RESEARCH OF THE TECHNOLOGICAL PROCESS OF COGWHEELS FURNISHING

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Summary. During the furnishing of cogwheels by free rolling methods an essential influence on the accuracy and quality of processing is exerted by the errors of a gear wreath resulting from its formation and chemical-thermal processing. The toothcut-wheel operation is preferable since it provides the best productivity and accuracy of the processing.

Key words: shaving, angle of the crossing, a stain of contact

INTRODUCTION

A big influence on the construction of the technological process of cogwheels processing is rendered by the design, required accuracy of manufacturing, type of manufacture. Finally, parameters of accuracy of the quality of the tooth's working surface on the processing wheels are determined, as a rule, on finishing operation [Kalashnikov, Kalashnikov 1985]. It is marked, that the greatest distribution was found with ways of furnishing of the cogwheels working on the method of free rollings. As theoretical researches have shown, at the furnishing of cogwheels by free rolling methods an essential influence on the accuracy and quality of processing is exerted by the errors of a gear wreath resulting from its formation and chemical-thermal processing. Such errors as radial palpation of a gear wreath, fluctuation of measuring inter-axial distance for one revolution of a wheel are corrected insufficiently. It is possible to reduce these errors by more exact basing and a choice of rational operations forming a gear wreath.

STATEMENT OF THE PROBLEM

During operations of grinding of a base aperture of preparations of cogwheels after chemical-thermal processing the best accuracy is provided with basing on a gear wreath with the help of three rollers. At a choice of a finishing operation to be grinding in or honings it is necessary to take into account that fact, that by virtue of available features of these processes there is a significant deterioration of the tool. It results in occurrence on the tool of the same regular errors which are present on a processing wheel. Regular errors usually appear as a result of chemical-thermal processing. Their influence can be reduced using the technological actions developed by the author of this work [A.L. 1968].Therefore furnishing cogwheels by free rolling methods is most effective if the errors have a casual character.

Owing to the features of the process of furnishing by the method of free crossed axes, the tooth tool contact with the processing wheel occurs on the small platforms determining the sizes of the contact ellipse [Lycshin 1967]. It results in a decrease of efficiency of correction of errors on a direction of a line tooth. In relation to this, at operations forming a gear wreath, special attention is necessary to the arising errors of a direction of a tooth of a wheel [Uminski 2003]. At furnishing of cogwheels in the process of removal of an allowance at a leg of a tooth the ledge which in the process of rolling adjoins to the head of a tooth of a processing wheel, and an occasional eradication of the head of a tooth of the tool. Therefore, in order to eliminate the defects of teeth located in non-working zones, it is necessary to delete sites of structures. For this purpose it is usual to cut gear wreaths at tool running. Special mills are applied for this.

RESULTS OF RESERCH

One of furnishing methods which is not essentially influenced by accuracy of preparations, is toothpolish. However, with an aim of finishing operation of grinding it is necessary to take into account, that decrease of accuracy of preparations results in a significant fluctuation of size cuttings during lateral faces tooth preparations. It causes deterioration of a processing surface, a crack, owing to heats in a zone of cutting [Suho-rukov, Evstegneev 1983]. These defects of the process of grinding are especially brightly shown at the processing of cogwheels, following chemical-thermal processing. The choice of a method of furnishing of cogwheels is defined by a significant number of factors. If during the furnishing by several methods, the accuracy is stimulated by the drawing and quality of a surface, an assessment of economic efficiency of each of these methods [Ponomarev *et al.* 1984] is reached. This parameter is one of the basic at a choice of this or that method. At a calculation of economic efficiency of various methods it is necessary to take into account features of the technological process construction, for each of them.

At a choice of a method of cogwheels furnishing it is also necessary to take into account the requirements of a processing surface. For example, in a case when finishing operation is applied instead of toothpolish operation the choice of a new method of furnishing is defined by the requirement both to quality, and to accuracy of a processing surface. As it was mentioned, the productivity and accuracy of honings furnishing are influenced with the size of an allowance. Therefore, with the purpose of increasing the accuracy of preparations, additional operations enter the technological process. Frequently, such cogwheels shavings come into action before the chemical-thermal processing. Besides, with the purpose of a more thorough training of the bases, a number of additional operations is entered.

The seventh degree of accuracy on the elements determining the parameters of smoothness of work of transfer can be achieved practically by all methods of furnishing. The sixth degree of accuracy can be achieved by grinding in, honings, shavings, electrochemical processing. As shown by the carried out researches, the greatest accuracy is reached in the process of cogwheels shavings and honings [Suhorukov 1992].

In Table 1 the data for a choice of typical operations of cogwheels processing at average modules with open wreaths are given. The degree of accuracy of a gear wreath of a wheel on the norms determining smoothness of work of transfer, specified in this table for variants 6-10, is reached in a case when at performance of operations of preliminary and final teeth furnishing, the complex method of an approach to the account of the statistical, dynamic and kinematic factors working in gearing-tool preparation is used. The use in honings processing of the modified design tools allows to raise the accuracy and productivity of furnishing [Uminski 2001].

CONCLUSIONS

From the given table it is visible, that for an increase of accuracy of processing it is expedient to enter shaving operations at a gear wreath. The greatest effect at the use of this method of furnishing can be reached by the following circuit of furnishing: cementation – shavings – heat treatment. Thus, due to reduction of errors which arise during cementation, substantial increase of accuracy of processing is reached. With reference to cogwheels of a reducer of the hydromachine (m = 4; $Z_1 = 31$; $\beta_1 = 15^\circ$; $e_1 = 40$ mm), rational construction of operations of technological process, alternation of chemical-thermal processing with shevings have allowed to guarantee a high accuracy of processing and to replace unproductive grinding operations shevings. The use of shaving as a finishing operation has resulted in a decrease of labour input in the process by 30-40%. As follows from the given table, the choice of the operation of formation of a gear wreath toothcut-wheel provides the best productivity and accuracy of the processing. Besides it is necessary to note the fact, that using a honing operation as the last one, as well as an introduction in the technological process of preliminary shaving operations allows to provide an increase of productivity and accuracy of furnishing.

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Variant	The									
	module, mm	Kind of p	processing	Received degree of accuracy on CT C3B 641-77 at type of manufacture						
		toothcut-wheel		Furnish		Individual		Serial		Busin
						Without	With	Without	With	Without
		Draft	Fair	Anticipat-	Furnishing	chemical-	chemical-	thermal-	thermal-	thermal-
				ing		thermal-	thermal -	processing	processing	processing
						process-	processing			
						ıng				
1	before5	-	potential	shavings	_	_	_	8–9	10	_
2	before5	-	potential	_	-	8-11	10	8-11	10	_
3	before5	-	potential	-	-	8-11	10	8-11	10	-
4	before5	potential	potential	_	_	8-11	10	8	10	_
5	2,5-5	potential	potential	shavings	-	-	-	-	-	-
6	2,5-5	milling	-	shavings	-	-	-	-	8-11	_
7	2,5-	potential	-	shavings	honings	_	—	—	7	—
8	2,5-5	milling	-	shavings	honings	_	—	—	7	—
9	2,5-5	the	_	shavings	grinding	—	-	—	5–6	_
		same			with the					
					subsequent					
					honings					
10	up to 10	the	potential	shavings	rollings	_	-	8-10	-	8-10
		same								
11	up to	the	_	_	electro-	_	_	8-10	8-10	8-10
1	10	same			chemical					

Table 1. The data for a choice of typical operations for cogwheels processing at average modules with open wreaths