Design and Analysis of M.S Roller in Sheet Metal Rolling Machine

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Abstract— Metal forming can be defined as a process in which the desired size and shapes are obtained through plastic deformation of a material without any significance loss of material. Bending is a metal forming process in which straight length is transformed into a curved length. Roller forming is a continuous bending operation in which a long strip of metal is passed through consecutive sets of rollers, until the desired cross sectional profile is obtained. The roller bending process usually produces larger parts of cylindrical or conical cross sections in large quantity. Normal practice of the roller bending still heavily depends upon the experience and skill of the operator. In this project, the objective is to analyses the frictional wear on the end support of the roller and the lifting force on handle of the rolling machine which result in slip due to bending force.

Key words: Metal Forming, Deformation, Bending Force

I. INTRODUCTION

Roller bending process can be used to deform a sheet or plate to hollow shapes of constant (i.e. cylindrical, elliptical) or varying cross sections like cone frustum. Cylindrical and conical shells are the basic components used for the various engineering applications like cylindrical tanks, boiler chambers, heat exchanger shells, pressure vessels, tunnels,etc. The process can be performed using many materials such as carbon and alloy steels, aluminum alloys and titanium alloys.

In three roller sheet bending machine sheet is bend with the help of load acting on upper roller, which is movable. 3 roller sheet bending machine mainly consist of following parts: 3 rollers (upper roller and 2 bottom rollers), motors, gears, power screw, and frame. Bending operation is done by applying load (force) with the help of upper roller, which is movable. It can be moved by adjusting the power screw manually. Two bottom rollers are fixed which acts as a support for holding the metal sheet. When upper roller moves in a clockwise direction, bottom rollers simultaneously move in anticlockwise direction. Motor is used in sheet bending machine for providing power transmission. Gear drives are used for minimize the rpm transferred from motor to the assembly (machine). Spur gears are used in 3 roller sheet bending machine. Spur gears used are made up of cast iron. Square threaded power screw is used to change the position of upper roller. This operation is totally manual. Frame is a fixed rigid support used for supporting the assembly and also prevent machine from vibrations.

II. IDENTIFIED GAPS IN THE LITERATURE

Normal practice of the roller bending still heavily depends upon the experience and skill of the operator, so the aim of this project, the objective is to analyses the frictional wear on the end support of the roller and the lifting force on handle of the rolling machine which result in slip due to bending force.

III. PROBLEM FORMULATION

To study & simulate the frictional wear on the support of rolling shaft and thread of handle. Design and Analysis new M.S Roller for Sheet Metal Rolling Machine. To compare static contact pressure distributions for varying conditions. To suggest the new material and change of thread design to overcome existing problem. Fabrication of the change in design with minimum costing.

A. Methodology:

- Modelling using solid works
- Static analysis of the model in order to solve the problem formulation
- Using different threads for same assembly
- Analyzing the threads.

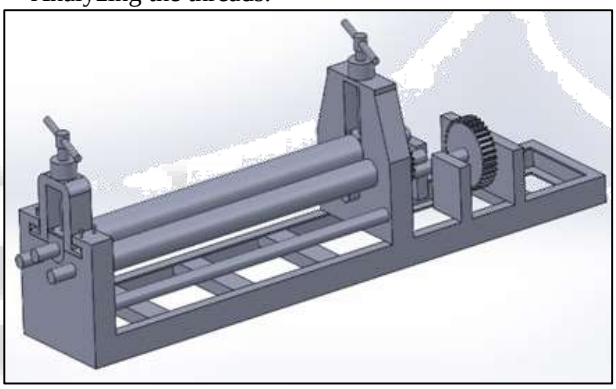

Fig. 1: Methodology

IV. ANALYSIS

A. Loading:

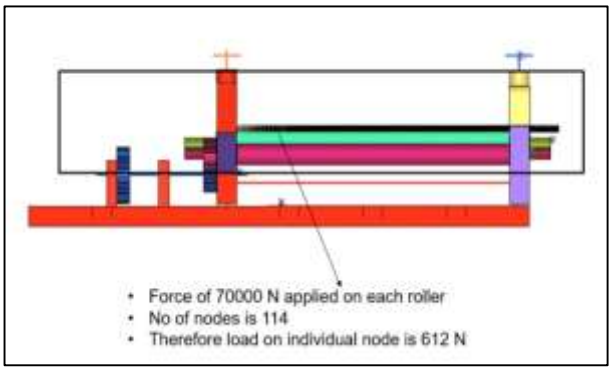

Fig. 2: Loading

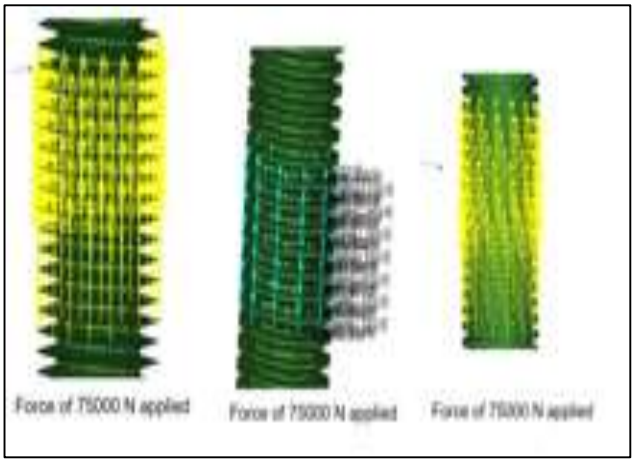

Fig. 3:

B. Solution:

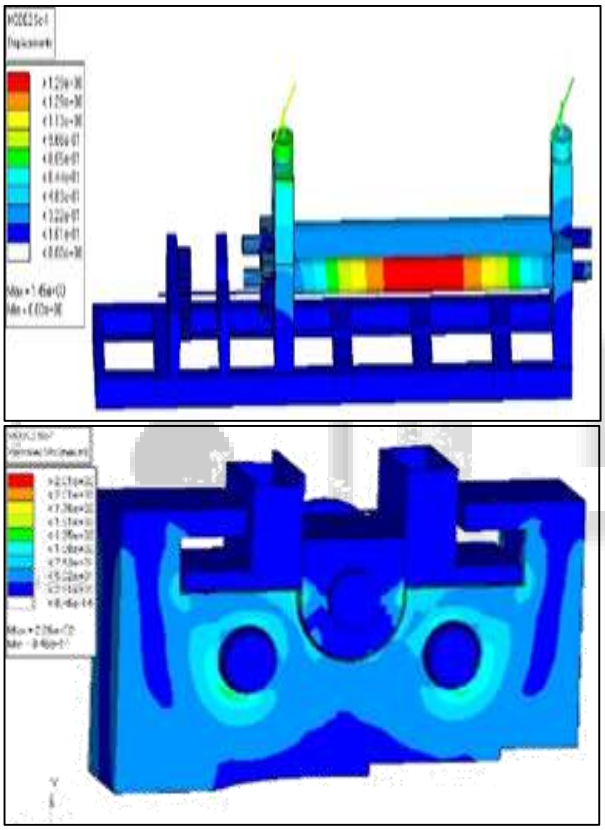

Fig. 4: Solution

High maintenance cost was incurred in rework of machine frame around the rollers. The region in the vicinity of the rollers failed due to high contact stresses, thus regular maintenance was carried out by adding material to the hole and then boring the hole to the correct dimensions. The solution to this problem was achieved by using the sleeves around the hole of very high grade steel (AISI4140) material whose strength is higher than the regular structural steel and thus it will be able to sustain the contact stresses for longer duration of time.

C. Thread Analysis:

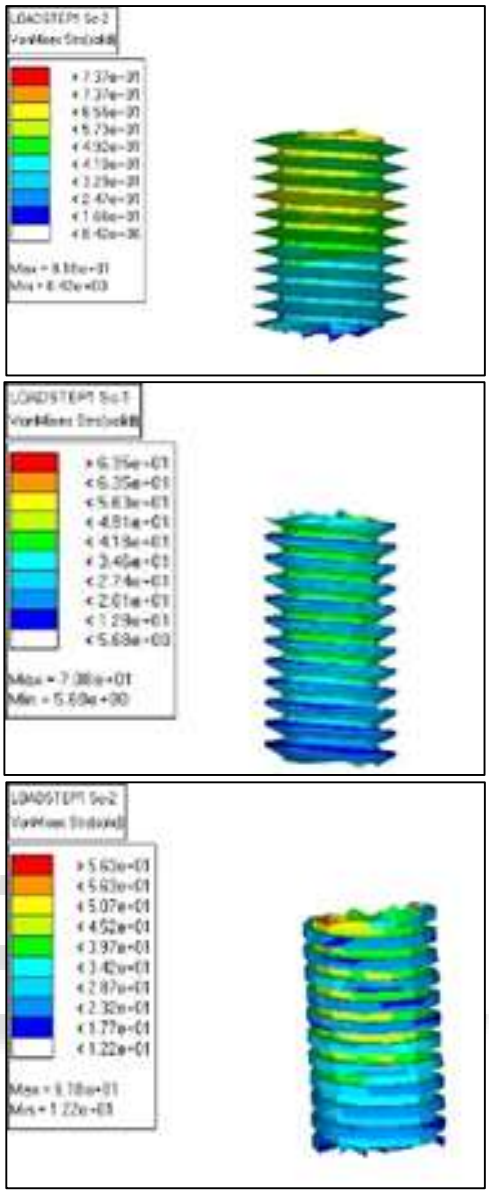

Fig. 5: Thread Analysis

V. CONCLUSIONS

In this project the main objective was to reduce the maintenance cost of the 3 roller plate bending machine. High maintenance cost was incurred in rework of machine frame around the rollers. The region in the vicinity of the rollers failed due to high contact stresses, thus regular maintenance was carried out by adding material to the hole and then boring the hole to the correct dimensions. The solution to this problem was achieved by using the sleeves around the hole of very high grade steel material whose strength is higher than the regular structural steel and thus it will be able to sustain the contact stresses for longer duration of time.

Also, the screw threads that were used failed too often as the load applied through them was very high (75KN), so the thread were changed to square thread which has higher strength and performs better than the original V- thread.

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