Finite Element Analysis of Mechanism for Pressing of Fiber Discs in Idle Roller in Hot Rolling Machine using F.E.A

Ms. Naz Ansari[1] Dr. C. C. Handa[2] Prof. V. N. Mujbaile[3]
[1]M.Tech Student [2]Professor [3]Assistant Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]KDK College of Engineering Nagpur, Maharashtra, India

Abstract— This project involves analysis of mechanism for pressing of fiber discs in idle roller in hot rolling machine. The objective of the project is design of mechanism for pressing of fiber discs in idle roller in hot rolling machine. That can be used for the pressing the fiber discs, to reduce the process time and performed the analysis of the tower by using finite element technique. This involved gathering of functional and structural requirements of fiber discs in idle roller in hot rolling machine from the client, Finite element Modelling, Finite Element Analysis. The result is explained on the basis of a comparative analysis of probable designs.
Key words: Fiber Discs, Idle Roller, Finite Element Analysis

I. INTRODUCTION

A typical hydraulic press consists of a pump which provides the motive power for the fluid, the fluid itself which is the medium of power transmission through hydraulic pipes and connectors, control devices and the hydraulic motor which converts the hydraulic energy into useful work at the point of load resistance.

Bending is a metal forming process in which a force is applied to a piece of sheet metal causing bending of it to an angle and forming the desired shape. Bending is typically performed on a machine called a press brake which can be manually or automatically operated. A press brake contains an upper tool called the punch and a lower tool called the die. The sheet metal is located between them. In automatic press brake the punch is forced into the sheet under the power of a hydraulic ram. The bend angle is determined by the depth which the punch forces the sheet into the die. Precisely, this depth is controlled to achieve the desired bend angle.

In most hydraulic presses, full force is available throughout the stroke. The full force of a hydraulic press can be delivered at any point in the stroke. This feature is a very important characteristic of most hydraulic presses. Deep drawing and forming applications often require large forces very high in the press stroke. Some mechanical presses do not develop enough force high enough in the downward stroke to permit severe drawing and forming applications such as inverted draw dies to be used without danger of press damage.

II. DATA ACCUMULATION

- Shaft diameter = 150 mm
- Disc inner dia = 150mm
- Disc Outer dia = 250mm
- Disc thickness = 50mm
- Length of shaft = 2000 mm
- Weight of shaft approx = 320 kg
- Weight of composite shaft = 400 kg maximum

Maximum 5 ton force required to press Fiber disc tightly

HOLE

Parameter	Value	Unit
Designation	150 H7	---
Hole Upper Deviation	40	µm(0.001mm)
Hole Lower Deviation	0	µm(0.001mm)
Maximum Hole Size	150.04	mm
Minimum Hole Size	150	mm

SHAFT

Parameter	Value	Unit
Designation	150 h6	---
Shaft Upper Deviation	0	µm(0.001mm)
Shaft Lower Deviation	-25	µm(0.001mm)
Maximum Shaft Size	150	mm
Minimum Shaft Size	149.975	mm

FIT TYPE

Parameter	Value	Unit
Designation	150 H7/h6	---
Fit Type	Clearance fit	---
Maximum Clearance	65	µm(0.001mm)
Minimum Clearance	0	µm(0.001mm)

Fig. 1:

III. BOUNDARY CONDITIONS

A linear static analysis of Fiber disc press machine is performed with the following boundary conditions. Base of the machine is constrained and the hydraulic force of 49050 N is applied on piston and cylinder.

IV. FINITE ELEMENT ANALYSIS

A Linear static Analysis is performed with above mentioned boundary conditions:

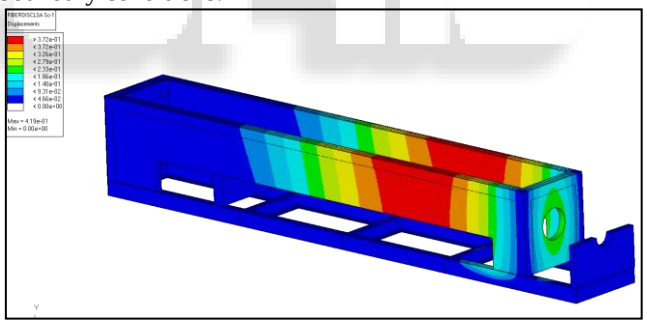

Fig. 2: Maximum Displacement obtained is 0.419 mm

A. FEA Results

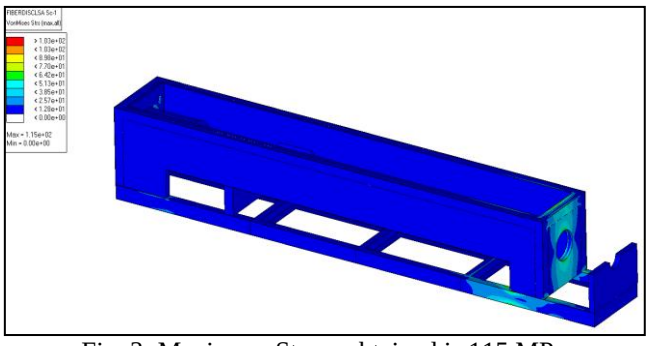

Fig. 3: Maximum Stress obtained is 115 MPa

B. Press Arm

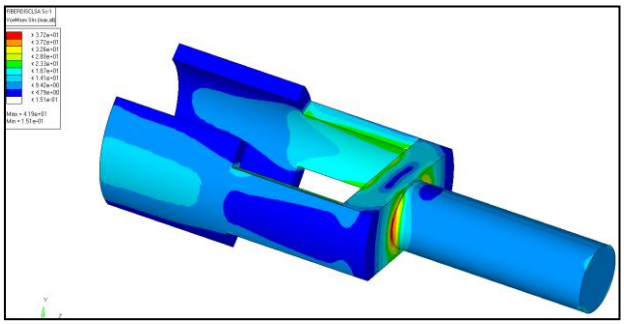

Fig. 4: Maximum Stress obtained is 41.9MPa

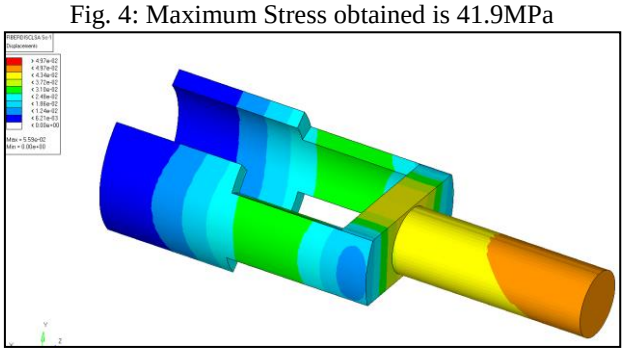

Fig. 5: Maximum Displacement obtained is 0.05 mm

C. Frame

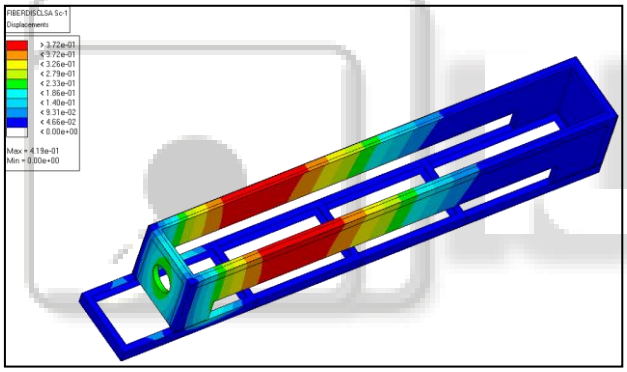

Fig. 6: Maximum Displacement obtained is 0.419 mm

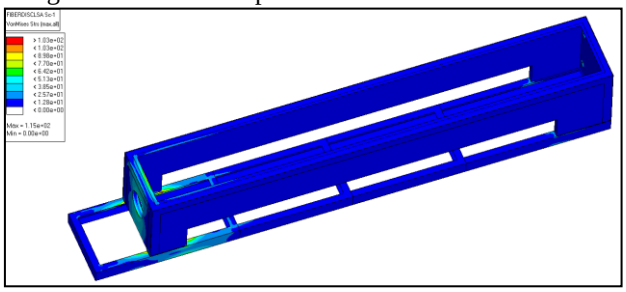

Fig. 7: Maximum Stress obtained is 115 MPa

V. RESULT DISCUSSION

As per the requirements we have analyzed a fiber discs in idle roller in hot rolling machine by using Finite element analysis techniques. From the linear static analysis it is observed that maximum displacement of fiber disc machine is 0.419mm. By using finite element analysis maximum stress of fiber disc in idle roller in hot rolling machine is 115MPa, the maximum stress and maximum displacement of Press arm is 41.9Mpa and 0.05mm respectively. The maximum stress and maximum displacement of Frame is 115MPa and 0.419mm respectively.

VI. CONCLUSION

The main objective of the project is analyse special purpose hydraulic press machine, analyse machine that can be used for the pressing the fiber discs, to reduce the process time and performed the analysis of the tower by using finite element technique. On the basis of objective, the Finite Element Modelling and Finite Element Analysis was carried out by using HYPERMESH and Nastran respectively. The linear static analysis results shows that the stresses are well within the safe limit, hence the design is safe. It can be concluded that a linear static analysis of Fiber disc press machine is performed. Base of the machine is constrained and the hydraulic force of 49050 N is applied on piston and cylinder.

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