Fabrication of Hydraulic Press Machine

[1]Amith P, [2]Ashok D K, [3]Bhojraj Kotin, [4]Dayanand S and [5] Jegadeeswaran N

[1,2,3,4]Students, School of Mechanical Engineering,REVA University, Bengaluru, India

[5]Professor,School of Mechanical Engineering,REVA University, Bengaluru, India

Abstract *:*In this present work the design and fabrication of 10 Ton Hydraulic press machine. A Hydraulic press is a machine using a hydraulic cylinder to generate a compressive force, which works on Pascal's principle. Frame, hydraulic cylinder, piston arrangement and the hydraulic circuit are the main components of the hydraulic press. In this project hydraulic press machine is designed by the design procedure and fabricated. Hydraulic press is analyzed to improve their performance for press working operation. Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure. An attempt has been made to reduce the volume of material.

A 10-ton hydraulic press was designed, constructed and tested using locally sourced materials. The principal parameters of the design included the maximum load, the distance the load resistance has to move, the system pressure, the cylinder area and the volume flow rate of the working fluid.

Index Terms: Maximum load, load resistance, system pressure, cylinder area, hydraulic circuit.

I. INTRODUCTION

Presses are one of the most commonly used machine tools in industry for the forming of different materials. In the past, mechanical presses were more frequently used in the industries, but nowadays hydraulic presses take precedence due to their numerous advantages, such as full force throughout the stroke, moving parts, stroke that can be fully adjustable which contributes to the flexibility of application, can be made for very large force capacities. A hydraulic press is a device using a hydraulic cylinder to generate a compressive force. It uses the hydraulic equivalent of a mechanical lever. The concept of the hydraulic press is based on Pascal's theory which states that when pressure is applied on fluids in an enclosed system, the pressure throughout the system always remains constant.

In hydraulic press, the force generation and transmission are achieved by fluid under pressure. In a simple application, a smaller piston transfers fluid under high pressure to a cylinder having a large piston area, thus amplifying the force.

Punching processes make use of large forces by punching tools for a short time interval which results in cutting or shaping the sheet metal. Since, punching process does not involve heating of the parts, close tolerances and high surface finish can be obtained on the part. Since presses can produce components at fairly fast rates, the unit cost of labour for operating the press is fairly low.

II. LITERATURE SURVEY

K.Shravan Kumar[1] have designed the press frame and cylinder as per design procedure. The frame and cylinder are modelled by using modelling software CATIA. Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material. So in this paper consideration for an industrial application consisting of mass minimization of H frame type hydraulic press.

Fisayo Adesina[2]have developed a manually operated hydraulic press which encompasses the design, fabrication and performance evaluation of the press. The components parts of the machine were designed using various design equations. The design results were used to select materials for various components. The detailed drawing of the developed machine was done using Pro E software. In fabricating the machine, mild steel was used as the locally sourced material. Some of the bought-out parts include: ram assembly, pressure hose, pressure indicator and hydraulic pump.

Malachy Sumaila[3]have attempted to alleviate the problem of the dearth of equipment in our laboratories in most of our higher institutions, 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.

Izzettin Osman Egüz[4] have constructed a hydraulic press for the assembly operation. The project started with a new construction of a hydraulic press for the bearings' assembly. The goal within the thesis work was to fit the three bearings to the housing by only one press motion. This operation should be very safety because of the sensitive tolerance at the bearings and housing. Construction of the cylinders, rams and bolster were the most important parts at this project because this parts' functions

are very important for this assembly. The next step of this thesis was to calculate the hydraulic press components' parameters and then choose the suitable components.

III. EXPERIMENTAL WORK

Table I includes details of all components required for building the actual model of Hydraulic press.

Table I.Details of components

S. No	Name of the part	Material used
1	Square tubing frame	Mild steel
2	Bottom plate	Mild steel
3	Top plate	Mild steel
4	Cylinder	En8
5	Piston	Mild steel
6	Piston rod	Mild steel
7	Tie rods	Mild steel

Frame

Fig.1 Fabrication of Frame

Figure 1 shows the fabricated frame. The frame of desired square tubing is cut to size. The edges are cleaned of paint, grease and chip all the pieces are welded together by MIG welding. Extra support is provided at the bottom to avoid bowing. On one side solid blocks are welded in order to attach the tank. The top surface is drilled to accommodate the bottom plate.

Top and Bottom Plates

Fig.2 Machining of Top and Bottom Plates

Figure 2 shows the machining of top and bottom plates. The raw material is cut to size. The plates are then milled by using a horizontal milling machine to obtain a rough finish. Surface grinding is performed to gain smooth finish and the plates are drilled to align into the frame. The drilled holes are tapped and then bolts are used to fix the frame and the bottom plate. Two more holes are drilled to accommodate the tie rods. The top plate is also drilled and tapped to accommodate the flange of the cylinder.

Hydraulic tank

Fig.3 Hydraulic Tank

Figure 3 shows the hydraulic tank. The material is cut to size and the frame is made up of L-angles and the edges are ground in order to weld, MIG welding is used Sheet metal is welded on the frame of the tank .A bottom orifice is provided in order to drain the oil completely an oil indicator is also provided. The top portion contains a directional control valve with an integrated pressure release an air breather is also present in order to avoid air locks a pump of 20lpm 0.5hp and 0.3kW is also integrated.

Hydraulic Motor

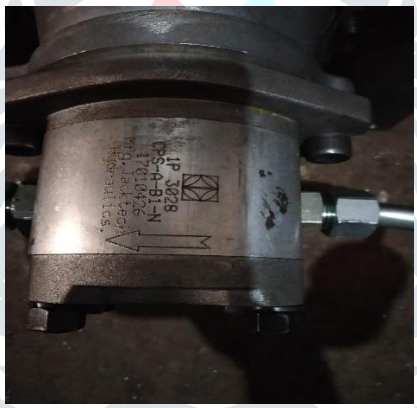

Fig.4 Hydraulic Motor

Figure 4 shows the Hydraulic Motor. A hydraulic press works on the principle of Pascal's law, which states that when pressure is applied to a confined fluid, the pressure change occurs throughout the entire fluid. Within the hydraulic press, there is a piston that works as a pump, that provides a modest mechanical force to a small area of the sample. A hydraulic press is a machine press using a hydraulic cylinder to generate a compressive force.

Hydraulic Pump

Fig.5 Hydraulic Pump

Figure 5 indicates the Hydraulic Pump. A hydraulic pump is a mechanical device that converts mechanical power into hydraulic energy. It generates flow with enough power to overcome pressure induced by the load. Second, its mechanical action delivers this liquid to the pump outlet and forces it into the hydraulic system.

IV. RESULT AND DISCUSSIONS

- Analysing alternative design concepts.
- Selection of an optimal concept.
- Detailed dimensional design of the selected concept.
- Fabricating a low-cost hydraulic press machine.

Fig.6 Fabricated hydraulic press

Fig. 7 Punched sheets

VI. CONCLUSION

Hydraulic press machine is a multi-purpose machine as it can be used for performing different operations by changing the die. Different operations like punching, bending, blanking etc. can be performed on a hydraulic press machine.

The design has main focus on reducing the cost, improving the flexibility and make operation more convenient, and to achieve dimensional accuracy. Components of the hydraulic press are designed to avoid bending failure due to applied load. Mild steel is selected as material based on its properties such as high tensile and bending strength and its compatibility with operations like machining, welding, finishing, cutting etc.

VII. REFERENCES

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