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Design and Manufacturing of Portable Hydraulic Die Fitment Opening Machine

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***Abstract*— The invention provides to solution of die fitment opening in sheet metal industry. Usually the die fitment is given to the press die for supporting and aligning the press die. As the fitment is of male and female section tighten in each other. So, the skilled operator in sheet metal industry opens the die fitment by hammering, it causes damage to the die alignment and surface finish. In the present scenario, time constraint is crucial part for completion of any production process. Thus, with the aid of atomization i.e. by using portable hydraulic system for fitment opening with reduced damage of alignment and higher degree of accuracy. Thus, an attempt has been made to provide less effort and rapid functioning of die fitment opening with the help of hydraulic system.**

***Index Terms*—Press Dies, Hydraulic Power pack, Die fitment.**

I. Introduction

A progressive die performs a number of operations like piercing, blanking, punching etc. in a single die at each workstation. Also, these dies perform two or more operation subsequently in a single stroke. At each stroke of press machine, finished part is obtained. In a progressive die the strip is feed from one end and final part is collected from the other end [1].

A press is a tool to produce compressive force by mans of fluid which depends upon Pascal's principal. By means of hydraulic system larger forces can be produced in contrast with mechanical and electrical systems which used for press work application [2]. Press work is method of mass production involving the cold working of metals, usually in the form of thin sheet or strips. In sheet metal work press working is one of the extensively employed methods of fabricating parts of intricate shapes [3].

Figure 1 : Press Die

II. Design of Hydraulic Die Fitment Opening Machine

Hydraulic die fitment opening machine is very useful for opening of die in industry as the human effort is reduced also time required for die opening is very less. Hence this machine is very economical for industry.

Table I

Properties of Hydraulic Oil ISO 68

Property	Value in matric unit		Value in US unit	
Density at 15.6°C	0.880*10^3	Kg/m^3	54.9	lb/ft^3
Kinematic Viscosity at 40°C	68	cSt	68.0	cSt
Kinematic Viscosity at 100°C	10.2	cSt	10.2	cSt
Viscosity Index	135	-	135	-
Flash Point	204	°C	400	°F
Pour Point	-40	°C	-40	°F
Aniline Point	88	°C	190	°F
Color	Max 7.0	-	Max 7.0	-

A. Design Calculation

Force Required (F) = 8000 N

Velocity for lift (V) = 0.5 m/min

Stroke Length (S) = 0.250m

Step 1: Selection of Hydraulic Cylinder [4]

Assuming maximum pressure of vane pump (p) =70 bar.

D= [(4*F)/ (3.14*p)]^(1/2)

D=0.038m =38mm

Selecting A3 Cylinder Heaving,

D=50mm and d=35mm

Step 2: Selection of Vane Pump [5]

Pressure during working stroke

p = F/A = 40.74 bar

Discharge during working stroke

Q=A*V = 0.9817 lpm

Selecting P1 pump,

It has

Q = 8.5 lpm at 0 bar

Q = 7.1 lpm at 35bar

Q = 5.3 lpm at 70 bar

Step 3: Selection of Reservoir [6]

Capacity of Reservoir > 3* Q_{max}

= 25.5 lpm

Selecting T1 Reservoir,

Having Capacity = 40 lit.

Step 4: Selection of other Component [6-8]

Max. Pressure = 40.74 bar

Max. Discharge = 8.5 lpm

TABLE II

TECHNICAL SPECIFICATIONS OF OTHER COMPONENT

Sr, No	Component	Model	Pressure Range	Flow Rate Range
1.	Strainer	S1	-	38 lpm
2.	Pressure Gauge	PG3	0-100 bar	-
3.	Relief Valve	R3	70 bar	30.4 lpm
4.	Flow Control Valve	F4	70 bar	24.6 lpm
5.	Direction Control Valve	D2	210 bar	38 lpm
6.	Check Valve	C2	210 bar	30.4 lpm

B. Proposed CAD Model

The following parts have been modeled to fulfill the assembly and manufacturing requirement of setup.

1. Oil Reservoir
2. Pump
3. Pressure Relief valve
4. Direction Control Valve
5. Flow Divider
6. Double Acting Cylinder

The hydraulic oil stored in the oil reservoir. Also, it has another function such as cool the hot return oil and remove the air bubble. The hydraulic oil pumping the hydraulic oil and supply to the system. It converts mechanical energy into hydraulic energy. Pressure relief valve is connected to the outlet of pump the main function is to release the oil back to the tank when pressure increased beyond preset value. The direction control valve controls the direction of flow of oil by which it performs extension and retraction of double acting cylinder. The flow divider divides the flow of hydraulic oil into equal amount and supply to the double acting cylinder and double acting cylinder extend.

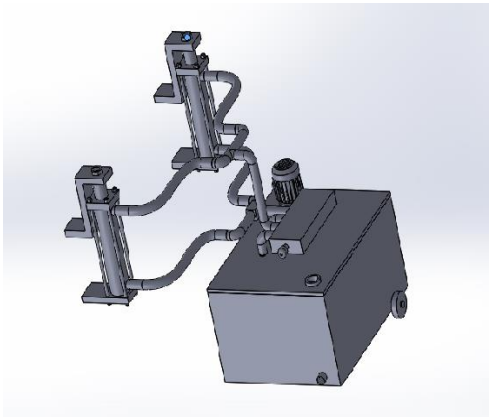

Figure 2: CAD Model

III. FINITE ELEMENT ANALYSIS OF PLATE USED FOR SMALL DIES

The material of plate is used as mild steel. Total four plates are used for four cylinder and apply the force of 2000N on each plate. After that the stress induced in the plate is 121.49 MPa and this is less than yield strength of mild steel i.e. 250 MPa. So the design of plate is safe.

For small types of dies the clearance between two plates is small as compared to total height of cylinder so we use this type plate for small dies.

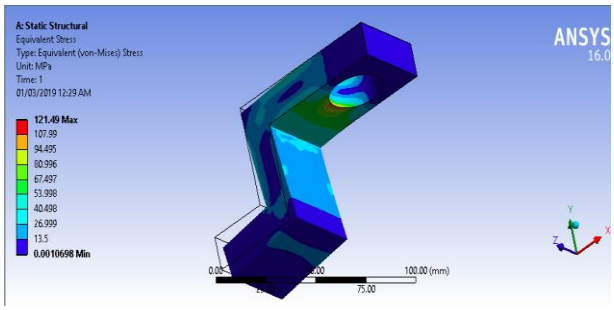

Figure 3: Plate without stripper

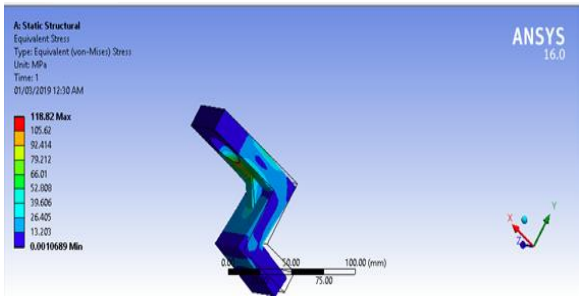

Figure 4: Plate with stripper

TABLE II

STRESS ON PLATE

Plate	Force	Stress
Plate Without Stripper	F=2000N	Stress=121.49 Mpa
Plate With Stripper	F=2000N	Stress=118.42 Mpa

IV. EXPERIMENTAL TESTING

First, four cylinders was placed inside the die, at four corners of die and then the pressure is applied by pump and four cylinders extend simultaneously. Hence the upper part is lifted upward and die will be open.

Figure 5: Close Position of die

Figure 6: Open Position of die

Figure 7: Actual Model

Initially in industries the die is open by hammering on each corner at equal force but this process required more time up to 2-3 minute. After using this experiment the time required for opening of die is reduced and time up to 30 seconds require and human effort of hammering is reduced.

The above two figure shows the position of close and open dies. When no force applied on pillar side the die is in close position. When we apply the equal force with the help of four hydraulic cylinder on pillar side the die will be open as shown in figure.

V. CONCLUSIONS

The Portable hydraulic die opening machine is an economical way to open fitment with the varieties of characteristics including strength, durability and wear resistance. This machine has been designed for applying equal force to the die setup for easy removal of die fitment.

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REFERENCES

[1] Tejas Patel, Vikas Panchal, SaurinSheth, Purvi Chauhan "Design and Development of Hydraulic Press with Die", 5th National Conference on Recent Advances in Manufacturing, May 2015.

[2] Rupali Chavan, Navneet Patil, "Design, Development and Analysis of Press Tool for an Industrial Part", International Journal of Mechanical and Industrial Technology, Vol 4, pp 112-123, April 2016.

[3] Prabhakar Purushothaman "Types of press tool", January 2012.

[4] M.O. Abdalla, T. Nagarajan, "Computational Study of The Actuation Speed of Hydraulic Cylinder under Different Ports Sizes and Configurations" Journal of Engineering Science and Technology, Vol.10, 2015, pp160-273.

[5] S. L. Ukwuaba, S. C. Afoegba, A. D. Atadio, "Development and Construction of a Sliding Vane Pump", International Journal of Emerging Engineering Research and Technology, Volume 6, Issue 5, 2018, PP 1-7.

[6] Mr. Arun Balkrishna Kulkarni, Mr. Y. P. Ballal, S.G.Bagi, "Enhancement of the Performance of Hydraulic Power Pack by Increasing Heat Dissipation'', International Journal of Trend in Research and Development, Volume 2(5), Oct 2015.

[7] E. Boye, Adeyemi, I. Olabisi, Eyere E. Emagbeter "Design and Finite Element Analysis of Double - Acting, Double - Ends Hydraulic Cylinder for Industrial Automation Application", American Journal of Engineering Research, Vol, 6, pp131-138, 2017.

[8] Kishor. S. Joshi, C.S. RajshekarS, "Study of Hydraulic Directional Control Valve with Cylinder Performance using MATLAB Simulink", International Journal of Innovations in Engineering and Technology, Vol. 4 Issue 1 June 2014.