FREEWHEELING CLUTCH AND POLYHEDRAL RING CALCULATION FOR CONTACT STRENGHT

O. Belcin, I. Turcu
Technical University of Cluj - Napoca

INTRODUCTION

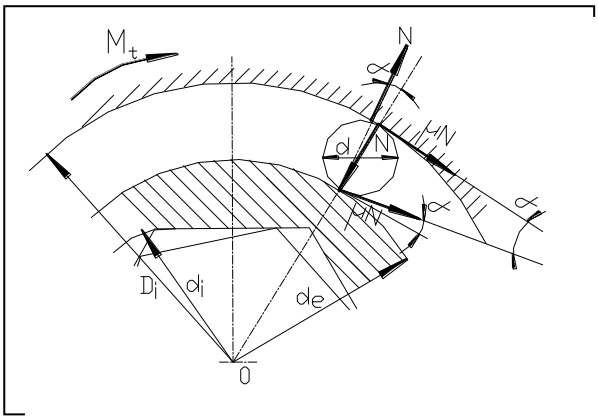
Freewheeling clutch and polyhedral ring resets in mechanical coupling category, intermittent, controlled, and asynchronous and are similar from functional point of view with unisense coupling. .

The roller blocking phenomena between two mating surfaces it is possible to be realized gradual or instantaneous with adequate adjustment of a regulation liquid pressure from hydraulic circuit.

To this couplers, the moving energy are dissipated on the hydraulically way. In this way, is not possible to produce the coupler heating in case of repeated operation, with high frequency.

1. CALCULATION ELEMENTS

For lifting power of freewheeling clutch and polyhedral ring establish in case of strength fatigue, we using the notations from figure no.1.



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or

$$\sigma_k = Z_E \sqrt{\frac{N}{\ell \cdot \rho}} \le \sigma_{ak} \qquad (1')$$

were : $Z_E = \sqrt{\dfrac{1}{\pi\left(\dfrac{1-\nu_1^2}{E_1} + \dfrac{1-\nu_2^2}{E_2}\right)}} \approx 191\sqrt{MPa}$

is the materials elasticity factor;

$N = \dfrac{2M_t}{\mu \cdot z \cdot D_i}$ - normal force in contact;

$\dfrac{1}{\rho} = \dfrac{2}{d} + \dfrac{2}{d_e}$ reduced radius of curvature;

ℓ - the roller length (the contact length) .

After the replacing in relation no.1 we obtaining:

$$\sigma_k = Z_E \sqrt{\frac{2M_t}{\mu \cdot z \cdot D_i \cdot \ell}\left(\frac{2}{d} + \frac{2}{d_e}\right)} \le \sigma_{ak} \qquad (2)$$

Spelling the M_t from relation No.2, results:

$$M_t \approx 3{,}5 \cdot \mu \cdot z \cdot \ell \cdot d^2 \left(\frac{\sigma_{ak}}{Z_E} \right)^2 \qquad (6)$$

If in relation no 6 we adopting:

$Z_E = 191\sqrt{MPa};$

$z = 12role;$

$\mu = 0{,}06;$

$\ell = 1mm$

we obtaining:

$$M_t \leq 6{,}9 \cdot 10^{-8} \left(d \cdot \sigma_{ak} \right)^2 [N \cdot m] \qquad (7)$$

were: d[mm] ; σ_{ak}[MPa]

$M_t=f(d,\sigma_{ak})$ dependence indicated by rel.no.7 is graphical represented in fig.no.2, using the table no.1 date.

Fig.no.2 is very useful for this type coupling projection (design), from resistance point of view for strength fatigue of contact.

From indicated dates in table no.1 and figure no.2, we remarque the special lifting power for this coupling.

Table no. 1. The moment of torsion values transmission for contact strength by length unit of roller.

d [mm]	5	6	7	8	9	10
σ_{ak} [MPa]	**M_t** [N.m]					
1000	1,72	2,48	3,38	4,41	5,58	6,9
1500	3,88	5,58	7,60	9,93	12,5	15,5
2000	6,9	9,93	13,5	17,6	22,3	27,6
2500	10,7	15,5	21,1	27,6	34,9	43,1
3000	15,5	22,3	30,4	39,7	50,3	62,1

The using rollers be cylindrical, short, from II or III grade of tolerance, which be used like separate rolling elements, according STAS 8088.

The using standard type dimensions, the dimensional and state variation line for diameters and length are indicated in STAS 8088.

The rollers material is steel for rolling contact, type RUL 1 or RUL 2 STAS 1456. The rollers hardness after the thermal treatment must be 60…65 HRC. The difference between hardness roller values can be maximum 3 units HRC.

The elastic ring with polyhedral interior will be manufactured from roller contact bearing steel and the crown gear, from cementation steel. Is recommended as rolling track hardness to be 55 … 62 HRC.

The permissible stress calculation for contact strength fatigue (σ_{ak}) will made according with [3,5].

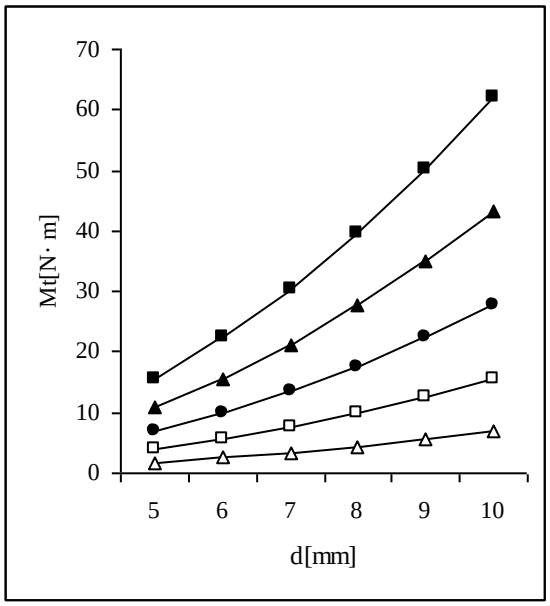

Figure 2. The moment of torsion dependence, transmitted by unit of length of roller, dependent on the roller diameter and the permissible stress for contact strength.

Δ - $\sigma_{ak} = 1000$ MPa

□ - $\sigma_{ak} = 1500$ MPa

● - $\sigma_{ak} = 2000$ MPa

▲ - $\sigma_{ak} = 2500$ MPa

■ - $\sigma_{ak} = 3000$ MPa

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