

Review on Design of Mechanism for Pressing of Fiber Discs in Idle Roller in Hot Rolling Machine

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Abstract— Hydraulic Presses are one of the oldest basic machine. In its modern form, is well adapted to press work ranging from coining jewellery to forging aircraft parts. Hydraulic Press forming are widely used for industrial cold press forming today. As wide range in shapes of products manufactured. In the present review paper an effort is made to study the previous investigations that have been made in the different structural analysis and optimization techniques of hydraulic press. Design validation and finite element analysis of special purpose Hydraulic machine will be performed in next article based on this design calculations.

Key words: Hydraulic Press, CAD, FE Analysis



Fig. 1: Actual Images of the Machine

I. INTRODUCTION

The development of engineering over the years has been the study of finding ever more efficient and convenient means of pushing and pulling, rotating, thrusting and controlling load, ranging from a few kilograms to thousands of tons. Presses are widely used to achieve this. Presses, as defined by Lange (1975), are pressure exerting machine tools. In hydraulic press, the force generation, transmission and amplification are achieved by using fluid under pressure. The liquid system exhibits the characteristics of a solid and provides a very positive and rigid medium of power transmission and amplification. In a simple application, a smaller piston transfers fluid under high pressure to a cylinder having a larger piston area, thus amplifying the force. There is easy transmissibility of large amount of energy with practically unlimited force amplification. It has also a very low inertia effect.

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.



II. PROBLEM FORMULATION

Behind a visit to AI ENGINEERING ENTERPRISES, it was revealed that there is requirement of special purpose press machine. Currently they have a hydraulic press for this purpose but it is passable type, so they want standard machine for this purpose. This press machine is used to press the fiber discs which are mounted over the surface of solid shaft. After the pressing of fiber disc, the shaft is forward towards the furnace for the bonding of fiber discs.

This project is an industrial project for AI ENGINEERING ENTERPRISES. It involves the design and analysis of special purpose press machine. AI Engineering Enterprises provides leading-edge engineering and manufacturing solutions. This includes product development, process development, optimization, Manufacturing of Heavy machinery and Specialization in Coining development work.

III. DATA ACCUMULATION

Shaft diameter = 150 mm
 Disc inner dia = 150mm
 Disc Outer dia = 250mm
 Disc thickness = 50mm
 Length of shaft = 2000 mm
 Maximum 5 ton force required to press Fiber disc tightly
 5 Tonne maximum load
 Single hydraulic operated piston
 Force from hydraulic power pack,
 $5 \times 1000 \times 9.81 = 49050 \text{ N}$.

IV. LITERATURE REVIEW

A. Malachy Sumaila & Aki Okonigbon [1]

In this paper a 30-ton hydraulic press was designed, constructed and tested using locally sourced materials. The principal parameters of the design included the maximum load (300 KN), the distance the load resistance has to move (piston stroke, 150 mm), the system pressure, the cylinder area (piston diameter = 100 mm) and the volume flow rate of the working fluid. The major components of the press

designed includes the cylinder and piston arrangement, the frame and the hydraulic circuit. The machine was tested for performance with a load of 10 kN provided by two compression springs of constant 9 N/mm each arranged in parallel between the upper and lower platens and was found to be satisfactory. The cost estimate for the hydraulic press was N47, 890.00 (US\$320) at prices in Benin City, Nigeria, as at the time of press manufacture.

The machine was tested to ensure conformability to design objectives and serviceability. The machine was found to be satisfactory at a test load of 10KN.

B. Parthiban, P. Eazhumali [2]

A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. Frame and cylinder are the main components of the hydraulic press.

In this project press frame and cylinder are designed by the design procedure. Press frame and cylinder are analysed to improve its performance and quality for press working operation. Structural analysis has become an integral part of the product design. The frame and cylinder are modeled by using modeling software CATIA. Structural analysis has been applied on C frame hydraulic press structure and cylinder by using analysing software ANSYS. An integrated approach has been developed to verify the structural performance and stress strain distributions are plotted by using ANSYS software. According to the structural values the dimensions of the frame and cylinder are modified to perform the functions satisfactory.

Actual structure of the frame and cylinder were designed and analyzed. According to the design and analysis results the thickness of the plate is reduced in frame. The cylinder is modified in fillet radius from 25mm to 15mm.

C. Tejas Patel, Vikas Panchal [3]

The aim of this paper is to integrate the mechanical system of hydraulic press with hydraulic system to facilitate the ease of operation to manufacture the smaller parts in a bulk. In the present scenario, time constrain is a crucial part for completion of any production process. Thus with the aid of atomization, the production time can be reduced as well as higher degree of accuracy can be achieved as the human efforts will be alleviated. Thus an attempt has been made to provide the smooth and rapid functioning of press work with the help of hydraulic system.

Thus here a hydraulic system is used to develop a press. The press will be useful for mass production of Washers. This may increase the productivity and increases the accuracy of the production. Even the press can be complete rely atomize by using the concept of electrohydraulics. Direction control valve can be solenoid actated to make the system close loop. Which may lead to higher production rate.

D. Akshay Vaishnav, Path Lathiya [4]

This work is based on optimization of a 250-ton four pillar type hydraulic press considering constraints like design, weight and cost. Hydraulic presses are being used for forming and pressing operations with wide range of capacities. Hydraulic press machine works under continuous impact load. Because of this continuous load, tensile and

compressive stresses are experienced in various parts of machine. These stresses cause permanent deformation in some parts of machine. The work is focused on design and optimization of top plate of the press machine. Top plate holds the hydraulic cylinder and is one of the most critical parts of the machine. The design is based on sizing optimization method and the results are validated by Finite Element method with proper boundary conditions. The CAD modeling has been carried out by PTC CREO and for FEA, ANSYS software is used.

E. Amith Kalekar , S. B. Tuljapure [5]

A bush pressing machine is designed for pressing bronze bushes into a pump frame or casing. Finite element method (FEM) based software ANSYS is used for modeling & analysis work. As the machine is symmetrical about a vertical plane, only half model is prepared using the modeling facilities available in ANSYS. Meshing is done using tetrahedral (Solid-45) elements. A force of 17.78 KN is applied on the job mounting plate & cylinder mounting plate in the form of pressure. Deflections and stresses are observed after the analysis. Both deflection & stresses are the allowable within limit. The stress values obtained by FEM are in well agreement with the analytical values.

F. Manar Abd Elhakim Eltantawie [6]

In the proposed work small hydraulic press for V-bending operation is designed, manufactured and modeled. The hydraulic bending press consists of hydraulic circuit, punch, die and PLC control unit. Automation studio and Sim. Hydraulic in Matlab/Simulink library are used to model the hydraulic circuit. Using PLC program, the bending operation is controlled. The press had to be capable of withstanding 2 tons of force. The punch and dies are designed to be rigidly fixed and easily removable, changeable to any kind of forming operation with decreasing of spring back effect of the sheet metal.

The bending press is tested by using a low carbon steel sheet metal with 3 mm thickness. Results show that, there is a little amount degree in the spring back and there is no defects on the work piece surface.

G. S. M. Bapat & Dessai yusufali. [7]

This paper deals with the FEA implementation for analysis and optimization of hydraulic forming press machine. Metal forming is one of the manufacturing processes which are almost chip less. These operations are mainly carried out by the help of presses and press tools. These operations include deformation of metal work pieces to the desired size by applying pressure or force. Press machine always works under impact load condition. Because of continuous impact load, the hydraulic press machine always experience continuous stress. Some parts of the machine experience compressive stresses and some experience tensile stresses. Press machine continuously deals with stress and because of that there are frequent structural failure problems in the machine. Different components of the machine are subjected to different types of loading conditions and are analysed using FEA tool. ANSYS is one of the FEM tool, which is incorporated in the present work. Weight optimization of

press frame and upper head is done, which in turn resulted into reduction in thickness of frame structure and material.

H. H.N.Chauhan & M.P.Bambhanian [8]

This paper presents the design and analysis of 63 ton power press machine by using Fem. Press machine always working under impact load condition. Because of continuous impact load, frame of press machine always experience continuous tensile stress. Press machine continuously deals with stress and because of that frequently structural failure problem occurred in machine. Instead of sharp corner in C-plate fillet is provided, then it is useful to reduce failure in structure. Amount of fillet depends on load condition experienced by frame and that can be analyzed by using FEM Tool. It is also helpful to reduce thickness of plate of frame structure so that material saving and cost benefit will be considerable.

V. CONCLUSION

In this proposed project we are performing design of special purpose fiber disc press machine which can increase the efficiency, reduce the process time and increase the productivity and increases the accuracy of the production. This will reduce the cost of labor at the site significantly. Also, it will ensure the higher productivity at minimum required time.

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