DEVELOPMENT OF TECHNOLOGICAL PARAMETERS DESIGN SOFTWARE FOR THE PRODUCTION OF DEFORMED SEMI-FINISHED PRODUCTS FROM PRECIOUS ALLOYS

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The designing of technology is difficult, multi-step dynamic process. The requirements for the quality and deadlines of projects are getting stricter now. You can satisfy them with help of computer-aided design (CAD) - systems. The effectiveness of such systems is higher, if they are adapted to a particular technology process. That's why programs focused on the design of specific processes are being developed. It is topical for the evolution of non-ferrous metals processing industry.

Non-ferrous metals and alloys and their products have a wide range of applications in various fields of our life. Two of the basic processing operations of non-ferrous metals and their alloys are rolling and drawing. Flat products (tapes, strip, and sheets) can act as independent products or as intermediate products for subsequent operations of stamping, punching, etc. Bars produced by section rolling can be processed by wire drawing thereafter it.

The known methods of technological modes calculating for rolling and drawing of non-ferrous and ferrous metals require a long time to carry them out, in addition there are difficulties with the processing of the experimental data, there is also a significant chance of error because of inaccurate determination of the rheological characteristics of the alloys.

Metal forming algorithms and computer programs are used to automate the deformation modes calculation. However, the analysis of scientific literature shows that such designs usually have a narrow scope of application.

So the algorithm has been designed and the program «PROVOL» has been created to calculate deformation modes of cold sheet and section rolling and drawing of nonferrous metals and alloys, including new precious alloys whose properties are not described in the literature. It greatly reduced the time required for calculation, made the analysis of results easier, and their accuracy higher.

The program is divided into three units: "Sheet rolling", "Section rolling" and "Drawing". The general structure of the program represents the following sequence: unit selection calculation, input source data; presentation of calculations in the form of tables and graphs. The algorithm of the program includes the initial data, calculation of the geometric dimensions of the processed metal, calculation mode of breakdowns by the aisles and definition power parameters, in this case the methodology for determining the technological regimes rolling and drawing that is given in refs [1, 2], is used.

Like the mechanical properties of metals and alloys we take into account values of ultimate strength, which vary depending on the degree of deformation. The approximations of the available experimental dependencies for more than 20 non-ferrous alloys were carried out. There are aluminum alloys, copper, copper-nickel and precious alloys.

Fig. 1 – Example of calculation deformation regimes of rolling

As the initial information the program includes database for equipment and alloys. The database is designed to store and retrieve data, presenting information in a convenient form and automate repetitive tasks. To create a database we have used the program product Access that allows to develop a simple and easy data entry form, and to perform data processing and delivery of complex reports. Moreover, the database can work in combination with the program, or independently.
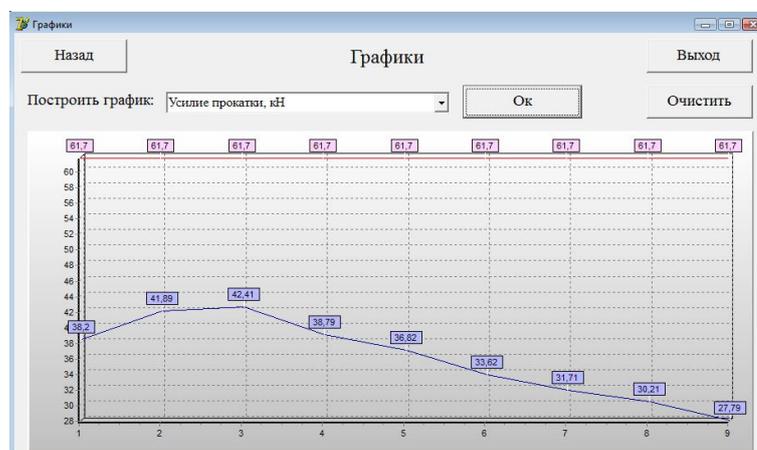

Fig. 2 – Example of diagrams window of software

The data obtained with the help of the developed software are used to perform calculations and to determine the power parameters for the following factory processing of new precious alloys forming [3]. Rolling initial ingot with the diameter of 10 mm was carried out in three stages. In the first phase rolling was led on the Famor TL 12T mill in calibers to the size of a square cross-section bars 3,6×3,6 mm (Fig. 1). Then - in two type BILER mills to size respectively 2,1×2,1 mm and 1,0×1,0 mm. The final stage to get the wire with 0,25 mm diameter is drawing process on the 10NFS COMEVI type mill.

As the output data the program generates a table of results and diagrams of calculated process parameters on the number of passes dependences (Fig. 2). The program also generates a drawing of calibers at calculated geometrical parameters (Fig. 3).
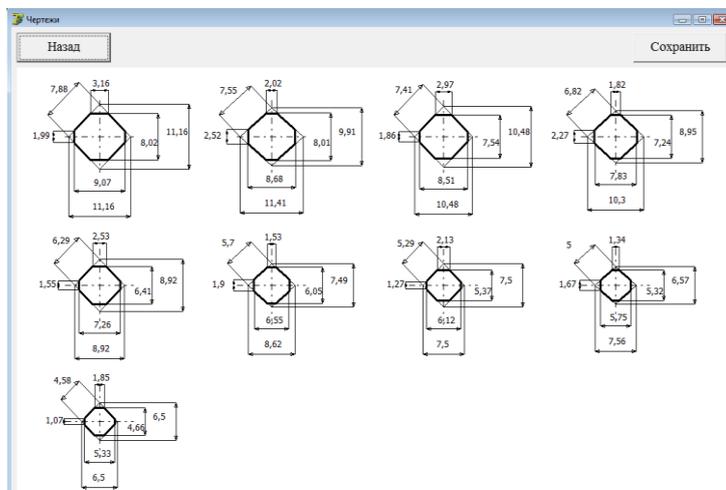

Fig. 3 – Calibers drawing window

The designed software was used in the calculations for "The Gulidov Krasnoyarsk Non-Ferrous Metals Plant" to analyze the modes used in production, and thereby improving modes of rolling and drawing of gold alloys. One example is the receiving of red gold alloy wire.

This software is designed for educational and production process. It is applicable for the design and analysis of new technological modes and the processing of new alloys. With the program «PROVOL» can be done multioperational calculations of technological parameters of manufacturing semi-finished deformed products in jewelry industry. Application of this program has helped to analyze and improve the manufacturing process of jewelry chains in production.

References

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