

## Design And Development of Compound Die

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**Abstract**— *The work deals with the development of a combined tool for an improvement of a process to be done in three wheeler vehicle product manufacturing plant. Research work deals with the combining two pressing operations done separately. This operation done for vehicle cable transmission part to be manufacturing. In the first pressing blanking operation is done & in second operation a hole is pierced in the same product. The project mainly focuses on different operations done on single setup of die punch in a single stroke, presently these operations are done on three separate setups which leading to reduce the production rate and increasing cycle time with cost as well. Compound die is a press tool of collective operations performed on the sheet metal. The various operations are carried out in a single stroke. The design of compound die is largely depends on material of sheet metal, thickness of sheet metal and complexity of design and operations.*

**Keywords**- Die punch, Press machine, Autocad, Rate of production.

### I. INTRODUCTION

A die is a specialized tool used in manufacturing industries to cut or shape material using a press. Like mould, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology.

Piercing dies are typically made by tool and die makers and put into production after mounting into a press. The die is a metal block that is used for forming materials like sheet metal and plastic. For the vacuum forming of plastic sheet only a single form is used, typically to form transparent plastic containers (called blister packs) for merchandise. For the forming of sheet metal, such as automobile body parts, two parts may be used, one, called the punch, performs the piercing, stretching, bending, and blanking operation, while another part, called the die block, securely clamps the work piece and provides similar, piercing, stretching, bending, and blanking. The work piece may pass through several stages using different tools or operations to obtain the final form. In the case of an automotive component there will usually be a shearing operation after the main forming is done and then additional crimping or rolling operating to insure that all sharp edges are hidden and to add rigidity to the panel.

Introduction to sheet metal die design – Design of sheet metal die is a large division of tool engineering, it has a rather complex and a fascinating subject which has its own importance and pertains to the added value of the particular industry. It is by far the most exacting of all areas of the general field of tool designing. The die designer originates the design of die employed, stamped and formed part from sheet

metal, assemble the parts together and perform a variety of operations. New ideas of rather innovative kinds and skill immersed only through experience. The word (DIE) is a general term and used in two distinct senses. When employed in general sense, it means an entire press tool with all components taken together. When used in limited sense, it refers to the components having machined cavity or opening to receive the punch.

Basics of blanking and piercing tool-A blanking die produces a flat piece of material by cutting the desired shape in one operation. The finished part is referred to as a blank. Generally a blanking die may only cut the outside contour of a part. Piercing is a shearing process where a punch and die are used to create a hole in sheet metal or a plate. The process and machinery are usually the same as that used in blanking, except that the piece being punched out is scrap in the piercing process

### II. LITERATURE REVIEW

B. Hogman has been presented, “Steel for Press tool” (2009) The ultra-high strength steel material is the best suitable as a press material due to its high tensile strength. The tensile strength of ultra-high strength steel can be up to 1400 MPa. Due to this very high strength the demand of automobile industry like weight reduction of material with increase in safety level can be fulfilled.

Vishwanath M.C. , Dr. Ramni , Sampat Kumar L. has been presented “Design of progressive draw tool”(2013) In this paper the author uses the software like Pro/E to design the cup for oil filter by the progressive die technique. He design progressive die for two stage operation i.e. piercing and blanking.

Kailash kumar Lahadotiya, Abhay Dinkar Kakirde and Ashutosh Kumar Pandey have presented “Mini review on designing of press tool for sheet metal component” (2013) in this paper the author mainly focus on economic consideration of the part (die) development. The selected material for die should be optimized with respect to tool life, higher productivity with reduced cost.

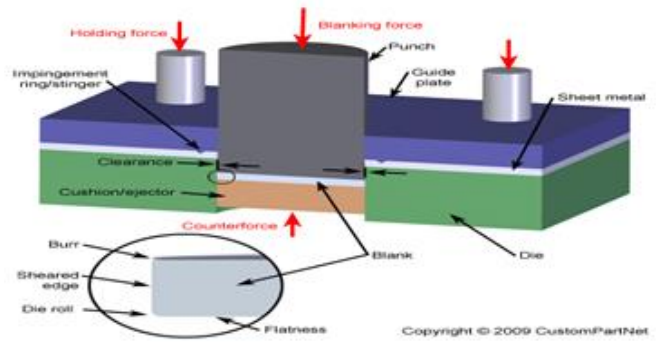
#### Problem Definition

For manufacturing of the compound die for cable transmission part making company do separate (blanking and piercing) operation.

1. Operation is blanking on station one.  
 2. Operation is piercing on station two.  
 So, the material handling increase as well as the working stroke time is also more. As the production demand is more with more accuracy the operation need to be perform quickly with less handling

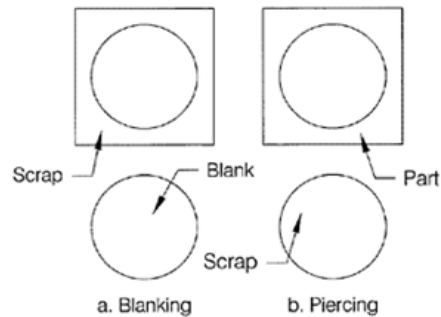
### III. Materials

1. Mild Steel (M.S.): - Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing. In applications where large cross-sections are used to minimize deflection, failure by yield is not a risk so low-carbon steels are the best choice, for example as structural steel.  
 2. EN-31: - EN31 is a high carbon Alloy steel which achieves a high degree of hardness with compressive strength and abrasion resistance.  
 3. D2: - D2 steel is an air hardening, high-carbon, high-chromium tool steel. It has high wear and abrasion resistant properties.



### • Piercing

The piercing is the operation of production of hole in a sheet metal by the punch and the die. The material punched out to form the hole constitutes the waste. The punch governs the size of the hole and is allowed the clearance on the die



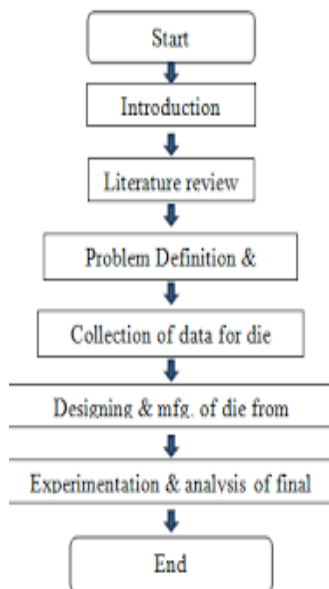
### VI. PRESS MACHINE

Under normal operation, the operator places the work piece into the die. He then engages the ram motion by a hand or a foot operated switch. After a stroke, the operator puts his hand into the die and takes out the finished product. It is necessary to ensure the safety of man, machine, material and tool during the whole process. Any safety system for this kind of a machine must have the following

### Concept:

The arrangement of the system is such that the operator finds it easy to operate the machine using the system itself, rather than finding any means to bypass it. The whole idea is to keep the mechanism very simple to use, but at the same time satisfy all the desired conditions. The system is a combination of two types of safety systems, one being the electrical circuit and the other being a positive pull out system. Yet another physical guard is included to prevent any accidental entry of anyone else's hands. The combination of the three to get a holistic approach towards safety provides a sense of security to both the operators and their employers. The system was designed to be understood by anyone; hence the parts used are simple yet reliable and easily available.

### IV. METHODOLOGY



### V. BLANKING AND PIERCING

#### • Blanking

The blanking is a operation of cutting of flat sheet of the desired shape the metal punched out is the required product and the plate with the role left on the die goes as waste.

●**Press load or press capacity:**

The related capacity of press is the force which the slide or ram will exert near the bottom of the stroke.

Press load or press capacity = blanking force or cutting load + strip load

$$=90.83+15.66$$

$$=106.49$$

Hence, press load is 160 tones is selected.



**VII. Scope of Project**

Earlier, the process of die design was considered an art rather than the science. Traditionally, checking the manufacturability of sheet metal parts and process of die design require experienced die designers, involve numerous calculations, and hence time-consuming tasks. But with the advancement in the field of AI around 1980s, these are being carried out using various AI techniques. But most of the systems developed using AI techniques are having limitation in extraction and representation of part feature data in more interactive format for displaying output. Further, most of the systems are developed for single-operation stamping dies using production rule-based approach.

Very few systems are developed for design of multi-operations dies and even these are not capable to fully automate the die design process. Therefore, there is need to develop an intelligent system by combining some suitable AI

technique and CAD system for manufacturability assessments/reasoning, concurrent planning and quick design of multi-operation dies. The system must have rich knowledge-based comprising knowledge of experienced die designers and process planners, must be interactive and user friendly and have low cost of implementation. The system finally must give its output in form of drawings of strip-layout, die components and die assembly. The authors are applying their research efforts in this direction to assist process planners and die designers of small and medium scale sheet metal industries.

Further we can reduce the no of component of the die by using the material selection method as we can eliminate the pad and use the support plate as both support and pad. We can also reduce the shut height which can optimize the production time as the ram required to travel less distance.

**VIII. Conclusion**

The compound die is designed for existing operation instead of simple die. The tooling cost is reduced so there is considerable saving in the raw material required for making of compound die and hence in manufacturing of compound die instead of existing dies. Due to contribution of compound die the rate of production is increased which directly affects on per unit cost of product. The unit cost of product is reduced. The main objective of the project is to improve productivity and reduce production cost. The exiting cycle time for blanking and piercing operation is approximately four minutes. After implementation of this project we can expect the cycle time will be 30 to 40 sec. Also we analyzed the, which type of press machine is suitable for compound die.

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