Elaboration and research of planetary precessional multiplier type K-H-V

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Abstract. The multiplier is an indispensable part of the micro hydropower plant and high power wind turbine. It helps to increase rotor low speeds limited by the water flow small velocity and by the relative big placement diameter of the blades that participate in the energy conversion. For example, the microhydrostation rotor's speed is *(2 – 3) min*$^{-1}$ for water flow velocity *V= (1...1,6) m/s* and for blade placement diameter *D = 4 m*. Diversity of requirements forwarded by the beneficiaries of mechanical transmissions consists, in particular, in increasing reliability, efficiency and lifting capacity, and in reducing the mass and dimensions. It becomes more and more difficult to satisfy the mentioned demands by partial updating of traditional transmissions. The target problem can be solved with special effects by developing new types of multipliers based on precessional planetary transmissions with multiple gear, that were developed by the authors. Absolute multiplicity of precessional gear (up to *100%* pairs of teeth simultaneously involved in gearing, compared to *5%-7%* - in classical gearings) provides increased lifting capacity and small mass and dimensions. To mention that until now precessional planetary transmissions have been researched and applied mainly in reducers. Therefore it was necessary to carry out theoretical research to determine the geometrical parameters of the precessional gear that operates in multiplier mode. Also, it was necessary to develop new conceptual diagrams of precessional transmissions that function under multiplier regime. The majority of precessional planetary transmissions diagrams developed previously operate efficiently in reducer's regime. Depending on the structural diagram, precessional transmissions fall into two main types – *K-H-V* and *2K-H*, from which a wide range of constructive solutions with wide kinematical and functional options that operate in multiplier regime.

1. Introduction

The majority of precessional planetary transmissions diagrams developed previously operate efficiently in reducer's regime [1]. Depending on the structural diagram, precessional transmissions fall into two main types – *K-H-V* and *2K-H*, from which a wide range of constructive solutions with wide kinematical and functional options that operate in multiplier regime. The kinematical diagram of the precessional transmission *K-H-V* (figure 1) comprises five basic elements: planet career *H*, satellite gear *g*, two central wheels *b* with the same number of teeth, controlling mechanism *W* and the body (frame). The roller rim of the satellite gear *g* gears internally with the sun wheels *b*, and their teeth generators cross in a point, so-called the centre of precession. The satellite gear *g* is mounted on the planet (wheel) career *H,* designed in the form of a sloped crank, which axis forms some angle with the central wheel axis θ.