

**5th INTERNATIONAL MEETING OF THE CARPATHIAN REGION SPECIALISTS
IN THE FIELD OF GEARS**

**INTERNAL GEARS MANUFACTURING POSSIBILITY ON THE GEAR
HOBBING MACHINE “FD250”**

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***Abstract:** The paper presents the possibility to modify the FD250 gear hobbing machine, with a device, in a machine apply to manufacturing internal gears. Redesigned and equipped with device it is possible to obtain a machine tool with higher universality and a possibility to decrease the manufacturing price for the internal spur and helical gear.*

***Key words:** Internal gears, gear hobbing machine, design, device.*

1. INTRODUCTION

The paper presents the possibility to manufacture the internal cylindrical gears on the gear hobbing machines. To the present almost all internal gears what is manufactured with metal cutting methods are use the gear shaping procedures.

With the presented solution it is possible to eliminate some problems what presuppose the gear shaping methods. In case when it's manufactured helical gear for each helix angle the gear shaper need a varied 3D cam. This 3D cam presents many technical problems when are manufactured and his precision has direct influence on the gear precision. On the financial side the gear hobbing machine are cheaper and his productivity are higher.

2. APPLICATION AREA

This method and the device find applicability in branch of gear manufacture firms in case when it is needs to obtain gears for prototype and small series. Concomitantly is a possibility to invest in the existing machines to growth the machines productivity.

With the presented device the universality of machines are growled and it is succeeding to manufacture on the same machine differed types of gears.

2. THE “FD250” GEAR HOBBING MACHINE

The FD250 gear hobbing machine (Figure 1.) was designed by the Cugir Mechanical Factory able to manufacture spur and helical gears with 250-300 mm maximal diameter and $m=6$ mm maximal module. On this machine it is possible to manufacture all work-piece with the generating method in the presented limits. For hob the maximal dimensions are the follows: $d_h=105$ mm, $l_h=100$ mm (hob diameter and length).

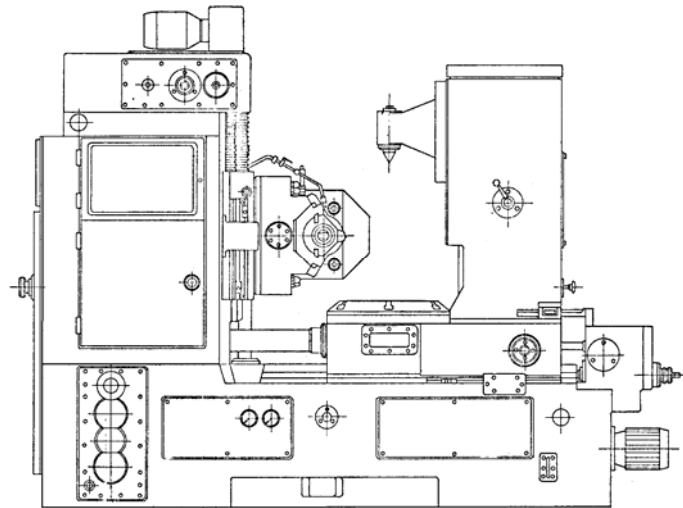


Fig. 1. *The FD250 gear hobbing machine*

4. THE “FD250” HOBGING MACHINE MODIFY TO BY ABLE MANUFACTURE INTERNALS GEARS

To effectuate the cutting procedure the cutting tools must by positioned inside of the donut form work-piece. For this the kinematics chain of primary motion for the hob must by to prolong. This proposed modification and the original kinematics chain are presented in (Figure 2.a. respective 2.b.)

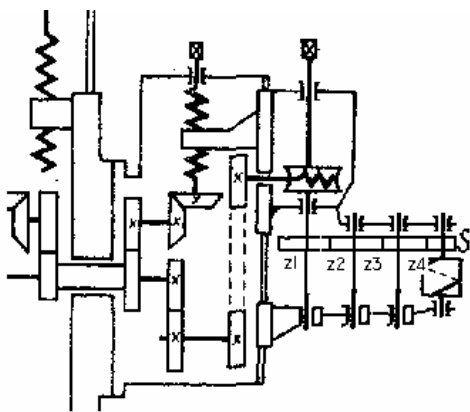


Fig. 2.a. *The modified kinematics chain*

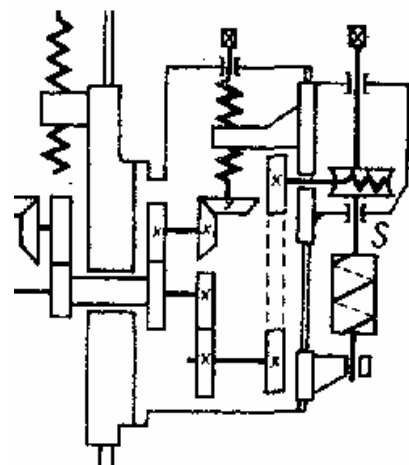


Fig. 2.b. *The original kinematics chain*

In conformity with the adopted manufacturing method form-copying method or generating method in kinematics chain of indexing must introduce a manually indexing device for form copying case.

After a dimensional and design study the follow possibility for modification are identified:

- 1- The work piece is fixed on the rotary-table and the cutting tool in device that introduce inside on the work piece, without modified the rear column. (Figure.3.)

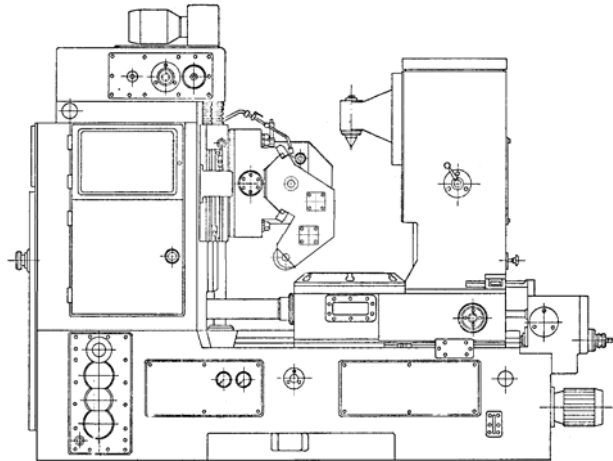


Fig.3. *Hobbing machine without modified the rear column*

This solution is applying in case of work piece with external diameter under 330mm, because the rear column limits the work piece dimensions.

- 2- The work pieces are fixed on the rotary-table and the cutting tool in device that introduce inside on the work piece and the rear column are dismantling. (Figure.4.)

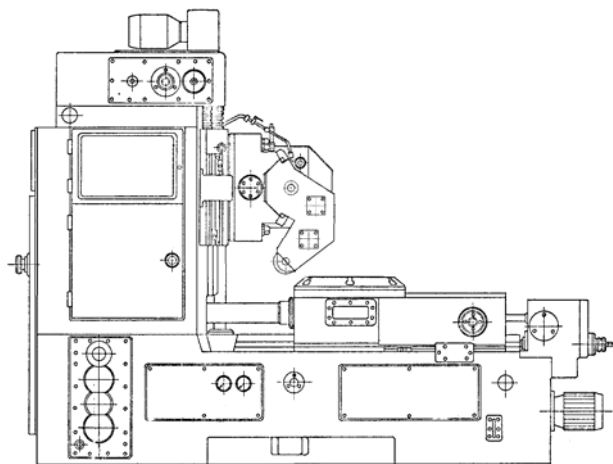


Fig.4. *Hobbing machine with dismantled rear column*

In this case it's possible to manufacture work piece with 800-850 mm maximum diameter. But in this case must by accorded a several attention for what cutting data are choice for avoid the over require the kinematics chain of indexing. It is imported to not forget that FD250 are designed for cutting data adequate for work piece with maximal diameter 250-300 mm.

The work piece is fixed on the rotary-table of gear hobbing machine with jaw church or with faceplate, in depends on his dimension.

5. USED CUTTING TOOLS

The possible used cutting tools are the followings:

- Gear-tooth side milling cutter, in case when the internal gear are manufactured with the form-copying method, tooth space by tooth space. (Figure.5.)

The tools profile is obtaining similar with the profile for external dears, taking in consideration the contact between the gears in gearing are convex-concave.

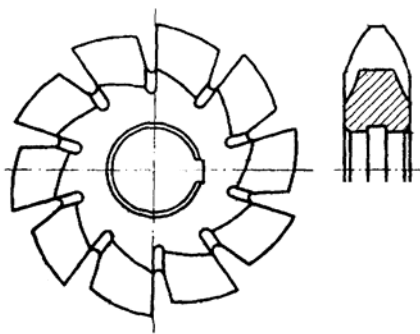


Fig.5. Gear-tooth side milling cutter

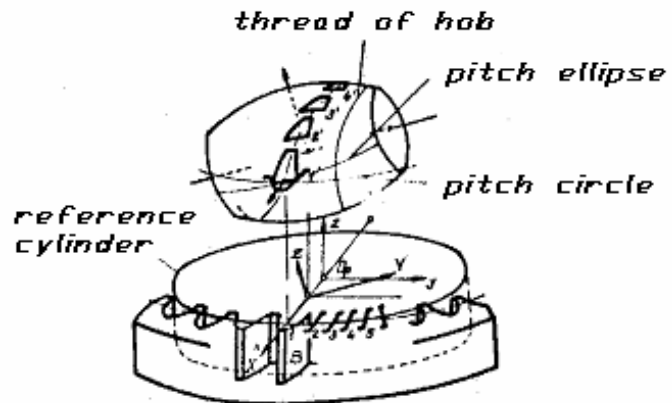


Fig.6. Ellipsoid hob and fly hob

- Ellipsoid hob (Figure.6.) and fly hob, in case when the internal gears is manufactured with the generating methods.
 With the ellipsoid hob and fly hob it is possible to generate worm wheel for the internal worm.

6. DEVICE FOR THE CUTTING TOOLS FOR MANUFACTURING INTERNAL GEARS AND WHEELS.

The proposed device for a simply use must by designed thus that do not modify the calculus method of the change gears compare with the toothed (external) gears. Namely the devices gearings must by have the constant equal with 1 and do not modify the rotation direction of cutting tools. For this the easy solution is using two gears z_2 and z_3 for to maintain the rotation direction and the toothed gear z_4 and the pinion z_1 are identical ($z_1=z_4$).

The cross slide "2" (Figure.7.b.) are dismantled and in they place are mounting the new device.

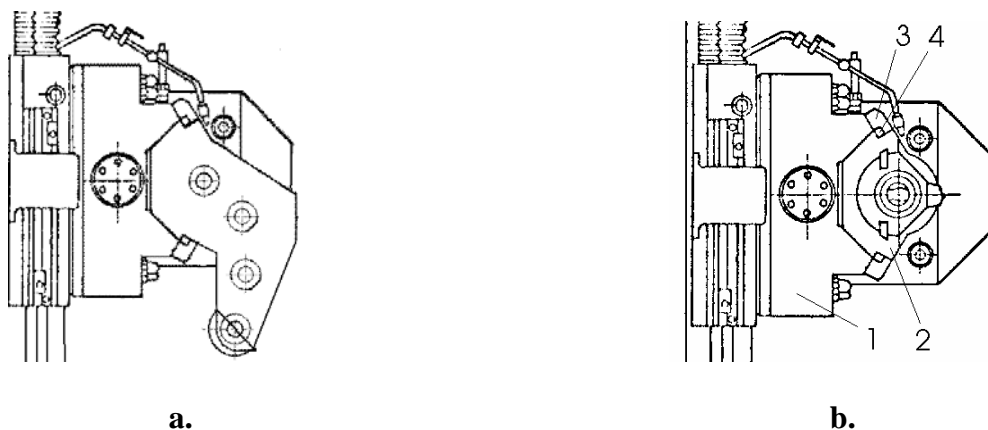


Fig.7. The mounting of the new device

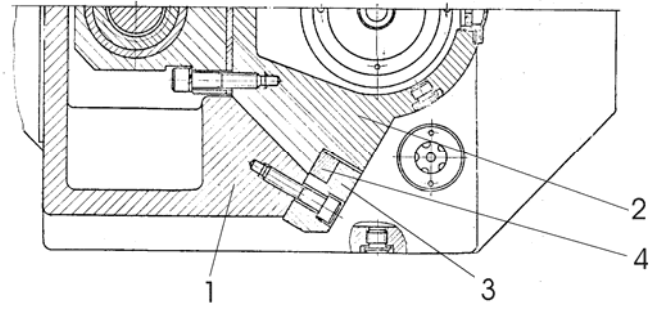


Fig.8. *The fixing method of the new device*

For mounting the device the hob support with the cross slide “2” (Figure.8.) are remove. His fixing system it is used to fix a new device. This system is with saddle key “4” for eliminate the clearance between cross slide “2” and the fixing gripper “3” (Figure.8.). The cutting tools and the z_4 -toothed gear are fixed on the same shaft-type arbor and the tools (ellipsoid hob, gear-tooth side milling cutter, fly hob) are drive by the principal shaft through the device gearings (z_1 - z_4).

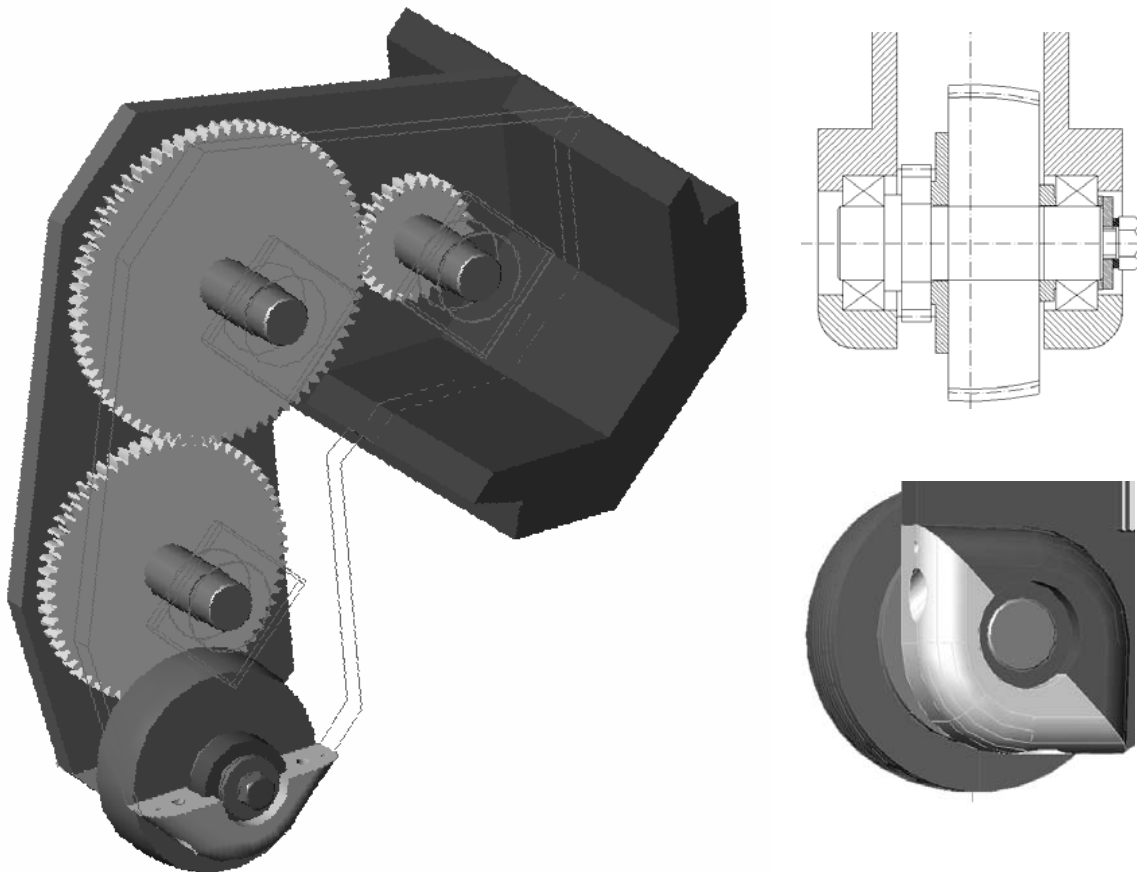


Fig.9. *The proposed device*

Figure.9. presents the 3D model of the proposed device. When the cutting tool is change, because exist a several dimension restriction inside a work piece the shaft-type arbor with the tool and toothed gear z_4 all is dismantled and remounting with the new tool.

7. CONCLUSION

- It is possible to manufacturing internal gears and wheels on the gear hobbing machine using a new device and adequate cutting tools.
- Using the presented device it is a real possibility to manufacture helical gear without 3D cam for each helix angle β , as are in case of manufacturing with the gear shaping methods.
- The ellipsoid hob has a good defined domain where are able to use and are differ for each gear with module “m” and number of tooth.

This device has possibility to be a beginning for few optional device families for the existing gear hobbing machines.

8. REFERENCES

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