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Press Tool Design and Manufacturing

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Abstract

Press tool is one of the important methods for producing small components of automobiles, different home appliances as well as big products like car bodies and doors, turbine blades etc. To convert raw material into finished product, the raw material undergoes different sheet metal operations like blanking, bending, piercing, forming, drawing, cutting off, parting off, embossing, coining, notching, shaving, lancing, dinking, perforating, trimming, curling etc. For every operation different dies and punches are required. Die designing is important activity in sheet metal industries.

Generally metals having thickness less than 6mm is considered as strip. Blanking is one of the sheet metal operations where we produce flat components of prerequisite shape. In Blanking the required shape periphery is cut and cut-out piece is called blank. The press tool used is for blanking operation is called as blanking tool, if piercing operation it is piercing tool and so on based on operation that we perform. The application of press operations are widely used in many industries like food processing, packing, defence, textile, automobile, aircraft and many apart from manufacturing industry. In this the press tool design, materials, manufacturing used for press tool and calculations involved in it.

Keywords: Blanking, Die Design, Manufacturing and Analysis, Sheet metal parts, Burr, Press Tools.

I. INTRODUCTION

High rate production industries generally use press machines. Thickness can vary significantly, although extremely small thicknesses are considered as sheet and above 4mm are considered as plate. Thickness of the sheet metal fed in between is called its gauge. Sheet metal is simply fed in between the dies of press tool for any press operation to perform. The reciprocating movement of punch is caused due to the ram movement of press machine. The press machine may be of electrical type, mechanical type, pneumatic type, manual type and hydraulic type.

In today's practical and cost conscious world, sheet metal parts have already replaced many expensive cast, forged and machined products. The common sheet metal forming products are metal desks, file cabinets, appliances, car bodies, aircraft fuselages, mechanical toys and

beverage cans and many more. Due to its low cost and generally good strength and formability characteristics, low carbon steel is the most commonly used sheet metal because high carbon Composition gives high strength to the material.

The other sheet metals used are aluminium and titanium in aircraft and aerospace applications.

1.1 Tooling

It refers to the hardware necessary to produce a particular component. Tooling consist of a vast array of cutting devices, jigs, fixtures, dies, gauges etc. used in normal production. The common classification of tooling is as follows –

- Cutting tool such as
 - o Single-point cutting tools
 - o Multi-point cutting tools
- Press tools

- Dies for die-casting.
- Forging dies
- Jigs and Fixtures
- Gauges.

1.2 Tool Design

Tool design is the process of designing and developing the tools method and techniques necessary to improve manufacturing efficiency and productivity.

1.3 Tool Design Objectives

The main objective of tool design is to lower manufacturing cost while manufacturing quality and increase production.

Various objective of tool design are as follows –

- To provide simple, easy to operate tools for maximum efficiency.
- To design tools which consistently produce of high quality.
- To design tool to make it fool proof and to prevent improper use.
- To select materials this will give adequate tool life.
- To provide in the design of the tool for maximum safety of the operator.

1.4 Precaution to Tool Design

The tool should be safe to operator. Safety should be planned into every tool design details. A tool should satisfy the following requirement as for safety is concerned.

- It should be easier to load and unload the tool.
- All sharp edges on tool should be chamfered.
- All control and clamps should be located within easy reach of the operator.
- Chip guards should be provided to protect the operator.
- Tool clamping device should not be loosening during tool operation.
- Tool body should be rigid enough to resist all cutting force.

II. OBJECTIVE

It is observed in industry during the manufacturing the various work pieces on press machine the Productivity of production is good but problem of burr and ejection is major As far as burr is concern, press machine alignment is an important factor which is responsible for the burr formation

so quality of production is reduces and there will be huge loss to company. Sheet metal parts play an important role in automotive industry. Different types of reinforcement, body parts, and door parts are manufactured in sheet metal scope. With every manufacturing process there are some defects associated with the same. In same manner in sheet metal components there are also many types of defects arises in different processes. But out of these defects the most common and prominent defect is ‘Burr’. This defect has a no. of cost effective impacts as follows-

1. Adding unnecessary processes i.e. rework.
2. Production loss
3. Quality issues
4. Risk of defect being passed to “customer”
5. Affecting 5-S

Due to the burr formation there are also the problems of operator safety and this is hazardous to the operator. Also ejection is one of the major problem faced by industry in press tool operation this problem is responsible for reduced production rate because cycle time of the production is increases due to this cost of production is increases also the extra employee is required.

III. PRESS TOOL COMPONENTS

• Punch

It is the main tool of die assembly which directly comes in contact of work piece during its processing, its detail have already been described.

• Punch Holder

It is also known by its other name upper shoe of die set. Punch holder is clamped to the ram of press. It holds the punch below it.

• Die Holder

It is also called die shoe. Its work as a support for the die block and it is rigidly fastened to the blaster plate of the press.

• Stop

Stops are used for maintaining correct spacing of the sheet metal when it is fed below the punch to maintain the quality of output. These restrict the feed of stock (work piece) to a pre-determined length each time without doing any precise measurements. Normally two types of stops are used bottom stop and lever stop as described below.

• Bottom Plate

Bottom stop is a type of mechanical mechanism. This mechanism stops the movement of punch after end of each cut. A button is located in such a manner when fresh stock is fed to die, the button is pressed due to the impact of the fed stock, indicating feeding of true length of the stock. This way the mechanism also acts as a fixture. Pressing of button enables the system ready for next cutting action. The button stop is used in hand presses and in slow acting power presses.

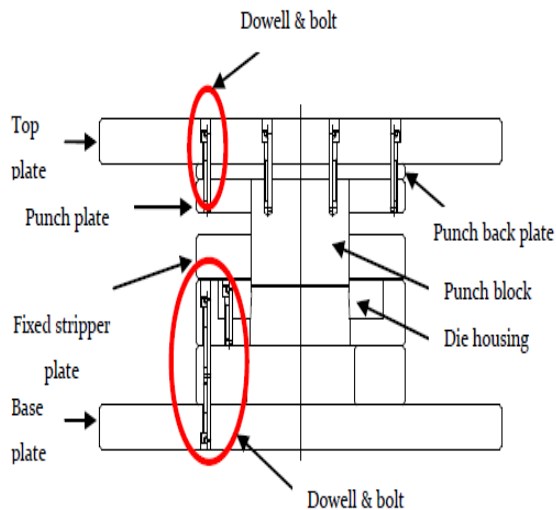


Fig. Press Tool Components

• Lever Stop

This mechanism operates with the help of a lever. After the completion of one cut, the stop mechanism stops the downwards movement of punch for next cut when fresh stock is fed it is stopped by a lever after feeding it up to certain length. The lever also enables the punch to move for cut.

• Pilots

Pilot is used for correct location of blank when it is fed by mechanical means. The pilot enters into the previously pierced hole and moves the blank to the correct position to be finally spaced by the stops. Normally pilots are fitted to the punch holders.

• Strippers

Stripper is used to discard the work piece outside the press after the completion of cutting or forming operation. After the cutting when punch follows upward stroke the blank is stripped off from the punch cutting edge and prevents it from being lifted along with the punch. This action of prevention is performed by the stripper.

• Guide Posts

Accurate alignment between die opening and punch movement is very important. Guide posts are used for correct alignment of punch and die shoe.

• Punch Plate

Punch plate is also known as punch retainer. This is fixed to the punch holder. Punch plate serves as a guide way to hold the punch in right position and properly aligned. This makes the replacement of punch quick and correct.

• Backing Plate

Backing plate is used to distribute pressure uniformly over the whole area (maintains uniform stress), it prevents the stress concentration on any portion of punch is generally made of hardened steel inserted between the punch & punch holder.

IV. SELECTION OF MATERIAL FOR DIE AND PUNCH

The material cost accounts for 20% of total cost. Sheet metal industries are given due considerations to reduce the manufacturing costs and hence to reduce the cost of production. Thus selection of proper material for manufacturing of tool components essentially increases the tool life and hence reduces the cost of production. Tool steels find many wide applications in stamping of large volumes of small and medium sized parts are inserts in larger dies. These steels are designed especially to develop high hardness level and abrasion resistance. Both through heat treatment and through existence of hard, stable and complex chromium, tungsten, molybdenum and vanadium carbides, we selected D2 from the AISI table for the modified tool. The old tool had ONHS for punches and dies. For our tool, the material ONHS vs. D2 is plotted and thus the tool life variation is shown between the modified tool and the old tool. The tool life increased considerably as shown below:

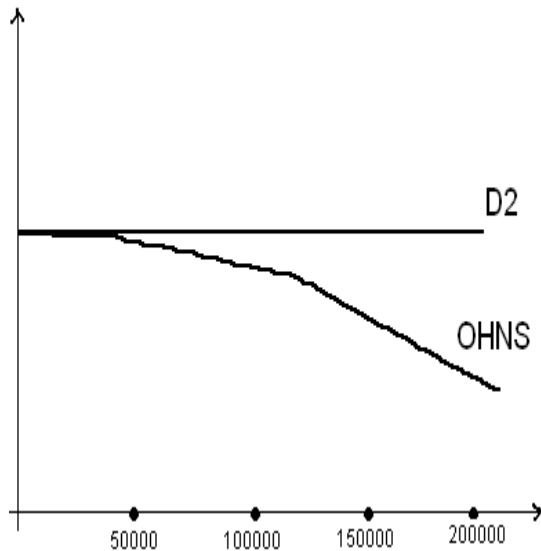


Fig.4.1 Tool Life Vs Number of Strokes

OHNS

Oil Hardened Non-shrinking Steel / Oil Hardened Nickel Steel has chemical composition of carbon content 0.95%, Manganese 1.15%, Chromium 0.5% and Vanadium 0.2%.

D2 (1.2374)

Also known as High Carbon High Chromium Steel. HCHCR Steel is widely utilized in punch and dies in metal stamping industry, injection mold tools, and barrel liners in plastic molding industry.

V. CONCLUSIONS

Design of press tool for blanks made for sheet metal component has been developed by following the fundamental die design principles. 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. The output received is Output product having 4mm thickness 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. of all D type is having more carbon percentage which indirectly possess more strength. They are mainly used for making of tools.

The stress region in punch and strain displacement is found. Therefore newly developed

combined press tool is recommended in order to have an improved productivity, improved efficiency, better flexibility, more economical manufacturing process with lower cost of the product.

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