Research Paper

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Design & Fabrication of Compound Tool

Engineering

KEYWORDS : Mass Production, Components, Sheet metal, Press working, shearing

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ABSTRACT

While converting a raw material into a finished product the product should be accurate .So to require the accurate product the design should be accurate .If the design is not accurate then defects will occur in manufactured product. Small mistakes in designing will make the product useless. So while designing the product only we should be very care full. By the implementation of the computers in design field, designing process became easier and the time also has been reduced. The basic fundamental reason for implementing the computer aided design is to increase the productivity, get more accuracy and also for sub dividing the parts which we required. There by reducing the time for synthesizing, analyzing and documentation purposes. In our project we used Catia for designing a Compound Die. The product which we designed is washer of M10 bolt generally the progressive tools are called as stage tool. We have done the two stage progressive tool which means the final component will come at second stage. The first stage is the piercing and the second stage is blanking.

1. INTRODUCTION

Sheet Metal industry is a large and growing industry. There are many special purposes machines used in this industry to-day. The proper selection of the machines depends upon the type of the work under-taken by the particular industry. There are many examples of Sheet Metal work, which can be seen in our everyday lives. The metals generally used for Sheet Metal work include black iron sheet, copper sheet, tin plate, aluminum plate, stainless sheet and brass sheet. Characteristic of the press working process is the application of large forces by press tools for a short time interval, which result in the cutting (shearing) or deformation of the work material. A pressworking operation, generally completed by a single application of pressure, often results in the production of a finished part in less than one second. Pressworking forces are set up, guided, and controlled in a machine referred to as a press.

1.1 Press Machine

A Press is machine tool used to shape or cut metal by applying force. Press machine represents a specific type of machine tool, essential in the performance of industrial manufacturing process. Presses deliver energy through a force that acts over a distance or stroke. Press machines tool used in metal extrusion and sheet metal fabrication processes. Hydraulic and mechanical are employed during sheet metal forming to the extent that sheet metal processes, in general, are often referred to as press working. Selection of a type of machine press depends on the factors of the manufacturing process. The first consideration would be the basic type of process the press tool will be employed to perform. Required press capacity is likely related to the size of the work stock and type of process. Maintaining the Integrity of the Specifications

2. PRESS TYPES

Hand press

Power press

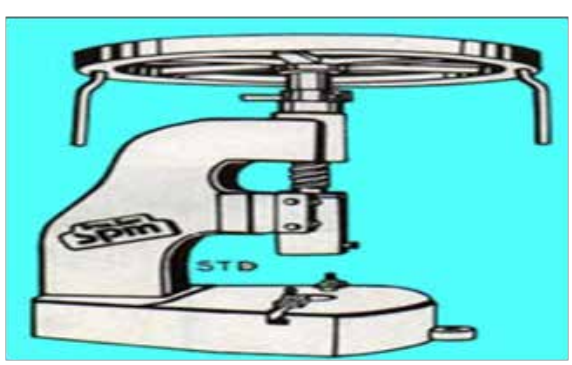
(a). Mechanical press

(b) Hydraulic press.

(C) Pneumatic press.

2.1. Hand press

Our manually operated hand press machine can be used for various types of application. Each basic manual unit is offered for purchase individually, or with one of custom made Die sets. Die sets can be designed upon request and according to the perforated Material. Usually a die set consists of Punch (male) and Die (female).The punch device mounts on the vertical main shaft (ram).



2.2 POWER PRESS

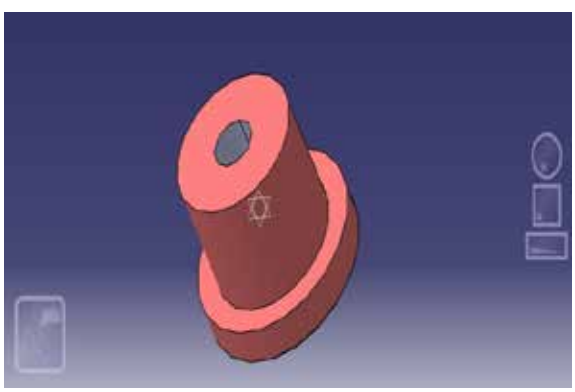
A Press is a machine tool used to shape or cut metal by applying force. There are three different ways of working sheet metal in presses. The constructional feature of a power press is almost similar to the hand press, the only difference being, the ram instead of driven by hand is driven by power. The power press may be des-

ignated as mechanical or hydraulic according to the type of working mechanism used to transmit power to the ram. In a mechanical press, the rotary motion obtained from an electric motor is converted into reciprocating movement of the ram by using different mechanical devices. In a hydraulic press the fluid under high pressure is pumped on one side of the piston and then on the other in a hydraulic cylinder to derive the reciprocating movement. Essentially, a press is comprised of a frame, a bed or bolsters plate, and a reciprocating member called a ram or slide, which exerts force upon work material through special tools mounted on the ram and bed. Energy stored in the rotating flywheel of a mechanical press (or supplied by a hydraulic system in a hydraulic press) is transferred to the ram for its linear movements.

3. SELECTION OF PRESS

Press tool designer has to make proper selection of the type of press to be used and also the kind of press tools to be provided. It is more economical to use a tool which will complete a number of operations at one stroke of the press than to employ a number of cheaper and simpler tools to perform the same work in a series of operations. The design of the tools should be simplest possible and the method of operation the most efficient one. While selecting a press the following points should be considered.

- Force required cutting the metal.
- Size and type of die.
- Stroke length.
- Method of feeding and size of sheet blank.
- Shut height.
- Type of operation.



4. DESIGN OF COMPOUND TOOL

4.1 DIE BLOCK GENERAL DESIGN

Overall dimensions of the die will be determined by the minimum die wall thickness required for strength and by the space needed for screws and dowels and for mounting the stripper plate. Wall thickness requirements for strength depend upon the thickness of the stock to be cut. Sharp corners in the contour may lead to cracking in heat treatment, and so require greater wall Die block thickness is governed by the strength necessary to resist the thickness at such points. Cutting force and will depend upon the type and thickness of material being cut. For very thin materials,0.5" thickness should be sufficient but, except for temporary tools, finished thickness is seldom less than 0.875",which allows for blind screw holes.

Design Drawings:

5. PUNCH DIMENSIONING

The determination of punch dimensions have been generally based on practical experience. When the diameter of a pierced round hole equals stock thickness, the unit compressive stress on the punch is four times the unit shear stress on the cut area of the stock. A large blanking or forming punch usually is made with a flange by which it is bolted and doweled to the punch holder after being aligned with the die

Block assembly.

5.1 CLEARANCES

Clearance is the space between the mating members of a die set. Proper clearances between cutting edges enable the fractures to meet. The fractured portion of the sheared edge will have a clean appearance. For optimum finish of a cut edge, proper clearance is necessary and is a function of the type, thickness, and temper of the work material.

Stock thickness, in. (mm)	Die thickness, in. (mm)*	Stock thickness, in. (mm)	Die thickness, in. (mm)*
		0.6 (15.2)	0.15 (3.8)
0.1 (2.5)	0.03 (0.8)	0.7 (17.8)	0.165 (4.19)
0.2 (5.1)	0.06 (1.5)	0.8 (20.3)	0.18 (4.6)
0.3 (7.6)	0.085 (2.2)	0.9 (22.9)	0.19 (4.8)
0.4 (10.2)	0.11 (2.8)	1.00 (25.4)	0.20 (5.1)
0.5 (12.7)	0.13 (3.3)		

* For each ton per sq in. of shear strength.

5.2 COMPOUND DIE

The term compound die usually refers to a one-station die, designed around a common vertical centreline, in which two or more operations are completed during a single press stroke. Usually, only cutting operations are done, such as combined blanking and piercing. A common characteristic of compound-die design is the inverted construction, with the blanking die on the upper die shoe and the blanking punchon the lower die shoe. The pierced slugs fall out through the lower die shoe. The part or finished blank is retained in the female die, which is mounted on the upper shoe. Compound dies are widely used to produce pierced blanks to close dimensional and flatness tolerances. Generally, the sheet material is lifted off the blanking punch by a spring-actuated stripper, which may be provided with guides to feed the material. If hand-fed, a stop is provided to position the strip for the next stroke. The blank normally remains in the upper die, and is usually removed by a positive knockout at the top of the press stroke. Ejection of the blank from the die by spring-loaded or positive knockout occurs at the top of the stroke. Because of this feature, the die does not require angular die clearance. Not providing angular die clearance both simplifies dies construction, and assures constant blank through the life of the die. Center hole is cut and the outer diameter trimmed in a single die station in one press stroke. The material is 0.015-inch (0.38 mm) cold-rolled steel strip. The piercing punch is attached to the upper die shoe. The blanking punch is attached to the lower die shoe. In this design, the piercing punch contacts the material slightly ahead of the blanking die. The part is stripped from both the blanking die and piercing punch by a positive knockout. The blanked strip is lifted off the blanking punch by a spring-loaded pressure pad.

6. DIE BLOCK GENERAL DESIGN

Overall dimensions of the die will be determined by the minimum die wall thickness required for strength and by the space needed for screws and dowels and for mounting the stripper plate. Wall thickness requirements for strength depend upon the thickness of the stock to be cut. Sharp corners in the contour may lead to cracking in heat treatment, and so require greater wall thickness at such points. Die block thickness is governed by the strength necessary to resist the cutting force and will depend upon the type and thickness of material being cut. For very thin materials, 0.5" thickness should be sufficient but, except for temporary tools, finished thickness is seldom less than 0.875",which allows for blind screw holes

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7. MATERIAL SPECIFICATION

7.1.PRESS MACHINE

Machine type : hand press
Material : cast iron

7.1.1Component details

Component name : washer
Operation : blanking and piercing
Material : aluminum
Sheet thickness : 1mm
Inner diameter : 8 mm
Outer diameter : 24 mm

7.CONCLUSION:

Thus the compound tool is designed to manufacture a compound tool the process planning and follow of the project by using macro and micro level process planning Exposure to industrial techniques and manufacturing methods comprising of precision machining like CNC, Wire EDM, and Cylindrical Grinding. Knowing the various methods of inspection of the tool parts and components developing the knowledge about various fits and Tolerance Exposure to tool try out and suggesting further corrections.

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