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Redesign of Dies forthe Manufacture of Electrical Terminal

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Abstract:*The Mexican industry related to the manufacture of automobiles, is a very important economic branch in Mexico and is in constant growth. The manufacture of parts produced from sheet metal by dies requires, facing tough competition scenarios, not only in Mexico but in the world. As an example of constant improvement, we present the redesign of tools for the processing of sheet, for the manufacture of an electrical terminal required for the electrical system of automobiles. This paper offerings the proposal to reduce the number of tools used with the reduction of manufacturing time of an automotive part.*C*urrently the piece that is taken as a case study, is manufactured in a small Mexican company, but the necessary to reduce manufacturing time to avoid changing supplier, due to strong international competition.*

Keywords: *Redesign, dies, sheet metal.*

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I. Introduction

The tool and die making industry has contributed to the economic development of several countries, contributing in an important way to their gross domestic product [1, 2].The correct design and manufacture of sheet-processing tools lead to success for the development of competitive products. The design and manufacture of dies until the advent of computer systems, was considered more an art than an applied science; it took many years to acquire the necessary expertise to design efficient die-cutting systems, in particular if progressive die-cutting was required (several die-cutting phases in a single tool), or if different tools were required to obtain the desired part.The electrical contact under study has two versions called left and right contact, as shown in figure

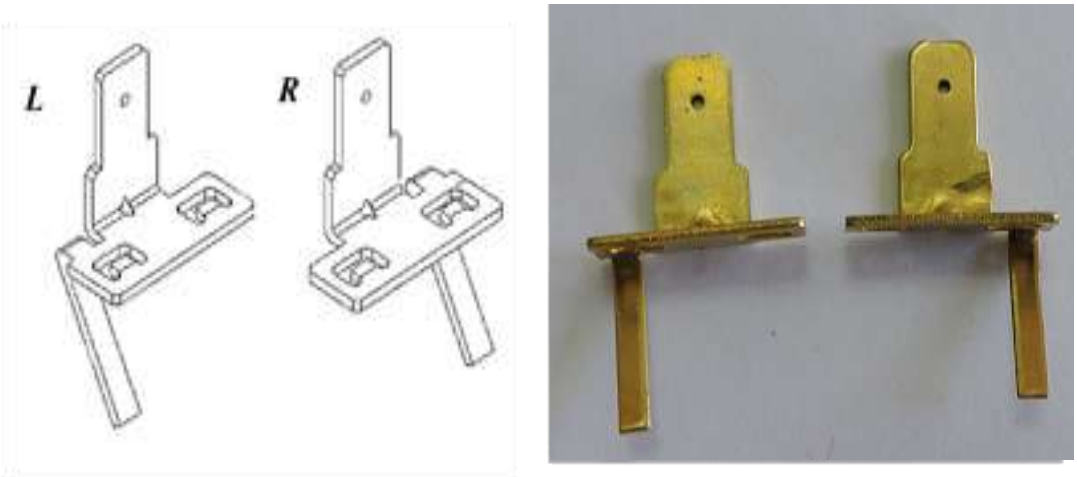


Figure 1. Part obtained by die cutting, left (L) and right (R) forms.

In their article Contact Electric Manufacturing [3] the authors described the forming of a part for the automotive industry, which is manufactured with three dies, that is to say in three different phases, which implies making the change of dies in the same machine or having three presses for each die, both cases represent high costs, which makes the production of the part uncompetitive.The three phases are shown in figure 2, where the three tools and their respective pieces of brass already die cut are shown.

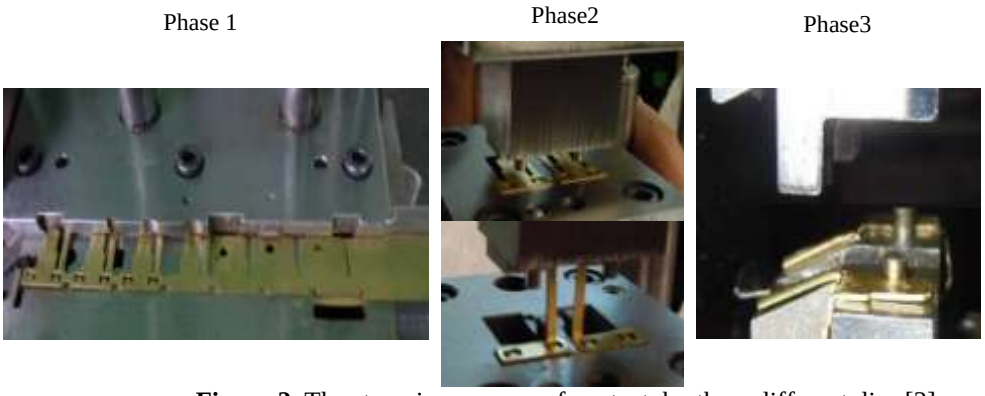


Figure 2. The stamping process of contact, by three different dies [3].

The stamping process of the contact, is by three different dies. The first is a progressive die that conforms the silhouette (flat part), in different phases of punching do form it. The second die performs two bends at 90 ° and the third one gives the requested angles.Despite some experience, the best blade processing systems are not always conceived, so it is necessary to modify the designs or processes, as part of the continuous improvement of products.Companies need to continuously adapt their manufacturing systemsand have to implement numerous engineering changes [4], that requires a systematic and fast method for planning and analyzing. hen a part is manufactured with different tools, as in our case, it is necessary to change the three dies in the same punch press, or to have several presses to assemble each die in one of them. This requires a lot of infrastructure that micro-enterprises in Mexico usually do not have. In case of using a press, the dies must be assembled and dismantled. In addition, the placement of the pieces in the dies 2nd and 3rd are done manually, which is time consuming and is not safe for the operator.In progressive dies, bends at 90 ° is relatively straightforward, which invites you to think of reducing the number of dies from three to two, but would require a redesign of the progressive die. Depending on the result of the analysis decide that the existing die can be modified and a totally new one will be required.

In mechanical engineering and manufacturing, re-engineering consists [5] in the use for new materials, up to date standards, modern manufacturing and CAD methods can favor the choice to improve the design; and re-design is a completely or to replace the original part. the phases for re-engineering are shown in figure 3.

Figure 3. Phases of re-engineering process.

When a part is manufactured with different tools, as in our case, it is necessary to change the three dies in the same punch press, or to have several presses to assemble each die in one of them. This requires a lot of infrastructure, which micro-enterprises in Mexico usually do not have. In case of using a press, the dies must be assembled and dismantled. In addition, the placement of the pieces in the dies 2nd and 3rd are done manually, which is time consuming and is not safe for the operator.

II. Analysis

Analysis of the stamping processes. - the stamping processes required for the manufacture of the part are punching and bending.

2.1 Actual process. - all punching is carried out in the progressive die (Phase 1)and the bends in two dies (Phase 2 and 3), as shown in figure 2.For both bending tools, the pieces obtained from the progressive die are placed manually, which requires the quadruple of time required to obtain a piece of the first die. Of course, the productivity of the part is not convenient which raises its cost considerably. For the aforementioned it is convenient to analyze ways of reducing die-cutting times, to reduce the number of tools, but with the smallest possible investment.

Weighting of changes. - The cost of the product increases due to the time required to place the pieces in the tools of phases 2 and 3; they are also risky procedures for the worker.As you can see in figure 4.

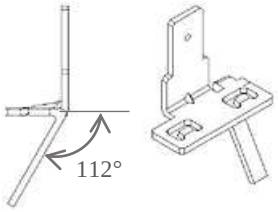


Figure 4. Side and isometric view of the piece.

In progressive dies, bends at 90 ° is relatively straightforward but more than 90 ° is not so simple due to the vertical rectilinear movement of the press, which invites us to think of reducing the number of dies from three to two, but would require a redesign of the progressive die. Depending on the result of the analysis decide that the existing die can be modified and a totally new one will be required.

Re-design. - It would be very convenient to be able to manufacture the piece with only one tool, but in the planting, that is being analyzed it is not possible given the folds that the piece requires. So, the redesign will focus on reducing the number of tools.Farsi y Arezoo [6],establishes a series of recommendations to select the most appropriate sequence of bends of a stamped piece of which an adaptation is presented in the figure 5.

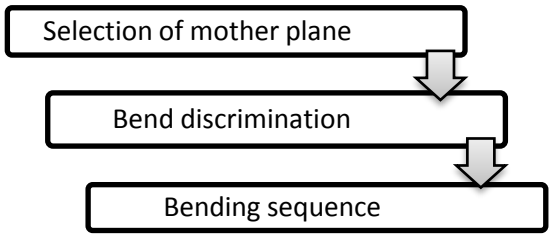


Figure 5. Phases for the selection of bends sequence. Adapted from Farci,Arezoo.

Figure 6 shows views of the piece, in which the selection of the mother plane is shown, which is the one that should be held to make the bends. Then, the two bends are made in opposite directions of rotation

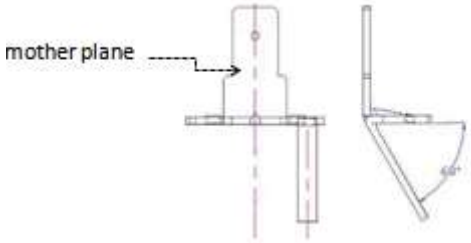


Figure 6. Phases for the selection

Figure 7 shows the metal strip with the processes of die-cutting and bending that is proposed as an alternative to redesign, which unlike the strip shown in figure 2 of stage one already includes thesequence of bends for right cut.

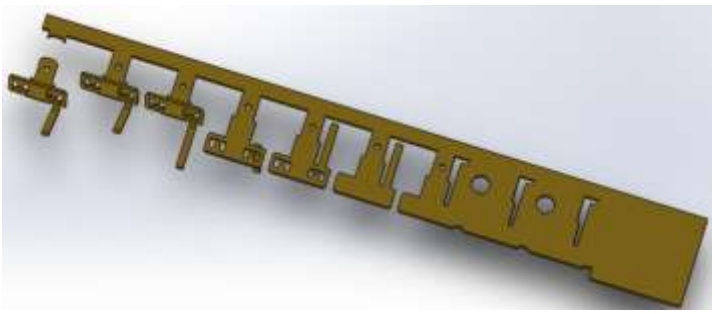


Figure 7. Template for right cut

Figure 8 shows the metal strip with the processes of die-cutting and bending that is proposed as an alternative to redesign, which unlike the strip shown in figure 2 of stage one already includes thesequence of bends for left cut.

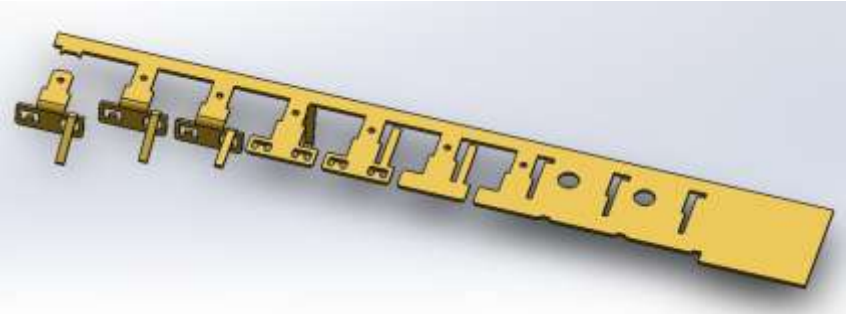
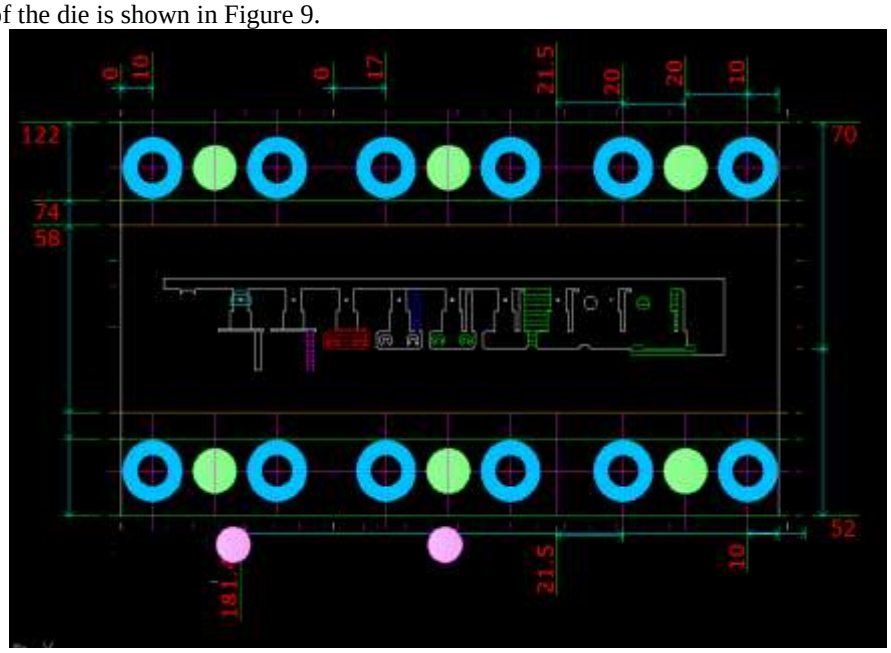
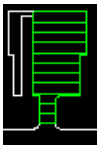
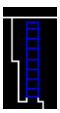
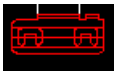
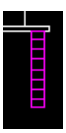


Figure 8. Template for left cut

The redesign of the die is shown in Figure 9.



Process	Symbol
Punch	
90 ° bend up	
90 ° bend down	
Bend 22° down	
punching for separation	

III. Conclusion

It is possible to manufacture the piece in a single progressive die,but the cost of the tool increases considerably. In addition, the maintenance of dies with several bends is usually complicated.

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