Development of Low Cost Rolling Machine

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Abstract- *Small scale industries and educational institutions are often facing an issue in rolling smaller ingots to get thin strips. Hence there is a need for compact rolling mills with a low cost which can roll very small thickness plates. In this work a rolling mill is designed to roll a maximum of 10 mm thickness and maximum draft value is 0.25mm per pass. In Sheet Metal working industry a wide range of power and hand operated machines are being used. In this study, different metals are been rolled by using two roller electrically powered rolling machine and its properties are analyzed.*

Keywords- Rollers, Motor, Reduction Gears, Chain drives.

I. INTRODUCTION

Manufacturing refers to all the processes that are used to convert the raw materials or scrap into useful products by adding substantial value. In metalworking, 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 is classified according to the temperature of the metal rolled. If the temperature of the metal is above its recrystallization temperature, then the process is known as hot rolling. If the temperature of the metal is below its recrystallization temperature, the process is known as cold rolling. Roll stands holding pairs of rolls are grouped together into rolling mills that can quickly process metal, typically steel, into products such as structural steel (I-beams, angle stock, channel stock, and so on), bar stock, and rails.

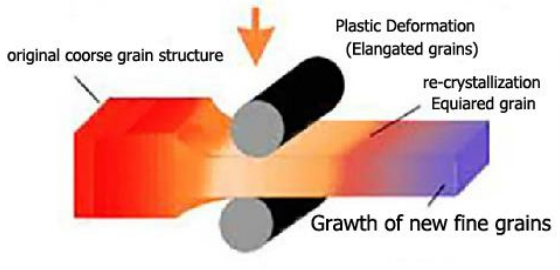

Figure.1 Metal rolling

II. LITERATURE REVIEW

The invention of the rolling mill in Europe may be attributed to Leonardo da Vinci in his drawings. The earliest rolling mills in crude form but the same basic principles were found in Middle East and South Asia as early as 600 BCE. Earliest rolling mills were slitting mills, which were introduced from what is now Belgium to England in 1590. These passed flat bars between rolls to form a plate of iron, which was then passed between grooved rolls (slitters) to produce rods of iron. Modern rolling practice can be attributed to the pioneering efforts of Henry Cort of Funtley Iron Mills, near Fareham, England. In 1783, a patent was issued to Henry Cort for his use of grooved rolls for rolling iron bars. With this new design, mills were able to produce 15 times more output per day than with a hammer.

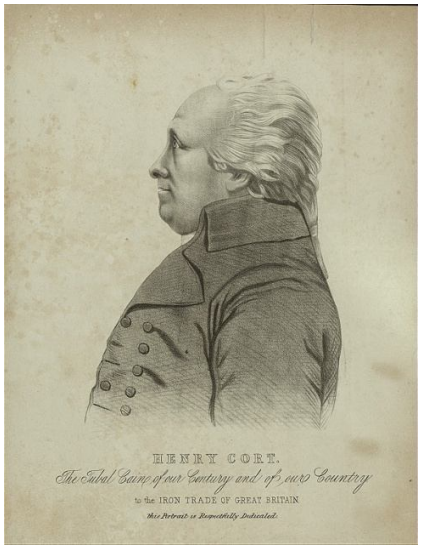

Figure.2 Henry Cort

III.OBJECTIVES

The main objectives of this project is to design and fabricate a rolling machine to reduce the thickness of a given metal.

Other objectives are as follows:-

- To carry out trials on machinery and implement which have proven successful in other regions.
- To reduce thickness of a given metal
- To focus in the area of manufacturing technology to design and to fabricate rolling machines.

- To calculate the experimental results theoretically.
- To calculate accuracy of the machine by measuring the difference between expected and actual results.

IV.METHODOLOGY

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 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.

V.FABRICATION

5.1 Rollers

The rollers are the most important part of the rolling machine that helps to get the thickness of a material reduced. The rollers are manufacture using EN8 material. EN8 carbon steel is a common medium carbon and medium tensile steel, with improved strength over mild steel, through hardened medium carbon steel. EN8 carbon steel is also readily machinable in any condition. The rollers are manufactured from EN8 material through various lathe operations such as turning, facing, step-turning, drilling, tapping.

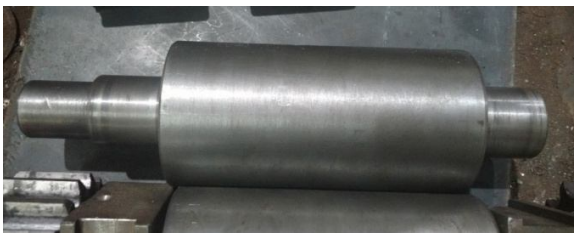

Figure.3 Roller

5.2 Motor with Reduction gears

The motor used in the rolling machine is a three phase induction motor. An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections with the rotor. The motor is coupled with a reduction gear box. A reduction drive is a mechanical device to shift the rotational speed. Reduction gears are used in order to increase the torque per unit rotation of the shaft.

Motor manufacturer- kirlosker
Max horse power- 3
Max rpm- 1380
Reduction ratio- 1:30

Figure.4 motor with reduction gear

5.3 Bush bearings

A bushing, also known as a bush, is an independent plain bearing that is inserted into a housing to provide a bearing surface for rotary applications; this is the most common form of a plain bearing.

Bearing bush material- Brass
Outer Diameter of bush- 60mm
thickness of bush- 10mm

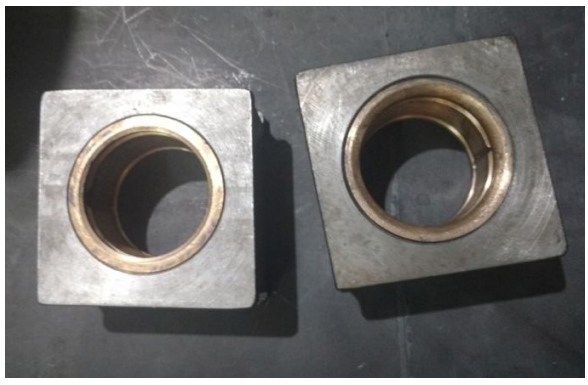

Figure.5 Bush bearings

5.4 Spur Gears

A gear or cogwheel is a rotating machine part having cut like teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage,

through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, producing translation instead of rotation.

No of Gears- 2
Material used- EN8 alloy steel
Inner Diameter- 40mm
Outer Diameter- 114mm
No. Of Teeth- 17
Distance between two teeth- 28mm
Thickness of each teeth- 10mm
Key way- 5x10mm

Figure.6 Spur gears

5.5 Chain drives

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power from the driver wheel to the driven wheel. The power is conveyed by a roller chain, known as the drive chain or transmission chain,[1] 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.

No. of teeth on sprockets- 14
Inner diameter of sprocket- 40mm
Outer diameter of sprocket- 125mm
Distance between two teeth- 25.4mm
Pitch of chain- 25.4mm
Distance between two sprockets- 470mm

Figure.7 Chain drives

5.6 Screw rods

The screw rods are used to adjust the thickness between the two rollers in order to obtain the desired thickness of the raw material. It is made up of mild steel.

Material- Mild steel
Thread size- M25
Pitch- 1mm

Figure.8 Screw rod

VI. CONCLUSION

The rolling machine is hence designed and Fabricated to perform the metal rolling operation for a maximum draft value of 0.25mm per pass. The thickness of the metal are reduced using the machine to extents that may have not been previously observed. The thickness of the metal can also be adjusted for different measurements. A raw material of a maximum thickness of 10mm can be easily rolled through the fabricated machine.

Figure.9 Developed Rolling machine

VII. ACKNOWLEDGEMENT

First and foremost, we would like to express our deepest thanks to our project guide Dr,Manjunath L H, Professor, Dept. of Mechanical Engineering, Reva ITM for his constant support and encouragement and providing with necessary facilities. We are highly indebted to him for taking keen interest in our work, monitoring and providing guidance throughout the course. We would also like to extend our gratitude to our friends and our beloved family in helping us accomplish this project.

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