Design and Fabrication of Rolling Machine

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Abstract- *In Sheet Metal working industry a wide range of power and hand operated machines are being used. As the sheet metal industry is a large and growing industry different types of machines are used for different operations. Rolling is a fabricating process in which the metal, plastic, paper, glass, etc. is passed through a pair (or pairs) of rolls. There are two types of rolling process, flat and profile rolling. In flat rolling the final shape of the product is either classed as sheet (typically thickness less than 3 mm, also called "strip") or plate (typically thickness more than 3 mm). In profile rolling the final product may be a round rod or other shaped bar, such as a structural section (beam, channel, joist etc.). In this study, different metals are been rolled by using two roller electrically powered rolling machine and its properties are being analyzed. The influence of rolling process parameters such as sheet thickness, sheet width, Elongation, Reduction in thickness on the Strip and shape and its profile have been investigated.*

Keywords- Fabrication, Rolling, squeezed

I. INTRODUCTION

Sheet Metal industry is a large and growing industry. There are many special purposes machines used in this industry to-day. The proper selection of the machines depends upon the type of the work under-taken by the particular industry. There are many examples of Sheet Metal work, which can be seen in our everyday lives. The metals generally used for Sheet Metal work include black iron sheet, copper sheet, tin plate, aluminum plate, stainless sheet and brass sheet. Rolling is a metal forming process in which metal stock is passed through one or more pairs of rolls to reduce the thickness and to make the thickness uniform. Rolling operation can be done on hand or power operated rolling machines. One of the most efficient ways of producing products that are long with respect to other dimensions and that have function that depends on cross-section shape, such a I-beam and rail road rails, is by rolling. An initial simple rectangular cross-section work piece can be passed between rolls that are shaped to produce the part cross-section shape

II. LITERATURE SURVEY

Abu Jadayil (2007) developed models for investigation on solid and hollow cylindrical rollers in pure rolling contact. The two rollers were analysed for combined normal and tangential loads. Using the fatigue life of the solid rollers as the reference fatigue life, the relative fatigue lives of hollow rollers were determined.

Hassan Eid et al (2007) developed the element model for asperity interaction of three dimensional elastic perfectly plastic contacts. This model consists of two connected neighbouring deformable hemispheres which are brought into contact with a flat rigid surface. For two asperities of the same height and the same radius, as the approach of the rigid surface is increased, the contact area changes from two isolated nearly circular contacts to a single oval shaped contact region. For asperities of different heights the results can be qualitatively similar to those for equal heights, but can also exhibit a shielding effect in which the first contact grows to eventually encompass the second lower peak. Results were given using dimensionless quantities for the force versus interference, and the contact area versus interference

HIMANSHU et al (2011) Thickness analysis for reduction of metal plates on heavy duty 2 roller bending machine. In this experiment they found out the equivalent thickness, equivalent width and maximum width analytically & based on power law material model.

AHMAD KTARI (2013) Modelling and computation of the two-roller bending process of steel metal .This experiment consists of two-dimensional finite element model of this process was built under the Abaqus /Explicit environment based on the solution of several key techniques, such as contact boundary condition treatment, material property definition, meshing technique, and so on.

JONG GYESHIN et al (2015) have done the experiment on Mechanics-Based Determination of the Centre Roller Displacement in Two-Roll Bending for Smoothly Rectangular Plates. The objective of this paper is to develop a logical procedure to determine the centre roller displacement, in the two-roll thickness reduction process, which is required in the fabrication of rectangular plate.

III. OBJECTIVES

The main objective for this project is to design and fabricate a rolling machine to reduce the thickness of the metals.

Other objectives are as follows

- To carry out trials on machinery and implements which have proven successful in other regions?
- Possible extend, to reduce the thickness of metals.
- Focus in the area of MANUFACTURING TECHNOLOGY to design and fabricate rolling machine.
- Calculate accuracy of the machine by measuring the difference between expected and actual results.

PARTS

- Motor with reduction gears -
- Chain drives
- Pairs of rollers
- Gears
- Column
- Stands

Fig. 1 Design Fabrication of Rolling Machine

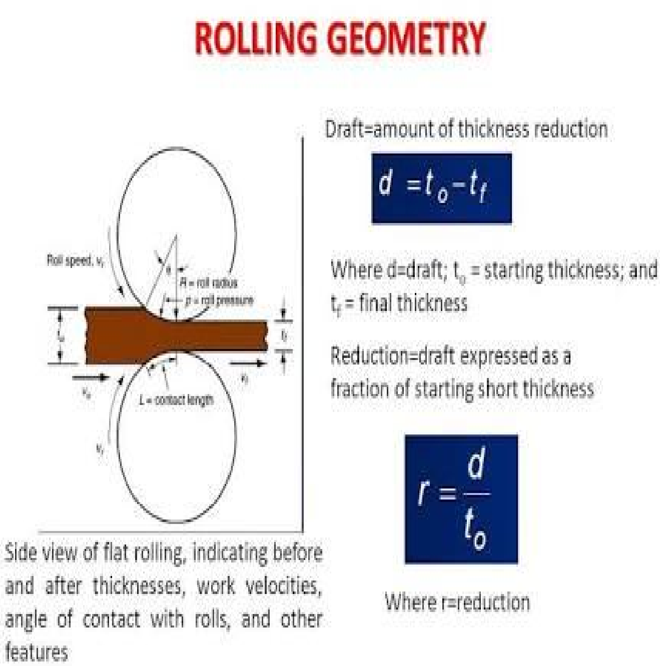
IV. WORKING PRINCIPLE

Heated metal is passed between two rolls that rotate in opposite directions. Gap between rolls is less than thickness of entering metal Rolls rotate with surface velocity that exceeds speed of incoming metal, friction along the contact interface acts to propel the metal forward. Metal is squeezed and elongates result in decrease of the cross-sectional area. Amount of deformation in a single pass depends on the friction conditions along the

Fig. 2 Work piece

Interface. If too much material flow is demanded, rolls cannot advance the material and simply skid over its surface. Too little deformation per pass results in excessive production cost.

Design-



ROLL PASS DESIGN CALCULATIONS

DRAFT is the reduction in bar height in the pass. Absolute draft is expressed in linear units and is the difference between the entry height and exit height of the stock.

hin = incoming bar thickness
hout = delivered bar thickness
Da = absolute draft
hin - hout = Da = Δh Relative draft is the reduction in height expressed as a percentage of the entry height.
Dr = relative (%) draft [(hin - hout) / hin] x 100 = Dr

SPREAD

Absolute Spread is the change in width between the stock entering and leaving a stand.
bin = input width bout = delivered width
Δb = spread
bout - bin = Δb

REDUCTION

Reduction is the decrease in area from stand to stand and is expressed as a percentage of the entry area. [(Ain - Aout) / Ain] x 100 = R

Average reduction is the average reduction per stand through the whole mill, or through certain sections of the mill, e.g., the average reduction through the roughing mill.

AVERAGE ELONGATION

Average elongation is the average elongation per stand through the whole mill. It can also be applied to certain sections of the mill, e.g., the average reduction through the roughing mill.

Ea = average elongation
n = number of passes n√ (Ain / Aout) = Eave

The billet elongates or gets longer after each pass. The total volume of the bar remains the same. If the cross section of the bar is reduced, then the length must increase. Therefore the final bar length (Lfinal) is the billet length (Lbillet) multiplied by the average elongation multiplied by the number of stands:

Lfinal = Lbillet x Ea(Stand 1) x Ea (Stand 2) x Ea (Stand 3) x Ea (Stand 4) x ..... Ea (Stand n) Lfinal = Lbillet x Ea(Number of Stands.

EXPECTED OUTCOME-

On completion of the proposed project, a rolling machine is designed and fabricated to reduce the thickness of metals. The results are tabulated for future use and to monitor the accuracy of the machine is measured in various steps that are very organized and tabulated. The thickness of the metal are reduced using the machine to extents that may have not been previously observed. The thickness of the metals can be adjusted for different measurements also.

APPLICATIONS

- It used in Automobile accessories manufacturing industry.
- It has a significant role in the manufacturing of jewellery in manufacturing machineries and their parts.
- It plays a very important role in all industries which use metal bodies.
- Outer cylindrical casing for motors employed in submersible pumps.
- Bodies of shells and condensers
- Compressors storage tanks etc…

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