STUDY THE CHAIN DRIVE, INDIVIDUAL DRIVE MECHANISM ROLLER AND FUNCTION OF U-SEAL IN FURNACE OF PLATE MILL

Aditya Anand
Mechanical Engineering
Dronacharya College of Engg. Gurgaon, Haryana

ABSTRACT
This project report deals with the study and review of STUDY THE CHAIN DRIVE, INDIVIDUAL DRIVE MECHANISM ROLLER AND FUNCTION OF U-SEAL IN FURNACE OF PLATE MILL. Normalising is a process of heating the plates to soaking temperature depending upon the composition of metal, cooling them in air. An industrial furnace in which stacked items are heated in an insulated car that is rolled out of the furnace on rollers or chutes, guided by rails or a grooved way. A crane is used to load and unload items for processing on the car, or roller hearth. Sand or water are used to seal gaps between the roller hearth and the walls in order to decrease the intake of air into the furnace. The heating time of plates in the furnace depends on the thickness of the plate. Equipment to heat metals to the desired temp for Change shape, Change properties. Liquid/gaseous fuel or electricity type of fuel are mostly used. Provision of water U-seal in the gas pipe line of normalising furnace for gas safety.

Keywords: Furnace, Plate, Drive, Mechanism, Useal

1. Introduction
Bhilai Steel Plant, located in Bhilai, Chhattisgarh, is a symbol of Indo-Soviet techno economic collaboration, is one of the three integrated steel plants set up by government of India. Bhilai Steel Plant is India's first and main producer of steel rails, as well as a major producer of wide steel plates and a variety of saleable steel products. The plant also produces and markets various chemical by-products from its Coke Ovens and Coal Chemical Plants.

This steel plant was set up with the help of the USSR in 1955 with 1 MT per annum hot metal production capacity. The ten time winner of the Prime Minister's Trophy for best integrated steel plant in the country, Bhilai Steel Plant (BSP), has been India's sole producer of rails and heavy steel plates and major producer of structural. The plant is the sole supplier of the country's longest rail tracks, which measure 260 metres. The plant also specializes in other products such as Rolled Steel Plates of more than 80 grades, wire rods and merchant products. It is major exporter of steel products with over 70% of total SAIL exports.

1.1 INTRODUCTION AND LAYOUT OF PLATE MILL
The 3600mm Plate Mill came into existence in 1983 under 4MT expansion programme. This giant rolling mill complex which extends over a kilometre in length has an overall covered area of about 15680m2. This mill is intended for an annual production of .95 million tonnes of finished plate in 5600 operating hours. It is called 3600mm Plate Mill because the barrel length of the work roll is 3600mm. The mill is certified with ISO 9000:2007 for Quality Standard, ISO 14000:2008 for Environment Management Policy and OHSAS 18001:2007 for Occupational Health and Safety.

1.2 MAJORS USERS OF PLATES
❖ Defence
❖ Ship Building
❖ Railways
❖ Oil Sectore
❖ Heavy Industries
❖ Coal India Ltd.
❖ Wagon Building
❖ Crane Manufacturing
❖ Pipe Manufacturing Units
Thermal Power Plant

1.3 Processes carried out in Plate Mill:
Continuously cast slabs in the length range of 5.6-10.2m are delivered in hot condition to the slab yard. These slabs are cut to smaller lengths in 3 flame cutting machines as per requirement. Inspection and conditioning is carried out after cutting of the slabs to the required sizes. Inspected slabs with proper identification are supplied to Plate Mill. The operation in Plate Mill can be easily understood in following steps
1. Slab Reheating
2. Descaling
3. Rough Rolling of the Plates
4. Finish Rolling of the Plates
5. End Shearing of Plates
6. Levelling of Plates
7. Cooling and Inspection
8. Shearing in required size, Cooling and Dispatch

The sequence of operation carried out in plate mill are clearly shown in the following figure-

2. Roller Hearth Normalising Furnace
Roller Hearth Normalising Furnace is an industrial furnace in which stacked items are heated in an insulated car that is rolled out of the furnace on rollers or chutes, guided by rails or a grooved way. A crane is used to load and unload items for processing on the car, or roller hearth. Sand or water are used to seal gaps between the roller hearth and the walls in order to decrease the intake of air into the furnace.
2.1 Chain drive Mechanism

In Chain drive mechanism each roller is driven by the chain with the help of motor and reducer. Chain drive is a way transmitting mechanical power from one place to another. The power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the 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.

The invention provides a chain transmission mechanism for a Roller-Hearth furnace, which comprises a transmission chain wheel, a tension pulley and chains which consist of a plurality of pitch chains, wherein the chains are arranged on the transmission chain wheel and the tension pulley. The outside of each chain is provided with planer mound layer in section. The planer mould mound layers are fixed with the furnace wall through a height adjusting mechanism. The chains are driven by the transmission chain wheel to move.

2.3 Chain drive Mechanism advantage

1. Through one chain the complete line shaft revolve due to this it provides or rotates all the roller of the furnace.
2. By using chain drive mechanism in furnace-1 we get high velocity ratio.
3. The power consumption in chain drive is low as compared to individual drive mechanism.

2.3 Chain drive mechanism disadvantage

1. The initial set up cost of chain drive mechanism is high.
2. The chances of breakage of chain drive is rarely happens.
3. This mechanism uses lubrication for smooth drive of shaft but in individual drive mechanism lubrication is not required.
4. Small sprocket is used in upper portion of the chain drive so to maintain proper tension in the chain.
5. Sometimes due to heavy load the line shaft chain got break down due to that the power will not be transferred to the roller.
6. After prolonged usage of chain it gets loose to maintain tension the chain either we have to remove some teeth of chain of make the chain tight.
7. The chain linked to the reducer 800 sometimes got break down due to load tolerance.
8. If the chain got breaks down in middle of the process the roller in the roll table also got damaged the rollers either may bend from the neck or some crack will appear on its neck or at its barrel.
9. The time consumption in joining the chain to one breaks or damaged frequently due to this process is not used more.

2.4 Individual drive mechanism
In individual drive mechanism each roller in the furnace is drive by an individual motor. Speed of the each roller is controlled by the help reducer coupled with the motor. Since each roller in the furnace is controlled by the separate motor, there is less chance of breakdown.

1. The initial set up cost of individual drive system is low as compared to chain drive system.
2. The breakage of disc in individual drive system is not frequently or year can say it occurs sometimes.
3. If one disc got damaged the entire process does not get affected because other discs will revolve & roll table continue to move.
4. The time taken by the disc to get correct is about 2 to 3 hours.
5. If 2 or 3 discs got damaged in the shaft then also the roller will continue to move as plates will pass upon it without any cracks.
6. The speed of the roller can be increased or decreased as per the need in individual drive mechanism.
7. In this to each roller individual motor is installed so if one roller got affected other may continue to work.
8. Maintenance cost in changing the discs of the shaft is also low.
9. Due to individual drive mechanism the chances of bending of roller containing disc in very less.

2.6 Disadvantages of individual drive mechanism
1. More power consumption occur in individual drive mechanism.
2. Since each roller have individual motor so the cost of the motor & its instalment is also high.
3. If more than 2 or 3 discs of the shaft got damaged the new shaft must be installed to avoid any cracks or bars in the hot plate.

3.0 U-SEAL
U-SEAL before U-seal is a process used to avoid leakage of gases (Mixed gas) from the pipeline and to prevent the hazard caused by leakage of gases by filling the U-shaped gas pipe with clean water at a certain level. The water comes from the water pipeline and deliver it to the inlet of the U-SEAL and filling it up to given level and through outlet valve of U-SEAL excess water gets discharged. This discharging of water gives 100% satisfaction that leakage of gas will not occur during the maintaince of furnace and whole system. In U-SEAL drain valve is also located at the bottom of it which is used to empty the U-SEAL when we need to start the system or say process to work. Through drain valve the water gets discharged and inlet valve is closed so that no supply of water takes place. After that mixed gas is supplied in the gas pipeline. When gases comes out of burner in the furnace, burner is switched on to fire the flame by bringing the flame near the burner of furnace and hence the overall process work.

3.1 **Advantage of using U-SEAL**

1. The U-shaped pipeline prevents leakage of gas through the gas pipeline due to its U-shaped design and filling of water in the U-seal.
2. U-seal gives 100% surety.
3. The overall design of the U-SEAL is so appropriate & creative that it gives proper satisfaction against of gas.

**CONCLUSION**
Roller Hearth Continuous Normalising Furnace is a heat treatment method, to enhance the mechanical properties of the plate. In roller hearth continuous normalising furnace plate inside the furnace is move from input to output door of the furnace with the help of roller which is drive either by the chain drive mechanism or by the individual drive mechanism. Chain drive mechanism and individual drive mechanism is operated with the help of motor coupled with the reducer. Individual drive mechanism required less maintaince than the chain drive mechanism and also consume less power as compared to chain drive mechanism. The overall shutdown of furnace due to breakage of chain in chain drive mechanism is overcome by the new design i.e. individual drive mechanism. It also saves the maintaince cost of drive mechanism due to less breakdown of drive mechanism.

U-seal is a process used to avoid leakage of gases (Mixed gas) from the gas pipeline and to prevent the hazard caused by leakage of gases by filling the U-shaped gas pipe with clean water at a certain level. This gives the 100% surety that there is no chance of leakage of gases through the gas pipeline.

**REFERENCES**
1. Bhilai Steel Plant Intranet.