CONVEYORS

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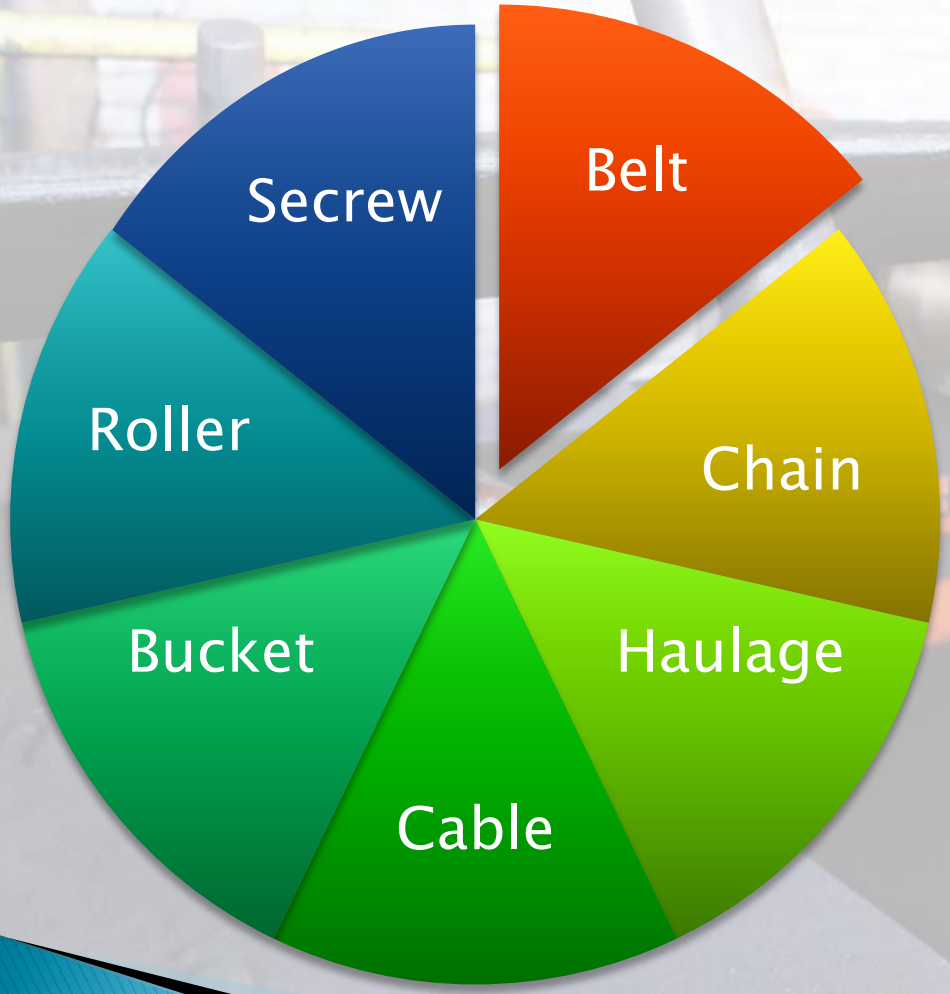
INTRODUCTION

CONVEYORS

It's gravity or powered equipment commonly used for moving bulk or unit load continuously or intermittently, uni-directionally from one point to another over fixed path.

CLASSIFICATIONS



1.DIFINITION

2.GENERAL CHARACTERISTICS

3.TYPES

4.ASPECTS OF DESIGN

5.STRUCTURE

6.APPLICATIONS

1. BELT CONVEYOR

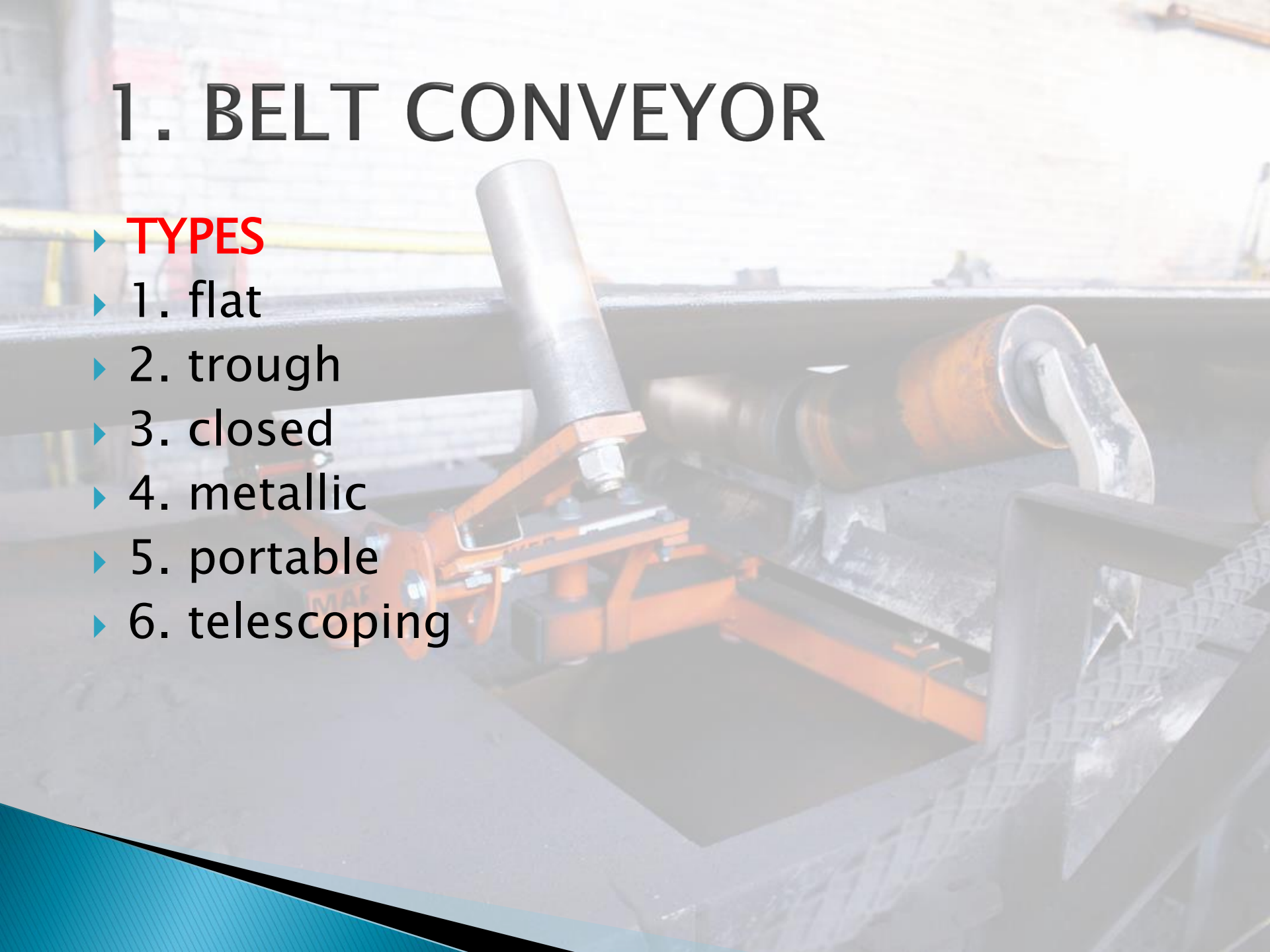
- A belt conveyor consists of an endless flat and flexible belt of sufficient strength, made of fabric, rubber, plastic, leather or metal, which is laid over two metallic flat pulleys at two ends, and driven in one direction by driving one of the two end pulleys.

1. BELT CONVEYOR

- **GENERAL CHARACTERISTICS**
- (i) Belt conveyors operate in one vertical plane, horizontally or with an inclination (up or down) depending on the frictional property of the load conveyed.
- (*ii*) For changing direction of the materials being conveyed, in the horizontal plane, more than one belt conveyors are needed.
- (*iii*) Conveying capacity of a conveyor can be controlled by changing belt speed.
- (*iv*) Belt conveyors are generally employed for continuous flow of materials.
- (*v*) Metal/special belts can carry hot, abrasive or reactive materials.

1. BELT CONVEYOR

- TYPES
- 1. flat
- 2. trough
- 3. closed
- 4. metallic
- 5. portable
- 6. telescoping



1. BELT CONVEYOR

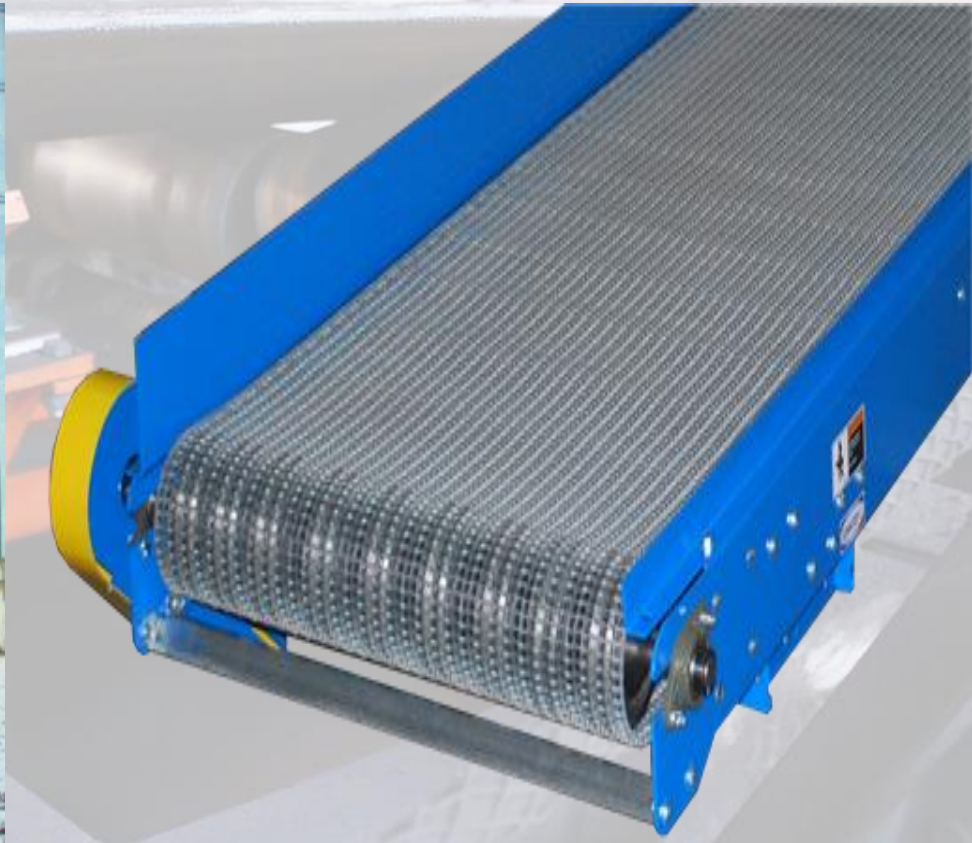
- Flat Type

Trough Type

1. BELT CONVEYOR

- Closed Type

Metallic Type



1. BELT CONVEYOR

- Portable Type

Telescoping Type

1. BELT CONVEYOR

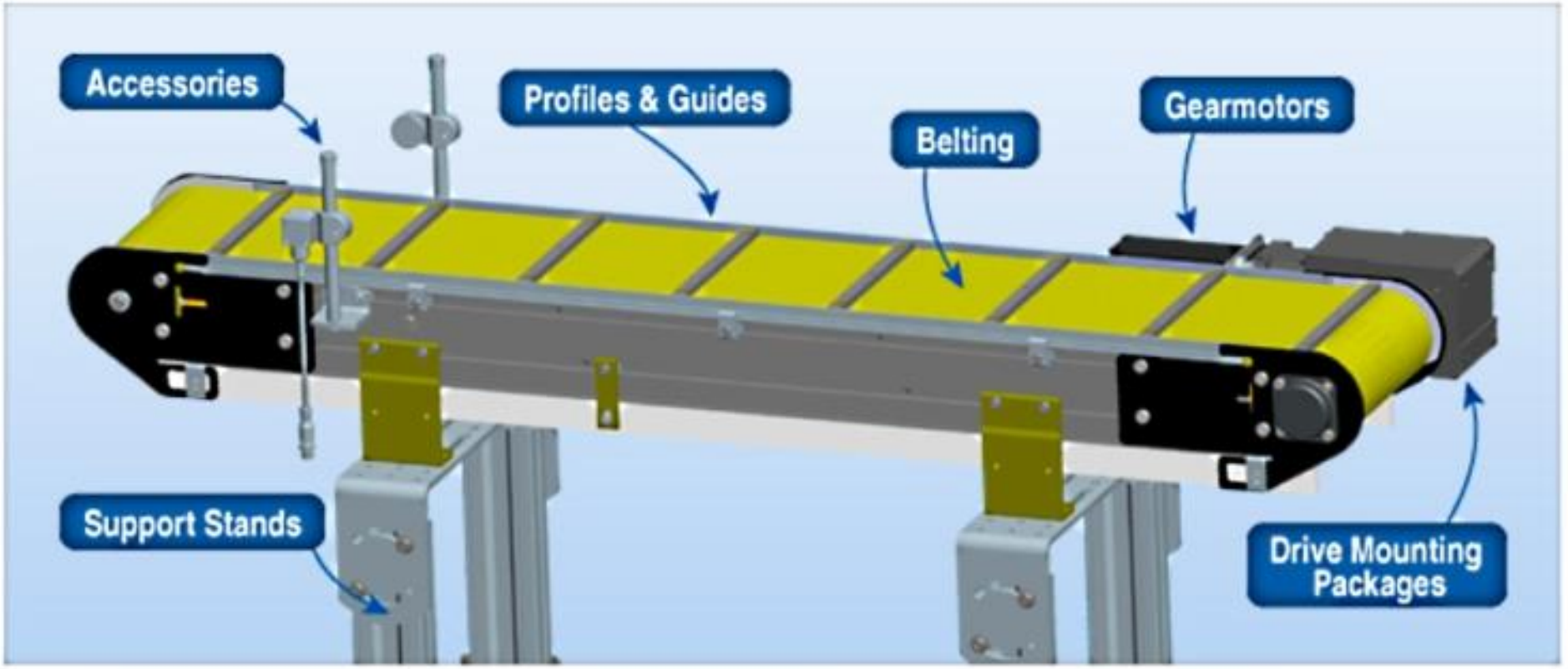
- APPLICATIONS
- Mineral industry, Underground mine transport, opencast mine, and Processing Plants
- Handling bulk materials of different classes
- Handle fragile materials
- Handle fine bulk
- Handle corrosive and reactive materials
- Handling food, chemical industry and for conveying hot and reactive loads
- Handle unit and lump materials through furnaces
- Loading/Unloading of trucks / transport vehicles

1. BELT CONVEYOR

- **STRUCTURE (PARTS)**

1. Belt
2. Idler
3. Pulleys
4. Drives for belt
5. Belt tensioning device
6. Loading/Unloading device
7. Belt Cleaner
8. Training idlers (for alignment Purpose)
9. Transfer terminals

1. BELT CONVEYOR/PARTS




End Drive


Cleated Belt


Fixtured Belt

1. BELT CONVEYOR/PARTS

1. BELT CONVEYOR

- **ASPECTS OF DESIGN**

1. Checking/determining capacity of a conveyor.
2. Calculating maximum belt tension.
3. Selection of driving pulley.
4. Determining motor power.
5. Selection of idlers and its spacing.

1. BELT CONVEYOR/DESIGN

1. Determining Conveyor Capacity

- To find out the size and speed of the conveyor to achieve a given conveying rate.
- BELT WIDTH

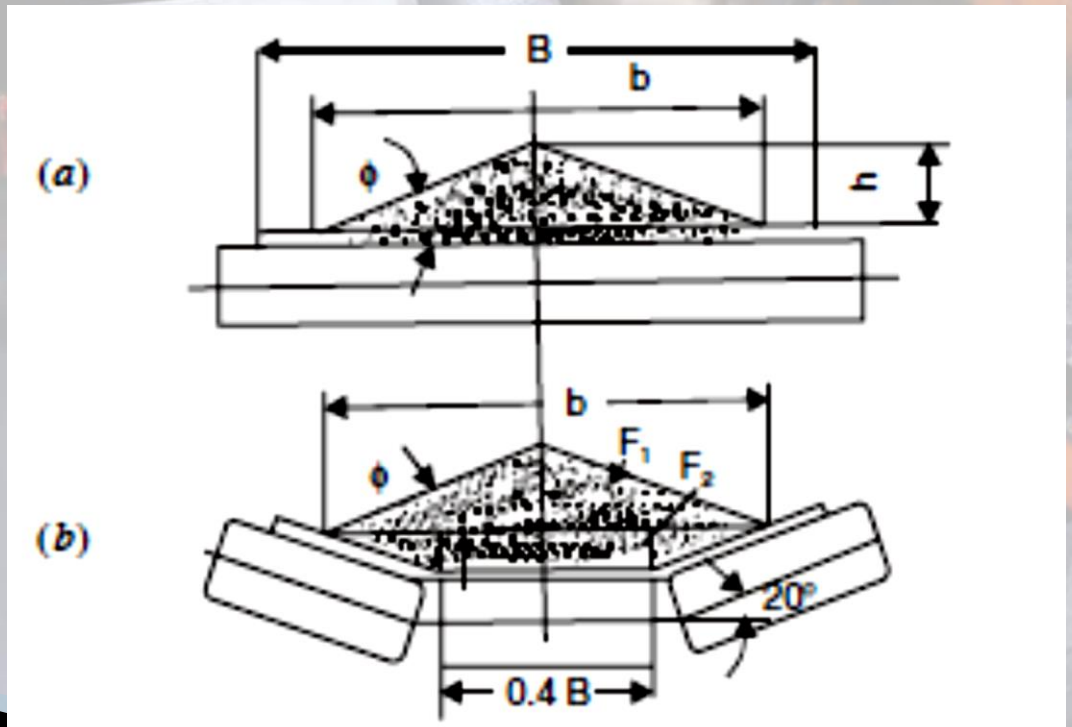


Fig. 6.1.12. Bulk load on flat and troughed belt conveyor

1. BELT CONVEYOR/DESIGN

(i) On a flat belt

$$F_1 = \frac{bh}{2} = \frac{1}{2}(0.8B \times 0.4B \tan\varphi_1) = 0.16B^2 \tan(.35\varphi)$$

Therefore, the conveying capacity "Q_t" of a flat belt conveyor is given by

$$Q_t = 3600F_1 \times V \times \gamma = 576B^2 V\gamma \tan(0.35\varphi), \text{ tons / hr}$$

1. BELT CONVEYOR/DESIGN

- (*ii*) For a three roller troughed belt conveyor

$$F = 0.16B^2 \tan(.35\varphi) + 0.12B^2 \tan\lambda = B^2[0.16 \tan(.35\varphi) + 0.12 \tan\lambda]$$

The conveying capacity "Q_v" of the troughed conveyor is

$$3600FVv = B^2Vv\,[576 \tan(.35\varphi) + 432 \tan\lambda],\ \text{tons/hr}$$

1. BELT CONVEYOR/DESIGN

- Calculations of Belt width and Clearance
- **Belt width**= [L+(2*H)] ...(1)
- **Max. Corner Dimentions**=$(L^2+W^2)^{\wedge 0.5}$ ... (2)
- **Side Clearance**=0.5(Belt width–Max. Corner Dimension)...(3)
- **Max.speed**=$\frac{No.\ of\ boxes*(wide+gap\ between\ two\ boxes)}{time*1000}$ ...(4)

- Example:

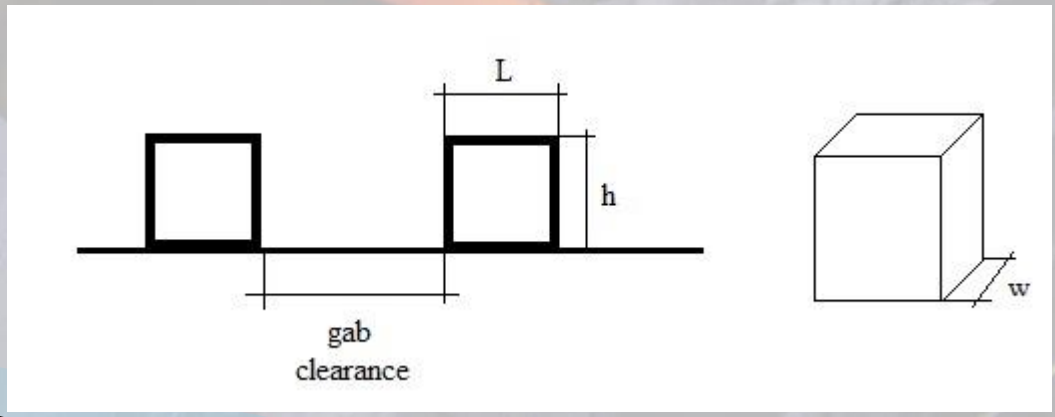
Boxes of size 220 mm × 180 mm × 100 mm have to be conveyed by a belt conveyor of sufficient belt strength, at the rate of 2000 boxes per hour. What will be the size and speed of the conveyor?

1. BELT CONVEYOR/DESIGN

- Solution:
- **Belt width**= [L+(2*H)]=220+(2*100)=420 mm

- **Max. Corner Dimentions**
  $(L^2+W^2)^{\wedge 0.5}$ $=(220^2+180^2)^{\wedge}0.5=284$ mm

- **Side Clearance**=0.5(Belt width-Max. Corner Dimension)
  = 0.5*(420-284)=68 mm
- **Max.speed**$=\frac{No.\ of\ boxes*(wide+gap\ between\ two\ boxes)}{time*1000}$
- $=\frac{2000*(180+200)}{60*1000}=$ 12.67 m/min



1. BELT CONVEYOR/DESIGN

- **(b) Belt Tension**

$$\frac{T_1}{T_2} = e^{\mu\alpha}, \qquad \ldots(v)$$

where, T_1 = Belt tension at tighter side

T_2 = Belt tension at slack side

α = Wrap angle in radian

μ = Coefficient of friction between pulley and belt

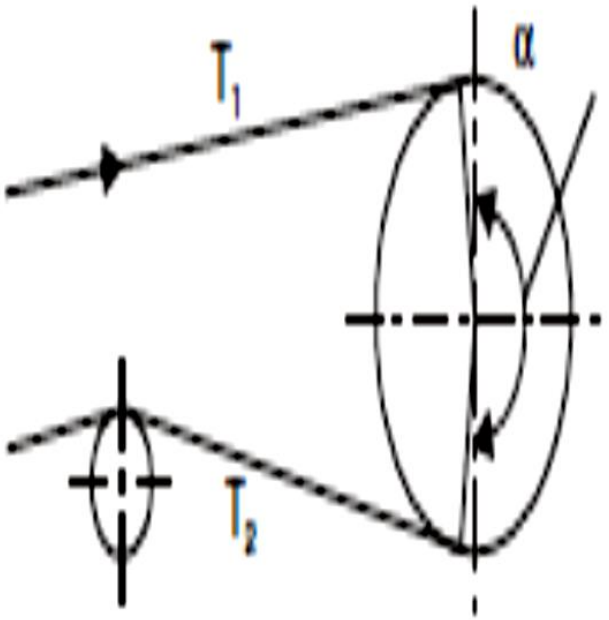


Fig. 6.1.13. Tensile forces on belt

1. BELT CONVEYOR/DESIGN

- **(b) Belt Tension**
- **Effective Pull in the belt**

$$T_e = T_1 - T_2 = T_2\left(e^{\mu\alpha} - 1\right)$$

1. BELT CONVEYOR/DESIGN

- (d)Motor Power

$$P_d = \frac{T_e \times V}{1000}\ \text{kW, where } T_e = \text{effective tension} = (T_1 - T_2)\ \text{in Newton}$$

$$P_A = \frac{T_e V}{1000} + \frac{(R_{wd} + R_{bd})V}{1000}\ \text{kW, where}$$

R_{wd} = wrap resistance between belt and driving pulley.

R_{bd} = driving pulley bearing resistance.

1. BELT CONVEYOR/DESIGN

- **(d)Motor Power**
- Additional Power Requirements
- (Belt tripper, and Belt Cleaner)

- Final Motor Power based on efficiency of the transmission used(gear,chain,coupling)

$$P_M = \frac{P_A}{\eta}$$

- Actual power $_{\text{safty factor}} = 15\%\text{–}20\% >$ calculated $_{\text{power}}$


End of Part-I