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Press Tool Design for Hand File Manufacturing

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Abstract - *This study is carried out to improve the performance of Press tool and to reduce manufacturing cost of hand file by reducing the scrap or wastage by innovative die design. Conventional hand file are manufactured by sheet metal working and in it die role is predominant. The hand files manufacturing involves different operation and heat treatment processes. The files manufacturing is a mass production activity and reduction in a small wastage resultant into multiply cost saving. For this purpose dies design was chosen and improved.*

Key Words: **Hand File1, Sheet Stamping 2, Scrap Reduction3, Manufacturing Cost4, Die Design5.**

1. INTRODUCTION

A file is a most common hand tool used to remove fine amounts of material from any work-piece. The hand files manufacturing involves different operation and heat treatment processes. The first step in the file-making process is to create a strip of metal that is roughly the right shape and size of the finished file. The strip is called the 'blank. To achieve this result, steel can be forged, melted and poured into a die to set, or pressed between two heavy rollers and then cut to shape[2].

Press tools are used to produce a particular component in large quantity, out of sheet metals where particular component achieved depends upon press tool construction and its configuration [3]. When the requirements of a component exceed 50000 pieces the product engineer should consider the possibility to manufacture by Press Tool [5]. The different types of press tool constructions leads to different operations namely blanking, bending, piercing, forming, drawing, cutting off, parting off, embossing, coining, notching, shaving, lancing, dinking, perforating, trimming, curling etc [1].

2. PRINCIPLE OF METAL CUTTING

The cutting of sheet metal in press work is shearing process. Punch is same shape of the die opening but the gap between the punch and die called as clearance. There is need to provide optimum clearance between punch and die [9]. One clear trend is that optimum clearance decreases as the material elongation increases [6]. Sheet metals are generally related with cutting as well as forming processes. The factors influencing the selection of materials of press tool components are very important [11]. Sheet layout is useful to control wastage and product quantity [10].

The die design plays predominant role for different functionality such as compound die, progressive die, combination die, Inverted die, etc. These die are functioned with their own perspective design criteria like die clearance etc. [7].

3. PROBLEM FORMULATION

The file tool is manufactured by sheet metal press working in mass. In File manufacturing material utilization is critical and important. In file manufacturing in stamping process approx. 40 gram material goes to as waste or scarp for one file as shown in Fig -1**.**

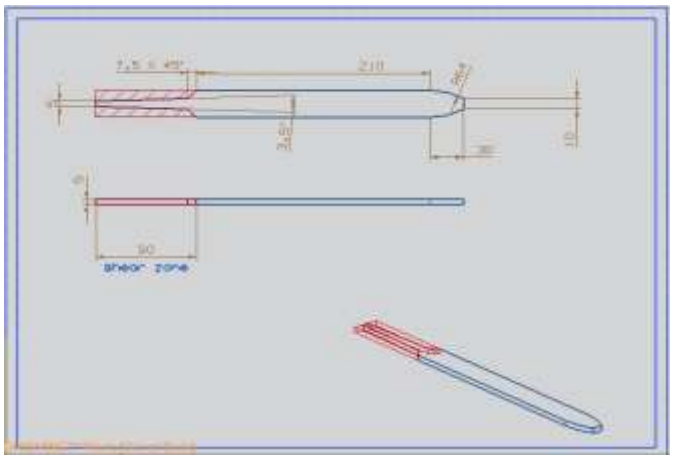

Fig-1. Wastage or scrap in conventional strip layout

The files are manufactured at JK Files (India) Limited, a subsidiary of Raymond Ltd enjoys a leadership position as the world's largest manufacturer of files with a presence in over 100 countries. JK Files has an impressive 32% global and 80% domestic file market share. A 250 mm flate file is considered for study. The easy way to reduce wastage is to change strip layout as shown in Fig-2.

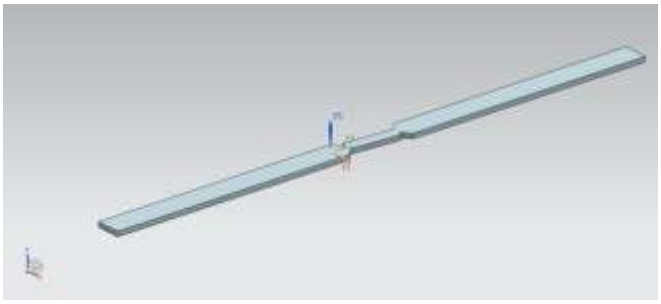

Fig-2 Two files manufactured in new strip layout

If two files are stamped, then bend Tang is the problem that created when strip layout changed to reduce the scrap by approx.33% as shown in Fig-3 & Fig-5. The material used for stamping operation for file was rolled sheet as shown in Fig-4.

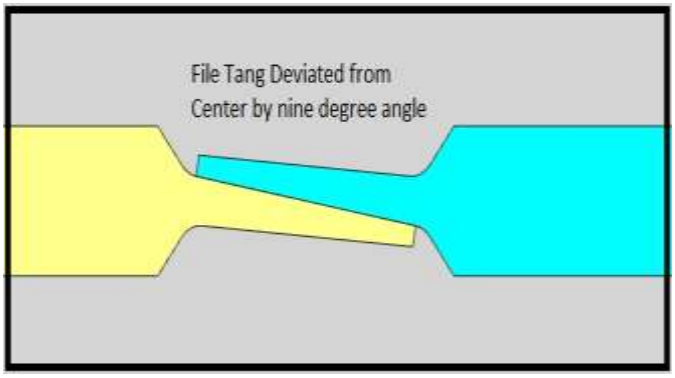

Fig-3 Two files manufactured in new strip layout

Fig-4 Material used in File manufacturing

Fig-5 Files manufactured in new proposed strip layout

4. DATA COLLECTION AND ANALYSIS

Handle is used as fitted on tang portion of any file. A hole is present in centre line of handle. By help of improved design for file handle an off-set in drilled hole position and angle is required in proposed new handle with bend tang. The other option is to straighten the bend tang without losing strength. New fixture is required during drilling of eccentric hole in proposed handle of file. The file manufacturer finally rejects the change in handle design. They preferred to straighten the bend tang as shown in Fig-6.

Fig-6. Straightened bend tang after induction heating

5. IMPROVEMENT NEEDED

The press tool is design according to new strip layout as shown in Fig-6. Optimization of strip layout is required [8].Cycle time for cropping of file is reduced as two file are manufactured in single work-station operation by two stamping operations. Length of stamped piece is doubled because two file stamped simultaneously. Heating of bend tang is require up to red hot, clamped in fixture and then straightened by applying force.

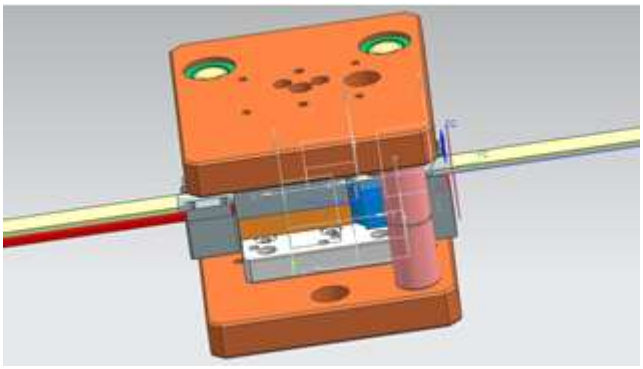

Fig-7.New dies used for proposed stamping operation

6. RESULTS

This study is carried out to improve the performance of Press tool and to reduce manufacturing cost of hand file by reducing the scrap or wastage by new die design. Conventional hand file are manufactured by sheet metal working and different processes and die role is predominant.

For this purpose dies design was improved. The productivity of stamping operation is improved as two file are processes at a time than single one in convention manufacturing as shown in Fig-8.

Fig – 8.Two files manufacturing with proposed set-up

Improvement in material utilization in manufacturing is obtained by reduced scarp and manufacturing cost is reduced approximately Rs5000 per day or Rs 0.10 per file when 480,000 files produced in a day. **Table-1**, indicates comparison of improved file with old conventional file. Two files manufactured in new strip layout. Cycle time for cropping of file is reduced as two file are manufactured in single operation, length of stamped piece is doubled because two file stamped simultaneously.

Table -1: Comparison of Improved file with old Fig-3 Two files manufactured in new strip layout Conventional file

SN	Points	conventional file	Improved file	Remarks
1	Weight of Scrap	40 Grams	17.5 Grams	44% reduction
2	Productivity of Stamping operation	Two files in 3 stamping operation	Two files in 2 stamping operation	Improved (33%)
3	Cycle time for cropping of two file	12 Seconds	08 Seconds	33% reduction
4	Manufacturing defect of Tangs	7-8%	6-7%	12-15% reduction

7. CONCLUSIONS

The proposed improved dies design resulted into two files manufacturing in two stamping operations at single work station as compared to three in conventional. We conclude the following points-

- Productivity improvement of any organization resulted also into profit to organization, customer and society.
- Any change in die design required knowledge of different software, tools and CAD model.
- Improvement is a continuous process ends with zero wastage.
- Any saving in Mass production system resulted into big saving to manufacturer as well as customer.

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