

Design & Analysis of 10 Ton Pneumatic Press

Harshal Puri¹, Rohit Rokde², Prashant Shingare³, Nitin Pote⁴

Department of Mechanical Engineering

^{1,2}G. H. Raisoni College of Engineering, Nagpur

³Assistant Professor, G. H. Raisoni College of Engineering, Nagpur

⁴Assistant Manager, Goodyear South Asia Tyres, Aurangabad

Abstract-Power press working is said to be burr less manufacturing process. We can also say as cold stamping process. The machine used for press working is known as press. This Project work deals with the Design, analysis and optimization of Pneumatic 10 Ton Press Machine. The aim is to reduce the Weight and cost of the Pneumatic press without reducing the quality of the output. Using the best possible resources in design can affect decrease in the weight and cost of the press machine. One way of doing, it will be the optimizing the volume of material utilized for building the complete structure of machine. Here we have consider an industrial application project consisting of mass minimization of a Pneumatic press. For reduction of volume of material Forming operation consider. For analysis Purpose ANSYS has been used.

Keywords:FEA, Structural optimization, Weight reduction, Forming operation.

I. INTRODUCTION

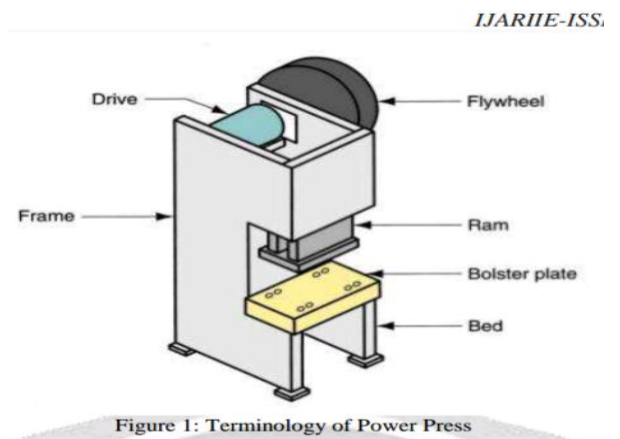
Power press are used for producing large quantities of articles quickly, accurately and economically from the cold working of mild steel and other ductile materials. A Press Machine is a machine that supplies force to die used to form, blank or shape metal or non-metallic materials. The Metal forming manufacturing process is almost chip less. Press tools are used to carry out this operation. Deformation of work piece to desired size is done by applying pressure. In this Project Work Pneumatic Press Machine are mainly used for sheet metal Forming Operation. It consists of bed, frame or bolster plate, Pillar. The ram exert force upon sheet metal or working material through unique tools mounted on the bed or ram. The Energy supplied by a pneumatic cylinder in a pneumatic press is transferred to the ram to provide straight movement. Presses are considered best and most capable way to form a sheet metal into final finished products. Pneumatic presses are commonly used for punching, forging, molding, clinching, blanking, deep drawing and metal forming operation. Pneumatic press is used for producing huge quantities of articles economically, quickly and accurately. The components which are produced range over a very wide field and are used all over industry. By means of particularly designed press tools and combination of operations, most of

the sheet parts of any shape are produced. The selection of the proper press and design of die or tool to be mounted on it is very important for any operation to be carried out on the Press Machine.

II. POWER PRESS WORKING

We know that there are mainly three types of power presses: mechanical, hydraulic, and pneumatic. Their control systems may be mechanical or electro-mechanical. Through these three major types power presses share some common features, the mechanical power press is the most commonly used and researched. In power press two major are stationary bed and a moving ram. Mechanical press works on the phenomenon of reciprocating motion and the main components for power transmission are the flywheel, and crankshaft, clutch. A motor gives the rotation motion to flywheel and clutch is used for couple the rotation flywheel to the crankshaft. The crankshaft converts the rotary motion of the flywheel to the two and forth motion of the press ram. A work piece is fed into the lower die, either automatically or manually, and the machine cycle is initiated. On the Down stroke, the ram (with an upper die) moves toward the area of operation. When the upper and lower dies press together on the stock material, a re-formed piece is produced. Once the down stroke is completed, the formed work piece is removed and anew work piece fed to the machine and process repeated.

III. TERMINOLOGY OF POWER PRESS



Frame

It is a main body of the power press. It supports ram, driving mechanism and control mechanisms.

Ram

Main operating part of the press is RAM which works directly during processing of a work-piece. Motion of Ram is to and from within its guide ways with predefined stroke length and power.

Flywheel

In most of the presses driven gear or driven pulley is made of the shape of flywheel, which is used for storing the energy reserve wire of energy for maintaining homogenous speed of ram when the punch is pressed against the work-piece. Flywheel is placed in the driving mechanism just before the clutch is sequence of power transmission.

Base (Bed)

Base is the main supporting member for work-piece holding dies and different controlling mechanisms of press. The size of the work pieces depend on the table limits.

Bolster plate

Bolster plate is attached to the bed and it is also used to hold the die assembly.

Drive

In the power press different types of driving mechanisms like cylinder and piston arrangement in hydraulic press, crankshaft and eccentric mechanisms in mechanical press have been used and Ram driven by these mechanism which transferring the power from motor to ram.

IV. PRESS APPLICATION

- A. Mechanical Engineering
- B. Sheet Metal Products, Components, Assemblies
- C. Automotive Industry and Its Suppliers
- D. Heating, Ventilation, Air Conditioning
- E. Steel and Aluminum Construction
- F. Precision Engineering
- G. Aero Space
- H. Ship Building

C-FRAME TYPE POWER PRESS

In this process, work is on the C-frame type Pneumatic press machine knowing that the presses fall into

two types. One is gap frame and straight side presses. The frame used in Pneumatic presses is similar to those used in many mechanical presses. Main advantages of an open frame press design are economy of construction and unhindered access to the die area. Inclinable models and those with moveable beds or tables also offer a great deal of versatility, making them particularly useful for short run production or job shop applications. The disadvantages of the open frame design is that such presses are generally limited in practice to the use of single dies. This is a result of several factors including the lack of stiffness and the typically small force capacity and die area of open frame presses. The standard frame structure design of power presses and due to open from 3 sides, known as open front press. Key advantages of C Frame are operator can work from 3 sides as well as use maximum area of Press Bed or Bolster also convenient for progressive tooling. Compare to Ring Frame and H Type Box Frame Presses C frame presses are economical and disadvantage of frame deflection after long time.

V. WORK METHODOLOGY

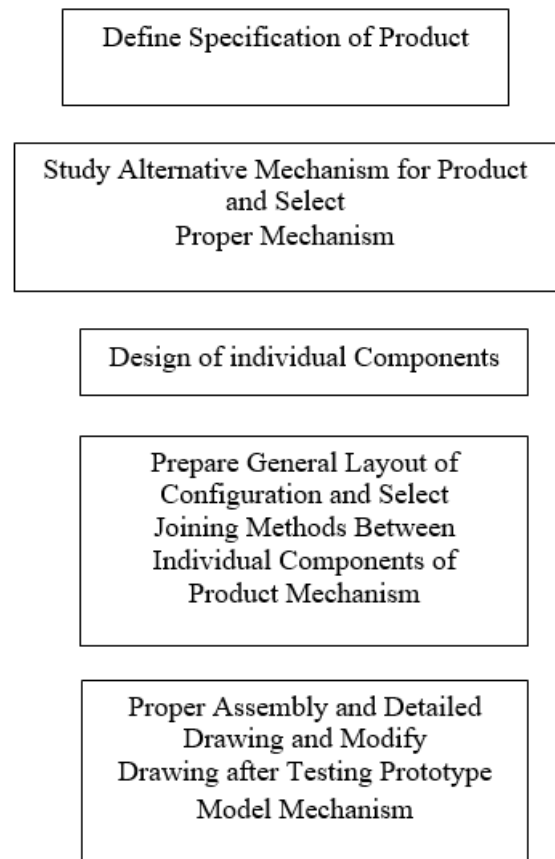


Table 1 :- Work Methodology

VI. LITERATURE REVIEW

A.G. Naik and et al [1] incorporated design process successfully into a structural shape optimization problem. The moto of their work is to minimize bending stresses causing bending of frame of a hydraulic cotton lint bailing press by optimizing the Top & Bottom frame. Reduction of cost and Improvement in safety was another aim of their work. Software ANSYS was used for this work. Due to new design a reduction in weight of frame was 13%.

H.N.Chauhan and et al [2]designed & analyzed frame of a 63 tonne power press machine using Finite Element method. Due to the impact loading at the end of the bolster plate there was development of a crack at the corner and stress generated was more due to continuous loading and stress concentration. Modifications were done by introducing the fillets of proper size. Also plate thickness was reduced which saved material.

Ankit H Parmar and et al [3]performed optimization of a hydraulic press structure to decrease total mass of structure while assuring adequate stiffness. In order to reduce mass while assuring adequate stiffness a method of structure optimization was recommended. In order to research relationship between stiffness, mass and design variables, common batch file was built by CREO and analysis was done in ANSYS.

VII. ASSUMPTION CONSIDERED

Following are the assumptions had been made for frame structure.

1. The load is consider as a perfectly vertical.
2. Frame material is homogeneous and isotropic.
3. The base is bolted to a solid foundation so all the deflections of the base plate are zero.
4. As the frame is having the symmetrical cross section area, one side is to be consider for the purpose of analysis.

Design Procedure of C Frame Press

The frame is the base machine element in press. It is designed by the following steps.

1. Function

The main function of the frame is to withstand the force developed by the RAM. Frame is used for mounting and housing thepress accessories like ram, die block, motor, flywheel, gears etc.

2. Determination of forces

The capacity of the press determines the major forces acting on the frame structure.

3. Material Specifications

Specification of Material

Designation: St 42 W.

Tensile strength: 420 to 540 MPa.

Density: 7850 kgf/m³.

Young's Modulus: 2.1 x 10⁵ N/mm².

Poisons Ratio: 0.3.

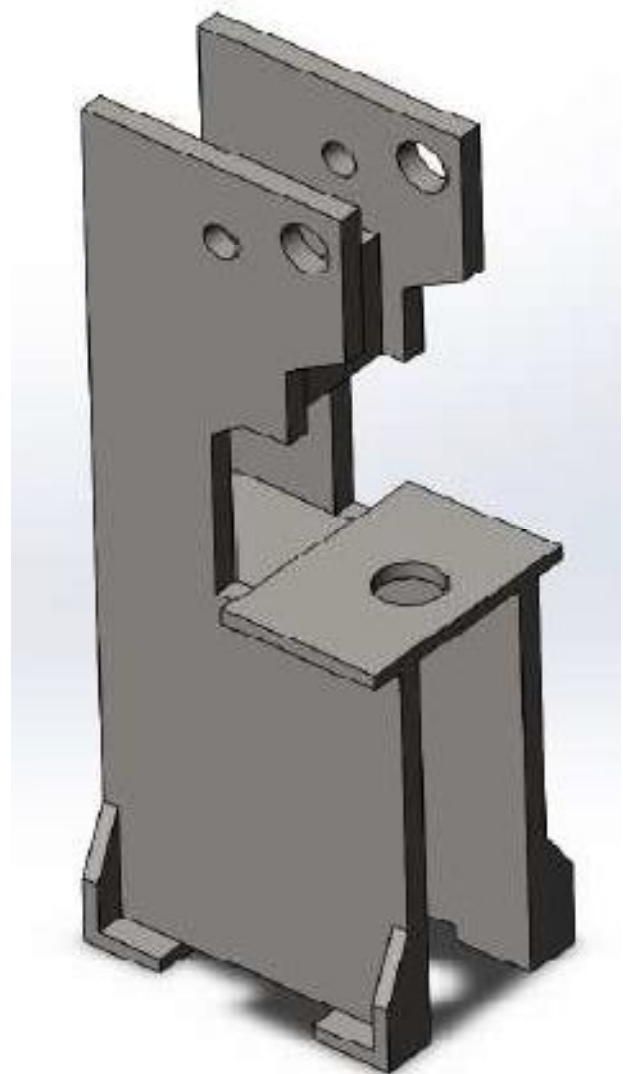
Factor of Safety: 4.

For impact loading

Stress Concentration Factor: 1.25

4. Design

Design of C-frame has been be done in solid works software.



VIII. CONCLUSION

In this paper an effort is made to review the previous analysis that have been made on the design and analysis of various frame structures of press machine. An attempt has been made in the present article to give an overview of various techniques developed for the analysis and optimization of frames. Majority of researchers have carried out work to reduce the unwanted stresses in the frame of Press Machine and number of work is carried out to optimize the structure of hydraulic press frame. The techniques of Design, analysis and optimization are going to be used for the current project of Design Analysis and optimization of a 10 Ton Pneumatic Press Machine. The human safety is a part of this project

REFERENCES

- [1] A. G. Naik, N. K. Mandavgade, “FEA Implementation In Analysis And Optimization Of Top And Bottom Frame ForHydraulic Cotton Lint Bailing Press”, International Journal of Scientific & Engineering Research Volume 3, Issue 7,2012
- [2] H.N.Chauhan & M.P.Bambhania, “Design & Analysis of Frame of 63 Ton Power Press Machine by Using FiniteElement Method”, Indian Journal of Applied Research, Vol.:3, Issue:7, pp.285-288, 2013
- [3] Ankit H Parmar and et al, “Design and Modification of Foremost Element of Hydraulic Press Machine”, InternationalJournal of Advanced Scientific and Technical Research, Issue 4, Vol. 3, 2014
- [4] Bhavesh Khichadia, Dipeshkumar Chauhan, “A Review on Design And Analysis of Mechanical Press Frame”,International Journal of Advance Engineering and Research Development, Volume 1, Issue 6, 2014

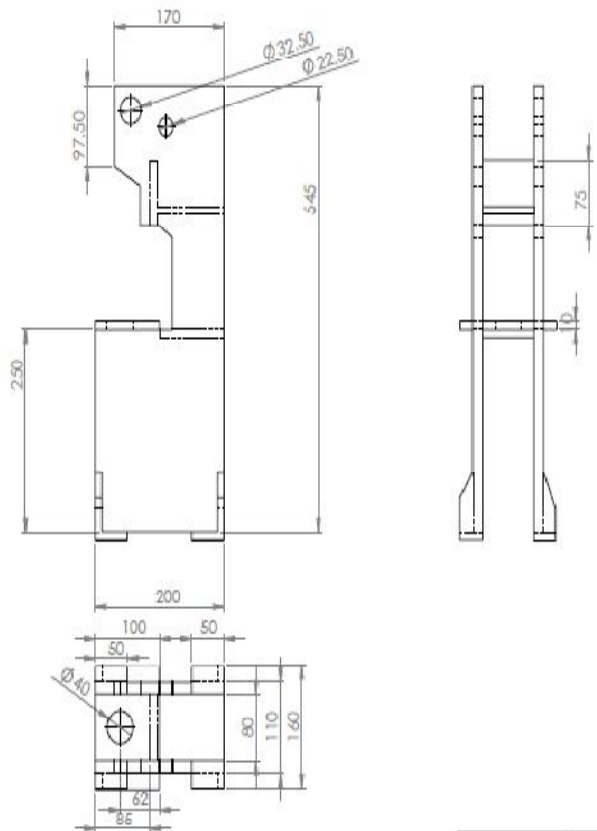


FIG 2 . 10 Ton Pneumatic Press

Specification of 10 Ton Press Machine

Capacity	10
Electric Motor (H.P./R.P.M.)	1/1440
Stroke Adjustment	06-50
Dist Bolster to Ram (SUAU)	195 Max
Side Adjustment	25
Side Face FB X LR	1100X2000
Size of Table (FB X LR)	1000X1600
Bolster Thickness	100
Flywheel Diameter	700
Stroke per minute	70
Weight Approximate	550Kg