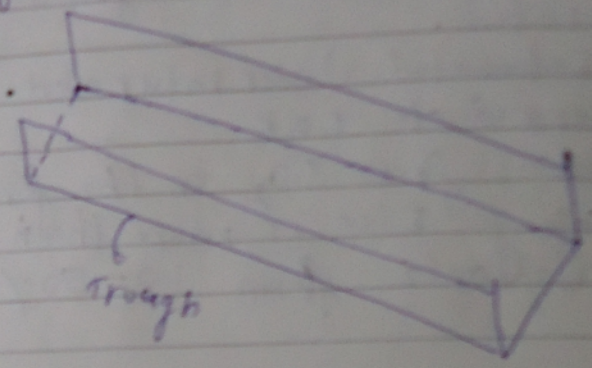
Power $P = \left(\frac{F_e \times V}{1000}\right) kW$

Q Specification

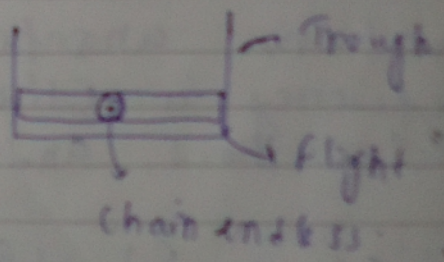
Material : coal.
Density = 800 kg/m³
Angle of repose = 38°
Capacity = 350 kg/s
Troughing idler = 38°
Length centre to centre = 450 m.
Lift = 60 m.

Mine Machinery (PE 501)

★ Chain Conveyor



Parts



(i) Trough
(ii) Flight
(iii) chain
(iv) Motor with Red^n gear (cross sectional view)
(v) Tensioning system.

(i) Trough

It consists of many sections of 1-1.2 meters made up of steel or mild steel. These joined by nut bolt. or hook

(iii) Chain

Made of steel or iron. Strength of chain > load of material to be moved.

- High breaking strength
- Frequent maintenance req.
- Long life
- Easy in dismantling and assembling.

It strength is 18-25 ton/m

(iii) Driving Head

It consists of an electric motor connected with redn gear through flexible couplings. The motor and gear should be protected against overload by using safety devices.

Pin coupling or hydralic clutches or automatic power autoff can be used as safety devices.

(iv) Tensioning System : Using screws.

(v) Loading and unloading arrangement :

Loading and unloading can be done at any point. The feeding of conveyor may be done at any point along its length, the unloading being done over the driving sprocket. Intermediate loading may be done through the opening of the

trough from its bottom.

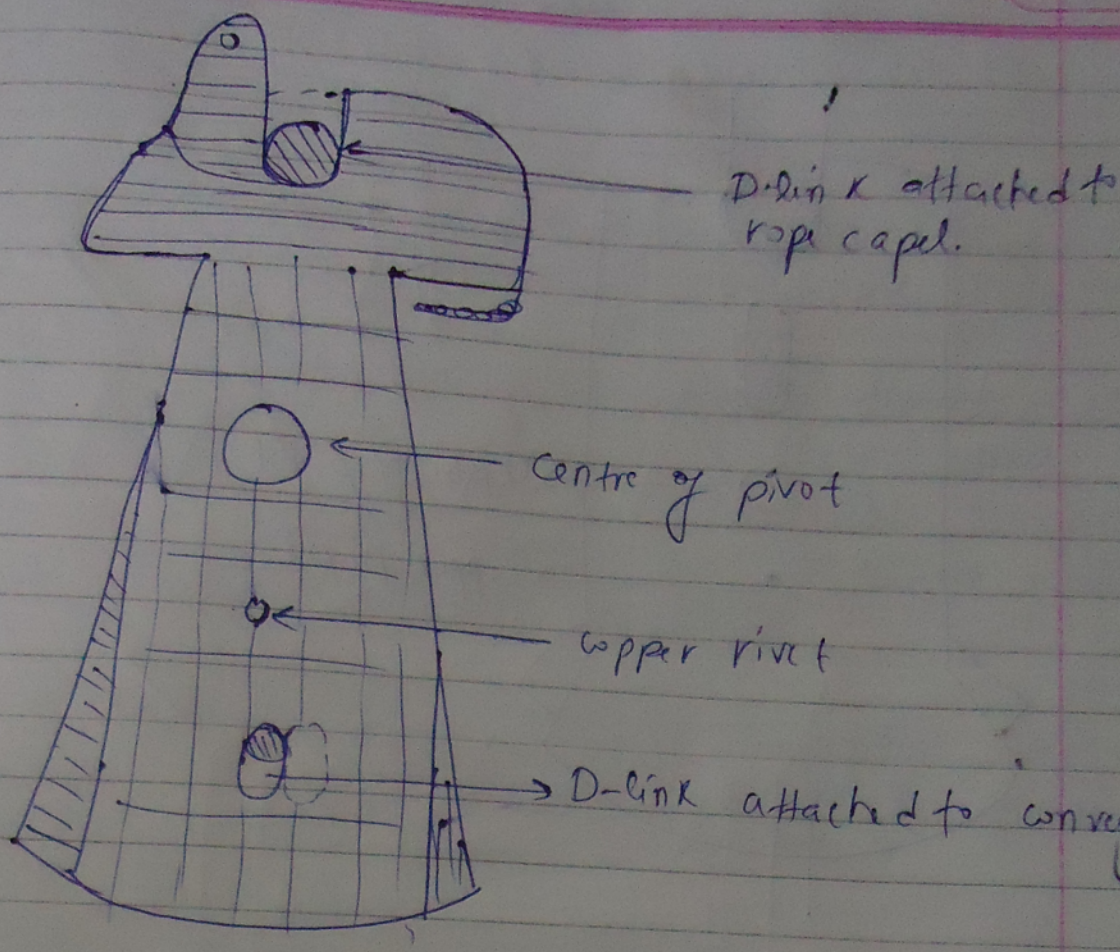
Types of chain conveyor

(i) First type chain conveyor is installed at a little away from face and the space nearest the face is occupied by coal cutting machine. AFC are heavyweight, robust and required high power.

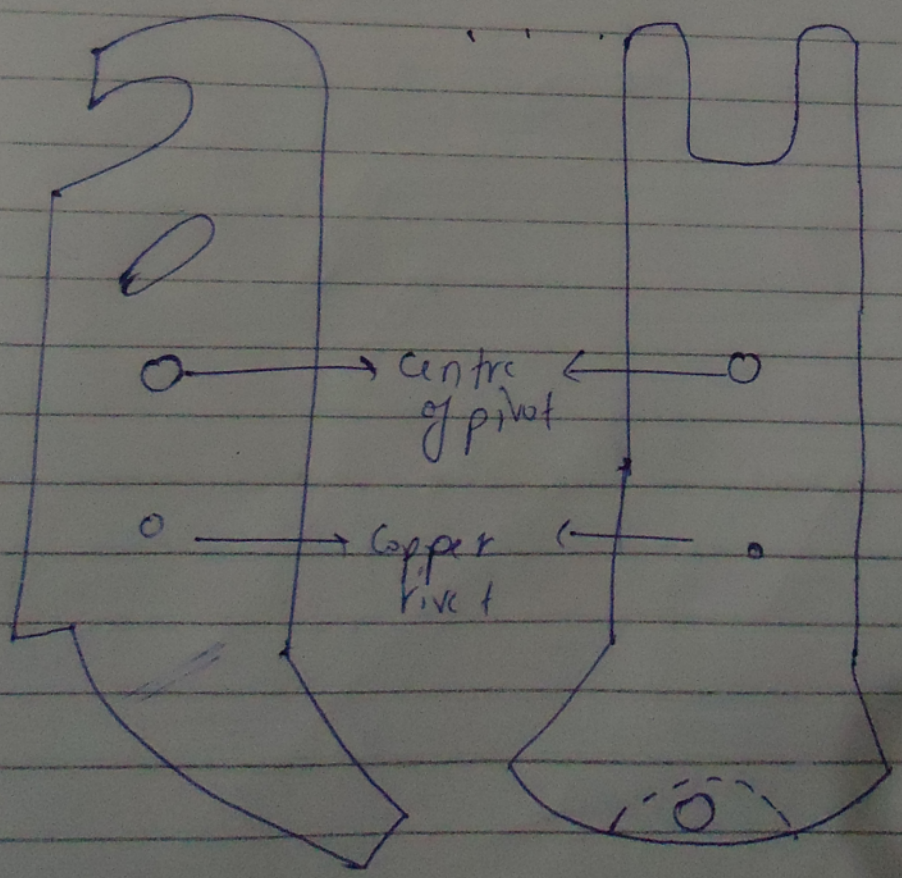
(ii) Second type chain conveyor is also used for additional operations. They guid and carry for coal cutter or combined and used in mine. AFC are in large weight, high capacity & require high power. They are usually installed very near to face and they can be pushed without being dismantled.

Production capacity = 40-50 ton/hr
AFC " = 100 ton/hr

* Advantages	* Disadvantages
(i) Strong	(i) High Power Req
(ii) Easy in maintenance	(ii) Noise
(iii) Easy in extension / modification	(iii) Expensive
(iv) Long life	(iv) Costly maintenance
(v) Unloading can be ~~done~~ at done at any point	
(vi) Can be used in high gradient.	


D-link attached to rope capel.
Centre of pivot
copper rivet
D-link attached to conveyance

2


Centre of pivot
Copper rivet

→ Driving Unit (Diesel, Electric or Compressed air)
~~and~~ should be flame proof.
Reduction gear. ~~70 strokes/min~~
Shaking is 70 strokes/min

→ Trough : of steel or iron.
1m length to 2m and complete length of system should not be more than 90 m.

→ Rollers.

Advantages

(i) Relatively cheaper than belt & chain conveyor.
(ii) Suitable for small mines.
(iii) Easy maintenance.
(iv) Trough can be easily dismantled and open at any position.
(v) Driving unit can be placed at any point.
(vi) Mainly used in stowing

Disadvantages

(i) Tends to break the coal and materials and increase the production of dust.
(ii) Noisy.
(iii) Less capacity.
(iv) Can't be used in weak roof & weak floor.
(v) ~~Ge~~ Not suitable on gradients.

Min Machinery (PP Sir)

* High Angle Conveyor (HAC)

→ Adv

(i) It eliminates truck haulage, transportation by in relatively deep surface mines. It can use upto 90° slope angle. in a limited span.

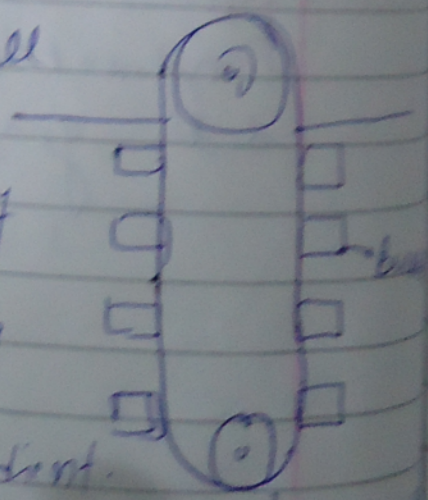
→ Types

(i) Flight Conveyor → Belt
→ Chain

(ii) Bucket Conveyor

(iii) Sandwich Belt Conveyor.

(i) The belt consists of several small buckets uniformly along its surface. Size is approximately 200mm. The material loaded in these buckets uniformly along the top of the surface. When the conveyor takes a steep gradient during the transportation of material the buckets hold the material within itself and the material is safely conveyed to the desired



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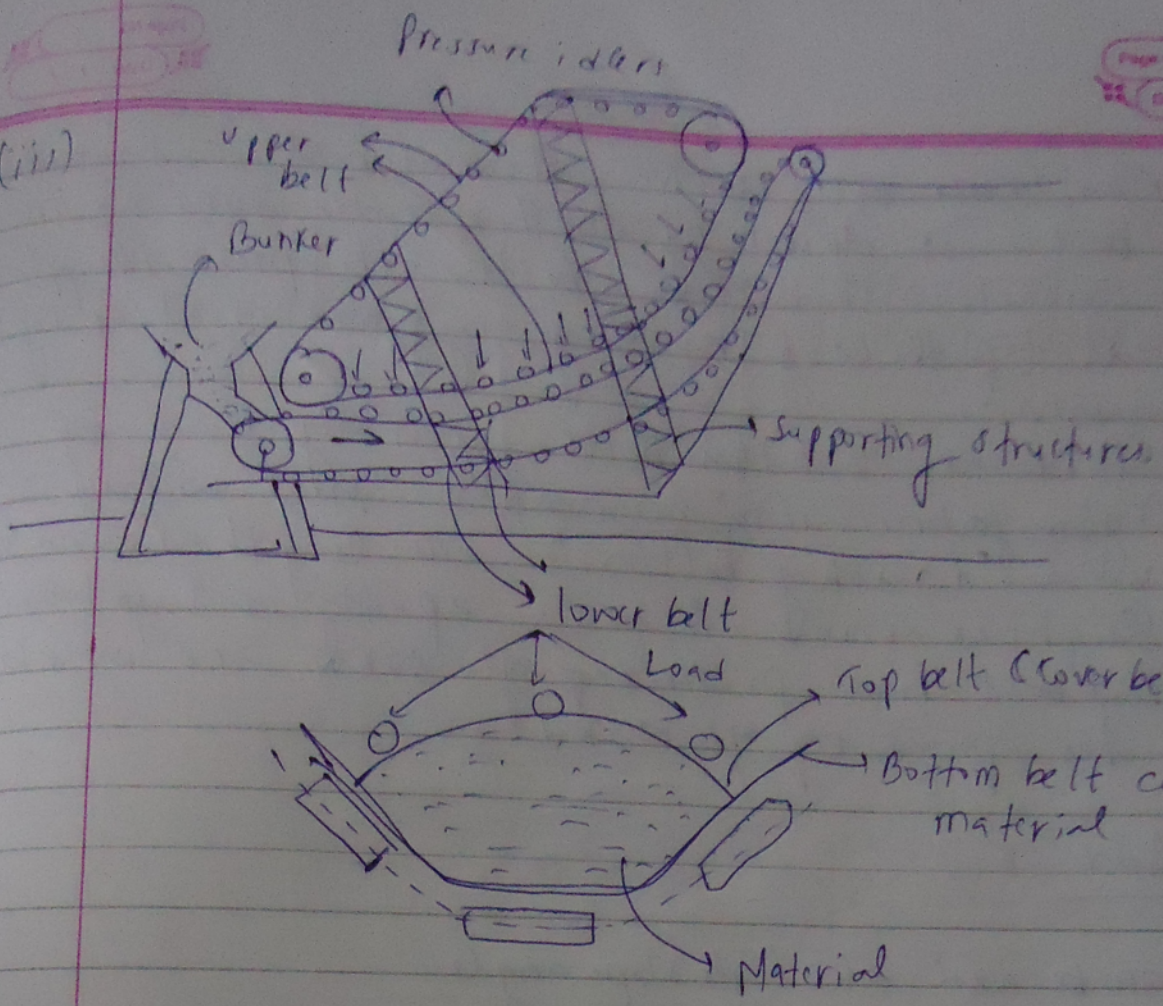
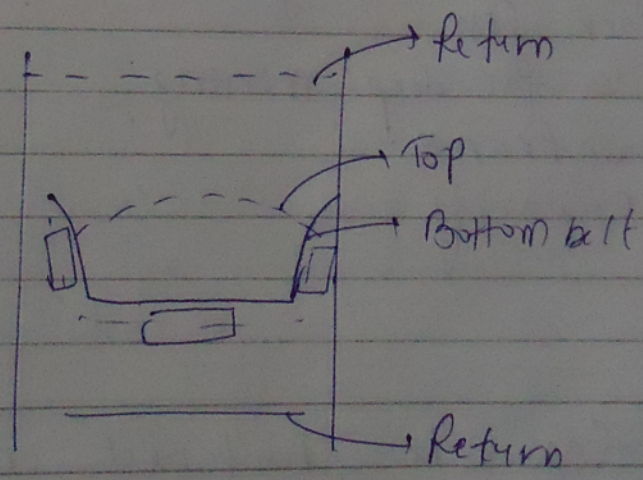
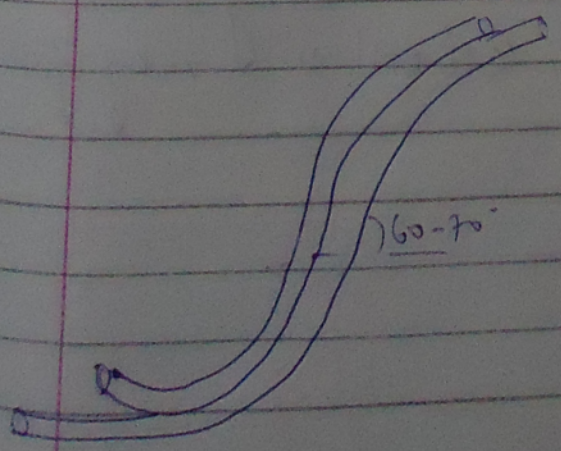
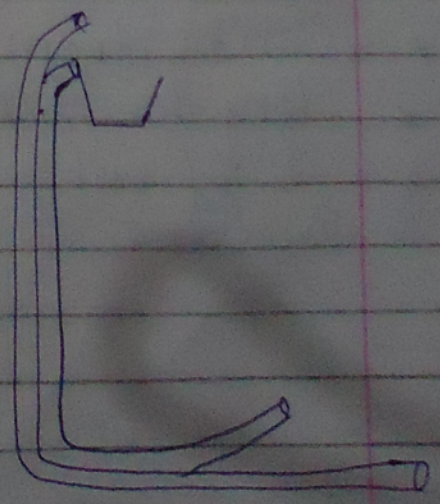






Layout 1

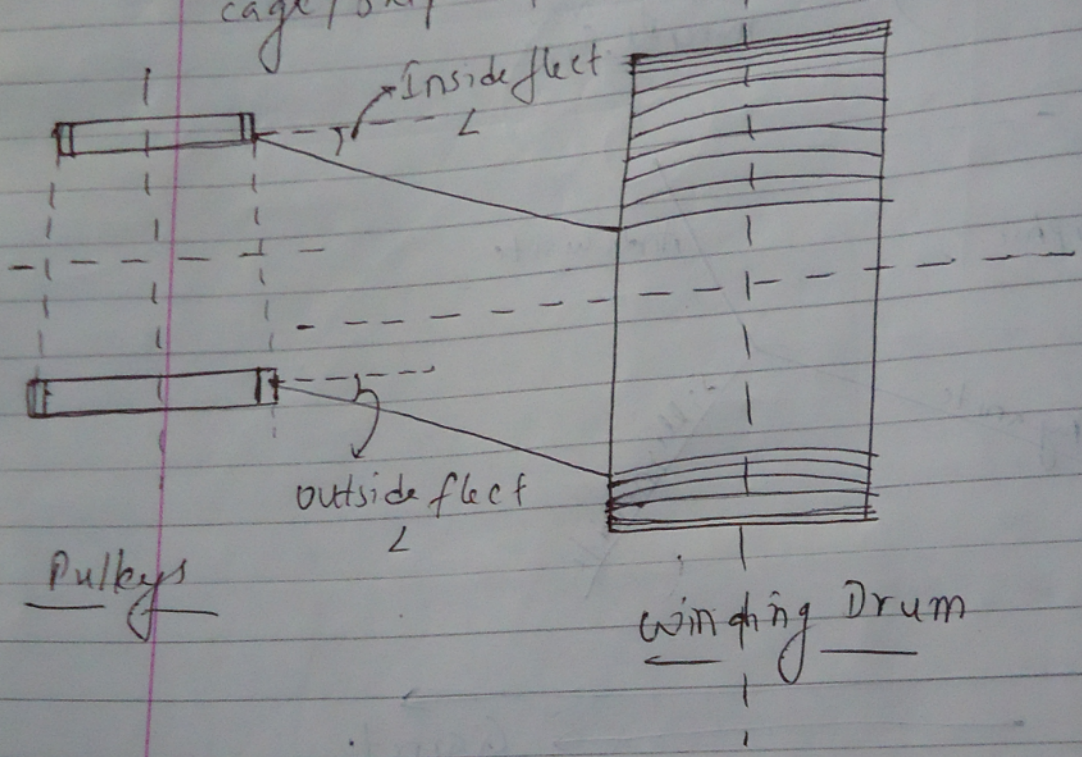


Layout 2

(SKP Sir)

Mine Machinery

* Fleet Angle :- It is the angle b/w the vertical plane of pulley and rope, when the cage/skip is at the pit top / pit bottom.



Importance

(i) No coiling of ropes.

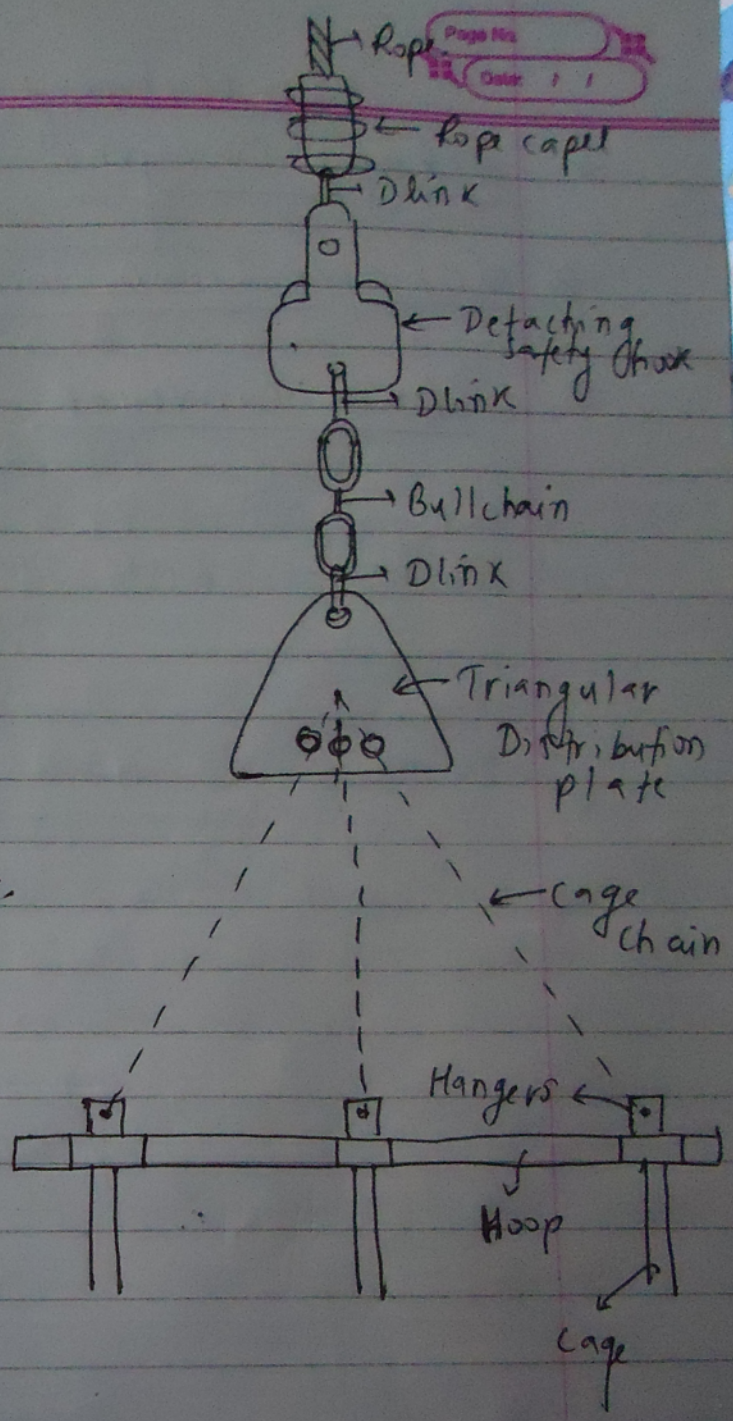
(ii) No wear and tear of ropes.

Max fleet angle is 1.5°

In tower mounted sys min^m fleet ∠ = 0.25°
ground. = 0°

* Cage Attachments

Rope
↓
Capel
↓
Detaching Hook
↓
D link
↓
Bull chain
↓
Triangular Dist. plate
↓
Hooke
↓
Cage chain
↓
~~Cho~~ cage



Detaching safety hook

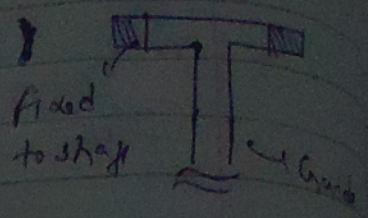
It is a safety device used in drum hoisting system, which acts when an overwinding occurs.

Bell Plate & Catch Plate

SKP (Mine Machinery)

★ Guides → Rigid (Wooden or steel)
→ Flexible (Wire ropes)

Rigid:
- Wooden (10cm x 20cm, Rectangular buntons at 1.8 - 3m interval)
- Steel (T-section upto 13 m length or flat-bottomed)



Flexible Guides

Wire rope
4 wire rope / cage

Locked coil link. (Non-rotating type rope)

Note:
For same mass locked coil has the superior strength

Rigid	Flexible
1. Wooden/Steel	1. Wire ropes.
2. Vertical shaft	2. Can be used for truely vertical shaft
3. Heat and noise generation high	3. Less.
4. Buntons in T-shape used which hampers ventilation	4. No buntons
5. Operating cost high	5. Low
6. Poor ventilating noise is less	6. less
7. More maintenance	7. Rope damage → complete rope [illegible]

8. Cheaper.	8. Expensive
9. No load on headgear.	9. Extra load on headgear

Cage Winding	Skip Winding
1. Used for man-handling	1. Used for ~~st~~ material handling
2. Safety factor higher	2. Lower
3. Payload / Gross weight of cage = 0.35	3. Payload / Gross weight of skip = 0.60
4. Lower production.	4. Higher production.
5. Manual or semi-automatic	5. Automatic in nature
6. Can be used in both VC and DC shaft.	6. Can be used only in case of VC shaft
7. Moderately deep shaft	7. ~~Dep~~ Deep shafts designing high o/p.
8. More manpower	8. Less manpower req
9. No separate arrangements req	9. Separate arrangements for men and material.
10. Material remains intact	10. Dilution of material from various levels.
11. Not req	11. Large excavation at pit-bottom (pockets, tipplers & bunkers)
12. Moderate strength.	12. High strength headgear in comparison.