Reduction of Equipment Failure in C-Hook System

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Abstract:

Bar and rod mill is used to produce bar, rod and coil production process performed by the coordinated working of different units. Each unit performs unique operation. For successive coil production, all units of system want to work properly. If any defect found in single unit will affect the entire coil production process. C hook system is used widely in bar and rod mill. Generally, c hook system is used to lifting and carries the coil from reform tub to unloading process for the application of normalizing. In a c hook system, it consists of stoppers which is used to slowdown the c hook movement by the stopper plate. If the stopper plate got damage, it would affect or to stop the coil production line.

The general problem arise from the c-hook system is stopper plate failure. Due to this stopper plate failure, the performance of coil production is reduced. To overcome this problem we did 3D modelling of the plate and do the stress analysis in the ansys. So we are found the problem, where it will create. After that we change the dimension of the plate and do ansys. But factor of safety is not good and we change the material of the plate. Finally the plate has become safe.

Keywords: Stoppers change, Stemlor Conveyer, C- Hook System

INTRODUCTION

In Bar and Rod mill, the standard size of 340 x 400mm and 250 x 250 mm high carbon steel billets are processed to produce the required size of rolled steel bars, rod, TMT –bar and coils. In Bar and Rod mill, the standard shapes of steel billets are square and round corner square (RCS). The corresponding sizes of square and RCS are 60-200mm and 55-240mm.If the required output size of steel is more than 100mm, 340 x400 mm sized steel bars will be used as input. If the required output size of steel is less than 100mm, 250 x 250mm sized steel bars will be used as the inputs. In Bar and Rod Mill, to produce required size of mild steel as well as high carbon wire rods of diameter 5.5–13.0 mm and TMT re-bars of diameter 8.0–12.0 mm. From the input to output, the steel bars are subjected to various processes. The processes are Reheating, Descaling, Sizing, Cutting and Cooling.

In Reheating, the steel bars are placed inside the furnace about 4 hours. The furnace has three sections – namely preheating zone, heating zone and soaking zone. In this, the steel bar is attained 1100 – 1275 °C. The heated steel bar contains scaling on its surface. It leads to poor surface finish. To avoid this, the hot steel bar is subjected to descaling process. Through descaling process, the scaling products are completely removed.

After descaling process, the size reduction process of steel bars is carried out. This process is carried out through reversible mill and continuous mill. After the size reduction process, the steel bar is sized according to the customer requirement. The cutting process is carried out after the sizing process. In cutting process, the steel bars are cut to the required length according to the customer requirement. The final process of steel production is cooling process. The cooling process is done by placing the hot rolled steel bars in cooling bed. In this, the cooling process occurs with the atmospheric air. The rack arrangement which operated by hydraulic system ensures the even cooling of all sides of hot rolled steel bar. After the cooling process, the steel bars are subjected to the surface finishing process. Finally, the steel bars are delivered to the customers. Before the coil delivery, it is coiled by normalizing process using c-hook overhead chain conveyer. Finally the coil is tied by steel wire and the coil is placed in outside of the plant. Finally it is transported (ship, roadways etc.) to the customer.

PROCESS OF COIL PRODUCTION

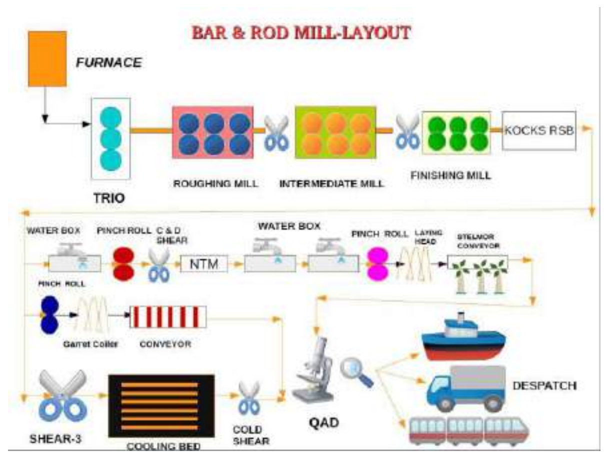


Fig 1: Process of Coil Production

REHEATING FURNACE

Reheating Furnace is the heart of any hot rolling mill where in the charge is heated to rolling temperature. The charge could be in the form of billets, blooms, slabs or ingots. The type of furnace could be pusher, walking hearth or walking beam – either top fired or top and bottom fired. The fuel used could be either oil or gas. The burners are located in a manner so as to achieve uniform heat distribution. The radiation heat energy is efficiently transferred through the useful heat transfer area created by the charge bed. The furnace is basically divided into three zones namely preheating, heating and soaking zones. The actual heating takes place in the heating zone. The temperature uniformity up to desired limits between the core and the surface is achieved in the soaking zone. The flue gases move in a direction opposite to that of the charge thereby ensuring considerable amount of waste heat recovery by convection in the preheating zone, which is also termed as the recuperative zone.

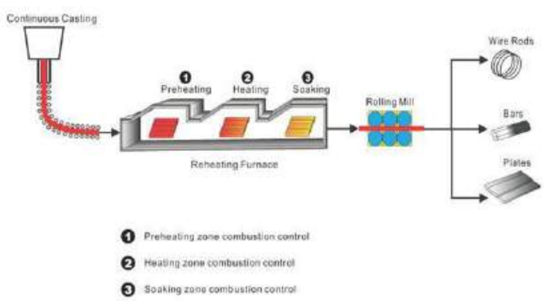


Fig.2 Reheating Furnace

ROUGHING MILL

The roughing stands are used to reduce the thickness of the steel while at the same time extending the overall length. As the name suggests, the roughing stands are used to form the metal to roughly the final thickness. Since most of the reduction is made in the roughing mill, the speed of the process and the product quality is dictated by the metal temperature and the desired reduction. The finishing stands are used to form the strip to the final dimensions. A consistent metal temperature at this point in the process is critical for a consistent surface finish and for consistent thickness.

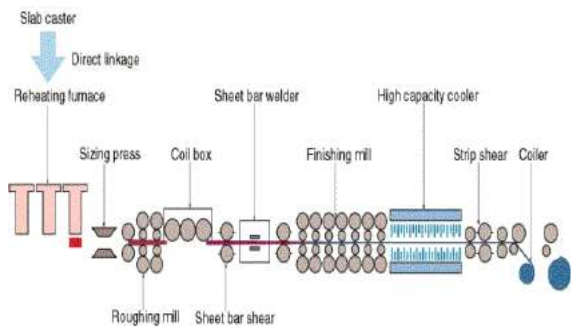


Fig 3:Roughing Mill

PINCH ROLLER PROCESS

In the hot strip steel mill coiler application the pinch rolls are a set of top and bottom rolls at the entrance to the coiler. Their purpose is to receive the head end of the hot band and direct it into the coiler area. In addition, the pinch rolls also provide back tension for the strip during coiling.

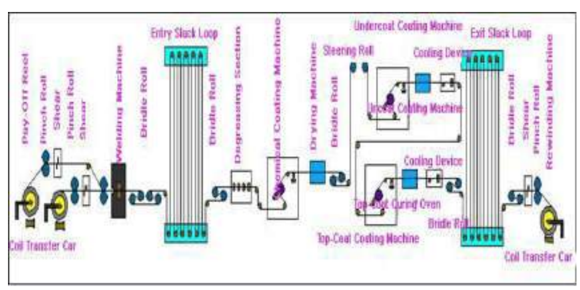


Figure 4: Pinch roller

LAYING OF WIRE ROD

One of the most important aspects of product quality in a long rolling mill that produces bar or rod in coil form is the quality of the finished coil. High-quality coils have orderly rings within the coil and uniformity of the inner and outer diameters for tangle-free payoff in downstream user operations, plus compactness of the coil package for efficient storage and shipment. The ability to obtain high-quality coil starts with the design and control of the equipment upstream of the coil reforming station and continues through to the coil-handling system.

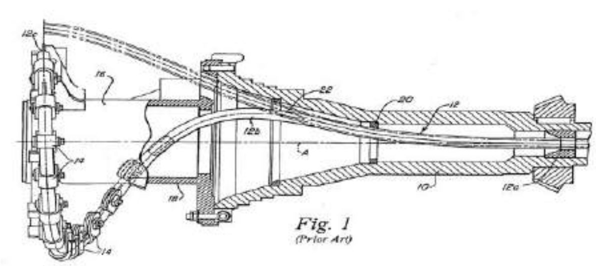


Figure 5:Laying of Wire road

STELMOR CONVEYER

To understand and predict the microstructure evolution in various grades of steel, a heat transfer coupled with phase transformation model has been formulated with an enhanced Stelmor cooling module. This module is capable of handling both blower assisted high cooling and retarded cooling using hoods. The Stelmor module incorporates the change in ring spacing of the wire loops on the Stelmor due to a change in mill speed and conveyor speed of the wire rod mill. A geometrical approach to convective and radioactive losses taking into account the void fraction and shape factor of wire loop is reported. This makes the model robust by strengthening the heat transfer formulation. This paper deals with the correlation of wire rod mill process parameters on the cooling curve of wire rods. The cooling of wire rods is dependent on the Stelmor operating parameters. Commercial high carbon grades require high capacity blowers for efficient cooling to refine the pearlite microstructure and impart greater strength. Welding grade wire rods (low carbon grades) on the other hand require retarded cooling to increase the ferrite grain size and decrease the ultimate tensile strength.

C-HOOK SYSTEM

C-Hooks are engineered and manufactured to meet the most challenging operational and safety constraints for industrial coil handling applications. Features incorporate the ultimate design for durability and reliability. Standard products are of solid one piece constructions with exception to bails, counter weights and lifting leg support saddles which are welded to the main assembly. Optional features such as replaceable pin lifting bails and protective pads are available upon request. Winkle engineering and production teams provide expert remanufacturing services that include complete inspection, failure analysis and detailed reporting. Our remanufacturing services support any type of c-hook and all repairs meet or exceed original equipment manufacturer's specifications. C-hooks that meet specific application and physical dimension requirements for your operation. All C-Hooks are designed, manufactured and certified in accordance to the latest ASME B30.20 specifications.

STOPPERS

In bar and rod mill, the purpose of stoppers is very important in c-hook system. The stopper is used to block the movement of coil in chain conveyor.

- ✓ To increase the time for normalizing process, it gives more periods to cool the coil.
- ✓ To give more time to solve the defects produced on coil edges and give more time to unloading process, it helps to workers to tie the coil.

STOPPERS DESIGN

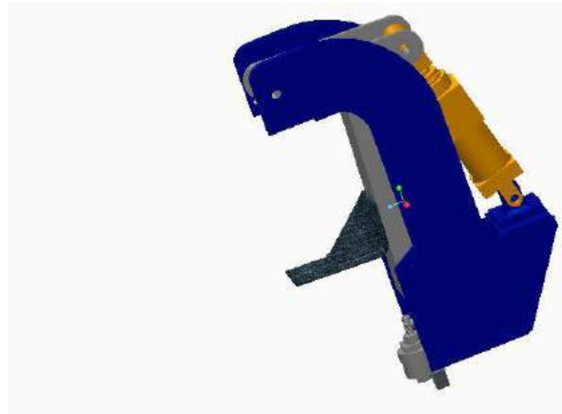


Figure 6: Stopper assembly

The stopper plate is attached for stopper plate pneumatic cylinders is helping for movement and functions process is using this assembly equipment

CHANGE THE MATERIAL

S.No	Material	Composition
1	Fe	96%
2	Ni	1.83%
3	C	0.7(min)
4	P	0.035(max)
5	Cr	0.7(min)
6	S	0.04(max)
7	Mn	0.7%
8	Si	0.23%
9	Mo	0.2%
10	Density	7.485g/cc
11	Brinell hardness	290
12	Ultimate tensile stress	1207 Mpa

13	Yield strength	1145 Mpa
14	Modulus of elasticity	205Gpa
15	Poisson ratio	0.29
16	Percentage elongation of break	14.2
17	Fracture toughness	55 Mpa (m) ^0.5
18	Thermal conductivity	44.5w/m-k
19	Specific heat capacity	0.475 J/g-k
20	Co-efficient of thermal expansion	6.84E^-6/k
21	Electrical Resistivity	0.00016 ohm-cm

AISI 4340 OIL QUENCHED

Table 1: Showing the requirements of materials used to change the stopper plate

DESIGN ANALYSIS

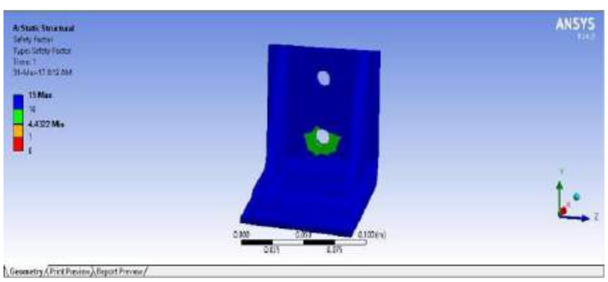
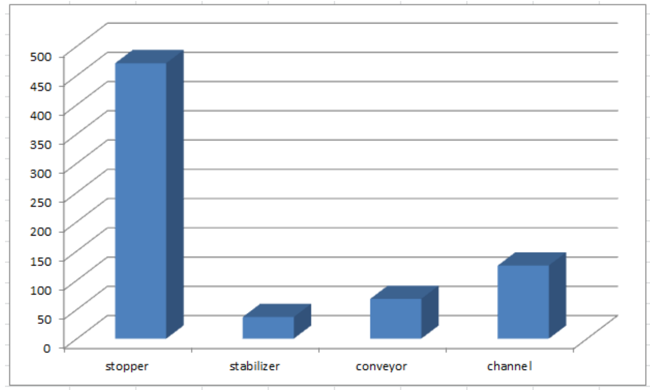


Figure 7:Factor of Safety

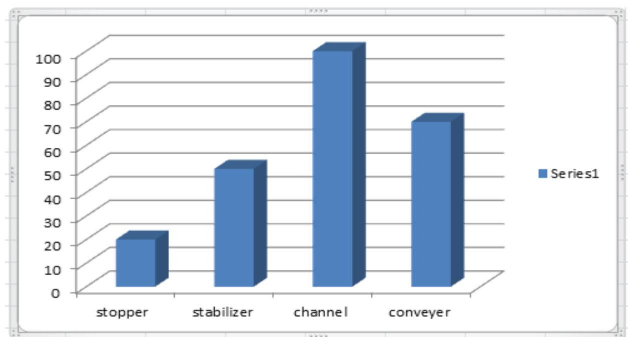
The following bar chart shows the difference between the stopper plate failure and increase in coil production

Delay time: Before material change



Graph 1: Denotes the stopper failure before change

Delay time: After material change



Graph 2: Denotes the stopper failure after change

Above this chart is indicated for benefits of different types of charities is stable for the caring the loads in different operations is use in the operations is mansion the bar chart.

CONCLUSION

Through this project, the c-hook stopper failure is reduced by changing the material of the stopper plate such as AISI 4340 OIL QUENCHED. Due to that, the delay period of stopper plate failure is reduce from 150 min to 20 min per month. So it helps to increase the production rate of coil.

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