ELABORATION OF NONCONVENTIONAL TECHNOLOGICAL METHODS AND EQUIPMENT FOR PRECESSIONAL GEARS MANUFACTURING BY MEANS OF PLASTIC MOLDING

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ABSTRACT: The planetary precessional transmissions represent a new principled type of the mechanical transmission. Precessional planetary transmission has a number of advantages: increased bearing capacity, high mechanical efficiency, large kinematical possibilities. The mechanical efficiency of precessional planetary reducer is η=(0,85÷0,95 (at transmission ratio i = 10…300). The teeth of the central wheel have nonstandard variable convex-concave profile described by parametric equations according to the fundamental theory of the precessional gear. Because the teeth of the satellite have circular profile this fact allow its relative simple fabrication. The performed analysis of the state-of-the-art in the field of technology of fabrication of the wheels of the kinematical planetary precessional transmissions, demonstrated the need to elaborate the constructive-technological procedures for decreasing of the power loses. This work contains a broad justification of the method for plastic materials selection necessary for toothed wheels fabrication. As well, the plastic mass selection and functioning criteria are presented. Also a range of adequate materials for toothed wheels manufacturing are described.
KEY WORDS: Precessional, Transmissions, Kinematic, Plastic wheels

1. INTRODUCTION

A problem for engineering companies (especially in the metalworking industry, automotive, chemical and metallurgical industries) is to satisfy the ever-increasing requirements to the transmissions used in majority of industrial machinery and technological equipment related to bearing capacity, compactness, mass and dimensions, low cost of production, etc., and, in particular, to kinematical characteristics, structural compatibility with other aggregates of the equipment, etc. Gearings are considered the most sophisticated components of machines. Machine reliability depends very much on the gearing mechanical transmission operation, in general. In solving complex problems related to "*gear synthesis profile research – fabrication*" an important role belongs to developing efficient methods of teeth manufacturing, which would ensure maximum productivity, reduced cost and quality.

Manufacture of precessional gear wheels with convex-concave and variable tooth profile cannot be achieved by existing generation technologies, but through fundamentally new technology. Generation technology of precessional wheel teeth must ensure continuity of motion transformation function with the following conditions: non-standard and variable tooth profile, and satellite carrying out sphere-spatial motion with a fixed point. To achieve the above, a new procedure for teeth processing is proposed by self-generating method with precessional tool against rotating blank [1,2].

Know-how in the elaboration of multicouple precessional gear, manufacturing technology and control methods, and a range of precessional transmission diagrams belong to the research team from the Technical University of Moldova. In low power transmissions the satellite wheel is designed with circular profile teeth (fig. 1) (compared to conical rollers in power precessional transmissions. In this case, the machining of the toothed crowns of the satellite by cutting is difficult. Therefore the most optimal method is to form teeth in moulding forms.

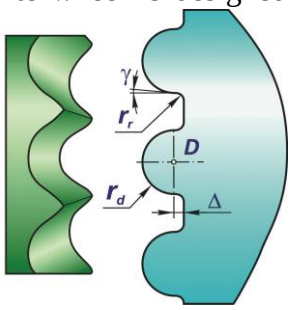

Figure 1. Circular profile of the teeth of the satellite.

1. MATERIALS USED TO MANUFACTURE GEAR WHEELS FOR KINEMATICAL GEARINGS

The materials used to manufacture gear wheels are very different. In machine building, gear wheels are made of carbon steel and alloy steel, cast iron; in medium equipment gear wheels are made of bronze, titanium, aluminium alloys, metal powders, in addition to steel. Plastics are used most often in small power kinematical transmissions. There are also examples of the use of plastics in medium load transmissions. In the production of unique plastic wheels, they are 50% more expensive than steel ones. Use of plastic wheels is more rational and efficient in terms of production in large series by