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Introduction

The non ferrous metals and alloys have numerous applications. They are used in various in forms as castings, forgings, rolled products, drawn/deep drawn components, powder metallurgy products and so on.

The major non ferrous metals are Copper, Brass, Bronze, Aluminium and its alloys.

Aluminium Titanium alloys need a special mention due their applications in aircraft and aerospace industries.

The manufacturing techniques use technologies which have changed and improved with time. These changes in technologies led to improvements in productivity, quality and lower the cost of production.

The material requirements of copper and copper alloys, including brass, bronze, and ever more new materials, are what determines the design of a cold rolling mill. It depends upon the product mix and its required capacity. The best

Modern Cold Rolling Processes for Non Ferrous Metals

solution may be a tandem non-reversing or a reversing cold mill, 4 High, 6-high, or a 20-high stand designs. Furthermore, optimal mill solutions for all rolling tasks must be provided.

An arrangement for rolling of thin copper strip is shown in figure 1.



Fig. 1 : Design for Finish Rolling of Ultra-thin Copper Strips

The mill housing, uncoiler, recoiler, drive, control room, fume exhaust are seen.

Typical processes involved in rolling are roughing, roughing and intermediate

rolling in one mill, intermediate and finish rolling in one mill, and finish rolling.

The rolling mills used for producing hot/rolled strips also underwent lot of changes and improvements. Modern mills incorporate following techniques.

- 1) Accurate thickness measurements and controls (AGC).
- 2) Auto slow down (ASD) technique which help in control of thickness of the strip in the initial and final portion of the strip being rolled. These techniques enable maximum portion of the rolled strip within desired thickness limits and minimize the off gauge portion of the rolled coil.
- 3) With increasing demand on the quality of cold rolled strips, the control of shape of strip has also become critical. Hence, modern rolling mills also have an arrangement for measurement of shape of the strip to produce a flat strip.

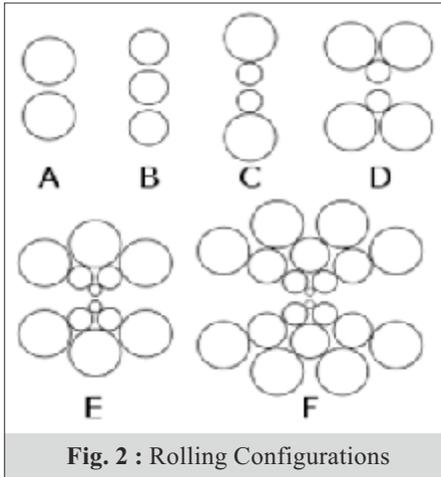


Fig. 2 : Rolling Configurations

Various basic rolling configurations are shown in figure 2.

These configurations show work rolls and other supporting rolls' arrangement in each type of configuration. Based up on total number of rolls the rolling mills are designated as 2 HI, 3HI, 4 HI, 6 HI and 20 HI mills (1-2-3-4 type). 20 HI mill is also known as Sendzimir mill after its inventor).

The improvements in the design of mills involve changes in the size of work rolls, number of stands which house the rolls, drives of different capacity to meet speed of rolling, impart desired thickness reduction and so on. The number of stands can be one or more. More number of stands enable savings in the rolling time thereby increasing productivity.

Modern Rolling Technologies include 6 HI mill or 20 HI mill and Tandem mill. The major benefits offered by these types of mills are,

- 1) High output.
- 2) Rolling of very thin gauges.
- 3) Good control on the shape of the strip (flatness of strip).
- 4) Power requirements of 20 HI mill are lower than other types of mills due to

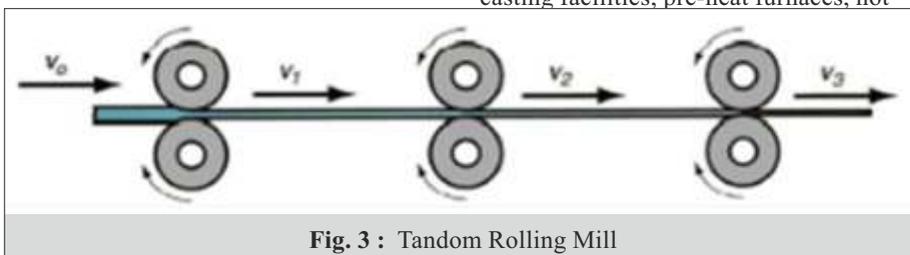


Fig. 3 : Tandem Rolling Mill

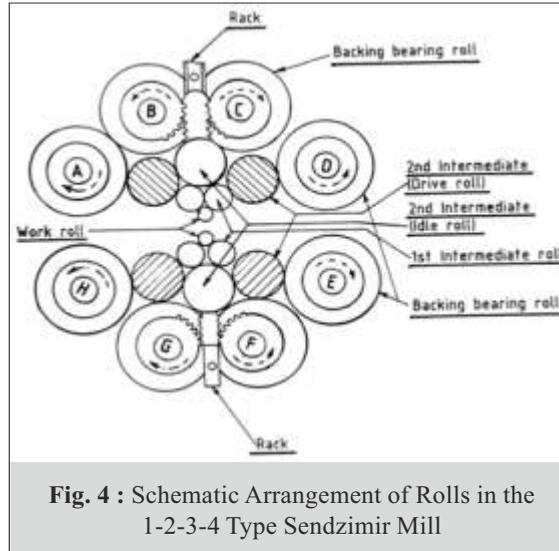


Fig. 4 : Schematic Arrangement of Rolls in the 1-2-3-4 Type Sendzimir Mill

very small size of work rolls as compared to rolls of other type mills.

Tandem mill can roll the strip to final thickness in less time and reversal of rolling direction is also not required. Tandem mill with 3 stands is shown in figure 3.

The roll arrangement in 20 HI mill is shown in figure 4. The Racks are used for adjusting the roll gap.

These mills are specially suited for rolling of thin gauge strips due to small work roll diameter. Smaller diameter of work roll means less rolling force for the same reduction in the thickness.

6 HI reversible mill is shown in figure 5. In this mill work rolls are supported by Intermediate rolls and Back up rolls.

A modern complex for Aluminium foil rolling consists of melting furnaces, DC casting facilities, pre-heat furnaces, hot

mill, cold mill and annealing furnaces. It involves a very large capital investment and can be fully justified on financial grounds if a big market is assured. If such facilities obviously are not fully utilised the economic viability is threatened.

As indicated above, however, hot mill coil can be obtained for further reduction in cold mills of lower capacity/speed/ complexity.

Conclusion – The modern technologies for non ferrous metal rolling include 6 HI mill

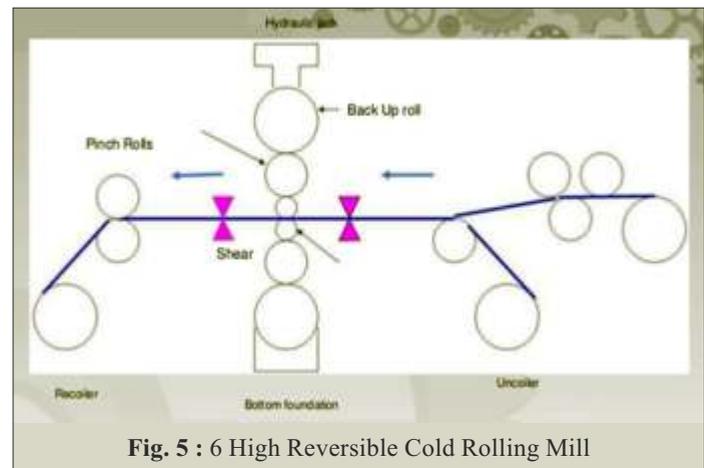


Fig. 5 : 6 High Reversible Cold Rolling Mill

or 20 HI mill or Tandem mill. The choice of the mill depends up on the type of product, cost of investment, availability of space and justification of tonnage.

About the author :

He is a Metallurgical engineer with B.Tech. (Hons) and M.Tech degrees from I I T Bombay. He is a Director of METCON, a Technical consultancy organization. The service areas include heat treatment processes for various alloy tool steels, cutting and forming tools, castings, stainless steels, hard facing jobs. Selection of heat treatment equipments. Setting up of Metallurgical Laboratory and quality assurance in cold rolling mills, process controls and Quality problems of cold rolled strips. Training of personnel for Heat Treatment and Quality assurance of CR strips.

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