



# A Review on design, development, and analysis of compound die for Automobile component

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**Abstract:** 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. This press tool has significance like high rate of production and minimum per unit cost of product. In compound die the variety of operations are performed at common work station. In present thesis the intensions is given on quality improvement along with production rate. Some drawbacks like spring back effect can be compensated in designing of compound die.

**Keywords:** Compound die, spring back effect, complexity of design, rate of production.

## I. INTRODUCTION

Press tool is one of the important method for producing tiny products like 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 shearing, blanking, piercing, bending, deep drawing etc. For every operation different dies and punches are required. Die designing is important activity in sheet metal industries. High degree of accuracy in die designing is directly effects on the final quality of the finished product. According to complexity of operation required to finish out particular product the design may be simple die, progressive die, or compound die. The factors must be considered in die designing like type of material, thickness of material, length of stroke, cutting area, clearance between die and punch. For designing of dies and punches special hard materials are used to enhance the life of tooling. The initial cost of tooling is more while press manufacturing requires very low running cost. So proper selection of die material is important, to avoid the un-necessary wear of dies. If the bending operation is involved in manufacturing then the spring back and spring go effect will be considered.

## PRESS MACHINE

According to the arrangement of press punch and dies, press machines are mainly subdivided into three types as

1. Simple die
2. Progressive die &
3. Compound die

## SHEET METAL PRESS WORKING OPERATION

Press working of sheet metal means that sheets are given a variety of shapes and size with the help of suitably designed tools and correctly selected press which may hand or power operated. The press may be power operated, pneumatically or hydraulically operated. Small capacity presses are used for production of tiny component. These are also used for assembly work such as riveting. Heavy mechanical and hydraulic presses are used to perform various operation of press working of sheet metal.

## II. LITERATURE SURVEY

Pawan Kumar Rai, Dr.Aas Mohammad, HasanZakir Jafri,has been presented, "Causes & Prevention of Defects (Burr) In Sheet Metal Component". Burr formation is common sheet metal process. Deburring is an important issue for industrialist and engineers. Mainly it is produced in shearing & cutting operations. In sheet metal parts large amount of burr causes defects. This leads to rework and quality problem of finished component. So controlling this defect is the issue of quality. This paper focus on the possible causes & how can to prevent it.

To produce burr free parts die & punch clearance, selection of the best materials and methods is the main factors which affect the burr formation. K. Dilip Kumar, K.K. Appukuttan, V.L. Neelakantha, Padmayya S. Naik have been presented Experimental determination of spring back and thinning effect of aluminium sheet metal during L-bending operation. The investigation carried out for determining the spring back along with thinning effect of aluminium sheet metal during L-bending operation. For different clearances between punch and die, the numbers of specimens with



thickness varying from 0.5 mm to 3.5 mm were prepared. In experiment it is observed that, beyond a particular clearance for each thickness the spring back and thinning effects were linearly increases below the certain value of clearance due to wear scratches on the surface were seen. Number of specimens with various thicknesses were prepared and the experiments were carried out for different clearances.

As the clearance between punch and die reduces it produces more wear on the punching surface. And increasing clearance it leads to increase the spring back effect and fracture propagation. Investigation was carried out to determine spring back and thinning effect of aluminium sheet metal during L-bending operation.

B Hogman has been presented, "Steel for Press Tools". Due to high strength of material it is widely used. The mechanical properties of the new ultra high strength sheet materials enhance the safety level to remain unchanged or improved even if the thickness of the steel sheet is reduced. A work material with such high tensile strength places very high demands of the tools.

Cheng Hua Wang, David a. Bourne has been presented, "Design and Manufacturing of Sheet Metal Parts: Using Features to Aid Process Planning and Resolve Manufacturability Problems". In this paper author discusses an integrated system for the design and production of sheet metal parts, and identified some important features for the sheet metal bending process. These features are automatically generated as the design progresses. The automatic process planning system uses the features and generates the production plans with minimum manufacturing costs

### GAP IDENTIFICATION

In the simple dies we can perform various operations like blanking, piercing, drawing, deep drawing, forming, notching etc. separately. And hence there will more time is required to complete the desired press operation on sheet metal.

### III. PROBLEM DEFINATION

- In this project I will design Compound Die for an automobile body part.
- The part is consisting of four different operations which are Blanking, Notching, Piercing, and Bending.
- Currently all these operations are completed in three different stations and it required three different press machines.

### IV. OBJECTIVES

1. Improve quality of finish product (scrap & rework minimization)
2. Reduced tooling and tool maintenance cost.
3. Per unit cost minimization.

### V. EXPERIMENTAL METHODOLOGY

#### 1. Design and optimization of Punch and Die

In this process the design of Punch and Die is done for carry out the operations. For this we can use some standard for die and punch size calculation. In Design calculation we can find out what amount of force is required for performing actual operation. Optimization is carried out by selecting different materials for die and punch. By selecting different material for die and punch we get variety of choices for choosing particular material. On the basis of properties of different material we will optimize specific material for die and punch.

#### 2. Assembly of Dies and Punch on 3D software and its animation

After die design, create all sub part modelling on 3D software and then assemble to each other. After assembly check animation of particular die, how it is work. If result is obtained properly then make 2D drawing of each sub part of assembly on AUTO CAD Software and release the drawing to the tool room department for manufacturing of compound die.

#### 3. Analysis of Spring back effect

Spring back effect will be analysed by taguchi method. As this effect depends on punch radius, material thickness and anisotropy of material, spring effect will analyse by varying these parameters and optimize the best suited dimensions for these parameters.

#### 4. Verification of Outcomes

The final results will be check by using ANSYS Software by applying the required force on particular part with giving its properties like modulus of elasticity, poissons ratio and by comparison of different parameters between existing and compound die method.



## VI. INVESTIGATION LAYOUT

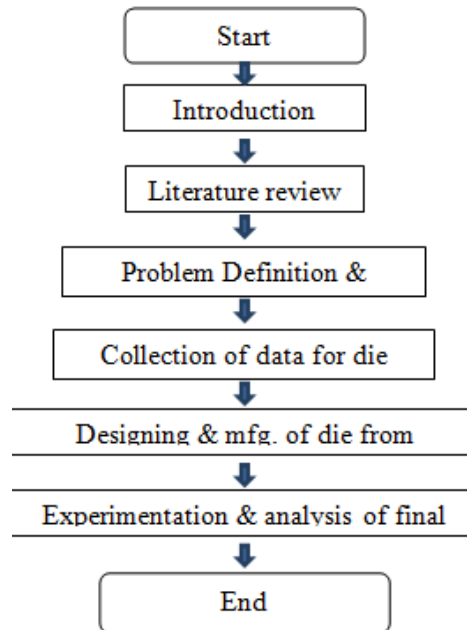


Figure-1: Investigation Layout

## VII. COCLUSION

Compound press tooling has a vital press tooling method due to its some advantages like high rate of production, per unit cost minimization etc. There is opportunity for designer to use the tool for quality improvement along with best utilization of various resources. By adopting the techniques of compound die the industrialist can gets more advantage belongs to different variables (resources) by comparing with other techniques of press tooling, this type of tooling proves its ability over others.

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