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Precessional transmissions with conform contact of the teeth in multi-pair gearing

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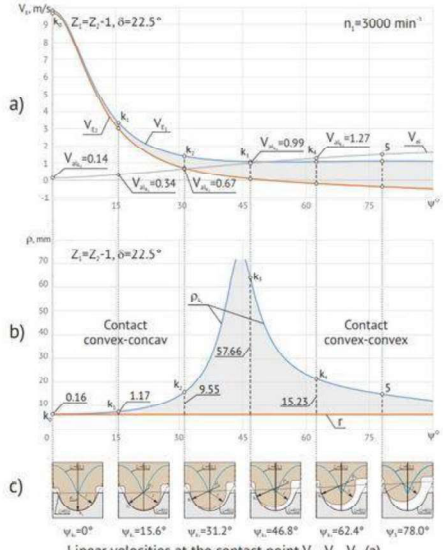
Goal:

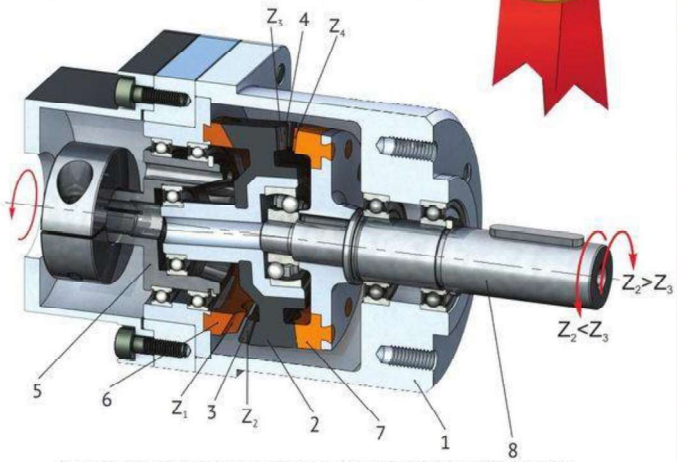
Increasing the convex-concave contact load bearing capacity by identifying the conjugated profiles with the small difference in the curvature radius.

Solution:

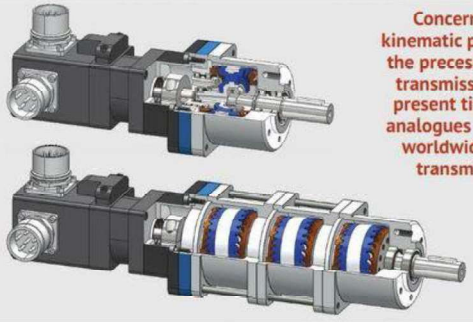
The teeth gearing is performed in contacts with convex-concave geometry, wherein the central bevel wheels are made with curvilinear flank profiles with variable curvature with one tooth less than the satellite wheel gear rings made with circular arc flank profiles, the teeth flanks mate with frontal overlap ε_f within the limits $1.5 \leqslant \varepsilon_f \leqslant 4.0$ simultaneously engaged pairs of teeth, at the same time the gearwheels are made with the conical axoid angle within the limits $0° \leqslant \delta \leqslant 30°$ with the angle between the axes of the crank and the central bevel wheels within the limits $1.5° \leqslant \theta \leqslant 7°$, and the circular arc radius of the flank profile of the *Z*-toothed satellite wheel gear rings is within the limits *(1.0-1.57) D/Z [mm]*, which generally provides a reduction of the difference in the curvatures of the flank profiles in the section with diameter D of up to *(0.02-1.5) D/Z [mm]* and a decrease in the pressure angle α between the flanks of up to *15°*, as well as a decrease in the relative sliding velocity between the mating flanks.



Linear velocities at the contact point V_{c1}, V_{c2}, V_w (a) the difference in curvature radii (ρ_1-r) (b) of the conjugated profiles in the contact k_i (c) depending on ψ for Z_1=Z_2-1 and δ=22.5° (Z_1=24, Z_2=25, θ=3.5°, δ=22.5°, r=6.27mm, R=75 mm)



Precessional toothed gear transmission comprises a body (1), a satellite wheel (2) with two bevel gear rings (3) and (4) driven by a crankshaft (5) in sphero-spatial motion around a fixed point, two central bevel wheels (6) and (7), one immobile (6) fixed in the body (1) and the other mobile (7) mounted on a driven shaft (8).



Concerning the kinematic possibilities, the precessional gear transmission at the present time has no analogues among the worldwide known transmissions.

Advantages:

- ✓ Increasing the load-bearing capacity of the transmission by engaging the teeth in contacts with the convex-concave geometry and the minimum difference in the curvatures of the mating flanks;
- ✓ Increasing the mechanical efficiency by changing the tooth shape, reducing the pressure angle between the flanks and at the expense of increasing the rolling share of the engaging teeth by decreasing the relative frictional sliding between the flanks with a reduction in the frontal overlap degree and a compensatory increase in the longitudinal overlap degree with pure rolling of teeth in the sphero-spatial interaction of the mating wheels with the nutation angle θ;
- ✓ Extending the kinematic and technological possibilities.

Stage: Technical project, industrial prototype.

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