CONTRIBUTIONS OF GENERATING THE INTERNAL INVOLUTE SURFACES OBTAINED BY WRAPPING WITH HOBBING CUTTER

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Abstract: This issue is giving a new technological solution for hob internal gear. The tests and the experimental results are relevant for extending this method.

Based on theoretical and experimental results of the subject, they can be outlined the main contributions of the author on developing of an universal hobbing cutter (which depends only on module and reference rack) and present results, meanings, conclusions.

1. General aspects

Theoretical assays of generating the inner evolventic surfaces obtained by wrapping with hobbing cutter are of a recent term, which did not permit the developing of a individual method of this tool profile.

At present, some major technological difficulties caused the theoretical employment of these theoretical assays to obstruct the comparison of their results. The key to solving this problem is the manufacturing technology and an appropriate control of the tool, so that the theoretical study could be applicable in view of working the internal gear.

This type of tool is made in a couple of countries, each of them keeping its manufacturing process concealed, and having its own solutions both theoretical and constructive-technological.

2. Contributions at the technological producing of the internal involute surfaces

The machining procedure of the internal teeth using the hob, which is a relatively new procedure, was not extended in the industrial field due to some specific constructive-technological hindrances, such as the teeth cutting head having an wheel cutter, an attached module to the tool-machine, as well as remarkable hindrances when manufacturing the barrel hobbing cutter.

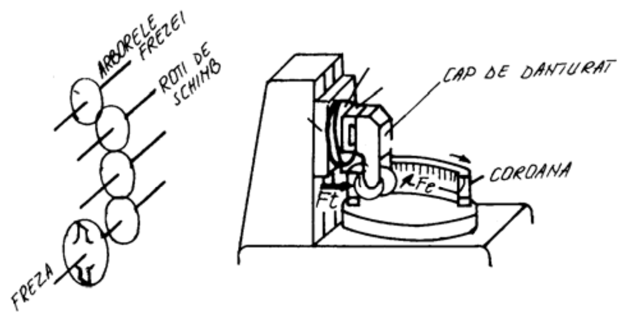

Fig. 1

In the figure 1 it is scheme representation this machining procedure, respectively the kinetic chain from the interior of the cutter head.

The basic idea is to get a universal hob, depending only on module and reference gear rack, having an increased rigidity and precision.

3. Testing of the conceived and produced hobs

Experimental testing of hobs for machining by means of generating the internal gear was done with tools having the following parameters:

a) for the blades alternative: m = 12; $\alpha = 20^{0}$, f = 1; c = 0.25; number of beginnings i = 1 dr. (fig. 2)

Fig. 2

b) for the removable teeth alternative: m = 16; $\alpha = 20^{0}$, f = 1; c = 0.25; number of beginnings i = 1 (fig. 3)

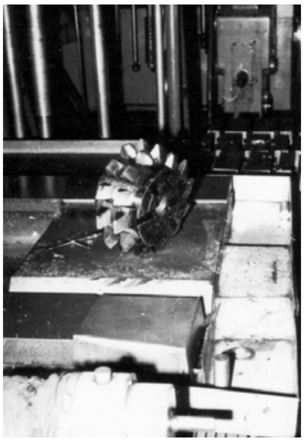

Fig. 3

Internal teeth was done on the tool-machine for cutting KARATZ - 3600 gears with the help of a cutting device with hob – fig. 4.1

The characteristics of the holding-tool device used are as follows:

- range of modules which can be machined m = 12 ÷ 20;
- maximum diameter of the hob Φ 320 mm;
- minimum diameter of the semi-finished product Φ 650mm;
- maximum diameter of the semi-finished wheel Φ 4720 mm;

The machined parts have the following characteristics:

a) m =12; $\alpha = 20^0$; f = 1; c = 0.25; $z_2 = 120$; $x \cdot m = 0.962$; B = 220; in the alternative of machining with the blades hob.

b) m =16; $\alpha = 20^{0;}$ f =1; c = 0.25; $z_2 = 94$; $x \cdot m = 25.3$; B = 320; in the alternative of machining with the teeth hob.

In both cases, the constituent matter of the parts to be machined was 40 C 10, forged, improved to 260 ÷ 280 HB.

The centering error of the parts was 30μm in "a" example and respectively 45 μm in "b" example.

The hobs had radial and frontal knocking of 35μm respectively 15 μm in the blades alternative and 45 μm respectively 25 μm in the removable teeth alternative.

The cutting regimen used in this experiment was:

a) for the m =12 alternative:

n_{hob} = 18 rev./min, s = 0.8 mm/rev. of table; the cutting depth for the first passing t = 25 mm, and the second passing was made at the final depth.

b) for the m = 16 alternative:

n_{hob} = 16 rev./min, s = 0.65 mm/rev. of table; the cutting depth for the first passing t = 33 mm, and the second passing was made at the final depth.

4. Experimental results

After concluding the experiments, it resulted that the hob full load running, during the teeth cutting at the requested parameters, was normal, smooth, without shocks, this statement being checked by the electric energy consumption of the tool, read on the Ampere-meter attached. Compared with the idle running of the tool, when feed coupling is on, the electric energy consumption has not got a significant increase.

The vibration of the assembly tool – cutting head – tool-machine are comparable to the machining of outer gears with a hob, or cutting the internal gear with a wheel cutter. The roughness achieved in all cases was R_a = 3.2 μm

The hobs made the gearing of the parts without being re-sharpened. For emphasizing the depreciation, the active surfaces of the tool teeth were covered with lacquer. The observed depreciation was uniformly spread on all of the hob teeth, getting a facet, f = 0.2 mm, which could be considered as a normal value, comparable with the one got when using the hob for machining the outer gear.

It is remarked a reduction of 40% in the working time when compared with the usage of a module hob.

The picture at fig. 5 A, B, C, are aspects from the process of machining of the specific parts.

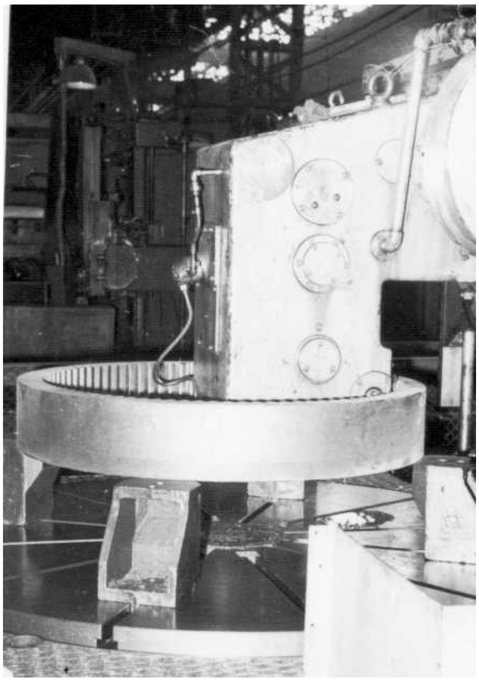

Fig. 5 A

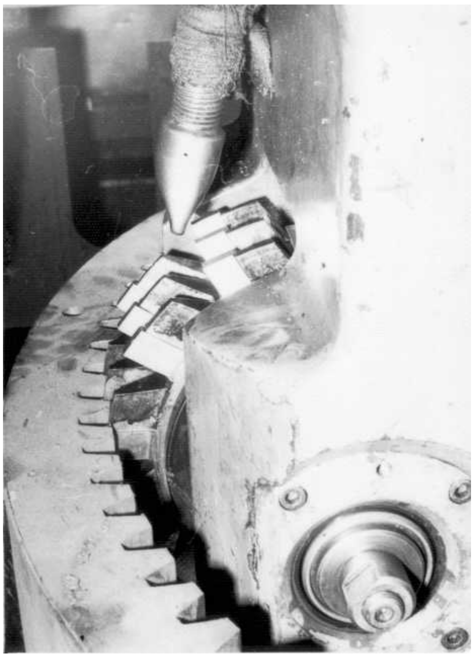

Fig. 5 B

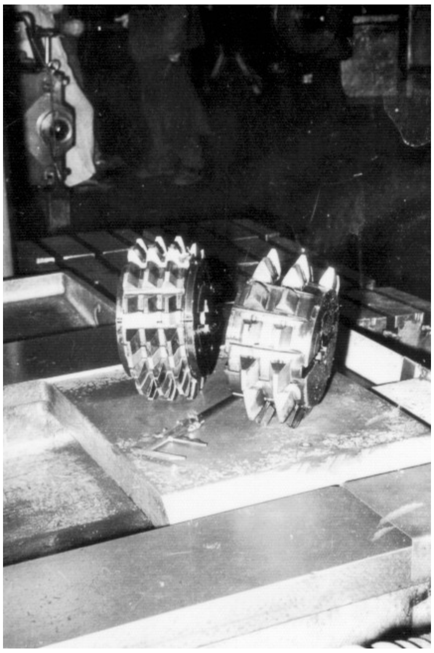

Fig. 5 C

Bibliography : Dorin Eftimie . Invention Bulletin no. 90773, Romania