



Research Paper

## DESIGN CONSIDERATION FOR HOT ROLLED PRODUCT TRANSFER MECHANISM

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In any industries material handling system plays very important role for increasing efficiency of industry. Now a day in many steel industry hot roll product handle manually due this accident chances accruing. In this paper the study is on handling the hot product by wheel trolleys mechanism. It transfer hot product in one source to one destination for that it's required to design all the component of wheel trolleys mechanism like load on structural frame, gear train ratio, chain drive system and power. This paper discusses the generalized design consideration for wheel trolleys mechanism.

Keywords: Wheel trolleys mechanism, Hot rolled product, Transfer mechanism

### INTRODUCTION

Handling of Hot rolled products is the major issue in many rolling industries, the finish product, i.e., long angle and channels are produced by rolling process. As the hot finished product is formed it is lifted by a manual process from the rolling mill bit and transfers it to desired storage for cooling. In this case lifting of the billet is very difficult to transport from one place to another place. As the process of formation of hot products is continuous and the temperature is very high, it is difficult to lift these products and move it to desired place. Also the hot products are very difficult to handle and improper handling may

causes the various defects and due to this quality of rolled product is get affected.

The lifting devise is used by the labor or worker due to change in dimension or irregular shape is formed it is difficult to handle the rolled products while lifting from mill to desired place. So, the mechanism is introduced to transferring the hot rolled products consisting of preferably of lifting frame that is U-shaped with leg that it is connected to a step and is arranged in up right direction which on its own wheel chassis and can move from one place to required desired place.

Due to this, the time required for handling the hot products is get saved and it's

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handling can be carefully done with the help of the transferring device. This mechanism is works like robotics arms. Also the mechanism of hydraulic pusher is used to reduce the human effort like while transferring it from mill to desired place. With the help of this mechanism quality of billet can be improve and the production is also increased.

### BASIC CONSIDERATION FOR SELECTING MATERIAL HANDLING SYSTEM

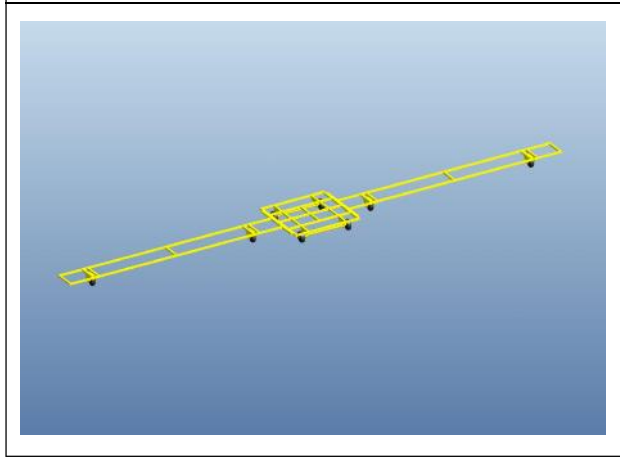
- Length of load travel.
- Properties and characteristics of the material Being handled.
- Existing layout and conditions of the work space.
- Working and climatic conditions.
- Temprature of hot product to the transfer.
- Method of loading and unloading.

### WHEEL TROLLEY

Wheel trolley is mechanical equipment which drives by motorized power from one source to another destination.

Wheel trolley mechanism consists of steel structure frame, chain drive system, gear drive system, motor and other electronic devices. It travels in desired direction by wheel which is motorized drive system on desired path. This system is automatic operated and it also operated manually if no power is available. It is friction less due to automatic operated the chances of accident. OR bending of product will be reduced and due to this efficiency of product will increases.

Figure 1: Proposed Trolley Mechanism



### SELECTION OF WHEEL TROLLEY MECHANISM

This subject is deal with exhaustively in trade literature, and it is only proposed to mention the main points to be consider briefly.

It is then necessary to decide drive unit, gear train ratio, chain drive system, type of wheel to established the basic parameter of the wheel trolley mechanism.

### DRIVE UNIT

#### Motor

It is an electrical devices which convert electrical to mechanical in the form impearl

Figure 2: DC Motor



rotation in market, different type of power rated and different loaded motors are available. For this wheel trolley mechanism we will need power rated 1/2 to 2 HP DC motor used.

### Gear Drive Ratio

Gear is tooth profile on the circumference of the circle which is used to transfer the power from one shaft to another. In this mechanism we used gear train for increasing speed ratio which is needed to transfer high load simply spur gear train is used of tooth profile.

Figure 3: Gear Arrangement



### Chain Drive System

Chain drive is A way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear. With the teeth gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

Roller chain and sprockets is a very efficient method of power transmission compare to belts, with far less frictional loss. Although chains can be made stronger than belts, their greater mass increases drive chain inertia.

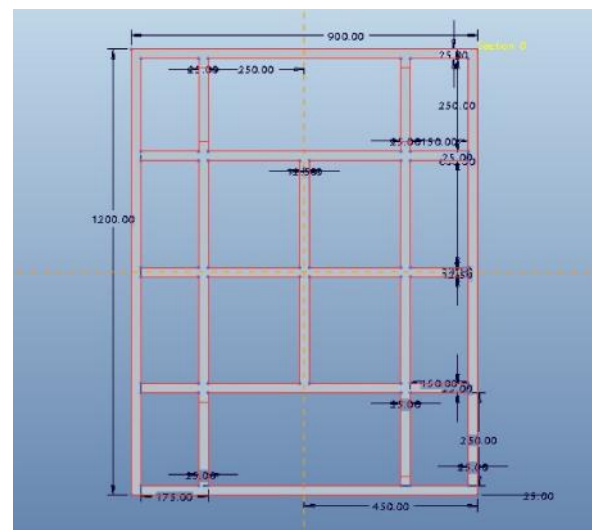
Figure 4: Chain Drive Mechanism



### STRUCTURE FRAME

In this wheel trolley mechanism, we will be used I.S.C.-20 hot rolled steel is used. Which is commonly used in structurally work, machine part, gears, liver, etc. This material easily transfer heavy material without bending. The required material of structural frame is used in the form of hallow rectangular pipe to reduce self weight and Increase high impact strength. The structure frame is joined by welding operations.

Figure 5: Structure Frame



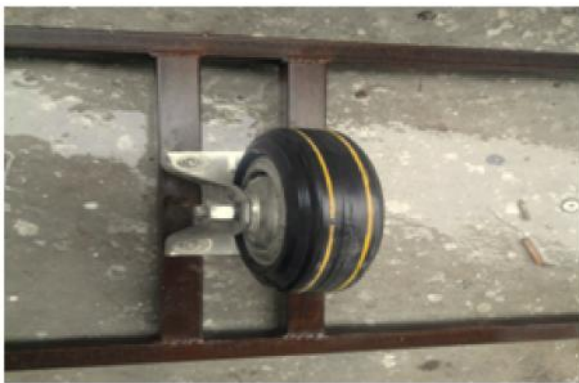
### CONTROL UNIT

It is electrical circuit consists of switches, relays, sensor and other electronic parts it help to switch ON-OFF drive units and also help to move in forward and reversed direction. Wheel trolley mechanism, from any location.

## WHEEL

In this wheel trolley mechanism SAE-4615 material is used freely movement of making wheel. Which help freely movement of trolley with high load. We used this material for manufacturing wheel by the working temperature so much high more than 400 °C it is corrosive resistance.

Figure 6: Wheel



## DESIGN OF VARIOUS PARAMETER

Both of the description and design calculations of the proposed systems are introduced.

Important factors are to be considered:

- Speed
- Bending Moment of structure frame
- Length and Width of structure frame

Select suitable data from design data book for calculation.

- Bending moment structural frame can be calculated at the support.
- Normal stress, shear stress, bending stress at the support can be calculated.
- Length and width can be determined as per the product to be transfer.

## Design Formulae for Chain Drive

- Design power  $(P)_d = (P)_R \cdot K_1$
- Tooth load,  $F_1 = (P)_d / V$
- Length of chain in pitches,  $L_p = T_1 + T_2/2 + 2C/P + P(T_1 + T_2)^2/4 \text{ } ^\circ\text{C}$
- Pitch diameter of sprocket,  $D_p = P/\sin(180/T)$
- Exact equation  $P = P^2(V/104 - V^{1.41}/526(26-25 \cos 180/T)) \times K_C$

## Design formulae for gear drives

- Design power  $(P)_d = (P)_R \cdot K_1$
- Tooth load,  $F_1 = (P)_d / V$
- Bending strength by Lewis equation,  $F_B = S_0 \cdot C_V \cdot b \cdot Y \cdot m$
- Endurance strength,  $F_{en} = F_{en} = S_{eb} \cdot b^* Y^* m$

## Design Formulae for Shaft

Design torque,  $T_d = 60 P \times K_1$

$\Theta = 32 \times 10^3 TL / \pi GD^4$ , radians

$\Theta = 584 \times 10^3 TL / GD^4$ , degree

Power estimation can be using

Power required = total force x speed

Power of motor = power required / transmission efficiency

## CONCLUSION

The system suggested is easy to install. The system is having greater reliability and protection. The system does not require any complicated components. 🌀

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