ANNALS of the ORADEA UNIVERSITY.

Fascicle of Management and Technological Engineering, Volume VII (XVII), 2008

CONTRIBUTIONS FOR ESTABLISHING THE RIGHT NUMBER OF NESTS THAT A CAST MUST HAVE

Cornelia IONESCU LUCA[1]

[1]"Gh. Asachi" Technical University,Iassy, Romania

E-mail:cionescu@tex.tuiasi.ro

Keywords: injection casts, dimensioning the number of the nests

Abstract. In this paper there is presented a method for calculating the best solution, economically speaking, in order to establish the number of nests that a cast must have.

1.INTRODUCTION

Considering the great variety of shapes/forms of the injected products, the casts can be with a single nest or with more nests.
The cast with more nests are assuring a greater efficiency, but with bigger costs for their execution.
In the paper there is presented a method for calculating the best solution, economically speaking, for establishing the number of nests that a cast has to have it.

2. THE BEST NUMBER ESTABLISHMENT FOR A CAST CORRELATED TO THE SIZE OF THE MANUFACTURING PROCESS

The number of nests, ***n***, of a cast it is established in most cases considering the injection machine's capacity [1], of the aggregate's capacity which the cast is designed for and it is calculated with the formula (1):

$$n = \frac{Q.t}{m} \text{ , piece} \qquad (1)$$

Where:
Q - the real capacity for melting of the injection machine, in Kilos/sec;
m - the weight for an injected piece, in kilos;
t - the time for an injection cycle, in sec.

The weight ,***m***, of the injected piece used in formula (1), represents the piece's dead weight multiplied by the correction coefficient from table 1 [1].

After calculating the nests' number it has to be checked if the closing force of the injection machine, ***Fd***, is strong enough. Practically it can be used the formula (2):

$$\mathrm{F_D} = k_1 \cdot p_0 \cdot A_{ef} \text{ , N} \qquad (2)$$

Where:
A_{ef} – the actual area for the injected piece's projection on the cast's joint surface, m^2;
k_1 – the coefficient for the injected thermoplastic materials (K1=0,3-0,5 for the injected

thermoplastic materials with a modular unit of plastering with a piston and if the plastering and the injection are made with a modular unit with snail, then K1=0,5-0,7);

p_0 – the polymeric melt pressure at mark x=0, which it is exactly at the entrance hole in theinjection form, N/ m^2 (Pa).

Table 1
The establishing of correction coefficient considering the dead weight of the injected piece

The dead weight of the injected piece $\cdot 10^{-3}$, Kg	The correction coefficient
0,3-0,5	1,5
0,5-1,0	1,4
1,0-3,0	1,3
3,0-5,0	1,25
5,0-10	1,20
10-20	1,15
20-50	1,10
> 50	1,05

The polymeric's pressure area corresponds to the experimental [2,4] formula (3):

$$p_x = p_0 e^{-k_2 x} \tag{3}$$

The values of the coefficient K2 it is between 0,035 at 280°C (553K) temperature and 0,06 at 200°C (473K) temperature. While the cast's injected material is cool down, the pressure is growing. The injection pressures are between 100-250 MPa, depending on the apparent viscosity of the melt, the construction and the dimensions of the melting ledge, the shape of the entrance hole, the walls' thickness, the configuration of the injected piece and the injection speed.

Knowing the injection's pressure and the entire surface of the nests, it will be calculated the actual injection force $\mathbf{F_{ef}}$, which has to be smaller than 1,2-1,3 times of the closing force on the injection machine, F_d. When this condition is not possible to be satisfied the calculated numbers of the nests have to be proper reduced.

The nest's number increasing of the casts gets to the process's efficiency growing but in the same time in the cost's increasing for the cast's execution. That why it's necessary before the number of nests are finished to be made economically calculus that will estimate how the casts' execution costs will attenuate with the profit gained on the growing of the cast's number. The optimal number, from the economical point of view, is calculated with formula (4):

$$n_e = \sqrt{\frac{MX \cdot t \cdot k}{3600 \cdot C}} \text{ , piece} \tag{4}$$

Where:

MX – the number of the pieces that will be injected, in pieces;
t – the time of an injection cycle, in sec.;
k – the entire costs of fabrication, lei/hour;
C – the execution costs of an single nest.

The utilization of this formula is simple and practical with the condition that the determined values of C have to be made with enough accuracy based on the statistic data.

There is the condition that casts' execution costs to be proportional to the production's capacity, with formula (5) can be determined which one is the most economic for getting the production's capacity **M_{ec}**, using the single nest casts or using multi nest casts.

$$M_{ec} = \frac{b-a}{k_1' - k_2'}\text{, piece} \tag{5}$$

Where:
a – the fabrication costs for a single nest's cast;
b – the fabrication costs for a multi nest's cast;
k_1' – the execution costs for the injected products using the single nest casts;
k_2' – the execution costs for the injected products using the multi nest casts.
There can be also used formula (6) and (7):

$$k_1' = t_1 \cdot k\text{, s/piece} \tag{6}$$

Where:
t_1 – the time for an injection cycle for a piece, in sec., using a single nest cast.

$$k_2' = t_2 \cdot k\text{, s/piece} \tag{7}$$

Where:
t_2 – the time for an injection cycle for a piece, in sec. using a multi nest cast.

3. CONCLUSIONS

The casts with more nests need bigger execution costs, that is why it is important to be designed regarding their efficiency, correlated as well with the production volume quantity.

Acknowledgements. The paper is a part of an extended research undertaken under the ExplorVIRT project, which is funded by Romanian Ministry of Education and Research in the framework of the CEEX National Research Project, INFOSOC subprogram.

REFERENCES

[1] Ionescu,C., 1*Matrițe şi procese de formare în matrițe pentru industria de încălțăminte,*(1995). Editura Cronica Iaşi. ISBN 973-9206-09-3

[2] Ionescu Luca, C., *New technologies for obtaining through injection the precasts for footwear,*(2006). Buletin I.P.Iaşi, Tomul LII (LVI), fasc.1-2, Textile-Pielărie.

[3] Ionescu Luca, C., Dragomir, A., *Constructive types of machines and injection aggregates from the footwear industry*, (2006). Buletinul Intitutului Politehnic din Iasi, Tomul LII (LVI), Fasc. 5A Secția Construcții de maşini, p.385-388, ISSN:1011-2855

[4] Ionescu Luca, C., Dragomir, A., *Contributions to the designing of mould cavities for footwear soles*, (2005) volum Leather Foot &Shoes, Bat'ova vila, Zlin, The Czech Republic.

[5] Ionescu Luca, C., Dragomir, A., *Leading and organizing systems of the injection process through the control computer the footwear industry*, (2006) Buletinul Intitutului Politehnic Iaşi Tomul LII (LVI), Fasc.5 A, Secția Construcții de maşini, p.381-384, ISSN:1011-2855