6th INTERNATIONAL MULTIDISCIPLINARY CONFERENCE

CONSIDERATIONS CONCERNING THE MANUFACTURING THE SPIROID HOB WITH REVERSE TAPERED

Vasile BOLOŞ, Codruța BOLOŞ, Bogdan BUCUR
"Petru Maior" University of Târgu Mureş
540088- Târgu Mureş, str. N. Iorga nr. 1, ROMANIA
vbolos@upm.ro, cbolos@upm.ro, bbogdan@upm.ro

Abstract: *The paper presents the manufacturing particularities of the milling worm used in the processing of the spiroid hob with reversed tapered. It is taken as an example the real case of the archimedical type worm milling tool used in the construction of spiroid wheels with axial module m_a=2,5 mm, Z_2=47 and axial distance A=56.*
Key words: *Hob, Hobing, Spiroid*

1. INTRODUCTION

The processing of the spiroid gears hobbing with reverse tapered is made through the process of milling with a special spiroid hob using a specific kinematics on a type FD 500-U.M.Cugir machine.

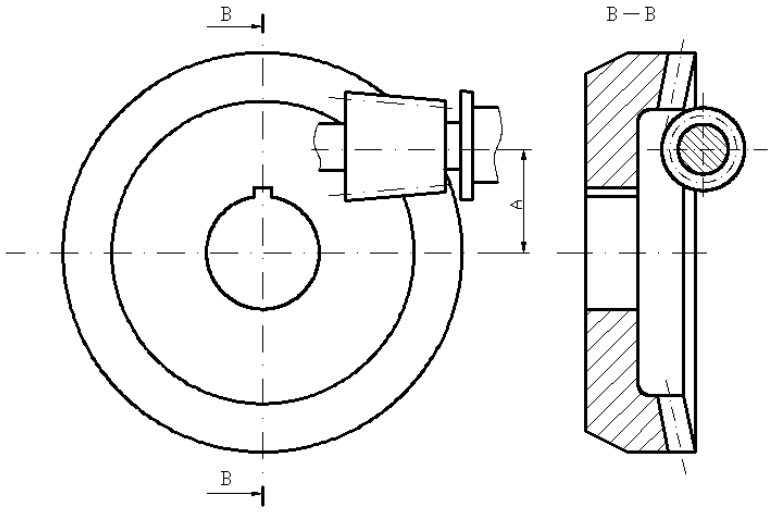

Fig. 1. Spiroid gearing with reverse tapered

In paper [4] there were presented main aspects regarding spiroid hob with reversed tapered's geometry. Using the notations and kinematics elements from paper [4], the worm sides of the spiroid hob in the system $O_1X_1Y_1Z_1$ are defined through the mathematical relations:

$$\bar{x}_{1k} = \begin{Vmatrix} x_{1k} \\ y_{1k} \\ z_{1k} \\ 1 \end{Vmatrix} = \bar{x}_{1k}(p,v) = \begin{Vmatrix} -\sin v \cdot [r_0 - h \cdot v \cdot tg\delta - g_0 \cdot (2k-3) \cdot \sin\delta + p_k \cdot \cos(\delta + \alpha_k)] \\ \cos v \cdot [r_0 - h \cdot v \cdot tg\delta - g_0 \cdot (2k-3) \cdot \sin\delta + p_k \cdot \cos(\delta + \alpha_k)] \\ [g_0 \cdot \cos\delta + p_k \cdot \sin(\delta + \alpha_k)] \cdot (2k-3) + h \cdot v \\ 1 \end{Vmatrix} \quad ,(1)$$

2. GEOMETRICAL AND BUILDING ELEMENTS OF THE SPIROID WHEEL MANUFACTURING

In order to highlight specific elements of the technological type of manufacture of the spiroid hob a real manufactured and tested case is presented (Fig. 2) [5].

The spiroid hob presented in the paper was designed to process a wheel belonging to a gearing with the following characteristics: transmission rapport I =47, axial module m_a=2,5mm, number of wheel teeth z_2=47, axial distance A=56 mm, tooth height h=7,642 mm, worm type archimedic, cone shaping of the tool $\delta=5^0$, the tool is made of rapid steel Rp3 STAS 7382-88 with a hardness of the splinting sides of 62-64 HRC. In finalizing the project a series of specific elements found in papers [1, 2, 3] were taken into account.

3. TYPE OF MANUFACTURE TECHNOLOGY

The spiroid hob manufacture technology of which is presented was entirely manufactured (except of heat treatment operation) in our Study Centre in the Gearing Domain (TAPFA) part of The "Petru Maior" University of Târgu Mureş.

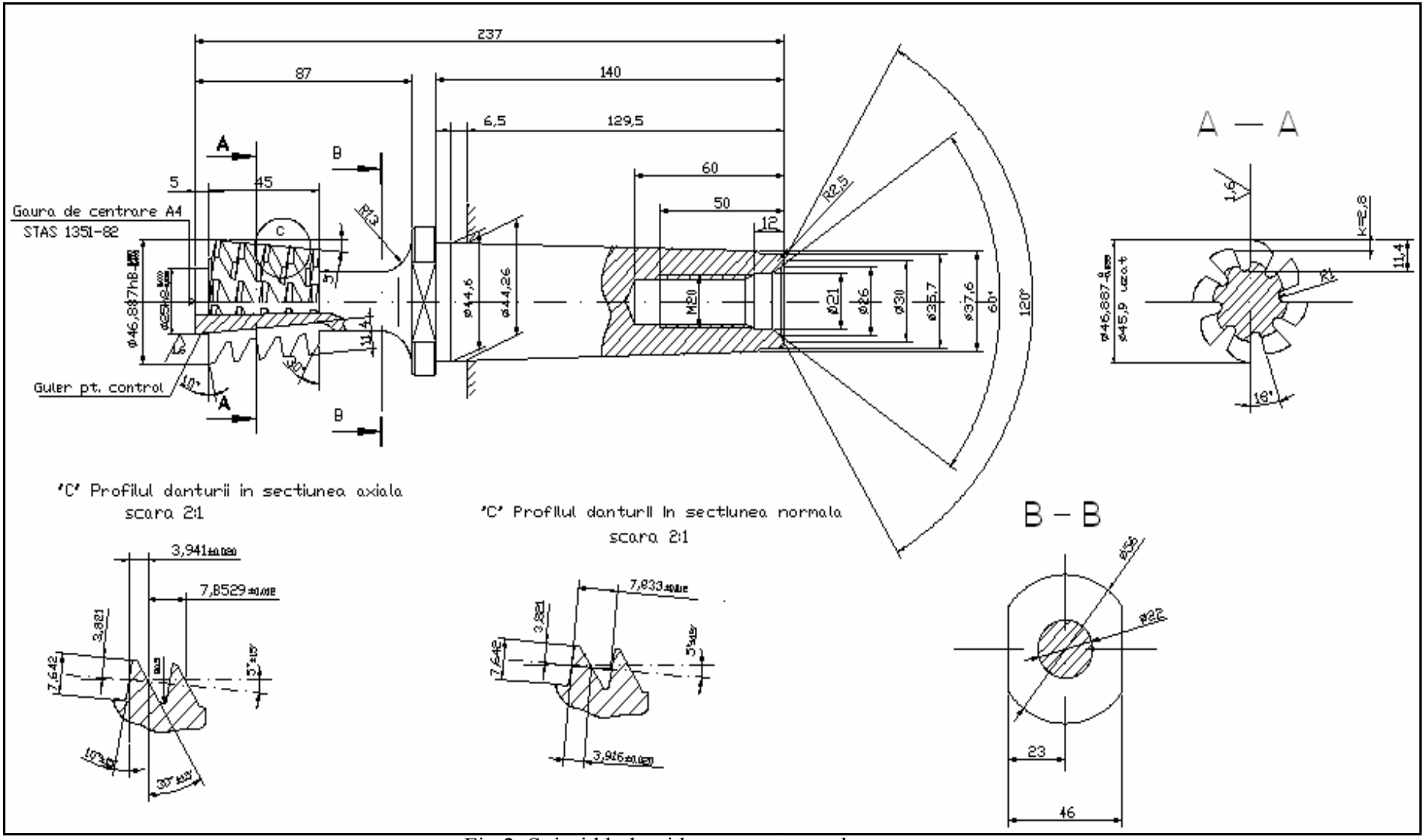

Fig.2. Spiroid hob with reverse tapered

It can be ascertained according to Fig. 2 drawing and Fig. 7 image, that the hob is manufactured in a one-piece construction. This construction creates some difficulties regarding a number of operations that need to be passed through, particularly the milling operation of the chips removal channels as well as the sharpening operation where an adequate space must be ensured for the manufacturing tool to come out.

Being the case of a tapered archimedic worm (5^0 angle) the flank manufacturing was made through lathe worm process, both roughing out stage and final machining stage distinctly for each flank. (Fig. 3), one adequate profiled cutting-tool at a time on relieving lathe (DH 250 Niles) using processing tapered helicoidally surface device with came groove.

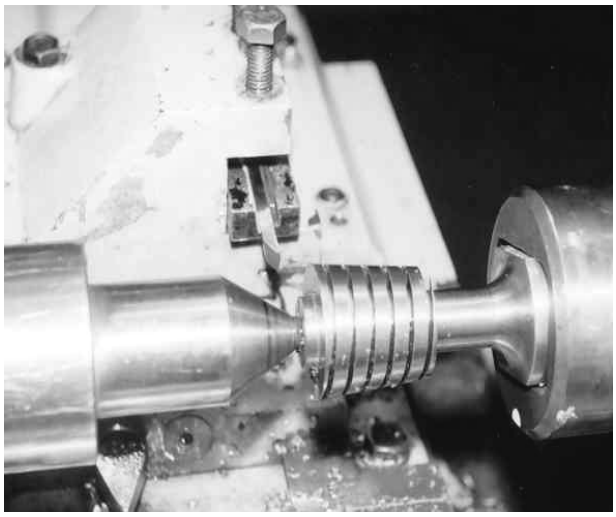

Fig. 3 Flank manufacturing process through lathe

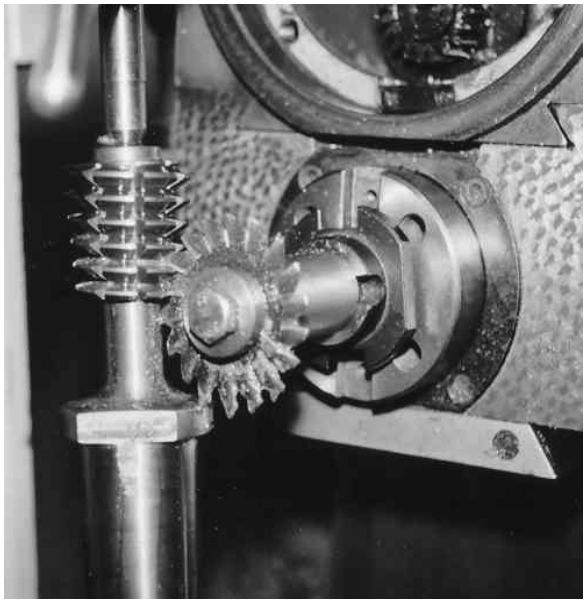

Fig. 4 Channels milling

Chips removal channels (eight channels) with a disc milling cuter (fig.4) profiled at 18^0 on FUS 22 machine tool

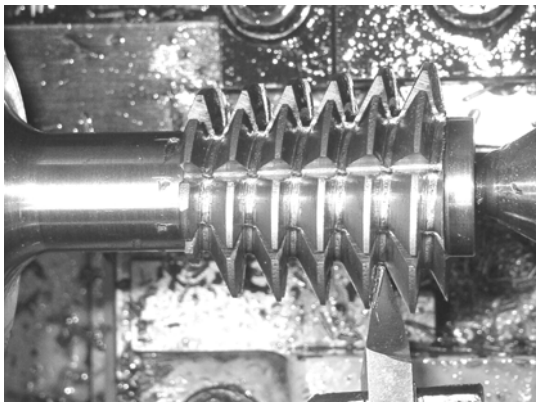

Fig. 5 Flank relieving

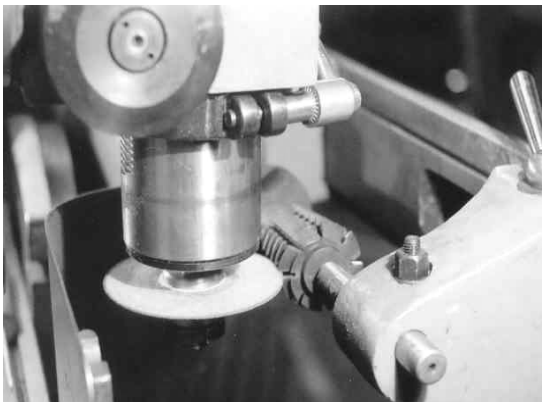

Fig. 6 Tool sharpening

Tool flank relieve (Fig. 5) was made on the relieving lathe (DH 250 Niles) separately for the back at the cog and then for each flank at a time.

Hardening heat treatment an then stress-relief heat treatment were done in the Râşnov Cutting Tools Company, Braşov and resulted in 62 HRC hardness on the tool's active zone.

The tool sharpening operation (Fig.6.) was facilitated by the constructive particularity of this tool in particular the fact that its channels are parallel with the tool's axis and not parallel with a helix as in the usual gearing milling worms.

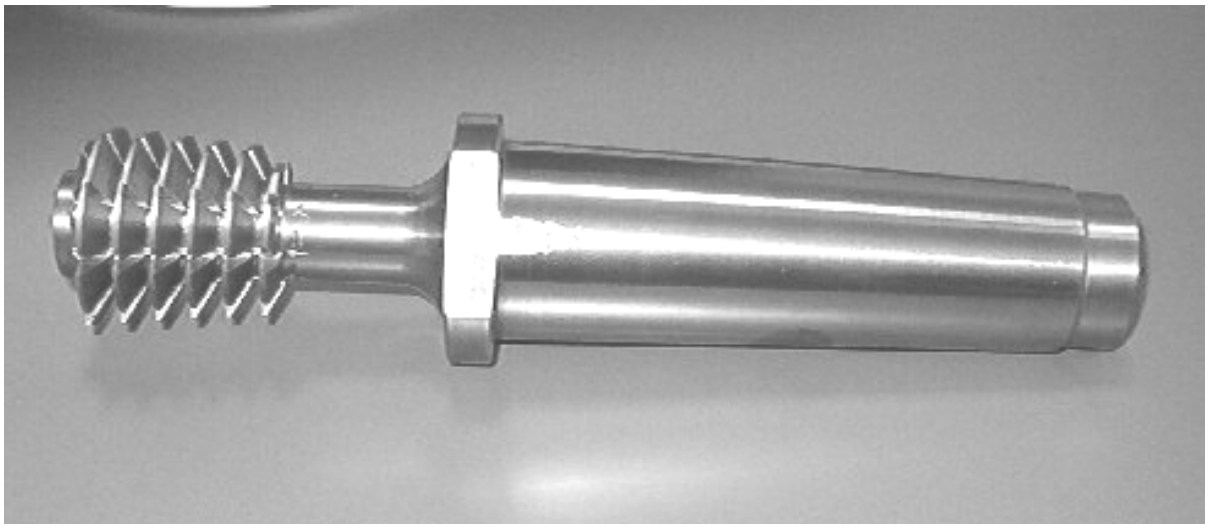

Fig.7. The spiroid hob with reverse tapered

4. CONCLUSION

- The spiroid hob with reversed tapered has a geometry relatively more complex than the hob used on usual cylindrical worm gears.
- The manufacturing technology of this tool (archimedical worm type) the precision requirements of which are not very high has specific but easily over fulfilled aspects.
- Manufacturing of high precision spiroid hob imposes the introduction of the flank baking-off clearance operation (after heat treatment), which brings about difficulties and high costs.

5. REFERENCES

[1.] BOLOŞ, V., BOLOŞ C., Aspects regarding wear of the spiroid hob. În: Proceedings 6 th International Congress on Tribology, Eurotib '93, Budapest, 1993 Volume 4, p.419-423.
[2.] BOLOŞ,V.,BOLOŞ C., Freza melc spiroidă cilindrică monobloc (The monoblok cylindrical spiroid hob),, În: Buletinul ştiinţific al Universităţii "Petru Maior" Tg.Mureş, Vol.IX-X (ISSN1221-3470), 1996-1997, pag 15-20
[3.] BOLOŞ,V., BOLOŞ, C., Worm hob for plan spiroid worm gear processing In:MicroCAD 98 International Computer Science Conference,Miskolc,1998 Section F,pag.47-50
[4.] BOLOŞ, V., BOLOŞ, C. , ŞINCAN , R .and BUCUR , B., The kinematics of the hobbing of the reversed tapered spiroid worm wheels. In: Proceedings of the Scientific Conference with International Participation Inter-Ing 2003, Tg.Mureş. Romania, 6-7 November 2003, vol I , ISBN 973-8084-82-2, pag.59-66
[5.] BOLOS,V.,BOLOS C. and BUCUR B, Spiroid hob with reverse tapered. In: Scientific Bulletin , Serie C, Volume XVIII, The International Meeting of the Carpathian Specialists In The Field Gears ,5 Th Edition, May 21-24,2004 Baia Mare ,ISSN 1224-3264, pag..49-52
[6.]* * * Helicon/Spiroid Gears and gear system. ITW-Chicago, 1980.

The paper was achieved with the financial support provided by the CNCSIS Grant no. 1153-2003.