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Die design and analysis of progressive tool for can lid lever

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Abstract

A progressive die performs a series of fundamental sheet-metal operations at two or more stations during each press stroke in order to develop a work piece as the strip stock moves through the die. Each working station performs one or more distinct die operations but strip must move from the first station through each succeeding station to produce a complete part. The linear travel of the strip stock at each press stroke is called the "progression", "advance" or "pitch" and is equal to the infestation distance. The main advantage of computer-aided progressive die design and machining is ability to build precision tooling in less time and at a lower cost.

In this paper main steps are Design and FE analysis. This design of die is of optimal design. By using this design we can produce accurate components. First step is manufacturing process. For manufacturing of can lid lever, manufacturing process are Blanking1, Blanking2 and Bending. In this project complete tools are to be designed, according to American Society of Mechanical Engineers (ASME) standards. Also mathematical correlations also have to be included for die design for die parts. Second step are FE analysis in this process boundary conditions are load on punch and die. The modeling, assembly and drafting is done by using PRO/ENGINEER software. Structural analysis is to done on the die by applying punching force. Analysis is done in Ansys

Keywords: *Design*, *FE analysis* ,*progressive die* .

1. Introduction

A progressive or follow on die has a series of operations. At rtion of the metal in which a hole had been pierced at a previous station. Thus after the first stroke, when only a hole will be punched, each stroke of the press produces a finished washer.

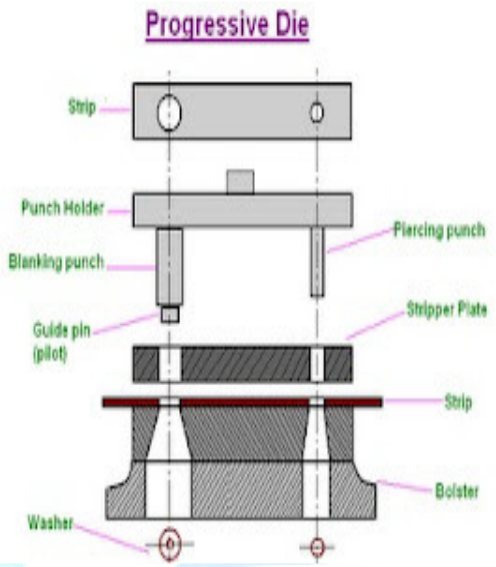

Figure 1.18 Progressive Die

Progressive tool differs from the stage tool by the following aspect, In progressive tool the final component is obtained by progressing the sheet metal or strip in many stages. In each and every stage the component will get its shape stage by stage the full shape will be obtained at the final stage. Progressive dies provide an effective way to convert raw coil stock into a finished product with minimal handling. As material feeds from station to station in the die, it progressively works into a completed part.

Progressive dies usually run from right to left. The part material feeds one progression for each press cycle. Early stations typically perforate holes that serve as pilots to locate the stock strip in later stations
each station, an operation is performed on a work piece during a stroke of the press. Between stroke the piece in the metal strip is transferred to the next station.

A finished work piece is made at each stroke of the press. While the piercing punch cuts a hole in the stroke,

The main objective of the paper is to design and analyze the progressive tool for can led leaver shown in fig2

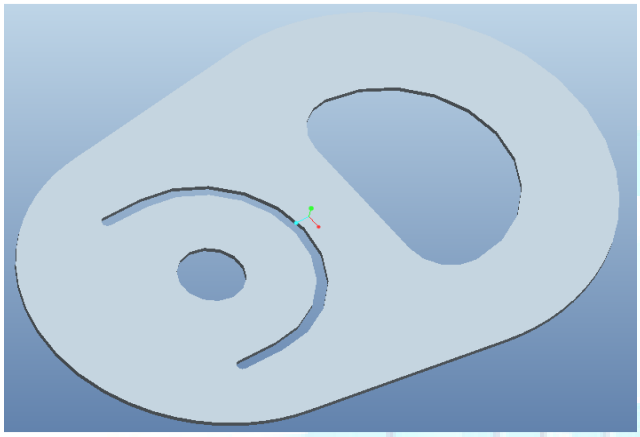

Fig 2 Component Model

3. Design of Die

The EN31B material was choosen for the progressive tool and the design caluculations was done as per the shear force and different sheet metal processes, after completing the design caluculations by using the PRO/E software the tool was designed as shown in fig 3

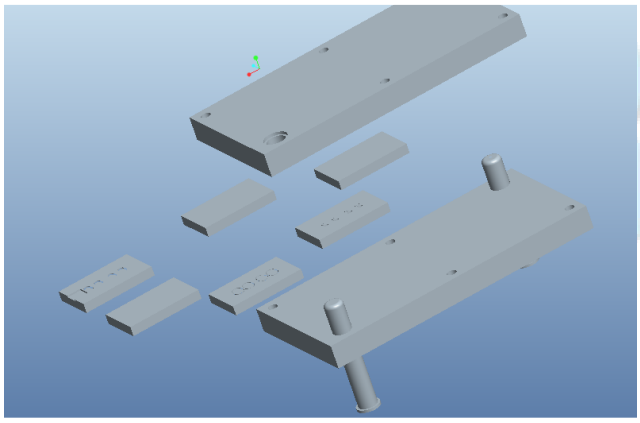

Fig. 3 parts of die

4 Finite element analysis results

Structural analysis was done for different parts of the progressive tool, the structural analysis results were given in the following figs and tables .

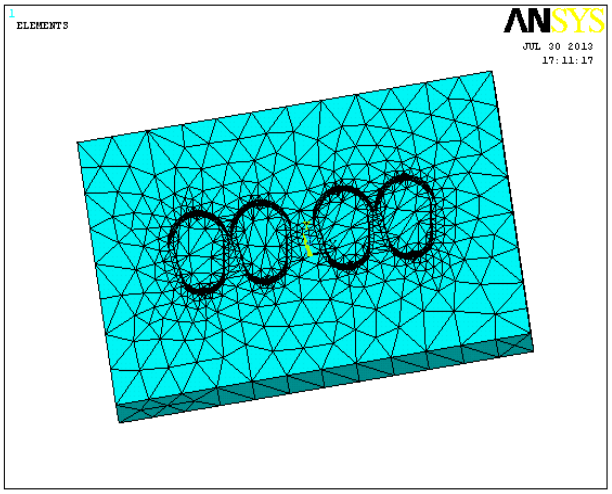

Fig 4 Meshing model of blanking die

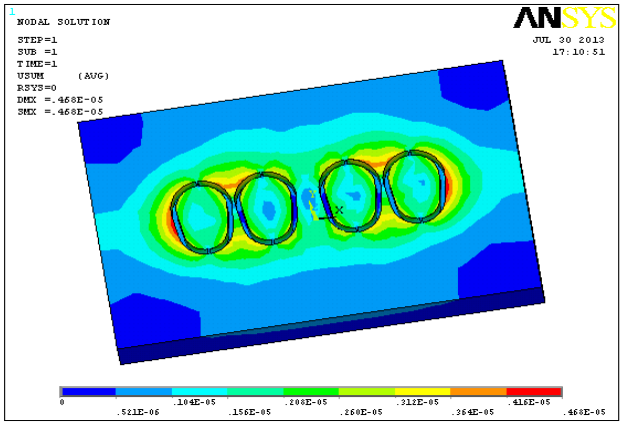

Fig 5 Nodal solution

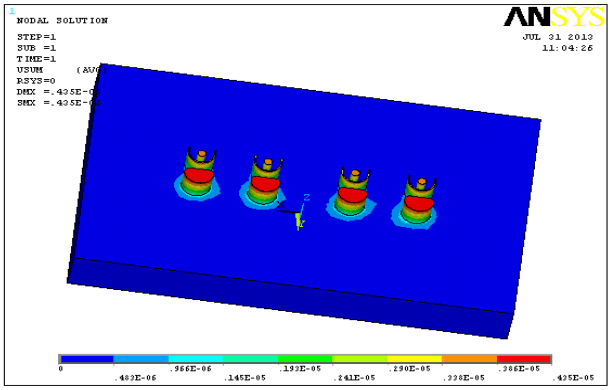

Fig 6 Nodal solutions of blanking punch

Table 1. structural analysis results of parts

	DISPLACEMENT	STRESS	STRAIN
DIE BLOCK	0.416E-05	0.298978	0.194E-05
TOP PLATE	0.384E-05	0.56198	0.392E-06
BOTTOM PLATE	0.141E-05	0.013049	0.921E-07
GUIDE PILLAR	0.010746	25.269	0.172E-03

Table 2 structural analysis results of blanking dies

	DISPLACEMENT	STRESS	STRAIN
BLANKING DIE 1	0.536E-05	0.395467	0.265E-05
BLANKING DIE 2	0.468E-05	0.336354	0.218E-05
BENDING DIE	0.516E-05	0.185979	0.131E-05

Table 3 structural analysis results of punches

	DISPLACEMENT	STRESS	STRAIN
BLANKING DIE 1	0.435E-05	0.228302	0.154E-05
BLANKING DIE 2	0.370E-05	0.121742	0.803E-06
BENDING DIE	0.380E-05	0.137191	0.924E-06

4.Conclusions

The individual components of progressive tool were modeled in Pro-Engineer 5.0. Each individual file was imported to Ansys12.0 software through Initial Graphics Exchange Specification (IGES) format. The following conclusions were made.

1. The results obtained through analysis are approximately nearer to the theoretical values. This demonstrates that the analysis carried out was correct.
2. It is also observed that the design of progressive tool is safe as all the stress values were less than the allowable stress of the material.
3. Progressive dies prepared so far have used stainless steel as the material. But according to this project, the material used is EN31B, which has many advantages and are as follows:
a.EN31B has good corrosion resistance when compared to that of the materials used till now.
b.Since the thickness for EN31B is less than 1mm(0.26mm) it requires less force during blanking and bending operations which in turn saves energy and fuel.
4. Since there is continuous movement of the strip from left to right, all the three operations can be done without any interruption where as in the operations used so far for the manufacture of this component, a separate die should be manufactured for each and every operation. Moreover some man power is required to transfer the strip from one unit to another after completion of a single operation.
5. Since the tin caps require mass production, especially used for domestic purposes, a balance can be maintained easily between consumption and production constantly.
6. Though initial cost is little high, it is very useful for high production.
7. Since the component area is less we are producing two pairs of the products at a time

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