Pinned shaft with four grooves

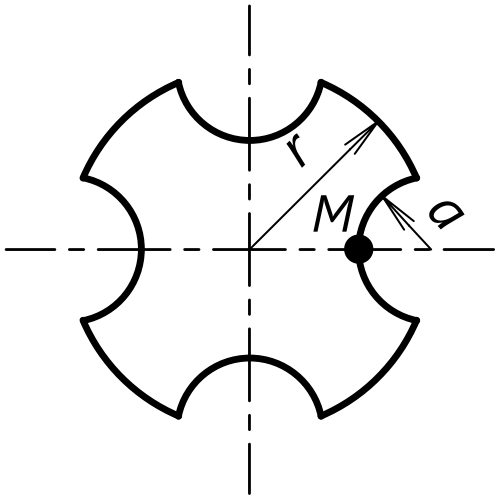

Fig. 1 - Pinned shaft with four grooves

Values for calculation:

Twisting moment	T	8000	Nm
Radius	r	42.5	mm
Dimension	a	20	mm
Length	L	1000	mm
Modulus of rigidity	G	80000	MPa

$$0.1 \leq \frac{a}{r} < 0.5 \rightarrow 0.1 \leq 0.471 < 0.5$$

Does suit.

$$C = 0.7854 - 0.0409\frac{a}{r} - 6.2371\left(\frac{a}{r}\right)^2 + 7.2538\left(\frac{a}{r}\right)^3$$
$$= 0.7854 - 0.0409\frac{20}{42.5} - 6.2371\left(\frac{20}{42.5}\right)^2 + 7.2538\left(\frac{20}{42.5}\right)^3 = 0.141$$

$$B$$
$$= 1.2135 - 2.9697\frac{a}{r} + 33.713\left(\frac{a}{r}\right)^2 - 99.506\left(\frac{a}{r}\right)^3 = 1.2135 - 2.9697\frac{20}{42.5} + 33.713\left(\frac{20}{42.5}\right.$$
$$+ 130.49\left(\frac{a}{\quad}\right)^4 \qquad \left(\frac{20}{\quad}\right)^4$$

$$+ 130.49\left(\frac{\quad}{r}\right) \qquad + 130.49\left(\frac{\quad}{42.5}\right)$$

$$= 3.311$$

Polar moment of inertia:

$$K = 2Cr^4 = 2 \cdot 0.141 \cdot 42.5^4 = 920036\text{mm}^4$$

Angle of twist:

$$\theta = \frac{T \cdot 10^3 \cdot L}{KG} = \frac{8000 \cdot 10^3 \cdot 1000}{920036 \cdot 80000} = 0.109\text{rad}$$

Torsion stress:

$$\tau_{at\ M} = \frac{10^3 TB}{r^3} = \frac{10^3 \cdot 8000 \cdot 3.311}{42.5^3} = 345.1\text{MPa}$$