

Modelling of Supporting Jig For Bead Rolling Machine

Govind G. Varma¹, Namit S. Devidan², Prof. Pankaj K. Bhoyar³

^{1,2}(Undergraduate students of Mechanical Engineering)

³(Assistant Professor, Department of Mechanical Engineering)

(MSS's College of Engineering Technology, Jalna, INDIA)

Corresponding Author: Govind G. Varma

Abstract: Bead roller machine is a machine which is used to form a groove on sheet by using bead rollers. It is a type of forming tool used in sheet metal work. This machine consists of two dies one male die (upper side) and other female die (lower side). Sheet is passed from between two dies. The two dies are placed one above the other, forming groove on the sheet metal.

There are two roller support provided at each side of the mould for support. As there is no medium for workers to place those rollers correctly it becomes very difficult. Because of the rollers misalignment, sometimes dent gets formed on mould while making groove. This paper is on to eliminate this problem from the machine and to model proper supporting mechanism for bead rolling machine.

Keywords: Bead rolling machine, design and fabrication, Auto-CAD.

I. Introduction

The major purpose of bead-roller machine is to provide groove on metal cylindrical sheet. This machine is mainly used in Rotational moulding industry for making grooves on sheet metal tanks. Before coming to the bead roller machine the metal sheets goes through various types of processes like cutting, bending, welding, grinding, etc. After coming from this process the sheet goes to the bead roller machine to form the cylindrical groove. These Grooves are provided on the metal sheet and mould for giving strength to the plastic tank. This groove has various thickness and depth. According to the requirement of the customer the location of the grooves varies on the cylindrical drum. Various types of dies are available in the industry to provide these grooves. While making the grooves on Cylindrical Metal Mould, Fixing of the drum on bead roller machine is improper. Due to this sometimes the edges of the drum gets damaged. To fix these damaged edges, there is a need for new structural design. As of now there are poles provided at the front of machine, which are circular rod, so that mould does not move, but because of these poles, edges get damaged. Sometimes there is misalignment of the mould thus causing Cross Groove.

II. Solution Regarding This Problem

- To eliminate the front and back poles, in order to avoid the deformation of end edges of metal sheets. We have given the solution to provide the end rings on the roller support
- The end rings should be adjustable because of the various types of sizes of the metallic sheet.
- As the previous stand was unstable while making grooves, so we have to provide proper fixing of the stand during the operation.
- As once the sheet is fixed in metal ring, it is very hard to remove it again and again to make new groove, so we have to provide the motion to the stand in X, Y and Z direction.

III. Methodology

1. Visit to industry

We have visited in to the **Vinodrai industries pvt ltd** and we have seen various types of processes in the manufacturing of the moulds.

2. Study various types of machine

We have seen the process the various types of machines are being used in to the industries. There were some problems arising on different types of machines. The list of problems is as follows;

- While making the flat sheet into cylindrical shape in roller machine there is misalignment into the feeding of flat sheet in the roller machine.
- Similarly same problem of misalignment was arising in the conical roller machine while making the cone from flat sheet.

- The third problem is arising in to the bead rolling machine due to the improper fixture of the supporting mechanism.
 - The fourth problem was arising while making the holes or drilling the holes into the mould ring.
- After discussion in to the industry with Boss and as per our interest we have decided to start making a project on bead rolling machine supporting mechanism.



Fig.1. Bead rolling Machine



Fig.2. Tank with beads

IV. Problem Identification

The problems arising were:

- Major problem occur while fixing the drum on bead roller machine stand.
- Locking mechanism of support from front and back poles are time consuming.
- Due to load of drum acting on supporting stand, it gets moved towards the outer side, thus it requires a proper fixing on ground.

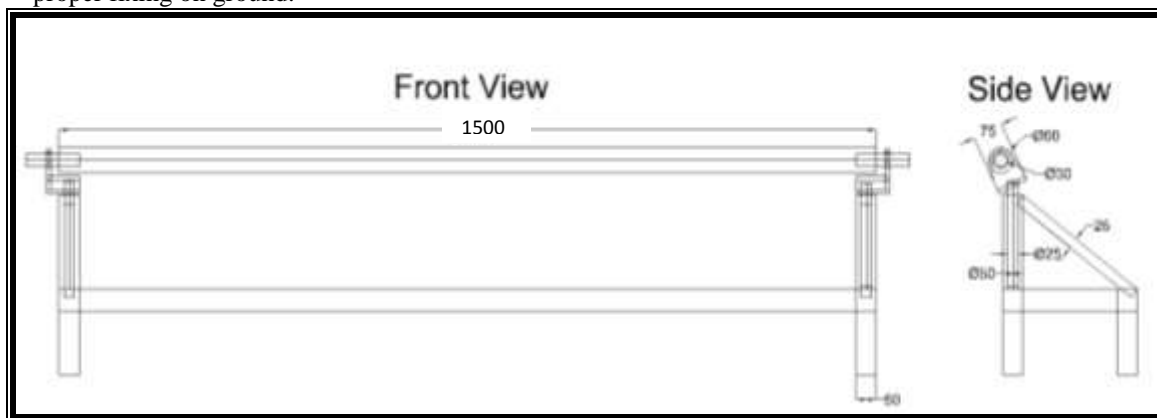


Fig.3. Orthographic View of Currently Used Jig

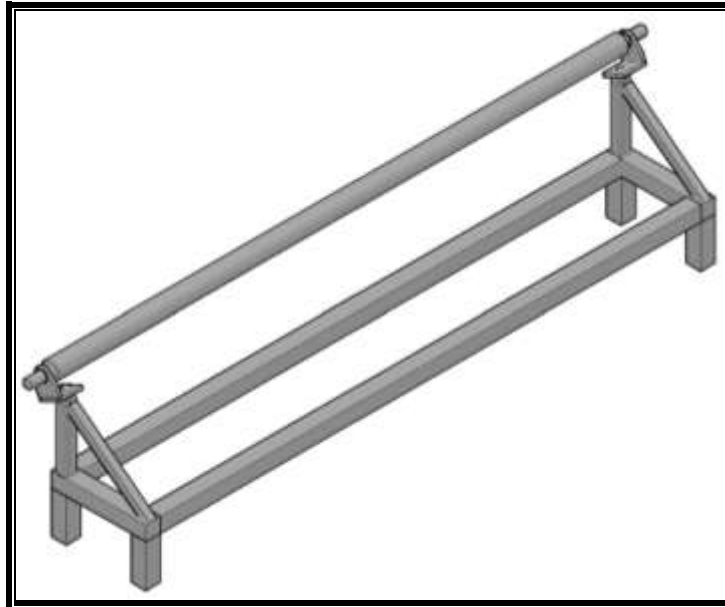


Fig.4. 3D Model of Currently used Jig

Fig.3 and 4 shows orthographic and 3D model of supporting jig used for bead roller machine

V. Modelling of Supporting Jig

1. CAD model generation

To provide the proper fixing and movement according to various loading condition we have drawn various types of CAD model in AutoCAD. Also we have drawn the drawing as per problems occurred in the machine. According to the problems arising in machine some of their parts were changed as follows

A. Elimination of front and back poles, by mounting the side supporting ring on to the hollow shaft

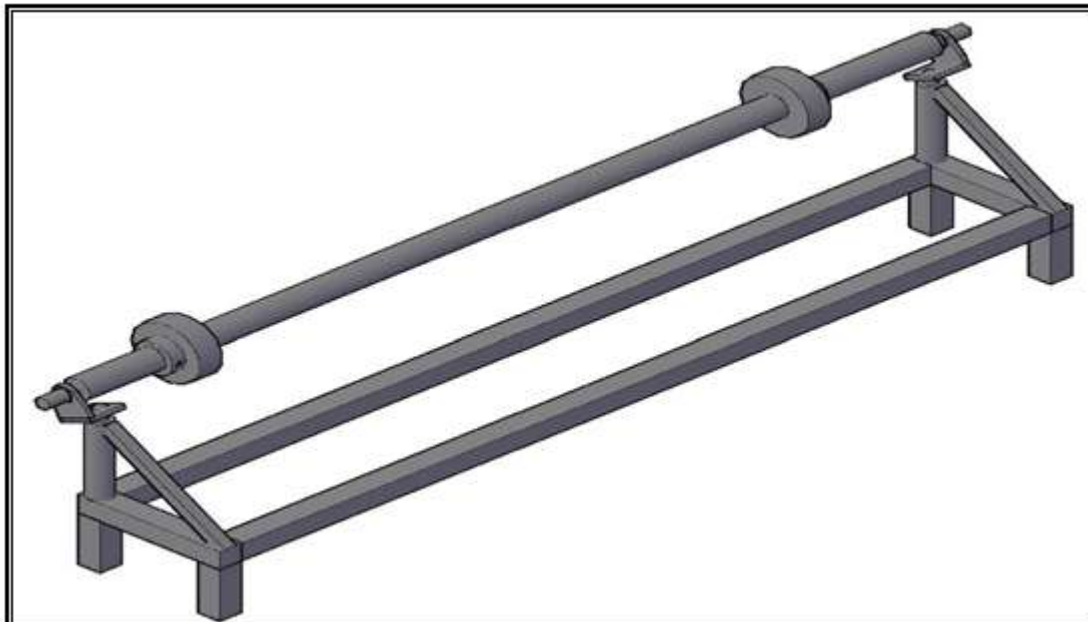


Fig.5. 3D Model after adding side supporting rings

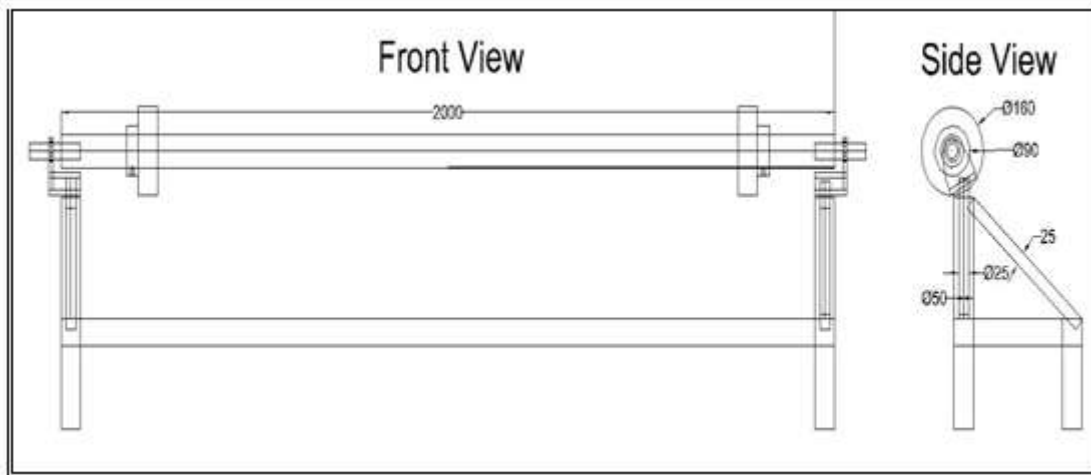


Fig.6. Orthographic View

This side supporting rings are provided to eliminate the poles and to reduce the time required to fix the cylindrical drum sheet. Due to this the time of working also reduces thus reducing fatigue of worker.

We are using hollow roller instead of solid shaft due to Advantages accruing to hollow shafting include weight reduction with minor increase in stress (for the same outside diameter), ability to circulate fluids for lubrication or cooling, and the use of thick-walled tubing as shaft stock. ^[1]

Roller is supported by bearings at two ends. Roller bearing is used instead of sliding bearing as roller contact bearing has following advantages

- Low starting and running friction
- Ability to withstand monetary shock load
- Accuracy of shaft alignment
- Low cost maintenance
- Small overall dimension
- Easy to mount and clean ^[2]

B. Movement provided to the stand.

Z

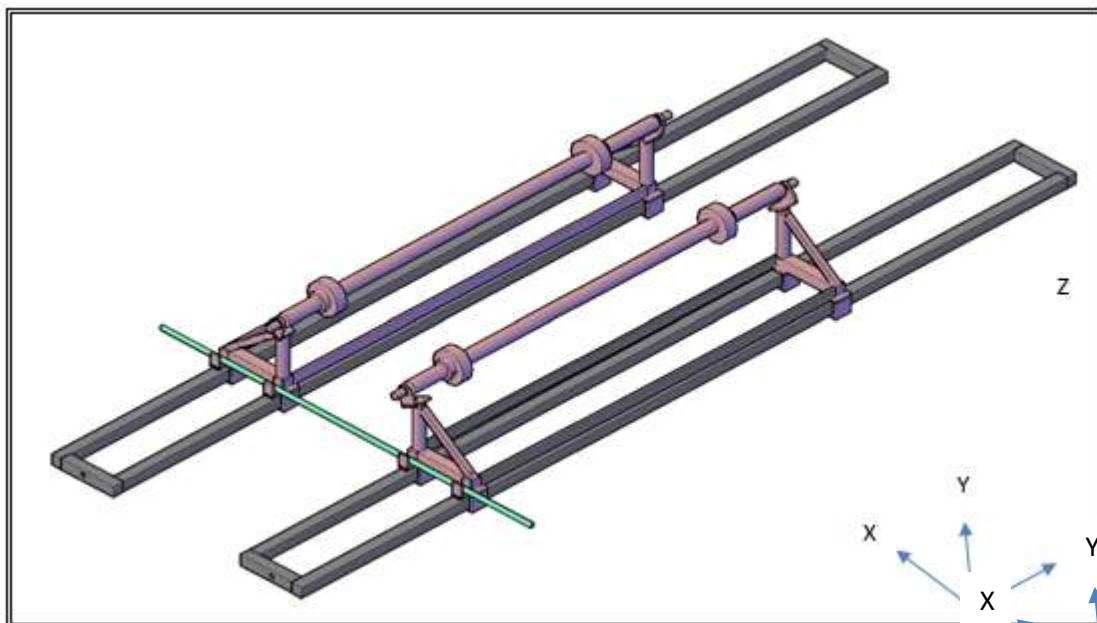


Fig.7. 3D model after providing the movement to stand.

To provide proper fixing and support to stand and to provide movement of the stand, we have made a basic fixture in the foundation. As it was practically not possible to make this stand because of the problems arising with the motion of the stand. The material that can be used for making of stand is Mild steels (i.e. of

angles ,bars ,sheets) as its price is also less as compared to other materials as shown in price chart of Engineering materials book. Also for mild steel is best suitable where structure is provided. [3]

For roller, Cast Iron can be used, as there will be continuous friction between the drum and roller. Cast Iron is best suitable for this purpose. [3]

C. Modification of stand to provide motion

To provide a motion in X and Z direction the design of stand must be separate. Two stands are designed, upper stand and lower stand. The design of upper stand and lower stand is as follows

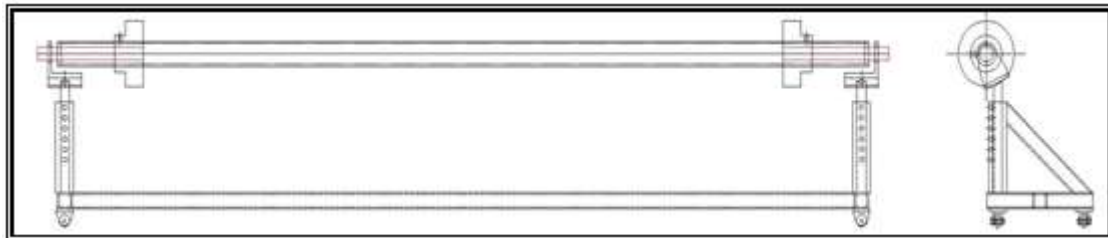


Fig.8. Upper Stand

In this modification we have also changed the length of hollow shaft because till now only 1000 Lit drum can be easily made on the previous length of 1500mm. Now after modification, the current length of shaft is 2250mm. This stand provide motion to Z direction and situated on the base (lower) stand. Also to reduce the weight of this stand instead of using two bars we have replaced it with only single bar.

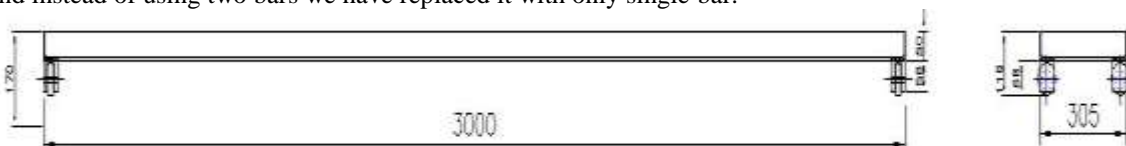
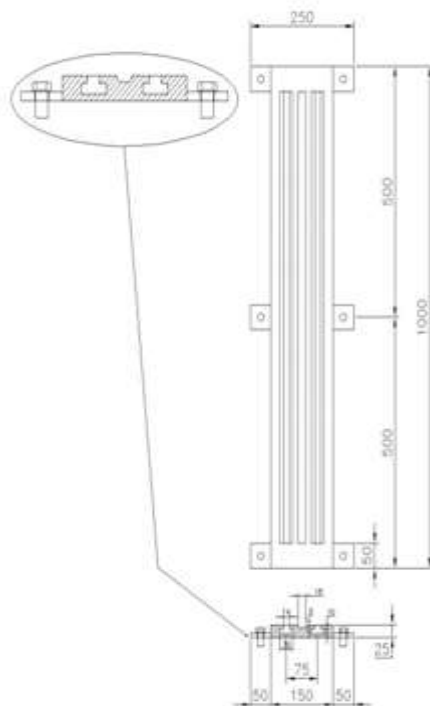


Fig.9. Lower Stand

This stand provides a motion in X direction. On this stand the upper stand has been situated. Upper Stand can move up to a certain limit on this stand. And to proper fix this stand at the base or foundation the foundation fixture plate is provided as shown in fig below



1. Advantage of Foundation Plate Fixture to lock stand

- The main advantage of the foundation plate is to provide the proper fixture to the stand at the base.
- Due to this fixture plate we don't have to make a groove on the shop floor.

2. Drawbacks of Foundation Plate Fixture to lock stand:

- The following fixture plate is very costly to manufacture
- The material required for making of the fixture plate is very large.

Fig.10. Foundation Plate Fixture to lock stand

D. Modification in Foundation plate fixture

As the initial cost and fabrication cost of previous T-Bolt locking mechanism foundation plate is very high, due to making it into VMC machine. So we can replace this foundation plate with a simple grooved plate as shown in above fig.8.

VI. Conclusion

As of now, the formation of beads on the drum, was not proper. After implementing this design, there will be no misalignment, deformation and grooves will be formed in parallel, accurately. Now, after each groove whole assembly needs to be setup, due to this design movement of drum is mostly eliminated. Only stand is moved at required position.

Acknowledgements

We would like to thank managing director Sunil Raithatha Sir and supporting staff from Vinodrai Industries Pvt. Ltd. We also thank our all Sir of Matsyodari Shikshan Sanstha's College of Engineering and technology, Jalna.

References

Books:

[1]. Joseph E. Shigley, Charles R. Mischke, *standard handbook of machine design* (McGraw-Hill)

Chapters in Books:

- [2]. R.S. Khurmi, J.K.Gupta, Rolling contact bearing, *A textbook of Machine Design*, (New Delhi, Eurasia Publishing House 2005)996-1020.
- [3]. Michael F Ashby, David R H Jones, The price and availability of materials, *Engineering Materials 1 An Introduction to their Properties and Applications*,(Butterworth-Heinemann 2002)15-27