



21-23 May 2020, Iași - România

12th EUROPEAN EXHIBITION OF CREATIVITY AND INNOVATION**“EUROINVENT”****research project**Technical University of Moldova,
Department “Fundamentals of Machines Design”

Non-conventional digital gear manufacturing technologies with non-standardized profiles from precessional transmissions

Viorel Bostan, *dr. hab., prof. univ.*; Ion Bostan, *academician al AȘM, dr. hab., prof. univ.*; Valeriu Dulgheru, *dr. hab., prof. univ.*; Rodion Ciupercă, *dr., conf. univ.*; Sergiu Mazuru, *dr. hab., conf. univ.*; Alexei Toca, *dr., conf. univ.*; Maxim Vaculenco, *dr., conf. univ.*; Ion Bodnariuc, *dr., conf. univ.*; Radu Ciobanu, *dr., conf. univ.*; Oleg Ciobanu, *dr., conf. univ.*; Nicolae Trifan, *dr., conf. univ.*; Iulian Malcoci, *dr., conf. univ.*; Ion Dicusară, *dr., conf. univ.*; Dumitru Vengher, *drd.*; Alexandru Buga, *dr., conf. univ.*; Alina Bregnova, *drd.*

Project description:

The success of the competition in which the producers of new industrial products are engaged is based on the time consumed in the activities of designing, making prototypes, testing and putting them into manufacturing. The main performance factors in the development of a new product are the reduction of the time and the costs of carrying out all the steps prior to its launch on the market.

The research field refers to the technological development of precessional transmissions.

The time and costs of achieving the precessional transmissions mostly refer to the manufacture of central wheels with non-standard convex-concave profiles and to the satellites with circular arch profiles of the teeth.

These objectives were achieved by developing non-conventional technologies based on digital manufacturing.

I. In case of precessional kinematic transmissions for the manufacture of wheels and satellite of the precessional gear with non-standard profiles of the teeth, three non-conventional technologies have been used:

1. Plastic injection molding of the wheels of the precessional gear with small diameters up to 42mm and averages up to 105mm (figs. 1, 2). The innovative elements consist in the construction of wheels with metallic

reinforcements which substantially reduce the inevitable deformations characteristic of the process. The inserts of the molds with negative profiles to the real ones are produced by digital manufacturing on numerically controlled machine tools based on the CAD / CAM system;

2. Pressing technology from metal powders (fig. 3). The innovative elements consist in the construction of pressing forms (double pressing) that provide airship porosity and lubrication regime with dry lubrication for operation in vacant spaces. The insertions of the pressing forms also have negative profiles to the real ones and are produced by CNC digital fabrication;

3. Direct digital manufacturing technology - 3D printing. Direct digital manufacturing is a process of obtaining the physical parts directly from a 3D CAD file. The main advantages of the process are: low energy consumption, small losses of material, high manufacturing speed, parts with complex geometries can be realized, reducing the time required to execute the industrial product.

II. For precessional power transmissions with bolt gear, the technology of digital manufacture of central wheels with variable convex-concave profile on CNC machine tools based on CAD / CAM system with straight and inclined teeth has been developed (fig. 4).

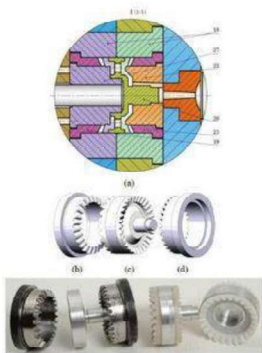


Fig. 1. Pressure injection molding form: (a) - the local section of the wheel-satellite forming node of the 2K-H precessional gear; (b), (c), (d), respectively, 3D views of the molds with tooth profiles of the teeth and the wheel-satellite; (e), (f), (g), (h) - respectively, manufactured samples of dies, crank shaft and satellite wheels.

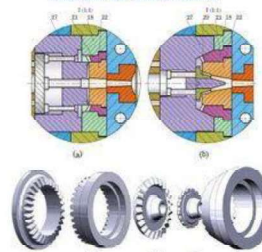


Fig. 2. Local sections of the mold forming knot: (a), (b) - for the manufacture of fixed and movable central wheels of the 2K-H precessional gear respectively; (c), (d) - 3D views of fixed center wheel and mirror profile die; (e), (f), (g) - respectively the views of the central movable wheel, the reinforcement and the mold with mirror profile.



Fig. 3. The technological equipment for individual pressing: the central wheels with convex / concave profile of the teeth (a); of the two-wheeled satellite-wheels in a circle arc (b); cogwheels and cogwheels with a diameter of 24, 38, 46, 62mm (c).

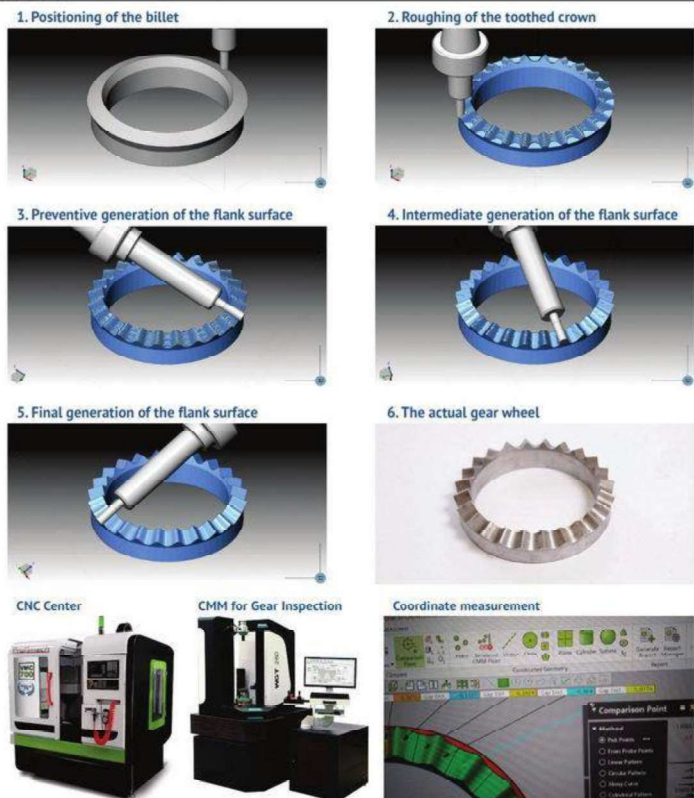


Fig. 4. Phases of manufacture on a machine tool with numerical control of the central cogwheel with straight teeth.