

MOULDS WITH INTERCHANGEABLE CAVITIES FOR THE FORMING OF THE FOOTWEAR PREFABRICATED SOLES

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Keywords: footwear, mould with interchangeable cavities, sole

Abstract: The footwear prefabricated soles are formed in moulds with unique cavities. For each sole model, it must manufacture one set of moulds which must have minimum one piece for each size number. The large diversity of soles models enforces the sets of moulds manufacturing in a large number, too. The more complex the soles are, the bigger the costs of the moulds manufacturing are. The paper presents some solutions for the manufacturing of the moulds with changeable cavities, which allow the realizing of more soles models by some modules interchangeability.

1. INTRODUCTION

All over the world, for the manufacturing of the footwear soles, there are realized moulds for each model of sole and for all numbers of sizes. The present technologies used for the manufacturing of the prefabricated soles may be: technologies for the rubber mixtures, technologies of forming by injection, in a fluid state, of the thermoplastic polymers mixtures and forming technologies of the polymers mixtures used for the polyurethanes obtaining. All these technologies use the spatial forming of the soles in close moulds whose cavities have shapes and dimensions conjugated with those of the soles. When a sole model of a sizes series is realized, about 16 moulds are necessary. Another model of sole needs the entire designing and manufacturing of another set of moulds. So, a large diversity of soles requires the fabrication of a moulds sets number equal to the soles models number. These devices, because of their complexity and high level of fabrication, need long period of fabrication times with high costs. Therefore, it determines the soles costs and, in the end, the footwear products costs. In the case of the most important soles manufacturers, which use the moulds till their physical wear, the costs for the new moulds fabrication may be redeemed without an essential influence to the soles costs. In the case of the small soles manufacturers, the moulds present obsolescence a long time before of their physical wear. When both the two kinds of soles producers are, in the same time, with the same products, on the market, of course, the great producers will dominate the market because of their soles lower costs. On the other side, the great manufacturers can't produce all the necessary footwear soles and, mostly, they can't satisfy all the fashion tendencies. It was often proved that the smaller producers are more flexible at the new fashion tendencies and at some certain requirements of the market at the time.

The paper presents some solutions for more shapes of the cavities obtaining in the same mould by some modules interchangeability. Assuming these solutions, the authors wanted to obtain smaller times and manufacturing costs for the fabrication of some new soles models and a better efficiency in all the moulds usage.

2. SOLUTIONS FOR THE FORMING OF SOME INTERCHANGEABLE CAVITIES

The moulds with unique cavities, used for the manufacturing of the prefabricated soles, usually have a moulding board (a sole plate), a cover plate and a die bed. Closing the moulding board and the cover plate, the cavities will be generated.

In the case of the moulds with interchangeable cavities, the mould has the construction presented in Fig.1. This kind of mould [1,2] has the following component parts: a moulding board, a cover plate, a die bed and a series of modules.

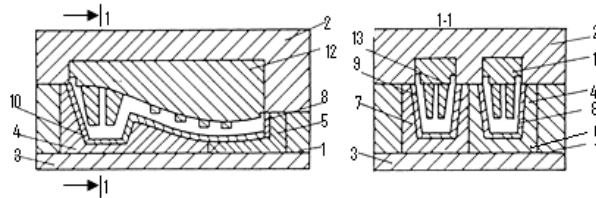


Figure 1. Structure of the mould with interchangeable cavity for prefabricated soles:
1-moulding board; 2-cover plate; 3-die bed; 4,5,6,7-cavity forming modules; 8,9-modules of the sole lateral surface; 10, 11-modules of the sole non-slip relief; 12, 13-modules of the holes made for a easier sole

The moulding board, the cover plate and the die bed have the same dimensions, whatever the sole model obtained in the mould cavity would be. So, these parts will be reused till their physical wear. The modules are partial or total replaced, in function of the new soles modifications. Some of the partial modifications are: the variety of the non-slip relief and/or of the model of the sole lateral surface; in this case, it will be remodeled only modules 8,9,10, 11; diversification of the sole shape only in the heel area; in this case, it will be remodeled only modules 5,7,8,9,10,11. When, in the new soles models, it will keep the same relief holes and the same mould stock, the modules 12 and 13 are not changed. When the soles models are essential changed, the modules will be integral remodeled.

Fig.2 represents a section through the work drawing of one mould; it can better see the modules which compose the cavity. [1,2].

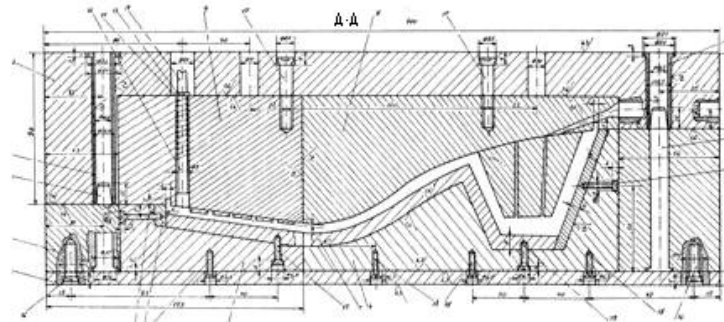


Figure 2. Work drawing of one mould with interchangeable cavity, in detail

Such of a mould structure allows the diversification of the soles models made for the same shoe last model. So, in the case of the moulds with interchangeable cavities, it is necessary to made minimum one set of moulds for each shoe-last model, for all sizes numbers of the series.

3. EXPERIMENT

There were made moulds with interchangeable cavities and the soles were injected [3,4]. Fig.3 represents a simplified mould, with one single cavity in which, one single sole is formed and Fig.4 represents moulds with two cavities used for one pair of soles manufacturing. The moulding boards and the cover plates of the moulds don't change the dimensions when the sole model is changed. They have holes for the assembling of the modules which will generate the shape and the volume of the cavities. The die bed is used for the fixing of the modules in the moulding board and of the mould on the equipment. Fig.

3 represents a mould with one single cavity. The soles models manufactured in this mould were diversified by the heel shape, the soles thickness, the model of the sole lateral surface, the model of the non-slip relief. In this case, the modules which have determined the cavities have had the entire soles models.

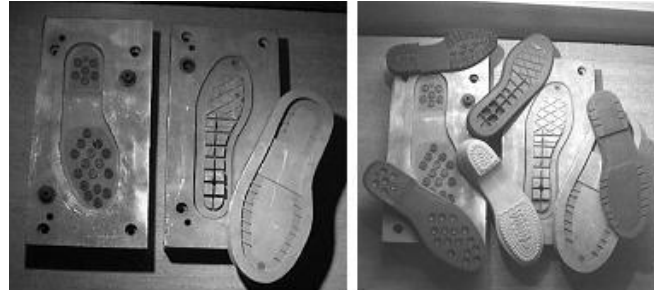


Figure 3. Moulds with interchangeable cavity with one cavity

Fig.4 presents the moulds used for one pair of soles manufacturing; here it was used a bigger number of modules. It can see modules which determine the shape and the volume of the cavities, modules which determine the models of the soles lateral surfaces, modules which determine the non-slip relief of the soles, modules which determine soles relief holes.



Figure 4. Moulds with interchangeable cavity with two cavities

It can observe that, in the assembling holes of the moulding board, it can fix a non-finite number of modules diversified by the cavity shape. It also can observe that, using the same shapes of the cavities, it can obtain a non-finite number of soles models using modules for the diversified of the soles lateral surfaces and non-slip relief.

4. RESULTS AND DISCUSSIONS

The experimentation of the moulds, designed to allow many soles models manufacturing by some models interchangeability, shows the following aspects:

- As a consequence of their structure, these moulds allow the non-finite diversification of the soles models;
- The modules assembling and disassembling is easy to make, keeping their quality, in the same time;
- Keeping the initial shape and volume of the soles, it can realize non-finite diversifications of the models by the diversification of the soles lateral surfaces and non-slip relief. These diversifications are made with minimum costs because they need the

remodeling of a small modules number;

- The relief holes are used to make the soles to be easier and they don't represent a diversification factor of the soles models. This is the reason because it can use the same modules for a bigger number of soles models;

- From the qualitative point of view, the soles which were manufactured in moulds with interchangeable cavities are similarly with the soles manufactured in moulds with unique cavities;

- The moulds with interchangeable cavities are realized using the same technology as that used for the moulds with unique cavities; they work with the same technological parameters, they are fixed on the same equipment and they may be used in parallel with the classic moulds;

- The manufacturing times and costs of some moulds with interchangeable cavities may be diminished from 20% to 80 %, in comparison with the entire manufacturing of some moulds with unique cavities. The lesser modules are remodeled, the smaller the manufacturing costs of the moulds are. The economy is more evident when the entire set of moulds is manufactured. This means that new soles with smaller costs can appear on the market more quickly;

- The efficiency of the moulds with interchangeable cavities using can be shown by other factors, too, such as: the decreasing of the materials consumptions, the decreasing of the energy consumptions, the reduction of the necessary labour, the reduction of the costs; the increasing of the profit etc.

5. CONCLUSIONS

- The moulds with interchangeable cavities have the same functional characteristics with those of the moulds with unique cavities; they are made for the same equipments and they can be used independent or in parallel with the moulds with unique cavities;

- The moulds with interchangeable cavities allow the fabrication of some new soles models, in a shorter time and with lower costs. Realizing a small number of moulds with changeable cavities, even one piece, it can obtain soles with different models and from different polymeric materials, to make research on new polymeric mixtures or to prospect the market;

- The moulds with changeable cavities may be used for the manufacturing of many soles models till their physical wear; so, the losses caused by the obsolescence are eliminated;

- The introduction of some moulds with changeable cavities in the soles manufacturing process, themselves or in parallel with the usual moulds, gives new perspectives in the field.

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