

# A Review on Design of Progressive Tool Dies

<sup>1</sup> Vrushabh Lambade, <sup>2</sup> Vaibhav Bankar

<sup>1</sup> M.Tech Student, <sup>2</sup> Assistant Professor,

<sup>1</sup> Dept. of Mechanical Engineering

<sup>1</sup> Vidarbha Institute Of technology Nagpur, Maharashtra (INDIA)

**Abstract:-** The design and Manufacturing, along with the analysis of the Progressive press tool, are designed primarily to carry out the operation on the sheet metal components. This is one crucial phase in sheet metal manufacturing. The components are manufactured using piercing, punching, and blanking processes, which have high dimensional accuracy; therefore, most industries depend on the press tool. The top connection strip is a part that is used in the connection of the electrode of capacitors in series to get the more output voltage or current generally, this type of series connection of capacitors are used in PFC (power factor correction) sectors for controlling power factors in industrial plants, electricity department substation, etc. The top connection of the capacitor is a sheet metal component made up of high purity copper material. Hence, based on the high production requirement of the same, an advanced tool for the Manufacturing of the top connection is needed. The project work consists of the design and Manufacturing of the progressive tool, the sequence of operations is planned initially, and then the press tool is designed. The design will make in AUTOCAD 2016, and solid modeling in Solid edge.

**Keywords:-** Press Tool, Piercing, Blanking, Sheet Metal, Punching.

## I. INTRODUCTION

The new top connection strip is the component which is made up of a sheet metal, and the material is of high purity copper, which is plated with the Tin for the soldering connection with the electrode of the capacitor. The design and development of the advanced tools for the sheet metal components is one of the crucial and critical phases in the sheet metal industry. An advanced tool can perform a series of the operation on the sheet metal to produce the final part as two or more stations during each press stroke to develop a work piece as the strip stock moves through the die. So that each working station performs one or more distinct die operations, but the strip must move from the first station through another next station to produce a complete final part. Dies are used in various forming and pressing stamping operations to obtain the required size and shape of the product. Metal forming operations are significant in mass production skills, and the experience of the die designer is a more critical aspect in the design and development of the die [1]. Press stamping is used as a prime preference for the mass production of numerous mechanical components. Parts with complex shapes can be formed or stamped by using a progressive die [2]. A new top connection strip used in the assembly of the PFC capacitor is required to manufacture using the progressive die. As the requirement of the components significantly increases by the customer, it is

required to manufacture the components in less production time. Operations like blanking, piercing, bending, forming, hole flanging, etc., can be performed using a press tool process. The main operation that is accomplished using a press tool is actively piercing and blanking. Presswork is defined as a chipless manufacturing process by which various components are made from sheet metal. The main features of the press tool are a frame that supports a ram or a slide and a bed and a source of mechanism for operating the ram in line and standard with the bed [3].

## II. LITERATURE REVIEW

So much research has been done to design and develop advanced tool dies. Few of them are taken into study for the advanced tool die design, and some are explained below. This study and observation are focused on the design and development of the die. The literature survey has been pioneering effort in this regard. The terminologies referred from kinds of literature for designing are discussed as follows:

A. "Design and Manufacturing of Progressive Press Tool" by Khosa,

*International journal of Advances in Mechanical and civil engineering, ISSN: 23394-2827*

This project describes a work consisting of designing and manufacturing an advanced press tool for a chain link. The chain link is made up of mild steel and is used for conveyor belts. The thickness of the link is 2 mm. An advanced tool is a tool in which the operations are performed in multiple stations. The tool is designed and manufactured. They also did the testing of the advanced tool. The production of the chain-link component for the conveyor for the movement of material from one station to another has two possibilities: a progressive press tool or a compound press tool. The author investigated the time required for both the process and concludes with the advantage of the progressive press tool over the compound press tool, along with the calculations and cost analysis.

B. "Design and Analysis of Progressive Tool for Photo Frame Hook" by Sandeep P.V.

*IJIST-Vol 3 Issue 6, June 2016*

This project is about designing and analyzing an advanced tool for a photo frame hook. The author modeled the advanced tool in the Pro-Engineer 4.0. Each file was imported to the Ansys 12.0 through IGES spectrum (Initial Graphics Exchange Specifications) format. The author did the design calculation for the bottom plate design, Top half design, stripper plate design, etc., and component analysis. Furthermore, it compared the results of the design calculation with the analysis results, and it concluded that the results obtained through analysis are approximately nearer to the theoretical values. It is also observed that the

design of the progressive tool is safe as all the stresses values were less than the allowable stress of the material.

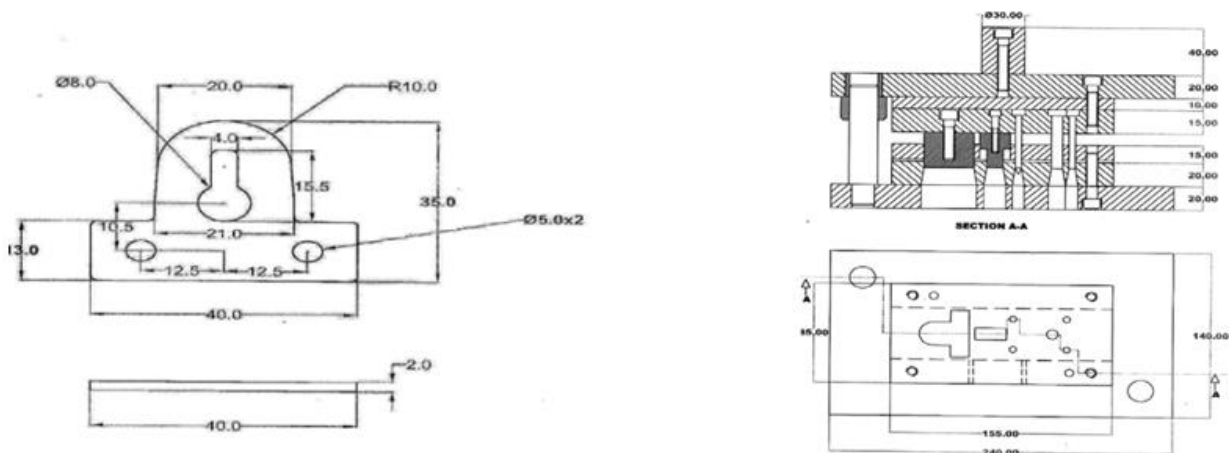


Fig. 1: shows the Component drawing of the Photo frame Hook and the assembled view of the progressive tool designed in the AUTOCAD by author.

C. “Design of Progressive Press Tool for Stator Lamination using Pro/Engineer” by B. Evangeline  
*International academy of Engineering and Medical Research 2017 Volume-2, ISSUE-5.*

The author reports in his project about the design of an advanced press tool for stator lamination using Pro/Engineer. The computer interactive design and manufacturing features in Pro-Engineer were utilized from the conceptual stage to the model of the press tool. A six-

stage advanced tool for sheet metal was designed. It relied on the cutting force in each stage, stock thickness, and total press tonnage. The component material used was silicon steel with a thickness of 0.5mm. The stator lamination was one of the parts used in the ceiling fan. The article concluded that the design resulted in a press tool achieving a high output, the economy in the use of material, the long life of the working parts of the tool, and convenient and safe operation at the minimum cost of manufacturing.



Fig. 2: Design of Stator Laminator

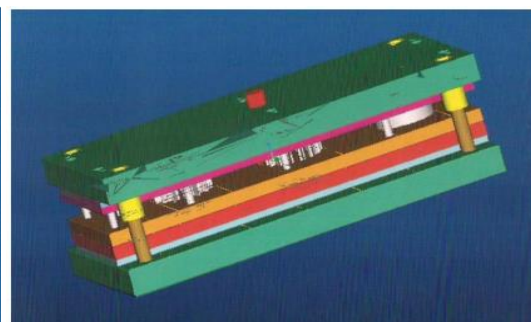


Fig. 3: Final Assembly of the Press Tool for Stator Lamination

Above figure shows the images of stator Laminator and assembly of the press tool for stator laminator described by the author in his paper.

D. “Design and analysis of progressive tool for an automobile components” by Harshal A chavan  
*IOP Conf: Series: Journal of Physics conf ser 1240 012058.*

The author reports the design and analysis of advanced tools for automobile components where he stated the component was initially manufactured from single station dies for different operations. The overall production rate was less compared with the requirement of the component due to the generation of defects and an increase in overall lead time. So it was developed by the author a progressive die for the same component with a reduction in the production time and cost without affecting the accuracy. The project's

objective was to reduce the production time along with cost, achieve maximum accuracy, and improve the quality of the product. Also, the author was done the static and modal analysis of the progressive die assembly using FEA and observed the results. Furthermore, by comparing the result obtained from the frequencies, stress, and strain values are intolerable range. The overall time required for manufacturing the component with the separate dies will be more than the progressive die. By using the progressive die, the rate of production will increase, and manufacturing and labor costs will decrease. The author compares the result of FEA, and theoretical calculations of the progressive tool die.

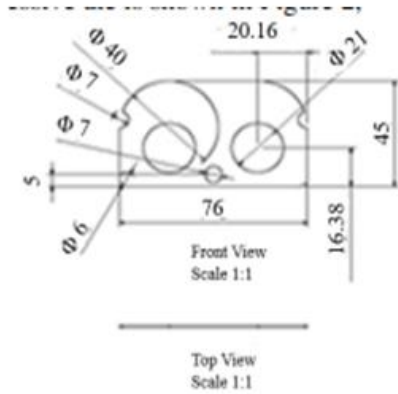


Fig. 4: CAD model of component

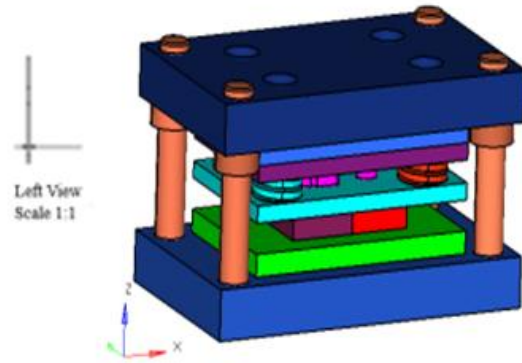


Fig. 5: Solid model of progressive die assembly

Above figure shows the images of CAD model of the component and the Solid model of Progressive die assembly designed by author.

E. “Design and analysis of progressive tool for moving contact holder” by Prof .K.D. Kattimani  
 July 2015, Volume 2, Issue JETIR (ISSN-2349-5162)

In this paper, the author describes designing an advanced tool for moving contact holder components and an analysis of the critical parts of the progressive tool for their better

functioning during the production of the component. The author also designed the strip layout required to manufacture the desired component. The various force calculations must be done to estimate the pressing force required to get the final component. The forces required to form the component are given below in the table.

Operation	Force equations	Force value in N
Blanking	Cutting Force = $L \times s \times \tau_{max}$	91525.9
Stripping	Stripping Force=20%of Cutting Force	18305.19
Embossing	Max Embossing Force = $Kr \times Ae$	6000
U-Bending	Bending Force = $\frac{C}{3} \times B \times s \times \sigma_s$	3874.2
Wipe Bending	Bending force = $\frac{0.33 \times B \times \sigma_s \times s^2}{W}$	703.71
Total Force :		120409.21

Table 1: Force calculation

Author modeled the individual components of the advanced tool in solidworks2012. Furthermore, I concluded the paper with the following observations.

- The results obtained through analysis are approximately nearer to the theoretical values. This demonstrates that the analysis carried out was correct and accurate.
- It is also observed that the design of the advanced tool is safe as all the stress values were less than the allowable stress of the material.

F. “Design of Die for Industrial Part” by Rahul A Patil  
 International Conference Proceeding ICGTETM Dec 2017 / ISSN: 2320-2882)

This paper presents a die design by combining the blanking and two piercing operations for the industrial part in a single die. Compound die generally consists of blanking and piercing operations performed in a single press stroke. This design tool is manufactured by the company and used in cargo load bodies. Required modeling is done with CATIA V5. In this paper, the author was done die design calculations for the selection of the advanced tool die and die component material. The below figure shows the developed blank and the finished blank designed in the paper.

