NON-STANDARD TOOL DESIGNS OF STAMPING DIE

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ABSTRACT

Usually the preliminary band design needs to be modified to make it technologically feasible. These modifications are influenced by multiple aspects that do not affect the order of the sequence of operations obtained. That is, the order is preserved but the number of stages varies.

Keywords. *Belt design, side flange bending, stamping die.*

АННОТАЦИЯ

Обычно предварительную конструкцию ленты необходимо модифицировать, чтобы сделать ее технологически осуществимой. На эти модификации влияют несколько аспектов, которые не влияют на порядок получаемой последовательности операций. То есть порядок сохраняется, но количество этапов меняется.

Ключевые слова. *Конструкция ремня, боковой изгиб фланца, штамповочный штамп.*

INTRODUCTION

The main factors that induce to modify the design are the following:

- Inclusion of holes that serve as a guide for search engines. This is an operation that is carried out in order to position and fix the band.
- Inclusion of free stages that are mainly introduced:

1. To free up or clear space on the die plates to ensure there is no interference between tools operating in that area.
2. To balance the moments that are generated in the die and avoid deviations during the manufacturing process.

DISCUSSION AND RESULTS

The design of the band that corresponds to the sequence of operations in figure 1 is shown in figure 1, in which a blank or empty stage has been introduced after the 2nd in order to visualize the different stages that make up the band design.

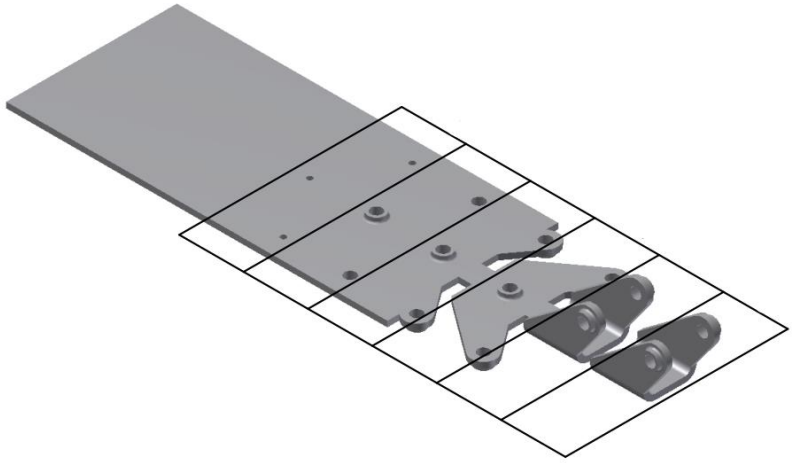

Figure 1: Belt design (preliminary) according to the stages of figure 1.

Figure 2 shows the final web design after applying the above criteria.

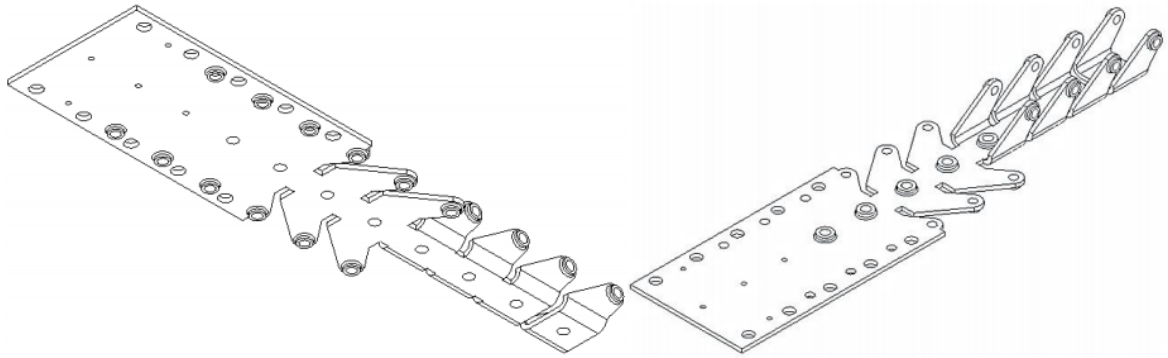

Figure 2: Belt design optimization.

By applying these conditions, the initial 5 stages have been passed to 10, making the die design viable. The modifications introduced are:

1. Punching of the holes of the finders. This operation is prior to the rest of the operations. In this case, it has been introduced in the initial stage together with the holes prior to the flare, since the precision required in the latter is not very strict.
2. Separation of the flaring. In the second stage, the lateral flaring is carried out while the central flaring is carried out in the fourth stage.
3. Third stage free between the two flaring operations, since they have the opposite direction and it is necessary to avoid overlapping of the tools.
4. Fourth stage. Central flare.
5. Free fifth stage to avoid tool overlap.
6. Sixth stage. The side tabs or lugs are punched out.
7. Seventh stage. Free stage, in this case due to the space that must be left in the die to be able to place the bending tools.
8. Eighth stage. Side flange bending.

9. Ninth stage. Side flange calibration. In this way, it is possible to avoid the elastic recoil that occurs in the eyelashes once they are bent.

10. Tenth stage. It is the final stage, in which the finished piece is separated from the band.

It is observed that, although the number of final stages is considerably higher than the initial one, the order in which the operations are carried out is the same as that obtained through the methodology developed, with the only one being the separation into two stages of the operations of flared.

Non-standard tool designs

Once the band design has been carried out, the die is designed, that is, the tool plates and other tools. To do this, the first step is to develop the necessary tools to execute the operations that have been defined in the previous steps, which are the following:

1. Punches to make the holes. They are standard tools, so they will be chosen by catalog or available databases.

2. Punches for the flaring operation. Like the previous ones, they are standardized, then we proceed in the same way.

3. Cutting tool for shaping the side tabs. In this case, the cutting punch is not standardized since it has to adapt to various geometric shapes, so the tool that adapts to said operation has to be designed. For its design, the methodology developed above is applied.

4. Tool for bending and calibrating the flanges. Both operations are carried out in consecutive stages, so the same tool is designed for both.

5. Final cutting tool for the piece. This is the final operation in which the part is separated from the belt. Depending on its dimensions, this tool may or may not be commercial. In the event that it is not, proceed as in the tools that shape the eyelashes.

Side flange cutting tool.

To design the cutting tools that shape the side flanges, the procedure developed here is followed. For them, the initial band design is used, without modifying, since the final band is identical to the previous one but with a wider distribution of the work operations.

The phases of this procedure proposed here are the following:

- Phase 1. The developed part is projected onto the band design as many times as there are stages in the die (figure 3).

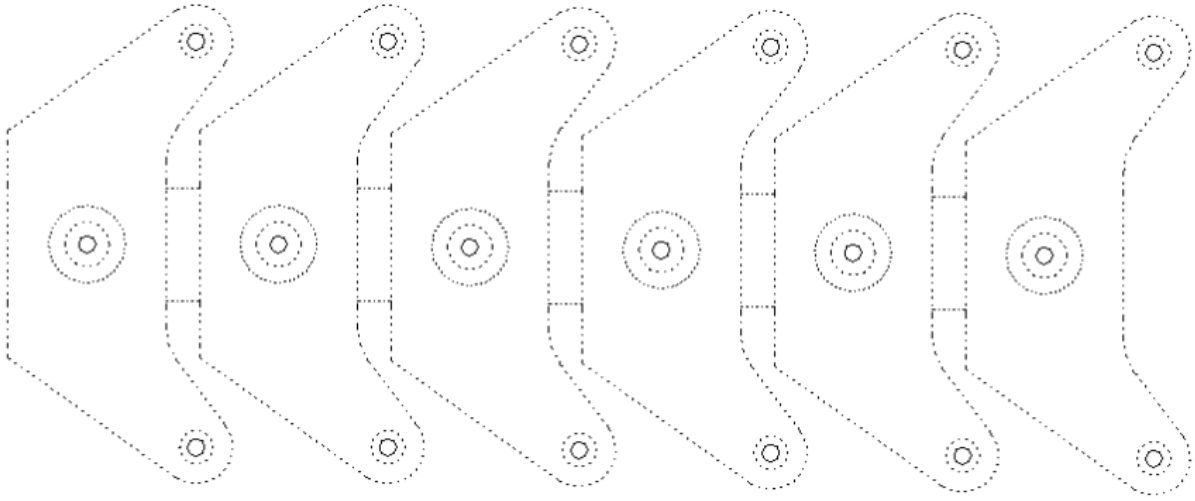

Figure 3: Band division.

- Phase 2. In the third stage, where the cut that generates the eyelashes takes place, the area affected by the cut is delimited in order to obtain the profile of the appropriate tool. Figure 4 shows the profile that said tool must have, as well as the corresponding cutting matrix.

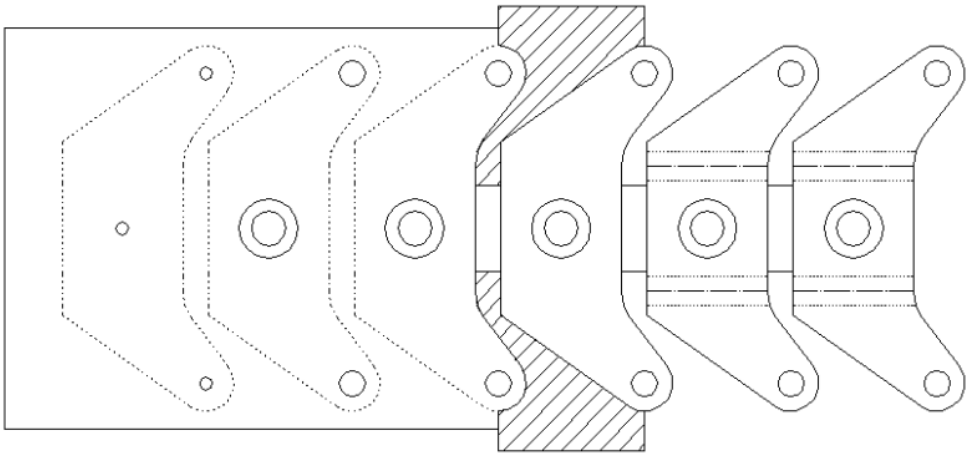

Figure 4: Obtaining the tool profile.

- Phase 3. Design of the tool (figures 5, 6 and 7). From the profile obtained, the tool and its matrix are designed to fit the die. The tools obtained are the following.

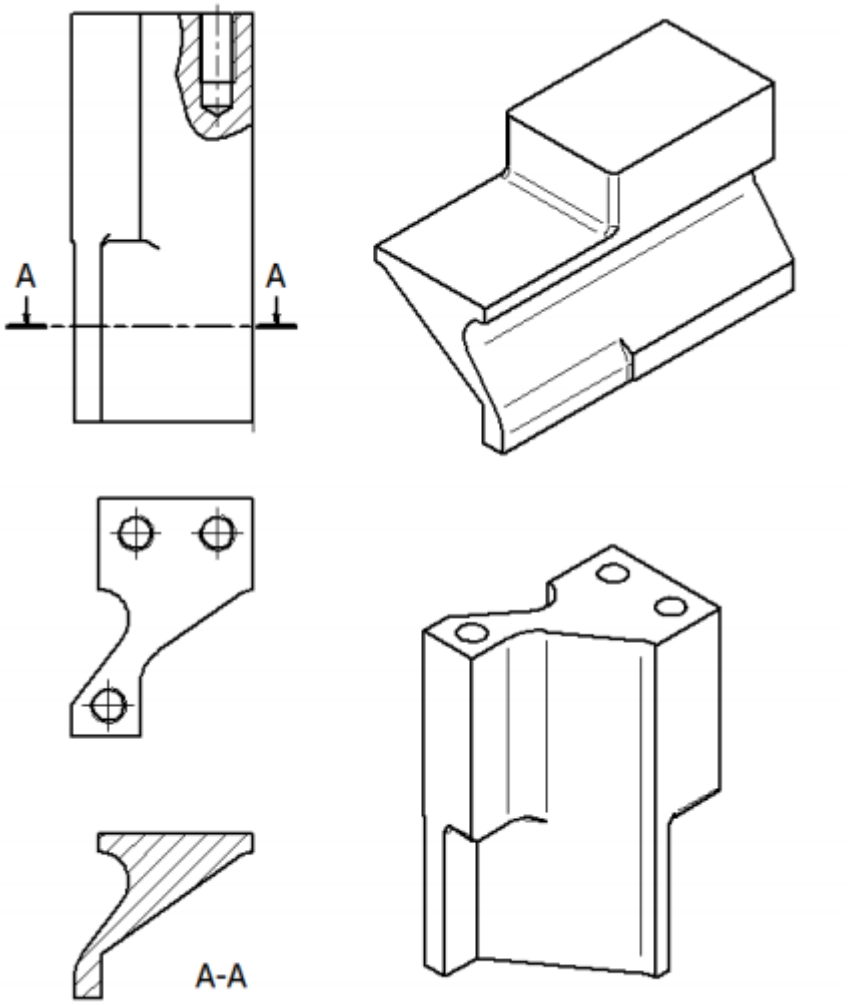

Figure 5: Cutting tool.

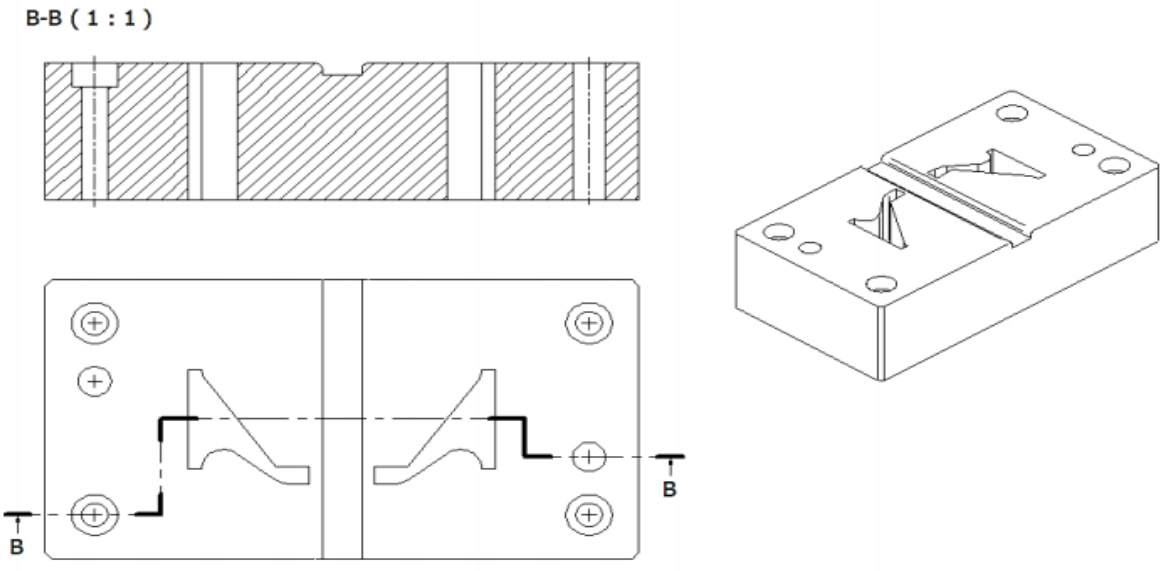

Figure 6: Die cutting tool.

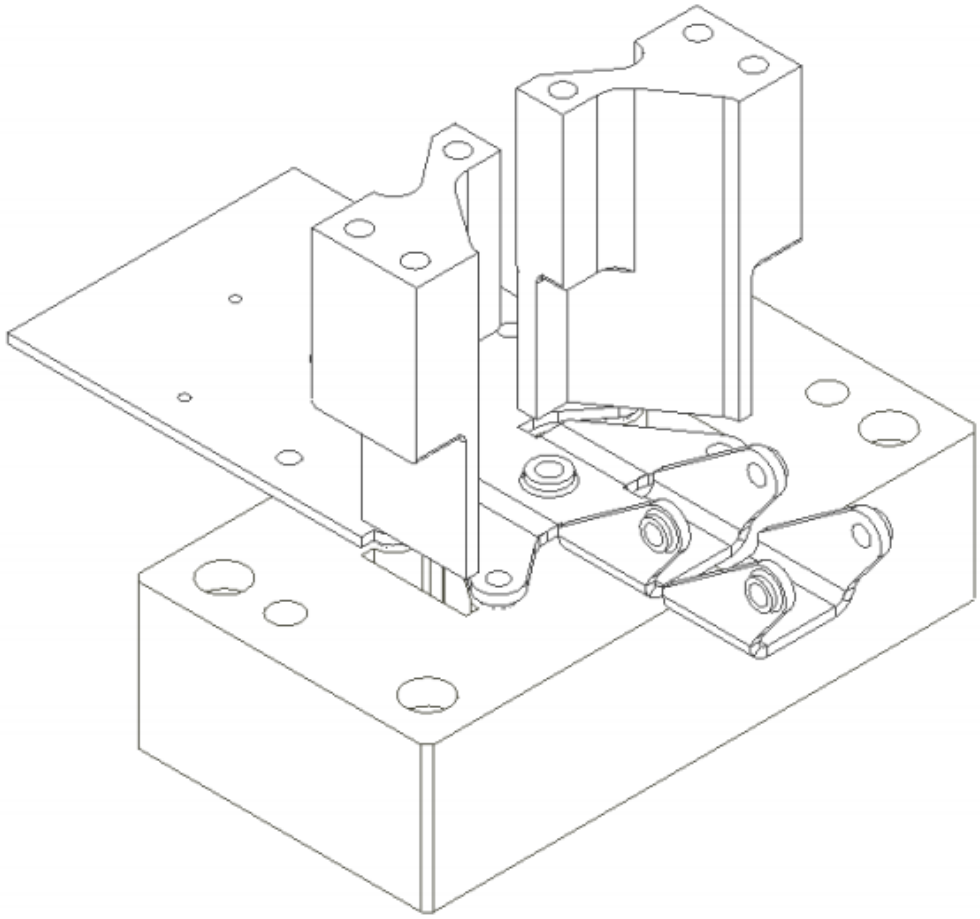

Figure 7: Cutting tool-band assembly.

In order to show the complete design of the die, once the methodologies and processes that have been developed and structured have been applied, it is carried out in the case that the design of the different constructive elements of the same is being exposed in order to appreciate the viability of the proposals made in this thesis.

CONCLUSION

The structure of a die is composed of the lower part and the upper part. In the case under study, the different designed or chosen plates that make up the two parts of the die are analyzed, as well as some of the unique elements present in the design.

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