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THE FORMING PROCESSING OF COPPER PROFILES BY METHOD OF HOT EXTRUSION AS TECHNICAL SYSTEM

Summary. In article is considered the technological process of receiving copper profiles by method of hot extrusion as technical system. The structure of this system which consists of the following subsystems is defined: "A way of impact on the processed material"; "Kinematic characteristics"; "The processing tool"; "Dynamic characteristics"; "Static characteristics". Fundamental subsystems of Method of Production of a Detail system (a copper profile) which are designated and analysed: "A way of impact on the processed material", "The processing tool".

Keywords: system, analysis, technological process, extrusion, copper, profile

The machine-building complex is united by the one task: providing a national economy with the products which are satisfying the consumer (as on a national scale, and on the scale of the certain person) according to the quality and cost indexes. Performance of this task is impossible without exact understanding of manufacturing techniques of products.

The technology is science about actions and parameters with the help of which it is possible to receive the end product with the quality parameters which is providing the demanded operational properties of a product.

Modern technologists is in a field of rigid criterion "at the set-up parameters of qualities and productivity to provide the minimal unit cost"[1-5]. This criterion demands the consideration of various production stages of a product as unique technostructure with mutual influence of various stages at each other. Parameters of quality of preparation are influenced quality of a final detail or product; technological capabilities of various elements of a technological chain (technological operations) influence precision parameters and a configuration, both preparations, and products in general.

The analysis of publications on a research subject. In technology of mechanical engineering the considerable attention is paid to a problem of technological support of quality of copper profile manifold, increase of efficiency and optimization of technological processes.

In traditional manufacturing technology of engine copper profile (lamel) manifold there is no system approach to providing a complex of indicators of quality because of insufficiency of scientifically and theoretical base.

The engine manifold is one of the most difficult knots of the electrical machine. It is explained by structure of the ring, which is made of the alternating copper and insulating plates, difficult geometrical forms of interface of details, use of diverse materials and a complex of operating forces under operating conditions.

Copper sections are very responsible production of subsector of a NF machining in accordance to requirements of normative documents have to:

- to possess high structural behaviour, such as hardness index for maintaining mechanical loadings and resisting to attrition;

- to have the appropriate accuracy of geometrical parameters of cross section, including tilt angles of sides (planar surface) of section to provide durability and reliability of knots of electrotechnical devices and devices;

- to meet the high requirements of surface quality;

- to have conductivity the level of which has to come nearer to conductivity of copper [1-5].

It is nesessary to notice that an actual problem is creation of theoretical bases and methodology of technological support of the set levels of parameters of quality of the engine manifolds caused by operational assignment and service conditions with the minimum labourship, material and energy resources.

Formulation an object of an article. The purpose of work is formation of structure of technical system "Hot Extrusion of a Copper Profile", creation of theoretical bases and methodology of design of highly effective resource-saving technological processes of production of engine manifolds of electrical machines.

Main part. During developing a technological chain of processing of one or several surfaces of preparation there is a requirement of con-

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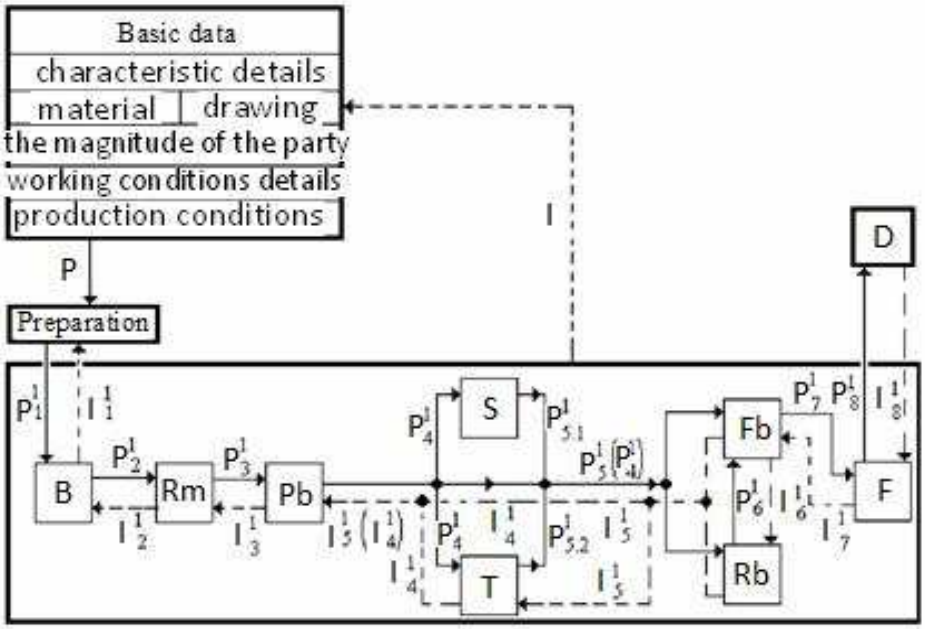
sideration of a set of options of processing, for a separate surface, and all sample in general

Plurality and diversity of manufacturing chain of production of details requireth the consecutive consideration of each technological chain, or to use a method of "steepest ascent" to optimum option. The method of steepest ascent is possible only at representation of technological process and each method of production of a detail by the type of technical system with the subsequent system analysis of the generalized block diagram of technological process of production of a product

Technological process of production of a detail can be presented in the form of the multilevel, difficult technical system consisting of a formal set of blocks (pict. 1).



Picture 1 - Structure of technical system "Technological Process": P – external Preparation block; B – the Processing of Basic Surfaces block; Rm – rough machining block; Pb – the prefinishing block; S – the Processing of Small Surfaces block; T – "Thermal and Chemical Heat Treatment" block; Fb – the Fair Processing block; Rb – the Restoration of Basic Surfaces block; F – Finishing Processing block; D – external Detail block; P - power communication; I – information communication

Basic data for this system are: the detailed drawing, material of detail, value of the processed batch, operating conditions of a detail in knot and machines in general, conditions of production ("Basic data" block).

The external block "Preparation" in the course of realization of technological process is exposed to power influence and changes (in geometrical and physical parameters), turning into a ready detail ("Detail" block). Preparation can be received by various methods of plastic deformation, molding, hot extrusion, or a combination of methods.

The Preparation block is connected by positive communication with the technological process (TP) of production of a detail (Э11): the method of receiving of preparation, its compliance determine structure, the contents and labor input of TP by geometrical and physical parameters of a ready detail. TP is connected with the external block "Basic data" feedback "I" since at realization of TP on concrete production the detail can be non-technological, and there will be a need of updating of the drawing of a detail.

The Operating Link (OL) – represents technological actions for change of indicators of preparation into detail indicators. One of the main elements of the operating link is the processing method.

In another way, the method of production of a detail decides by ways of formation of the set parameters of their quality on productivity corresponding to the smallest expenses in these conditions of production. It follows from this that a common objectives which is achieved at application of this or that method of production of a detail receiving a product with the set quality parameters. As any system a method of production of a detail has four main properties. They are: integrity and chlenimost; property of communication; organization; integrative qualities.

Property (entirety and dividedness) is shown in structure of system which represents steady orderliness in space and in time of its elements and communications.

"The Method of Production of a Detail" system is consist of five main subsystems (tabl. 1): "A way of impact on the processed material"; "Kinematic characteristics"; "The processing tool"; "Dynamic characteristics"; "Static characteristics". Each of these subsystems consists of subsystems of lower level which, in turn, can be divided into separate elements. Each of elements of system has the own purpose without which achievement the common goal of system can't be reached.

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Table 1

Structure of system "Method of Production of a Detail"

I. "A way of impact on the processed material":		
1.	The degree of deformation:	elastic deformation
		deformation in general flow condition
		deformation at hardening
		failure strain
2.	Sign of the strain	
3.	Strain rate:	straight
		contact
4.	Type of loading:	tension
		compression
		bending
		torsion
		shear
5.	Temperature deformation:	cold
		warm
		hot
6.	The dimensions of the deformation zone	
7.	Phase transformations	
8.	Physico-chemical characteristics of contact	
II. "The processing tool":		
1.	Form and macrogeometry working surfaces	
2.	Microgeometry working surfaces	
3.	Physico-chemical properties of the surface layer	
III. "Dynamic characteristics":		
1.	Admeasurements of the forces	
2.	Direction of the forces	
3.	Laws change the magnitude and direction of the forces	
4.	Rigidity process system	
IV. "Kinematic characteristics":		
1.	Mechanical trajectory	
2.	Driving Directions	
3.	Traveling speed	
4.	Acceleration of the motion	
V. "Static characteristics":		
1	The installation method semiman	
2	Method of installation tools	
3	A method of producing sized	

So, if by means of a way of influence physicomechanical properties of the processed material aren't definitely changed, during the cutting the chip formation will not be formed, and at superficial plastic deformation - decrease in a roughness of the processed surface and its hardening. Without having provided kinematic movements of the tool and a detail, it is impossible to carry out a shaping of the processed surface, to create it macro - and micro geometry. Without tool impact on the processed surface or volume of material can't be made. Disregarding static and dynamic characteristics, in particular, rigidity of technological system can't be provided the accuracy of the size, a form and arrangement of surfaces of a detail. Non-performance at least of one of the above private purposes involves non-performance of a common goal of all system "Method of Production of a Detail". Therefore, though the system also consists of a certain number of elements, at the same time it represents a whole since each of the above elements, is necessary for achievement of a common goal of system.

Collector plates (lamels) are produced generally from cold-drawn copper of trapezoidal section.

One of perspective directions of technology for production of copper profiles is hot extrusion which leads to increase in use of raw materials to 95% and reduces copper waste to 60%.

Fundamental subsystems of "Method of Production of a Detail" system are: "A way of impact on the processed material", "The processing tool".

Extrusion is carried out by expression of metal in the closed cavity through a stamp matrix by means of a mechanical or hydraulic press.

As the processing tool in the technological scheme of receiving a copper profile the compression mold for expression of a copper profile which has a difficult design. The basic of elements of this design is the matrix stamp (a working surface). The matrix stamp is made of steel 3H2V8F hardness – 46. 48 HRCa. For increase of hardness of a working surface of a matrix it is subjected by cementations, thickness of the cemented layer is 0,4. 0,8 mm, thus hardness increase to 60 ... 65 HRCa.

The matrix has a circle form with a macrogeometrical working surface with a diameter of 44 mm which has two trapezoidal openings, the size of which is presented in fig. 3.

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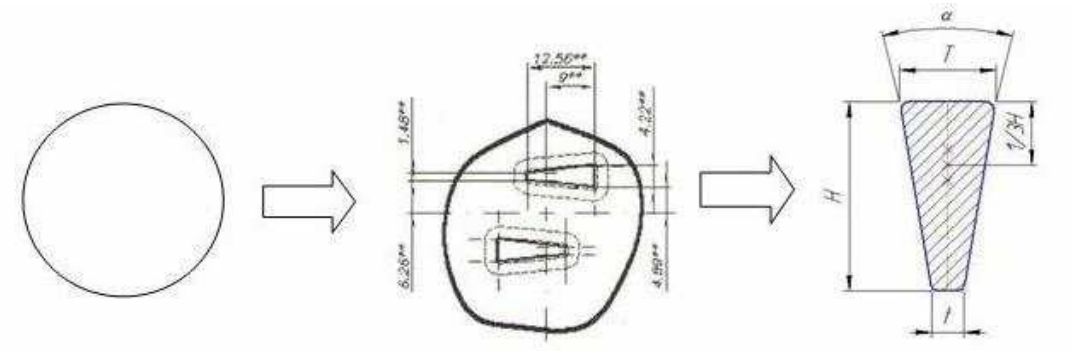
The subsystem "A way of impact on the processed material" according to fig. 2 includes the following information:

Extrusion creates the shifting effort and the squeezing loading, but thus doesn't create resistance to a gap – because of it there is possible a strong deformation without rupture of metal.

For the beginning the cylindrical preparation (d=40mm) is warmed up to the temperature of 8500C and located to the extrusive press. The plunger in this press together with backpad pushes the softened metal through an exact opening of a matrix after which preparation and takes the necessary form (pict. 2).



a b c

Picture 2 – Fabrication stages of a copper profile: a – initial preparation; b - the drawing of matrix openings ; c - a form of cross section of a profile (T - nominal rate of bigger thickness of a profile (the top basis of a trapeze), mm; t - nominal rate of smaller thickness of a profile (lower basis of a trapeze), mm; N - height of a profile, mm

Process of hot extrusion happens at rather high temperatures. An optimum interval of temperatures for copper when performing hot extrusion: 820 — 860 ˚C [6, page 4].

According to recrystallization curve and plasticity deformation, the copper should make with the sinkings exceeding 15%. At deformation of copper consider increase of resistance of deformation when processing by the closed methods, and also increase in speed of processing. [7, p. 60]. Thus pressure can vary from 35 to 700 MPas.

For improvement of copper passing and increase of the general quality of a profile the matrix and other tools were warmed up to the temperature of 350˚C.

High technological parameters (temperatures and pressure) make harmful effects on firmness of a matrix and other components, in the course of hot extrusion demand special greasing.

Conclusions and prospects of further researches. In article is considered technological process of receiving copper profiles by method of hot extrusion as technical system. The structure of this system is defined. Fundamental subsystems of Method of Production of a Detail system (a copper profile) which are are designated and analysed: "A way of impact on the processed material", "The processing tool". Prospects of further researches are formation and the analysis of subsystems: "Static characteristics", "Kinematic characteristics"; "Dynamic characteristics" for obtaining fuller information on opportunities of introduction of this technology in production.

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