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A STUDYING OF METAL FABRICATION BLANKS FROM LONG PRODUCTS

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ABSTRACT

The work present the result of the research process fabricating of the blanks from long steel round section depending on the precision of its diameter, cutting precision is from its preparation and from the method of heating. Given the original depends on the connection of the options and the mass of the forgings.

KEYWORDS: Hot Stamp, Metal Consumption, Blank, Forging

INTRODUCTION

This article is devoted to research opportunities to decrease in the proportion of metal waste , emerging in the connection of its production, as applied to the production of steel parts circular in plan (axially symmetric) in hot volume punching by crank hot presses ((КГШПП) followed by a mechanical process [1 – 3].

Define the following concepts:

- The minimum allowable mass of the work piece _ the mass of the workpiece allowing in this technical process (hot volume punching) get free forging. When reducing the weight of the workpiece bellow the allowing value is guaranteed by the occurrence of defects in the blank stamps prints the final transition.
- The minimum allowing mass of the forging, forging mass produced from the minimum mass .The minimum of the workpiece and forging characterized by the amount of metal fumes due to heating of the workpiece [1, 4, 5].
- In a practice as a rule, the filling engraving final transition is carried out at the same time with punch from a punching burr at the open or closed during filling compensator stamping. As a result to determine the minimum mass of the forging (and the workpiece , respectively) can be either experimentally or by numerical simulation
- The coefficient of the metal of technological process of manufacturing parts_ attitude the mass of the workpiece to the mass of the finished part [4]:

$$cK_M = \frac{M_B}{M_D} \geq 1, \quad мK_M = \frac{M_{\max}}{M_D} \geq 1, \tag{1}$$

Where, MB, M max _ the medium and the maximum mass of the workpiece, MD _the mass of the parts, obviously and more СКМ и МКМ the less technical process.

In addition to the metal loses in the in the implementation of (GOSH) can be quite substantial losses due to the appointment of allowances for the workpiece length:

- Rolled bar diameter deviations from the nominal value

- Inaccuracies at a segment workpiece

MATHEMATICAL MODEL

The real $(L \pm \Delta)$ length and diameter $\left(D_{D\min}^{D\max}\right)$ of the workpiece ,obtained from roll round section are not constant , the precision of the workpiece Δ depends on the method of its segments (scissor for cutting the long products ,segment in the stamp, the saw-cutting machine, etc.) and assumed to be known [1]. Deviations workpiece diameter (D min, D max) of the nominal value (D) determined by the appropriate standards.

The mass losses of the workpiece ,when it is heated (U min, U max) (depend on the heating method (flaming natural gas ,flaming on fuel oil ,induction) , time, the heating temperature of the workpiece material, measured as a percent of its mass, and also assumed to be known [1].

The first step of the technical process (ГОШ) including draft and final stamping. Solve the question of choosing the size of the workpiece. The initial data for this is the minimum volume of the forging (V min) and its diameter (DB). Mass of the workpiece and its associated volume of the apparent dependence: M min = V min · ρ, where ρ – density of the forging material. The density of the forging material. Volume of workpiece (VB), its diameter (DB) and the length (LB) must satisfy the following relations [2]:

$$1.25 \le \frac{L_з}{D_з} \le 2.5, \qquad V_з = \frac{\pi \cdot D_з^2}{4} L_з, \tag{2}$$

Where the volume and length of the workpiece may range from V min, L min to V max, L max, respectively. The diameter of the workpiece (DB) is considered to be a constant value, which value is usually assumed to be equal to the nominal diameter corresponding to the size of long products, from which the manufactured workpiece, or reduced by the amount of fumes. (1)

It can be shown that if the minimum and maximum diameters of the bar D min and D max, the respective workpiece diameters its fumes when heated:

$$d_{\min} = D_{\min} \cdot \sqrt{1 - 0.01 \cdot U_{\max}},$$
$$d_{\max} = D_{\max} \cdot \sqrt{1 - 0.01 \cdot U_{\min}}. \tag{3}$$

In formula (3) the maximum and the minimum mass loss value of the workpiece due to its burn when heated in a percentage time.

The minimum length of the workpiece in view of intoxication with a minimum diameter of a bar within a tolerance for its production:

$$l_{\min} = \frac{4 \cdot V_{\min}}{\pi \cdot (1 - 0.01 \cdot U_{\max}) D_{\min}^2} \tag{4}$$

The maximum volume of the workpiece with taking in to account the tolerance to its diameter and length

$$V_{\max} = 0.25 \cdot \pi \cdot (1 - 0.01 \cdot U_{\min}) \cdot D_{\max}^2 \cdot (l_{\min} + 2 \cdot \Delta),$$

Or lookup field expressions for (l min) and transformation:

$$V_{\max} = \frac{(1 - 0.01 \cdot U_{\min}) \cdot D_{\max}^2 \cdot V_{\min}}{(1 - 0.01 \cdot U_{\max}) \cdot D_{\min}^2} + 0.5 \cdot \pi \cdot (1 - 0.01 \cdot U_{\min}) \cdot \Delta \cdot D_{\max}^2 \quad (5)$$

Limit values of the lengths of the workpiece (L min and L max) diameter DB:

$$L_{\min} = \frac{4 \cdot V_{\min}}{\pi \cdot D_B^2},$$

$$L_{\max} = \frac{2 \cdot (1 - 0.01 \cdot U_{\min}) \cdot D_{\max}^2}{D_B^2} \left(\Delta + \frac{2 \cdot V_{\min}}{\pi \cdot (1 - 0.01 \cdot U_{\max}) \cdot D_{\min}^2} \right). \quad (6)$$

The value L min, L max и Db we will be called the conditional, these are the parameter of the workpiece were used in subsequent calculation (ГОШ.)

The size and mass (minimum, medium and maximum) of the real workpiece can get after its segments:

$$L_3 = \frac{4 \cdot (1 + 0.01 \cdot U_{\max}) \cdot V_{\min}}{\pi \cdot D^2} + \Delta \pm \Delta,$$

$$M_{\min} = \frac{\pi \cdot D^2}{4} \cdot (L_B - \Delta) \cdot \rho, \; M_{\max} = \frac{\pi \cdot D^2}{4} \cdot (L_B + \Delta) \cdot \rho, \; M_B = \frac{\pi \cdot D^2}{4} \cdot L_B \cdot \rho. \quad (7)$$

CALCULATION THE PARAMETER OF THE WORKPIECE

Calculation of the workpiece parameter in accordance with dependencies (1) _ (7) automatic

On the figure 1 presented the program window (6) calculation the parameters of the workpiece:

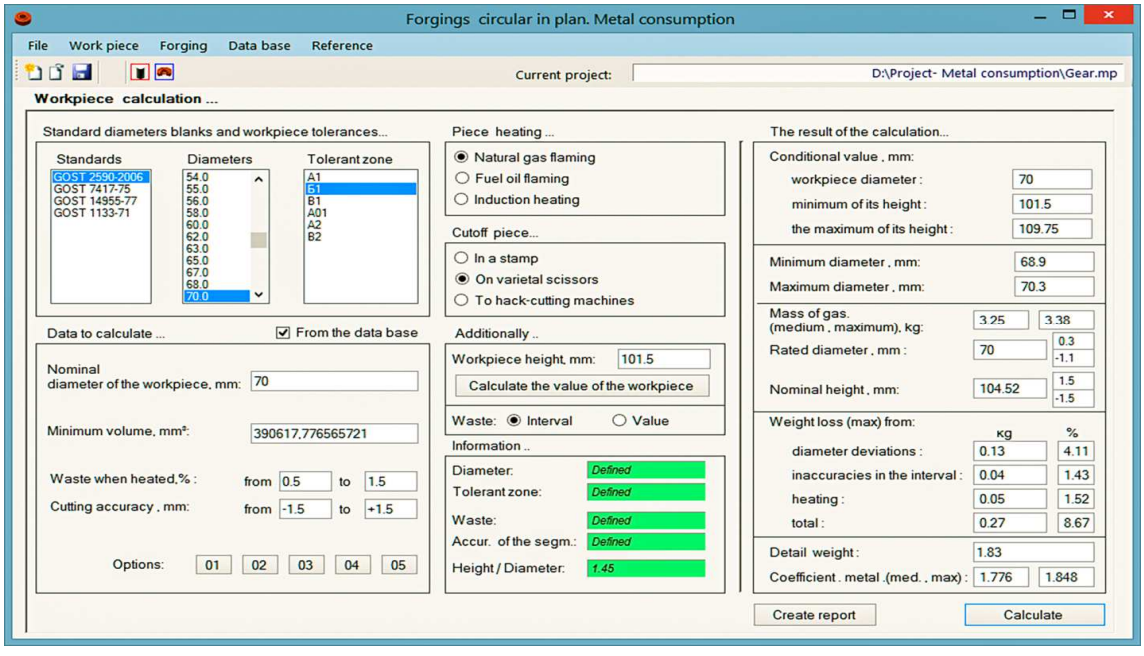

Figure 1: Calculation Automate the Parameter of the Workpiece

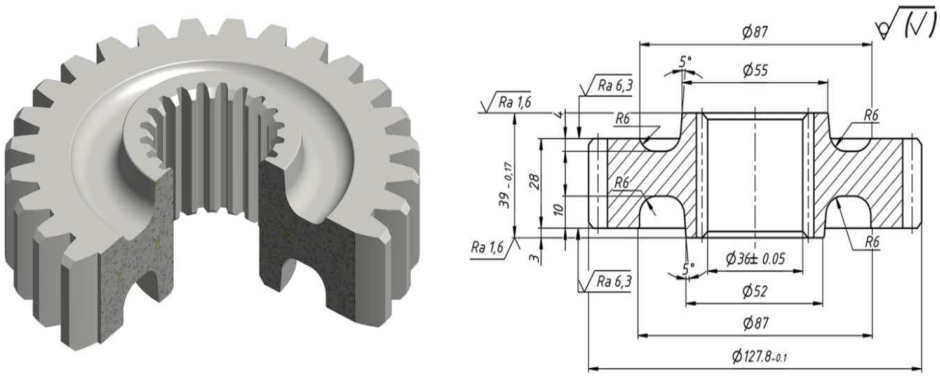

Figure 2: 3D Model and Drawing Details (Gear)

For the program of work must choose required standard, defining diameter parameter of the long products, nominal diameter and its accuracy, specify the minimum length of the work piece, heating method and the segments.

As a result of the calculation will be obtained conditional minimum and maximum lengths of the work piece needed for the simulation process GOSH, the nominal height of the work piece and its accuracy, as well as the calculated metal consumption coefficients in accordance with (1), and the mass loss due to inaccuracies diameter errors segments the work piece and intoxication metal work piece when heated

The calculation results shown in Figure 1, obtained with respect to the details of the "Gear", the drawing of which is shown in Figure 2?

CONCLUSIONS

In the work they based one mathematical model of the process of calculating the geometric parameters of workpiece from rolled round section, allowing to estimate the loss of metal in its production as a result of :

- Rolled bar diameter deviations from the nominal
- Inaccuracies length of the workpiece at its segment;
- Fumes that occurs when it is heated, taking into account fluctuations of its values.

Checking work of this model for example of the first stage of the design of technical process (GOSH) forging parts “gear”. A computer program that allows you to automate the process of searching for the standard parameters of long products in the relevant databases, calculation and analysis of the results.

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