DESIGN AND FABRICATION OF PNEUMATIC PRESS TOOL FOR PUNCHING OPERATION

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Abstract: Today several industries are using hydraulic, electrical and pneumatic components as a source of system. But pneumatic system is superior alternative than electrical or hydraulic to perform similar task. Because of low cost of pneumatic components it is more useful for mass production as it uses compressed air rather than any hydraulic fluid which is more costly. Now a day many applications come under pneumatics system due to low maintenance cost, high carrying capacity and moreover not dangerous. A pneumatic punching press tool used to generate high pressure on the piston with the help of compressed air. A solenoid valve is used to control the directional flow of air in and out of the cylinder. Pneumatic punches are faster than hydraulic punches and perform many jobs faster and more efficiently. The compressed air strikes to the punch with high pressure; plastic deformation of the sheet takes place due to pressure exerted by the punch.

Index Terms - Compressed Air, Solenoid Valve, Pneumatic Cylinder, Press tool.

I. INTRODUCTION

Pneumatic systems operate on a supply of compressed air and it must be made available in enough capacity and at a pressure to suit the ability of the system. A compressor is a machine that takes in air, gas at a definite pressure and compresses the air & delivered the air at a high pressure. This work is the study about the design and fabrication of pneumatic press tool. The ram exerts 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. The metal is punched to the desired requirement. The presses are exclusively intended for mass production and they represent the fast and more efficient way to form a metal into a finished punched product. Press tools are used to form and cut thin metals. Press tools operation can be simplified to a few simple operations involving punching a die. The main function of pneumatic press is to form or cut thin sheet metals or non metals using pneumatic power. In this work we have used punching process for simple application.

1.1 Objective of Project

To design and develop pneumatic punching machine which uses compressed air to produce high pressure to be applied on piston and this high-pressure air fed to punch, forces it on the material. And thus punching operation is performed.

II. METHODOLOGY

2.1 Selection of Materials: Press tools are generally made using **HCHCr**, Steel alloys with high carbon. But before that based on many factors like cost, strength, hardness, strain and many parameters selection should be made. The materials generally selected are **D2**, **EN31**. Mild Steel is used as supporting plate. Apart from those materials like D3, high carbide materials, chromium steels and high speed steels are also used. The properties of the materials used in the experimentation are tabulated below.

EN31 is a high carbon Alloy steel which achieves a high degree of hardness with compressive strength and abrasion resistance that are acceptable for many automobile applications such as heavy duty gear, shaft, pinion, cam shafts. It is neither externally brittle nor ductile due to its lower carbon content and lower hardness.

Table No. 1 Chemical Composition of EN31

Chemical Composition (%)				
Carbon	Silicon	Manganese	Sulphur	Phosphorous
0.18	0.35	1	0.05	0.05

Table No. 2 Physical ,Mechanical & Thermal Properties of EN31

Physical ,Mechanical & Thermal Properties					
Elastic modulus	Melting Point	Density	Rockwell hardness	Izod impact	Thermal properties
192-210 GPa	1421° C	7.7 x 1000kg/m^3	62	77.0 J	Thermal expansion 10.4x 1/10^{-6} /C

D2 Steel alloy is one of the Cold Work, high carbon, high chromium type tool steels**. D2** is a deep hardening, highly wear resistant alloy. It hardens upon air cooling so as to have minimum distortion after heat treatment. Used for long run tooling applications where wear resistance is important, such as blanking or forming dies and thread rolling dies. For properties of **D2** steel as shown in Table.

Table No. 3 Chemical Properties of D2 Steel

Chemical Properties							
Carbon	Silicon	Manganese	Chromium	Sulphur	Phosphorus	Vanadium	Molybdenum
1.6	0.6	0.6	13	0.03	0.033	1.1	1.2

Table No. 4 Physical, Mechanical & Thermal Properties of D2 Steel

Physical, Mechanical & Thermal Properties					
Density	Rockwell Hardness	Elastic modulus	Yield Stress	Tensile Strength	Melting Point
7810kg/m^2	65	215000N/mm^2	450N/mm^2	750N/mm^2	1540^o C

2.2 Geometric Construction of all the components:

2.2.1 Die

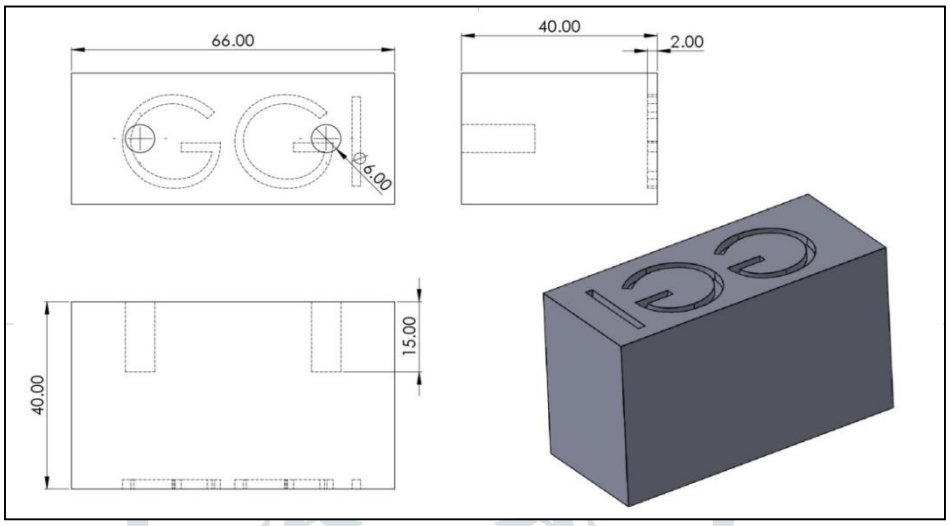

Fig-1 Construction of Die

2.2.2 Punch

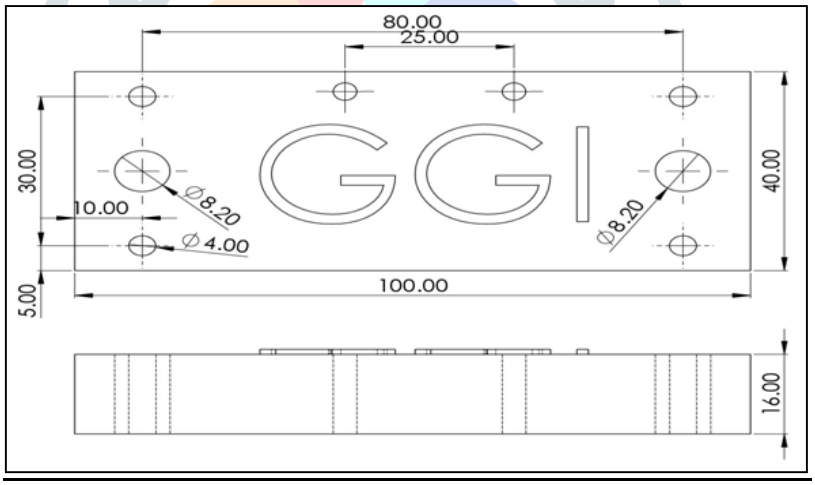

Fig-2 Construction of Punch

2.2.3 Top Plate

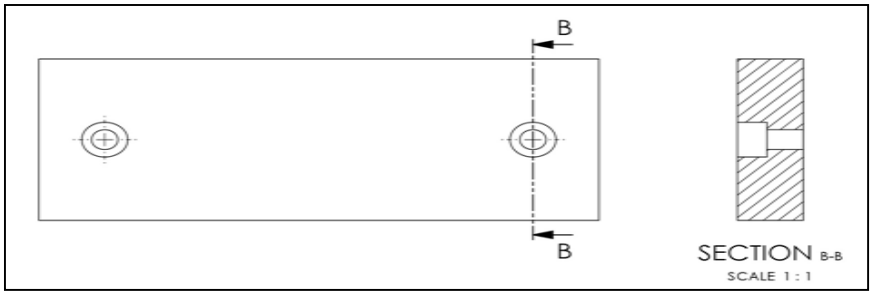

Fig-3 Construction of Top Plate

2.2.4 Bottom Plate

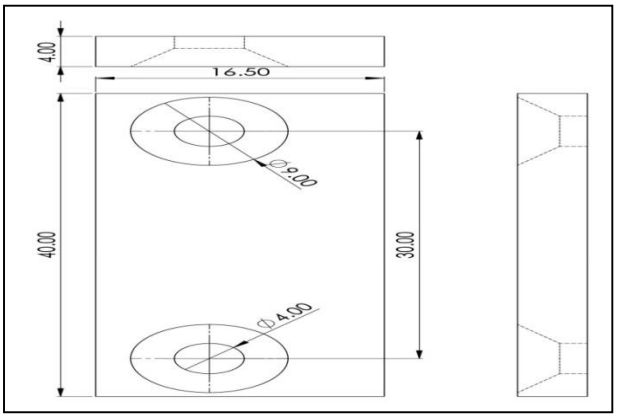

Fig-4 Construction of Bottom Plate

2.2.5 Guide Plate

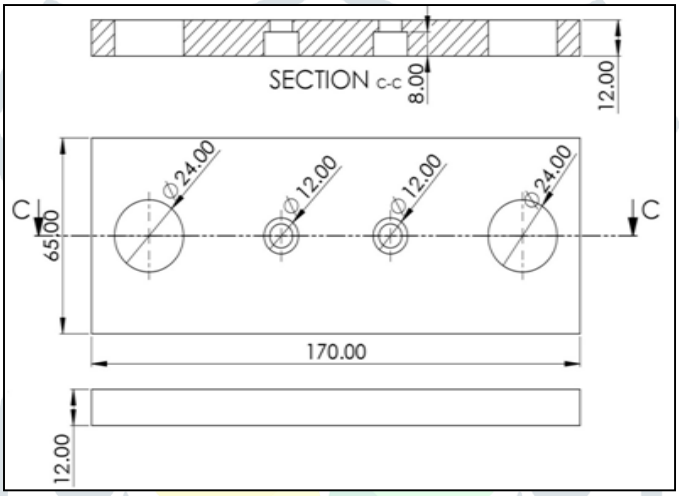

Fig-5 Construction of Guide Plate

2.2.6 Pneumatic Controlled Press Tool

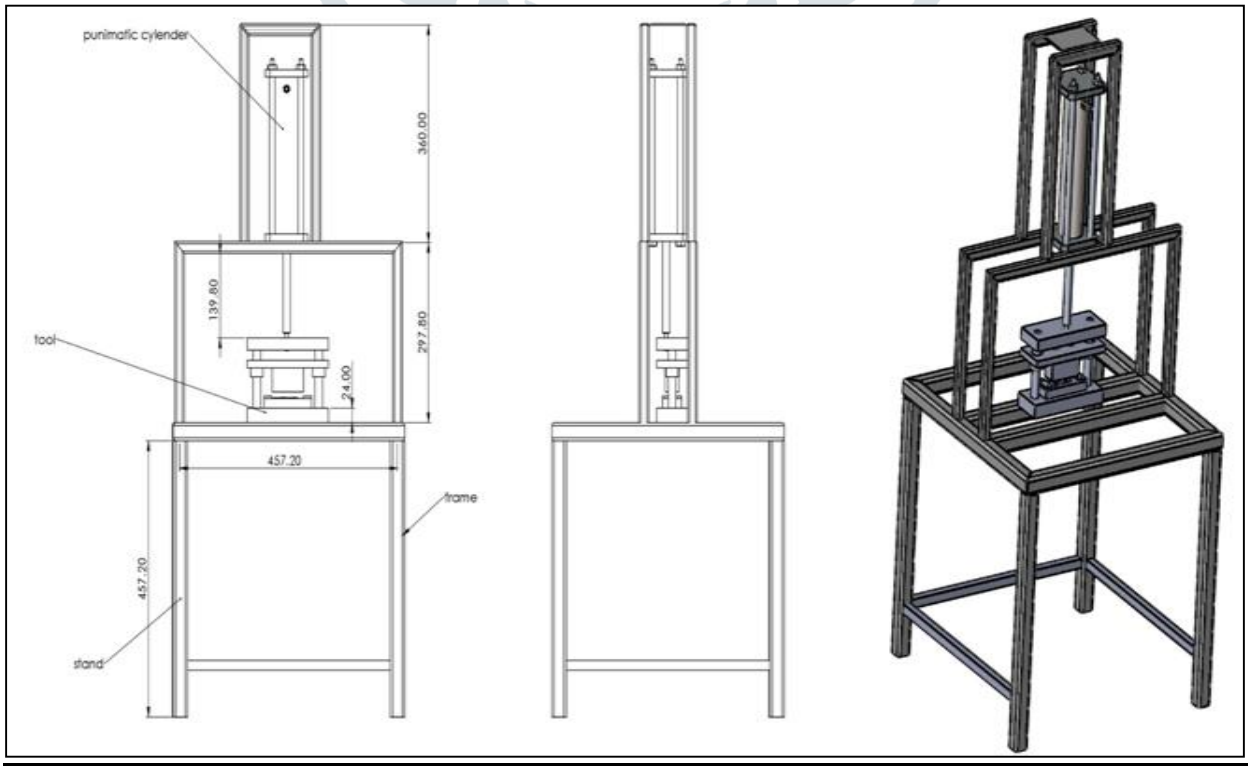

Fig-6 Construction of Pneumatic Controlled Press Tool

III. RESULTS

Press tool efficiency is lost through defects accumulating in press components. As the die significantly impact the overall efficiency of the press, defects the efficiency of the press tool. When defects arise, such as punch cracking and die corrosion leads to inefficient interactions between the punch and the die which increases the damage of the press tool ultimately reflects increase in the costs. Hence, to avoid, or at least diminish, elevated energy costs, the implementation of an improved press tool design, consistent with the findings of this paper, should be considered.
Meshing and vonmises are shown below:

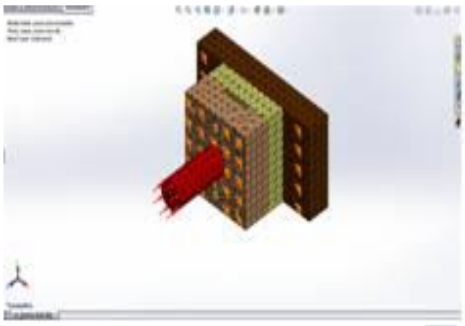

Fig-7 Mesh

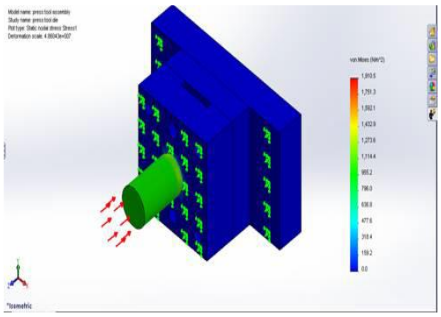

Fig-8 Vonmises Strain

IV. CONCLUSION

Design of press tool for blanks made for sheet metal component has been developed by following the fundamental die design principle. The press tonnage required for the operation is below the capacity of the machine which exists. So it is suitable for its preceding press ton machine. Moreover the geometrical compatibility of the mechanical press and the designed combined press tool is excellent.

Output product having diameter 20mm and its tonnage capacity is 2.2 tons. So it suits for above 2.5 ton press machines. The tools generally made from steel alloys. Based on carbon composition they are classified in P type, D type, H type. All D type is having more carbon percentage which indirectly posses more strength. They are mainly used for making of tools.

REFERENCES

[1] U.P. Singh, A.H. Streppel, H.J.J. Kals, Design study of the geometry of a punching/blanking tool, J. Mater. Process. Technol., pp-33,331 345, 1992.

[2] k.krantikumar, k.v.ss.saikiran, jakkoju satish, M.tech "pneumatic sheet metal cutting machine" International journal & magazine of engineering technology, management and research.ISSN:2348-4845.

[3] A.S. Adityapolapragada, K. Sri varsha-"Pneumatic auto feed punching and riveting machine"

[4] Rajdipsinh G. Vaghela and et.al., "Design and Analysis of C-Frame of 40 Ton Pneumatic Power Press Using FEA ", Journal of EmergingTechnologies and Innovative Research , Vol. 1, Issue 2, pp.78-91.

[5] D. Ravi, "Computer Aided Design and Analysis of Power Press", Middle-East Journal of Scientific Research 20 (10): pp.1239-1246, 2014

[6] Bhushan V.Golechha, P.S. Kulkarni "Design, Analysis and Optimization of 10 TON Pneumatic Press Machine", Vol. 4, Issue 3 , March 2017, ISSN: 2350-0328

[7] Akshay L. Soneraa , Dharmesh B. Chauhana , Tanvi K. Chaudharib, "Design of Pneumatic Press for Bending and Punching Operation" 2017 IJSRST | Volume 3 | Issue 3 | Print ISSN: 2395-6011 | ISSN: 2395-602X.

[8] Joanna Cyganiuk (2015) Pneumatic Press for Cold Bending of Metal Elements", 36 - 41, 2015 ISSN 1335-2393

[9] P.Goyal, G.Srivastava, R.Singh, N.Singh," Review on Pneumatic Punching Machine and Modification in Punch Tool to Reduce Punching Force Requirement", Volume 2 Issue 2 February 2015, ISSN 2394 – 3386

[10] Kakde DV [1] , Lokawar VL[2]," Design and Manufacturing of Pneumatic Burr Removing Machine" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064