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THE EJECTION SYSTEM MODIFICATION OF THE INJECTION MOLD OF THE BODY OF "FLIP-FLAP" BASKET

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Key words: injection mold, pneumatic ejector, cadence.

Abstract. In this paper the results of the experimental researches regarding to the ejection system modification for the injection mold of the body of „Flip-Flap" basket are presented.

1. INTRODUCTION

The "Flip-Flap" basket is a product manufactured by S.C. Plastor S.A. Oradea. It is made of the body (fig.2), the fixed cap and the fold cap. The body of „Flip-Flap" basket is an injected tapered part with thin walls. The research focused on the injection mold of the body basket.

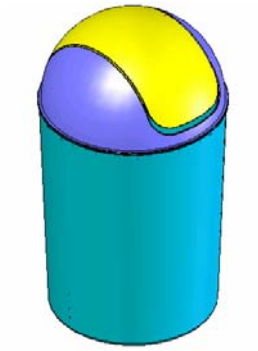

Fig.1 Flip-Flap basket

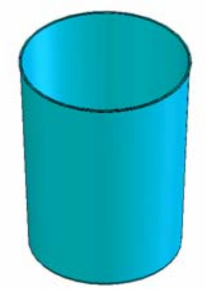

Fig.2 Body basket

2. THE MOLD DESIGN

The mold (fig.3) contains two half-molds, the fixed part and the mobile part.

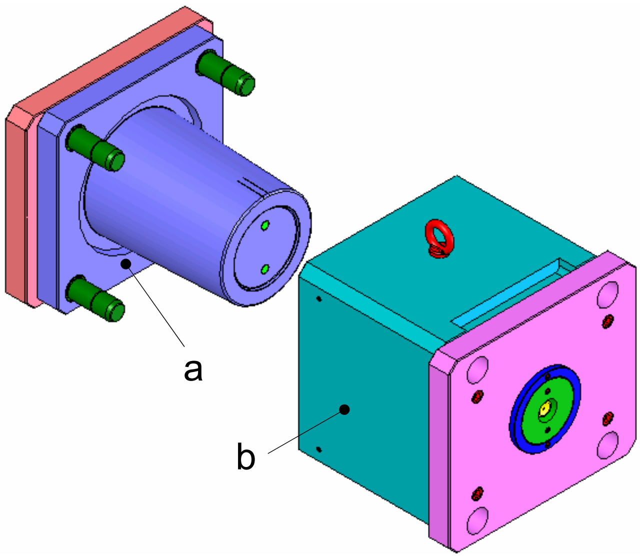

Fig.3 The injection mold of the body basket (initial variant)
a – The mobile part of the mold; **b** – The fixed part of the mold.

The part is formed in the cavity between the cavity and the core. The injection of plastic material is made through a nozzle with direct injection (fig.4, pos.6).

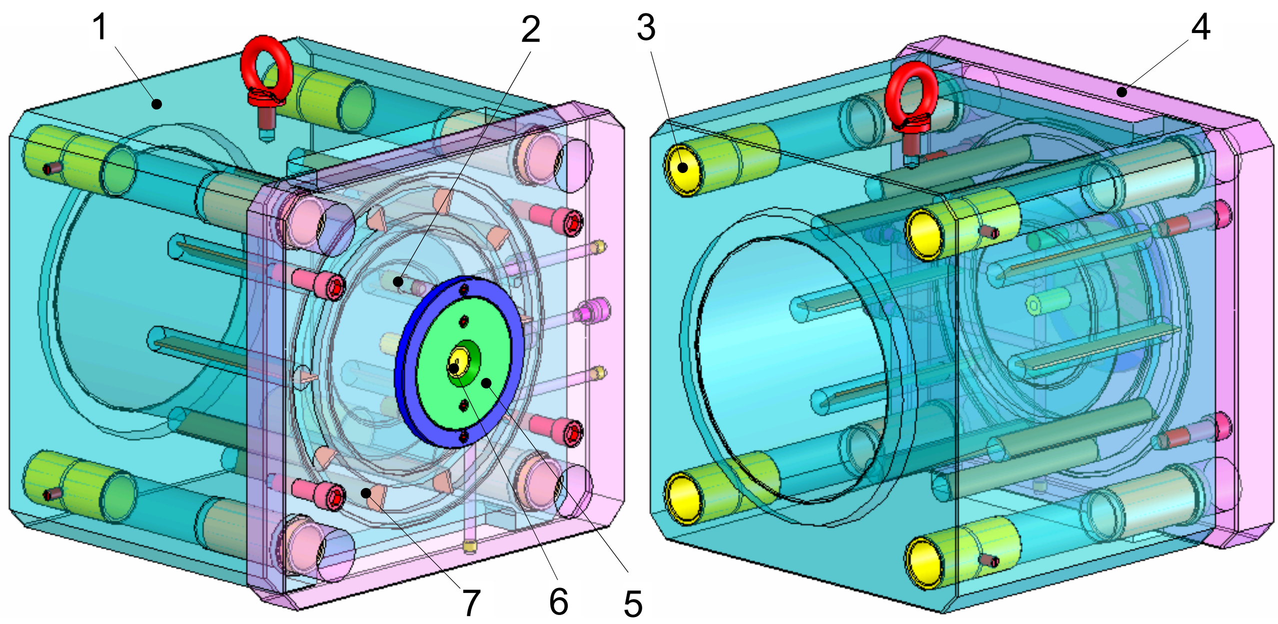

Fig.4 The fixed part of the body of „Flip-Flap" basket mold
1 - cavity; **2** - air valve ; **3** - leader pin bushing; **4** - nest plate; **5** - locating ring; **6** - nozzle; **7** - cooling system.

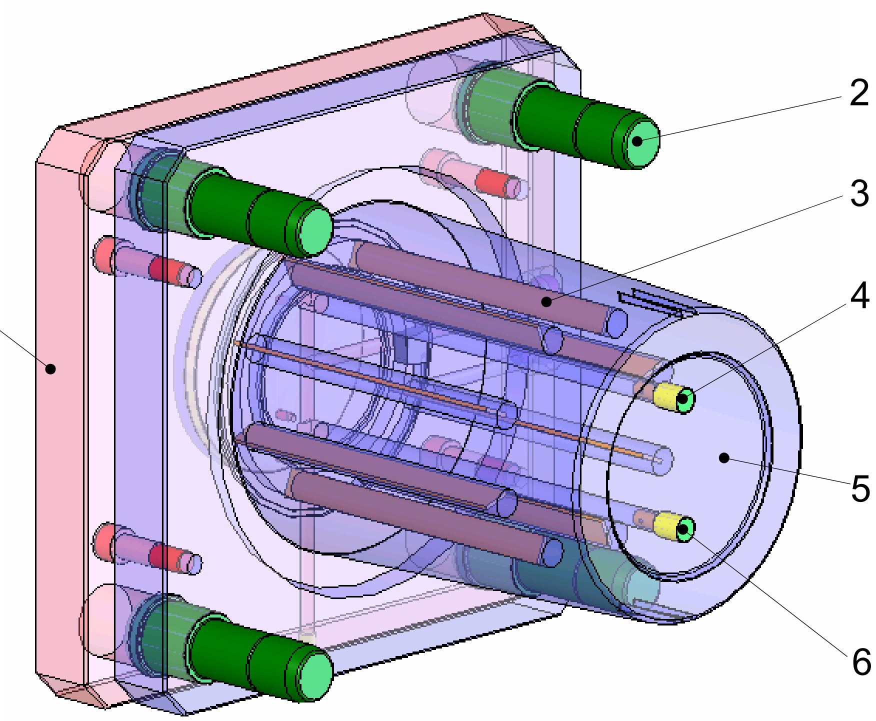

Fig.5 The mobile part of the body of „Flip-Flap" basket mold (initial variant)
1 - core plate; **2** - leader pin; **3** - cooling system; **4, 6** - air valves; **5** - core.

The fitting of the two half-molds is realized by a conic area and the guidance is performed through four leader pins and a leader pin bushing.

The water is used in order to cool down the mold. The cooling circuits contain canals with linked in series, both for fixed and mobile part of the mold.

The ejection system (fig.6) encompasses four air valves: two in the fixed part and two in the mobile parte of mold. When the mold is open the air valves from the nest are acted so that the part remains on the core. At the end of open stroke the two air valves from the mobile mold part are acted and the part comes off from core but it is not removed from the mold. For this reason we call this cycle a semi-automatic one.

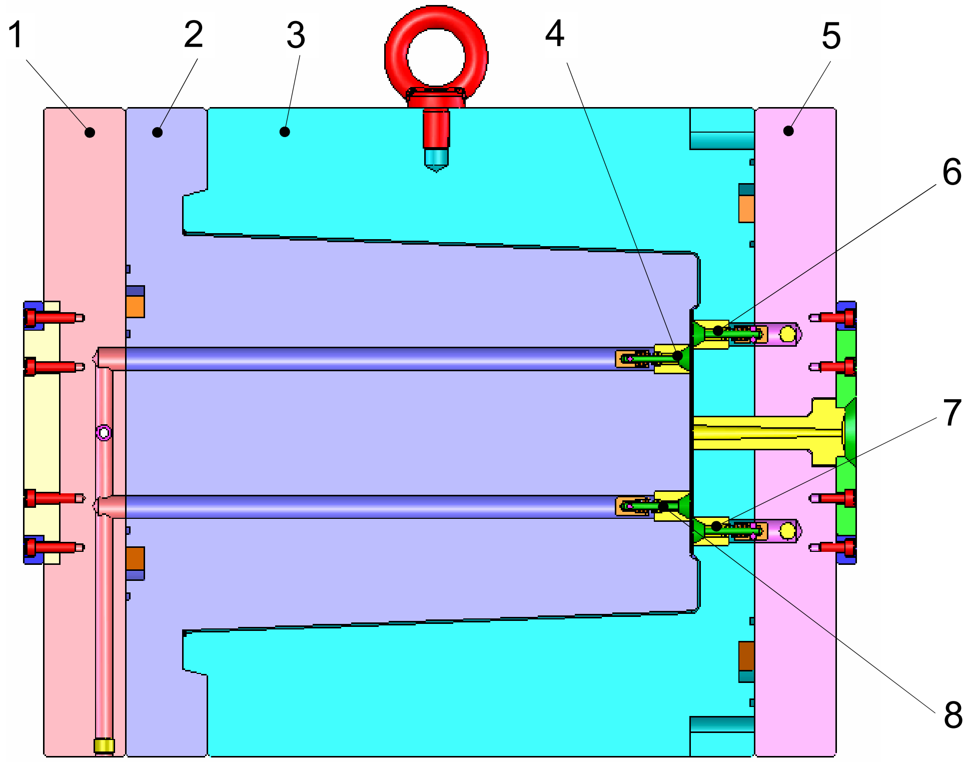

Fig.6 The ejection system of the body of „Flip-Flap" basket mold (initial variant)
1 - core plate; **2** - core; **3** - nest; **4, 6, 7, 8** - air valves; **5** - nest plate.

3. EXPERIMENTAL DETERMINATION OF CADENCE

The place of researches was S.C. Plastor S.A. Oradea, First Division, in the frame of the manufacturing process of the „Flip-Flap" basket.

For this mold (initial variant) it was measured the total time of an injection cycle $\mathbf{t_{ci} = 53.7\ s}$.

In this case the cadence will be:

$$f_i = \frac{1}{t_{ci}} = 0.018622\ \text{s}^{-1}$$

And the productivity will be:

$$P_i = f_i \cdot 3600 = 67.04\ \text{parts/hour}$$

4. THE MODIFICATION OF EJECTION SYSTEM

The ejection system was re-designed. A pneumatic ejector with double acting was mounted. The pneumatic ejector was optimal designed with the Genetic Algorithms method. The most important characteristics of pneumatic ejector are presented in table 1 and the 3D model is shown in figure 7.

Table 1 ***The optimal pneumatic ejector for the „Flip-Flap" basket mold*** [mm]

Pipe		O-ring I		O-ring II		O-ring III		O-ring IV		O-ring V	
d_c	h_c	d	$d_{Oring\ 1}$	D	$d_{Oring\ 2}$	D	$d_{Oring\ 3}$	d_{d2}	$d_{Oring\ 4}$	d_{d1}	$d_{Oring\ 5}$
30	1.5	15	2.65	27	3.55	27	2.65	33	2.65	35	2.65
		Denotation		**Denotation**		**Denotation**		**Denotation**		**Denotation**	
		26501500		35502000		26502240		26502800		26503000	
Number of the ejectors						**Volume of the ejectors**					
1						413310 mm^3					

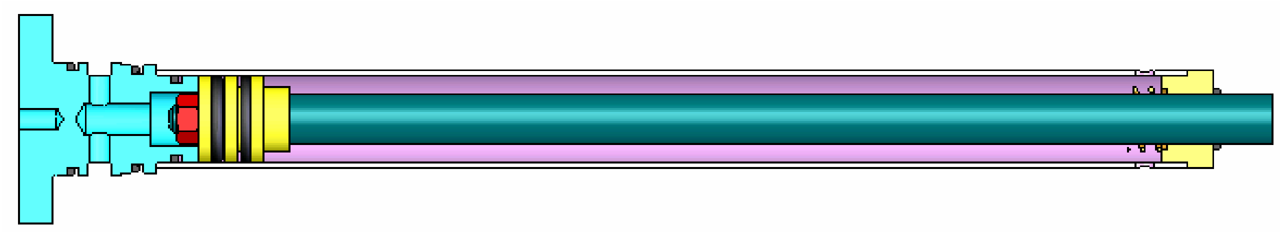

Fig.7 3D Model for pneumatic ejector

The mobile part of mold was modified (fig.8) by adding of an ejector. The position of the ejector in the mold is presented in figure 9.

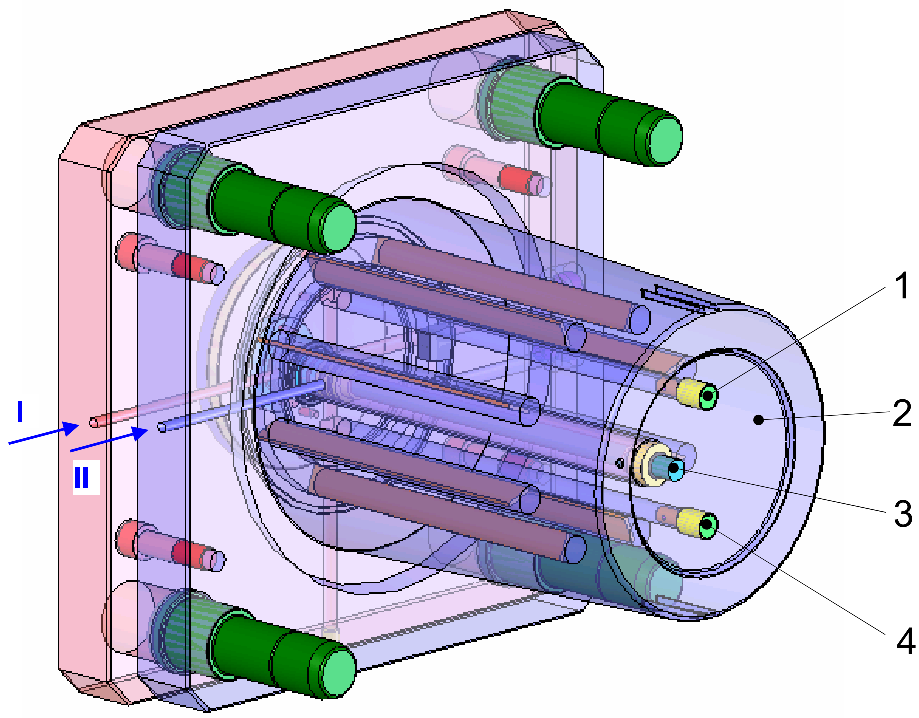

Fig.8 The mobile part of the body of „Flip-Flap" basket mold (modified variant)
1, 4 - air valves; **2** - core; **3** - pneumatic ejector.
I – air for ejecting course; **II –** air for backing course

At the end of open stroke of the mold the air which comes in through the injection valves burst forth from core and the pneumatic ejector accomplish the removal of the part. For this reason, the mold with pneumatic ejection system will work in automatic cycle.

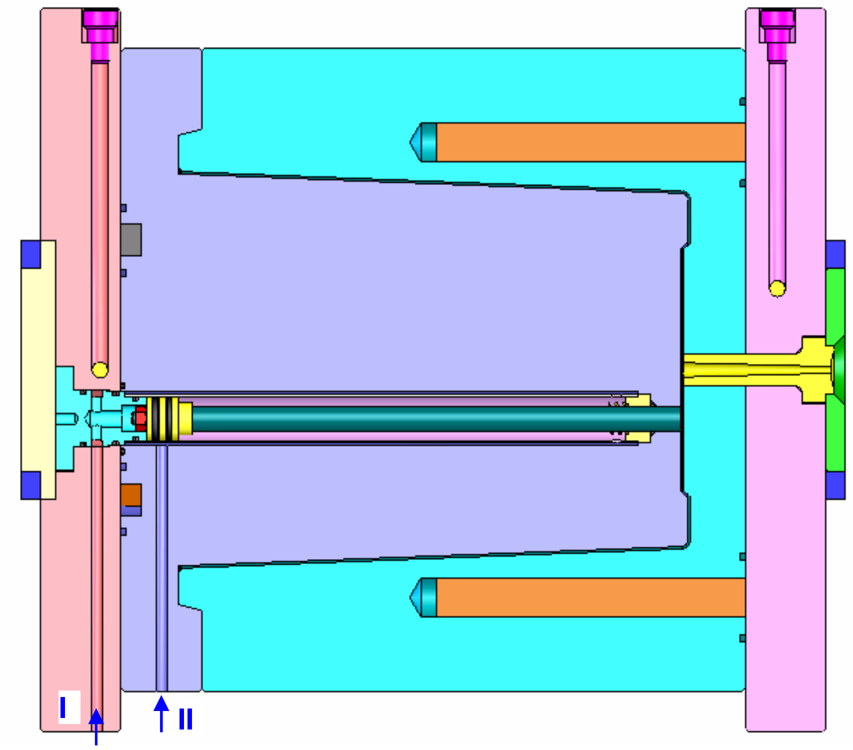

Fig.9 The position of pneumatic ejector in mold
I - air for ejecting course; **II** - air for backing course

5. THE EXPERIMENTAL DETERMINATION OF CADENCE FOR MODIFIED MOLD

For this modified mold it was measured the total time of an injection cycle: t_{cm}**=39.2 s**.

The cadence in this case will be:

$$f_m = \frac{1}{t_{cm}} = 0.025510 \text{ s}^{-1}$$

And the productivity will be:

$$P_m = f_m \cdot 3600 = 91.84 \text{ parts /hour}$$

It results that the utilization of the optimal designed pneumatic ejector increases the cadence with 36.99%. In reality the productivity increases with 36.99%. We can say that this result shows a high level of productivity.

6. CONCLUSIONS

We can draw the following conclusions:

- The design and utilization of optimal pneumatic ejectors are useful since they bring an increase of productivity. In order to make a comparison we need to measure the total time for an injection cycle. In the initial variant the mold worked in semi-automatic cycle.
- It was necessary to redesign the ejection system. It was mounted a pneumatic ejector with double action. The pneumatic ejector was optimal designed with the Genetic Algorithms method.
- The experimental research attests that if we change the mechanical ejector with the optimal designed pneumatic ejector the mold will work in automatic cycle and

the total time of the injection cycle will be reduce from 53.7 s to 39.2 s and practically the productivity increases with 36.99%.

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