

**O'ZBEKISTON RESPUBLIKASI OLIY VA O'RTA MAXSUS
TA'LIM VAZIRLIGI**

TOSHKENT TO'QIMACHILIK VA YENGIL SANOAT INSTITUTI

UDK 621.81

«Nazariy va amaliy mexanika» kafedrası

**“MASHINA DETALLARI”
FANIDAN MUSTAQIL ISHNI BAJARISH UCHUN
METODIK QO'LLANMA**

5320300- Texnologik mashinalar va jixoslar
5610600- Xizmat ko'rsatish texnikasi va texnologiyasi
ta'lim yo'nalishlari uchun mo'ljallangan

TOSHKENT 2017

Annotatsiya

Ushbu metodik qo'llanma texnik oliy o'quv yurt bakalavrlari uchun yozilgan. Qo'llanmada Texnologik mashina yuritmalarining kinematik hisobini uslubiyati berilgan bo'lib, namuna sifatida masala yechib ko'rsatilgan.

Metodik qo'llanmada yetarli darajada yuritmani kinematik hisobini bajarish uchun kerakli qo'shimcha materiallar berilgan.

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Metodik qo'llanma «Nazariy va amaliy mexanika» kafedra majlisida tasdiqlangan.

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Metodik qo'llanma TTYESI bayonnomasida _____ nusxa chop etilgan.

KIRISH

Loyiha bu texnik xujjatllarning umumlashgani bo'lib bironta mexanizmning tayyorlash uchun hamma chizmalar ularning hisobi va boshqa kerakli ma'lumotlarning yig'indisidan iborat bo'ladi. Bu loyihalangan mashina kerakli ishni mo'ljallangan vaqt davomida qo'shimcha xarajatsiz sifatli ravishda bajarilishi kerak.

Mashina detallarining geometrik o'lchamlari aniqlanib, ular mustaxkamlikka, bikirlikka, yeyilishga va ezilishga tekshiriladi.

Kurs ishini bajarish jarayonida talabalar kerakli chizmalarni chizib, zarur hisoblarni qilishni o'rganadi, bu esa bo'lajak muxandislar uchun birinchi bosqich bo'lib hisoblanadi.

Bu qo'llanma yordamida talabalar eng oddiy detallarni, sanoatda ishlatiladigan mashinalar uchun umumiy bo'lgan tishli g'ildiraklar, vallar, podshipniklar va shu kabi detallarning uzellarini loyihalash, ya'ni hisoblash va chizishni o'rganadilar.

YURITMALARNING KINEMATIK HISOBI. VALLARDAGI MOMENTLARNI ANIQLASH

Yuritmani loyihalash, uning kinematik o'lchamlarini hisoblashdan, bu esa o'z navbatida elektrodvigatel tanlashdan boshlanadi. Bunda quyidagi hollar bo'lishi mumkin:

1. Yuritma ishchi valning quvvati $P_{i.v}$, kVt. hamda aylanish soni n , min^{-1} berilgan bo'lsa (1-rasm), elektrodvigatel valdagi quvvat quyidagicha aniqlanadi.

$$P_{tal} = \frac{P_{i.v}}{\eta_{um}}$$

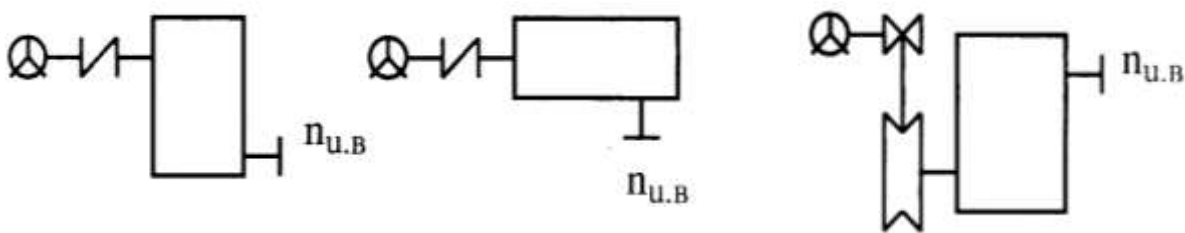
Bu erda η_{um} -yuritmaning umumiy F.I.K., har bir uzatma F.I.K qiymatlarning ko'paytmasiga teng. Uzatmalarni F.I.K qiymatlari 1-jadvaldan tanlanadi.

1-Jadval

Uzatmalarni F.I.K - η		
Uzatmalarning turlari	Yopiq uzatma	Ochiq uzatma
Silindrsimon uzatmalar	0,96-0,98	0,93-0,95
Konussimon uzatmalar	0,95-0,97	0,92-0,94
Chervyakli uzatmalarda uzatish soni:		
30 dan yuqori bo'lganda	0,70-0,50	
14 dan 30 gacha	0,75-0,85	
8 dan 14 gacha	0,80-0,90	
Zanjirli		0,92-0,96
Tasmali		0,94-0,96

Bir juft dumalash podshipniklar uchun $\eta = 0,99-0,995$

Bir juft sirpanish podshipniklar uchun $\eta = 0,98-0,99$



1-rasm

2. Yuritma ishchi valiga o'rnatilgan lentali, zanjirli konverlarni baraban yoki yulduzchalariga ta'sir qiluvchi aylanma kuch F_t qiymati hamda shu baraban yoki yulduzchanning o'lchamlari berilgan bo'lsa (2-rasm), tezligi aniqlanib, ishchi valdagi quvvat quyidagicha aniqlanadi.

$$P_{i.v} = \frac{F_t \cdot V}{1000}; kVt$$

Bunda: a) Lentali konveyr uchun

$$V = \frac{\pi D_b n_b}{60}; m/sek$$

b) Zanjirli konveyr uchun

$$V = \frac{\pi \cdot z \cdot t \cdot n_{(b)yu}}{60}; m/sek$$

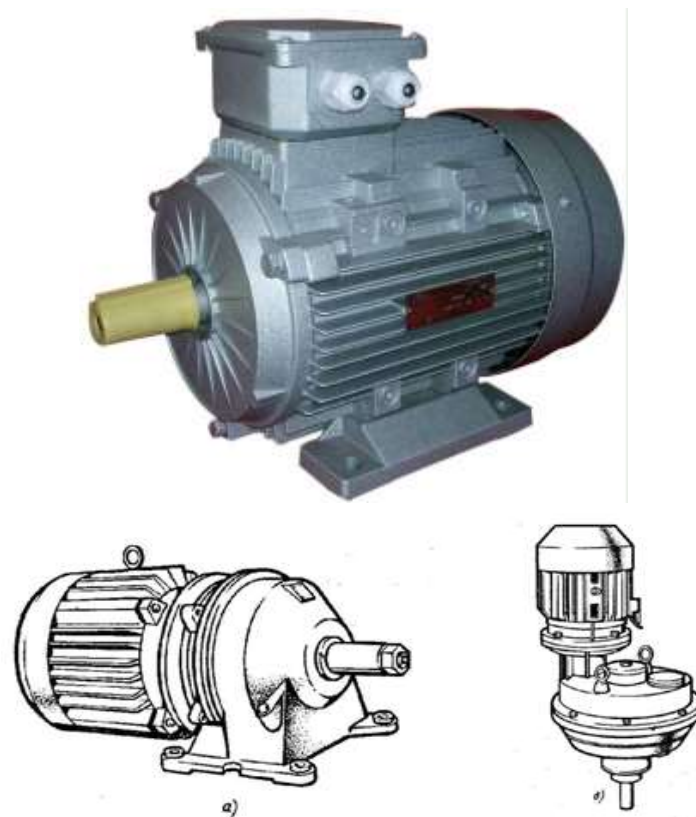
D_b -barabanning diametri; n_b , n_{yu} -baraban yoki yulduzchanning aylanish soni, min^{-1} ; z -tishlar soni; t -yulduzcha tish qadami, mm.

Asinxron elektrodvigatel turlari

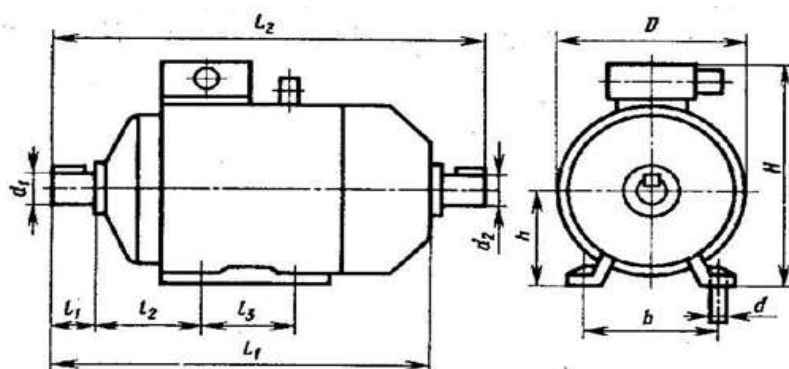
2-jadval

Quvvat P, kVt	n-sinxron aylanishlar soni, min^{-1}							
	3000		1500		1000		750	
	Marka	s,%	Marka	s,%	Marka	s,%	Marka	s,%
0,55	63B2	8,5	71A4	7,3	71B6	10	80B8	9,0
0,75	71A2	5,9	71B4	7,5	80A6	8,4	90LA8	8,4
1,1	71B2	6,3	80A4	5,4	80B6	8,0	90LB8	7,0
1,5	80A2	4,2	80B4	5,8	90L6	6,4	100L8	7,0
2,2	80B2	4,3	90L4	5,1	100L6	5,1	112MA8	6,0

3,0	90L2	4,3	100S4	4,4	112MA6	4,7	112M8	5,8
4,0	100S2	3,3	100L4	4,7	112MA6	5,1	132S8	4,1
5,5	100L2	3,4	112M4	3,7	132S2	3,3	132M8	4,1
7,5	112M2	2,5	132S4	3,0	132M6	3,2	160S8	2,5
11,0	132M2	2,3	132M4	2,8	160S6	2,7	160M8	2,5
15,0	160S2	2,1	160S4	2,3	160M6	2,6	180M8	2,5
18,5	160M2	2,1	160M4	2,2	180M6	2,7	200M8	2,3
22	180S2	2,0	180S4	2,0	200M6	2,8	200L8	2,7
30	180M2	1,9	180M4	1,9	200L6	2,1	225M8	1,8
37	200M2	1,9	200M4	1,7	225M6	1,8	250S8	1,5
45	200L2	1,8	200LA	1,6	250S6	1,4	250M8	1,4
55	225M2	1,8	225M4	1,4	250M6	1,3	280S8	2,2
75	250S2	1,4	250S4	1,2	280S6	2,0	280M8	2,2
90	250M2	1,4	250M4	1,3	280M6	2,0	315S8	2,0
110	280S2	2,0	280S4	2,3	315S6	2,0	315M8	2,0



3-rasm. Elektrodvigatel
a) gorizontaal; b) vertikal.



4-rasm. Elektrodvigatelning eskiz shemasi

3-jadval

Dvigatel markasi	Plyuslar soni	Dvigatel o'lchamlari									
		L ₁	H	D	d ₁	l ₁	l ₂	l ₃	b	d ₀	h
4AA50	2,4	174	142	112	9	20	32	63	80	5,8	50
4AA56	2,4	194	152	128	11	12	36	71	90	5,8	56
4AA63	2,4,6,8	216	164	138	14	30	40	80	100	7,0	63
4A71	2,4,6,8	285	201	170	19	40	45	90	112	7,0	71
4A80A		300									80
4A80B		320	218	186	22	50	50	100	125	10	
4A90L		350	243	208	24	50	56	125	140	10	90
4A100S	2,4,6,8	365	265					132			
4A100L		395	280	235	28	60	263	140	160	12	100
4A112M		452	310	260	32	80	70	140	190	12	112
4A132S		480									
4A132M	530				38			178			
4A160S	2	624	350	302	42	80	89	178	216	12	132
	4,6,8				48						
4A160M	2	667	430	358	42	110	108	210	254	15	160
	4,6,8				48						
4A180S	2	662			48			203			
	4,6,8		55								
4A160S	2	720	470	410	48	110	121	210	279	15	180

3. Yuritma ishchi vallagi aylanuvchi moment T , hamda aylanish soni n , berilgan bo'lsa, ishchi validagi quvvat quyidagicha aniqlanadi.

$$P = \frac{T \cdot n}{9550}; \text{ kVt}$$

4. Yuritma bironta valning quvvati aniqlangach, qolgan vallarning quvvati quyidagicha aniqlanadi, ya'ni, $P_2 = P_1 \cdot \eta_I$, $P_3 = P_2 \cdot \eta_{II}$

Aniqlangan P_1 quvvat bo'yicha 2-jadvaldan elektrodvigatel tanlanib, eskiz chizmasi chiziladi o'lchamlari 3-jadvaldan olinadi.

Yuritma uzatmalarning uzatish soni.

Yuritma uzatmalarning umumiy uzatish soni u_y elektrodvigatel valini aylanish sonini necha marta kamaytirib yoki valdagi aylanuvchi momentni qancha marta oshirib berishni ko'rsatadi, ya'ni:

$$u_{um} = \frac{n_{dv}}{n_{i.v.}}$$

Bu erda: n_{dv} - dvigatel valining aylanish soni, min^{-1} . $n_{i.v.}$ - yuritmadagi ishchi valning aylanish soni bo'lib, uning qiymatini quyidagicha aniqlash mumkin.

a) Yuritmda lentali konveyerni tezligi, V m/sek, hamda barabanning diametri D (m), berilgan bo'lsa; 2-rasm;

$$n_{i.v} = \frac{60V}{\pi D_b}; \text{ min}^{-1}$$

b) Yuritmada zanjirli konveyrning tezligi V , hamda yulduzchaning tishlar soni z , qadami t berilgan bo'lsa; 2-rasm;

$$n_{i.v} = \frac{60V}{\pi z_b \cdot t}; \text{ min}^{-1}$$

Aniqlangan u_y ning qiymati har bir uzatmaga taqsimlanadi, chunki:

$$u_{um} = u_I \cdot u_{II} \cdot u_{III}$$

Yuritmaning uzatish soni bir necha pog'ona uzatmalar bilan ta'minlansa quyidagi tavsiyalarga amal qilish kerak bo'ladi:

a) Loyixalanayotgan yopiq uzatmalarning gabarit o'lchamlari hamda og'irligi ahmiyatga ega bo'lmasa pog'onalar sonini kamaytirish tavsiya etiladi, bunda yopiq uzatma nisbatan arzon bo'ladi.

b) Loyixalanayotgan yopiq uzatmaning og'irligi, gabarit o'lchamlari kam bo'lishi kerak bo'lgan hollarda ko'p pog'onali uzatmalar olish tavsiya etiladi.

Kinematik sxemada uzatmalarni uzatish soni qiymatlarni quyidagicha olish tavsiya etiladi.

Uzatmalar uchun tavsiya etilgan uzatish sonlari.

4-Jadval

Uzatmaning turi	Tavsiya etilgan u ning o'rtacha qiymati	Tavsiya etilgan u ning eng katta qiymati
Bir pog'onali yopiq tsilindrsimon uzatma	3 ÷ 6	12,5
Ochiq tsilindrsimon uzatma	3 ÷ 7	15 ÷ 30
Ochiq va yopiq konussimon uzatma	2 ÷ 3	6,3
Yopiq chervyakli uzatma	10 ÷ 40	80
Ochiq chervyakli uzatma	10 ÷ 60	120
Zanjirli uzatma	2 ÷ 6	8
Tasmali uzatma	2 ÷ 5	6

Uzatish soni u qiymatini bir pog'onali yopiq tsilindrsimon va konussimon uzatmalar uchun GOST asosida quyidagicha tanlash mumkin.

1. qator – 2,0; 2,5; 3,5; 4,0; 5,0; 6,3.

2. qator – 2,24; 2,8; 3,55; 4,5; 5,6; 7,1.

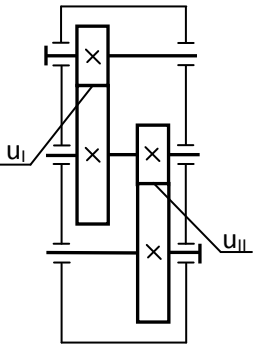
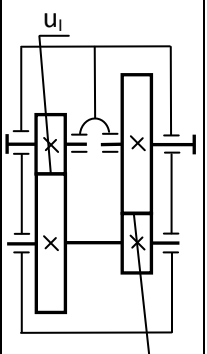
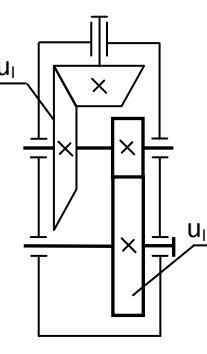
Ilova: asosan birinchi qatordan tanlash tavsiya etiladi.

Standart asosida yopiq bir pog'onali chervyakli uzatmalar uchun chervyak kirim soni $Z_1 = 1,2,4$ bo'lganda, quyidagicha tanlash mumkin:

1. qator – 10; 12,5; 16; 20; 25; 31,8.

2. qator – 11,2; 14; 18; 22,4; 28; 35,5.

Ikki pog'onali tishli uzatmalarda har bir pog'onasi uchun uzatish sonini qiymatini quyidagicha tanlash tavsiya etiladi.

Uzatmani sxemasi	Uzatish soni		Uzatmani sxemasi	Uzatish soni		Uzatmani sxemasi	Uzatish soni	
	u_I	u_{II}		u_I	u_{II}		u_I	u_{II}
2 pog'onali 3 o'qli silindrsimon reduktor			2 pog'onali o'qdosh silindrsimon reduktor			2 pog'onali konik-silindrik reduktor		

Vallardagi aylanuvchi momentlar.

1. Yuritma ishchi validagi quvvat $p_{i,v}$ hamda aylanish soni n , min^{-1} berilgan bo'lsa, aylanuvchi moment quyidagicha aniqlanadi.

$$T_{u.b} = 9550 \frac{P_{ub}}{n_{ub}}; \quad Nm$$

Tez harakatlanuvchi valdagi aylanuvchi moment qiymati

$$T = \frac{T_{ub}}{(u \cdot \eta)}; \quad Nm$$

Bu erda u – uzatmaning uzatish soni. η - yuritmaning F.I.K.

2. Yuritmada lentali yoki zanjirli konveyerlarni baraban yoki yulduzcha diametrlari hamda ta'sir qiluvchi aylanma kuch berilgan bo'lsa, valdagi aylanuvchi moment qiymati:

$$T = F_t \cdot \frac{D_{baraban}}{2}; \quad Nm \text{ yoki } T = F_t \cdot \frac{D_{yulduzcha}}{2}; \quad Nm$$

Bu erda:

F_t – aylanma kuch, N;

D_b, D_{yul} – baraban, yulduzcha diametrlari, m;

$$D_{yul} = \frac{P}{\sin \frac{180^\circ}{z}}; \quad mm$$

P – yulduzcha tish qadami;

z – yulduzchanning tishlari soni.

Yopiq tsilindrsimon uzatmalarni hisobi.

Uzatmalarni asosiy o'lchamlari bu o'qlararo masofa a_ω , uzatish soni u , tish eni koeffitsienti ψ_a ilashish moduli m , tishning qiyalik burchagi β .

Tsilindrsimon uzatmani hisoblash uchun kerakli uzatish sonini, ruxsat etilgan kontakt va egilishdagi kuchlanishni aniqlash, material tanlash yuqorida berilgan. O'qlararo masofa esa quyidagicha aniqlanadi.

$$a_\omega = K_a (1+u) \sqrt[3]{\frac{K_{H\beta} \cdot T_2 \cdot 10^3}{\psi_a \cdot u^2 \cdot [\sigma_H]^2}} \text{ mm},$$

bu erda: K_a - o'qlararo masofa koeffitsienti, qiya tishli uzatmalar uchun $K_a=43$; to'g'ri tishli uzatmalar uchun $K_a=49,5$; ψ_a - tish eni koeffitsienti qiymati etaklovchi g'ildirakni tayanchga nisbatan joylashishiga bog'liq:

Simmetrik joylashsa – $0,315 \div 0,4$

Nosimmetrik joylashsa – $0,25 \div 0,315$

Konsol joylashsa – $0,2 \div 0,25$

Tavsiya etilgan qiymatning kichigining g'ildirak tishlarini qattiqligi $HRC > 45$ bo'lganda tanlanadi. Tanlangan ψ_a ning qiymati standart bo'yicha muvofiqlashtirish kerak ya'ni $\psi_a = 0,1; 0,15; 0,2; 0,25; 0,4; 0,55; 0,63$.

$K_{H\beta}$ - yuklanish notekis taqsimlanishi hisobga oluvchi koeffitsient.

Tishli g'ildiraklarni materiallarini termik qayta ishlanishi a, b gurux

bo'yicha olingan bo'lib, etaklanuvchi tishli g'ildirak tezligi $V < 15$ m/s hamda tish yuzasining qattiqligi < 350 HB bo'lganda g'ildirak tishlari o'zaro tez moslashganligi uchun $K_{H\beta} = 1,0$; > 350 HB bo'lganda koeffitsient qiymati quyidagicha aniqlanadi.

$$K_{H\beta} = 1 + \frac{2\psi_a}{S} \leq 2,0$$

bunda $\psi_d = 0,5\psi_a(1+u)$ - tish eni koeffitsienti; S - tayanchlarga nisbatan tishli g'ildiraklar joylashganini hisobga oluvchi koeffitsienti, qiymati jadvaldan tanlanadi

Etaklovchi tishli g'ildirakni tayanchga nisbatan joylanishi	S
Tayanchga zoldirli podshipnik o'rnatilib kansol holatda joylashgan	1
Tayanchga rolik podshipnik o'rnatilib kansol holatda joylashgan	2
Nosimmetrik joylashgan	4
Simmetrik joylashgan	8

T_2 – etaklanuvchi tishli g'ildirak validagi burovchi moment, Nm hisobida;
 $[\sigma_H]$ – ruxsat etilgan kontakt kuchlanish, MPa. Aniqlangan o'qlararo masofa $a_w(d_{e2})$ standart bo'yicha yaxlitlanadi, mm

1 – qator	40	50	63	80	125	160	200	250	315	400	500
2 – qator	71	90	112	140	180	224	280	355	450	560	710

2. Etaklanuvchi tishli g'ildirak eni $b_2 = \psi_a \cdot a$
3. Etaklovchi tishli g'ildirak eni $b_1 = 1,12b_2$
4. Etaklanuvchi tishli g'ildirak tish bo'luvchi aylanasining o'lchami

$$d_2 = \frac{2a \cdot u}{(1+u)} \text{ mm.}$$

5. a_ω , b_2 , d_2 qiymatlari aniqlangach kontakt kuchlanishning hisobiy qiymati aniqlanadi.

$$\sigma_H = K_a \sqrt{\frac{F_t(1+u)K_H}{b_2 \cdot d_2}} \leq [\sigma_H]$$

bu erda: K – qo'shimcha koeffitsient to'g'ri tishli uzatmalar uchun 436, qiya tishli uzatmalar uchun 376; $K_H = K_{H\alpha} \cdot K_{Hv} \cdot K_{H\beta}$ – yuklanish koeffitsienti.

$K_{H\alpha}$ – yuklanishni tishlararo notekis taqsimotlanishi hisobga oluvchi koeffitsient, qiymati to'g'ri tsilindrsimon uzatmalar uchun 1,0; qiya tishli tsilindrsimon uzatmalar uchun 1,1;

K_{Hv} – qo'shimcha dinamik kuchlarni hisobga oluvchi koeffitsient qiymati, to'g'ri tishli g'ildiraklar uchun tish yuzasining qattiqligi ≤ 350 NV bo'lganda – 1,2; >350 bo'lganda – 1,1; qiya tishli g'ildiraklar uchun tish yuzasining qattiqligi ≤ 350 NV bo'lganda – 1,1; >350 NV bo'lganda – 1,08.

$K_{H\beta}$ – koeffitsient qiymatni aniqlash yuqorida ko'rsatilgan.

Hisobiy kontakt kuchlanish qiymati $\sigma_H \leq (0,9 - 1,05)[\sigma_H]$ shartni bajarish kerak, agar bu shart bajarilmasa a_ω , yoki b_2 qiymatlarini o'zgartirib hisob qaytariladi.

6. Uzatma g'ildiraklarning ilashish moduli

$$m_n \geq \frac{2K_m \cdot T_2}{d_2 \cdot b_2 [\sigma_F]} \text{ mm,}$$

bu erda K_m – modul koeffitsienti bo'lib, qiymati to'g'ri tishli g'ildiraklar uchun 6,8; qiya tishli g'ildirak uchun 5,8. Modulning aniqlangan qiymati standart bo'yicha yaxlitlanad, m , mm.

1 – qator	1	1,5	2	2,5	3	4	5	6	8	10
2 – qator	1,25	1,75	2,25	2,75	3,5	4,5	5,5	7	9	

Modulni asosan 1 – qatordan tanlash tavsiya etiladi. Quvvat uzatadigan uzatmalarda tish yuzasining qattiqligi $\geq 350\text{HV}$ bo'lganda $m > 1$ mm; g'ildirak tishlarini birortasini qattiqligi ≥ 45 HRC bo'lganda $m \geq 1,5$ mm olinadi.

7. Uzatma g'ildirak tishlarining qiyalik burchagi β hamda umumiy tishlar soni, Z_y

a) Qiya tishli g'ildirak uchun qiyalik burchagining eng kichik qiymati

$$\beta_{\min} = \frac{\arcsin 4_m}{b_2}.$$

b) Uzatma g'ildirak tishlarining umumiy soni

$$Z_y = \frac{2a \cos \beta_{\min}}{m},$$

Z_y ning qiymatini yaxlitlab qiyalik burchagini hisobiy qiymati aniqlanadi, ya'ni $\beta = \arccos(Z_y \cdot m / 2a)$. Qiya tishli g'ildirak uchun qiyalik burchagining qiymatlar $\beta_{\min} = 8^\circ - 15^\circ$. Hisoblanganda aniqlik darajasi verguldan keyin 5 – xonagacha olinishi kerak.

8. Etaklovchi va etaklanuvchi g'ildirak tishlari soni

Etaklovchi g'ildirak tishlar soni $Z_1 = Z_y / (1 + u) \geq Z_{1\min}$

Etaklanuvchi g'ildirak tishlar soni $Z_2 = Z_y - Z_1$

9. Uzatma g'ildiraklarning geometrik o'lchamlari, 1 – rasm

G'ildirak diametrlari	To'g'ri tishli tsilindrsimon g'ildiraklar	Qiya tishli tsilindrsimon g'ildiraklar
Tish bo'luvchi aylanasi o'lchami		
a) Etaklovchi g'ildirak	$d_1 = mz_1$	$d_1 = m_n z_1 / \cos \beta$
b) Etaklanuvchi g'ildirak	$d_2 = mz_2$	$d_2 = m_n z_2 / \cos \beta$
Tashqi aylanasining o'lchami		
a) Etaklovchi g'ildirak	$d_{a1} = d_1 + 2m$	$d_{a1} = d_1 + 2m$

b) Etaklanuvchi g'ildirak	$d_{a2} = d_2 + 2m$	$d_{a2} = d_2 + 2m$
Tish osti aylanasining o'lchami		
a) Etaklovchi g'ildirak	$d_{f1} = d_1 - 2,5m$	$d_{f1} = d_1 - 2,5m$
b) Etaklanuvchi g'ildirak	$d_{f2} = d_2 - 2,5m$	$d_{f2} = d_2 - 2,5m$

10. Tishli g'ildiraklarning ilashishda hosil bo'lgan kuchlar, 2 – rasm.

	To'g'ri tishli uzatmalar	Qiya tishli uzatmalar
Aylanma kuch, F_t	$F_t = 2T/d$	
Markazga intiluvchi kuch, F_r	$F_r = F_t \cdot \operatorname{tg} \alpha, \alpha = 20^\circ$	$F_r = F_t \cdot \operatorname{tg} \alpha / \cos \beta$
Bo'ylama kuch		$F_a = F_t \cdot \operatorname{tg} \beta$

11. Egilishdagi kuchlanishni hisobiy qiymati

Etaklanuvchi g'ildirak uchun

$$\sigma_{F2} = \frac{F_t \cdot Y_{F2} \cdot Y_\beta \cdot K_{F\alpha} \cdot K_{F\beta} \cdot K_{Fv}}{b_2 \cdot m} \text{ MPa,}$$

Etaklovchi g'ildirak uchun $\sigma_{F1} = \sigma_{F2} \frac{Y_{F1}}{Y_{F2}}$ MPa bunda $\sigma_F < [\sigma_F]$ shart

bajarilishi kerak.

$K_{F\alpha}$ – uzatma g'ildirak tishlarning aniqlik darajasini hisobga oluvchi koeffitsienti bo'lib qiymati to'g'ri tishli tsilindrsimon uzatmalar uchun – 1,0; qiyalik burchagi $\beta > 0$ bo'lganda g'ildirak tishlarini aniqlik darajasiga nisbatan quyidagicha olinadi.

Aniqlik darajasi	6	7	8	9
$K_{F\alpha}$	0,72	0,81	0,91	1,0

Y_F - tish shaklini g'isobga oluvchi koeffitsient qiymatijadvaldan to'g'ri tishli tsilindrsimon g'ildiraklar uchun tishlar soniga nisbatan tanlanadi, qiya tishli tsilindrsimon g'ildiraklar uchun keltirilgan tishlar soniga nisbatan tanlanadi.

$$Z_K = Z / \cos^3 \beta$$

Z yoki Z_k	17	20	22	24	26	28	30	35	40	45	50	65	≥ 80
Y_F	4,27	4,07	3,98	3,92	3,88	3,84	3,80	3,75	3,7	3,66	3,65	3,62	3,61

Y_β - g'ildirak tishlarining qiyalik burchagini egilishda kuchlanishga ta'sirini hisobga oluvchi koeffitsient

$$Y_\beta = 1 - \frac{\beta}{140^0}$$

K_{FV} - qo'shimcha dinamik kuchlarni hisobga oluvchi koeffitsient bo'lib qiymati tish yuzasini qattiqligiga nisbatan quyidagicha olinadi:

To'g'ri tishli tsilindrsimon g'ildirak uchun

$$\leq 350 \text{ NV bo'lganda } K_{FV} = 1,4$$

$$> 350 \text{ NV bo'lganda } K_{FV} = 1,1$$

Qiya tishli tsilindrsimon g'ildirak uchun

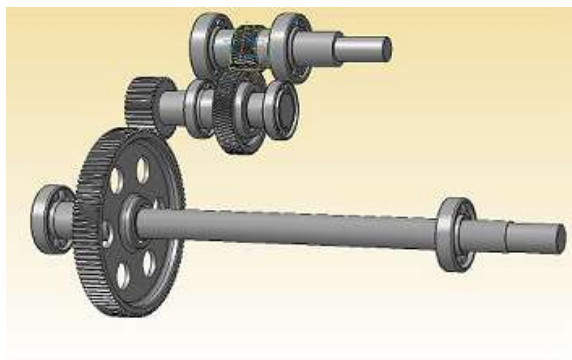
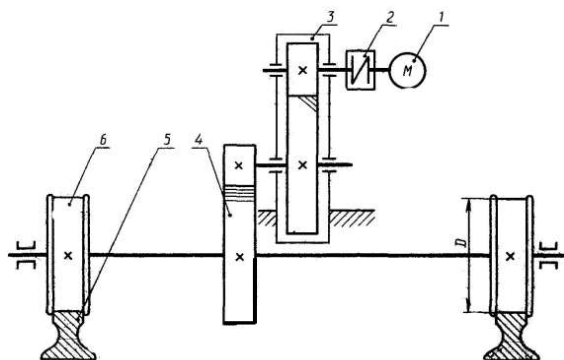
$$\leq 350 \text{ NV bo'lganda } K_{FV} = 1,2$$

$$> 350 \text{ NV bo'lganda } K_{FV} = 1,1$$

$K_{F\beta}$ - kuchlanishlarni tish eni bo'yicha notekis taqsimlanishlarini hisobga oluvchi koeffitsient. Tishli g'ildirak materiallari a, b - gurux bo'yicha termik qayta ishlangan bo'lsa - 1,0; >350 NV bo'lganda

$$K_{F\beta} = 1 + \frac{1,5 \cdot \psi_\alpha}{S} \leq 1,7$$

Misol uchun ko'priqli kran yuritmasining hisobini ko'rib chiqaylaik



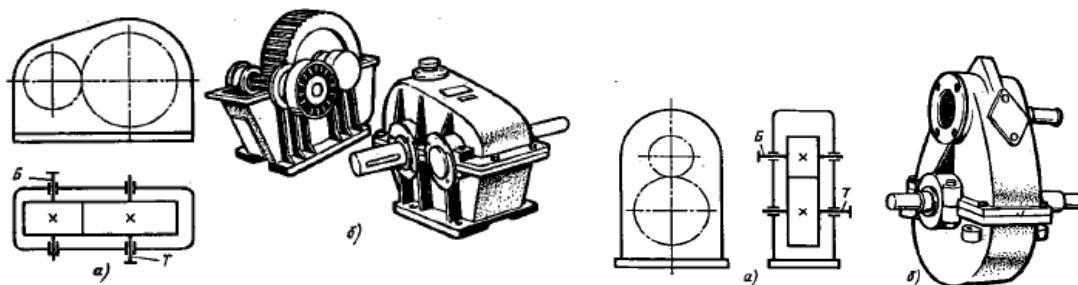
1-dvigatel; 2-mufta; 3-tsilndrsimon yopiq uzatma; 4-ochiq tsilndrsimon uzatma; 5-reis; 6-g'ildirak

Berilgan qiymatlari


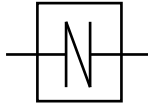
Ko'priqli xarakatiga qarshilik kuch F , kN 1,7

Ko'priqli tezligi v , m/s 1,65

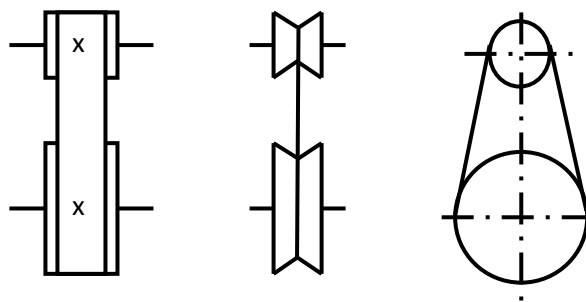
G'ildirak diametri D , mm 200



Uzatmalarning shartli belgilari

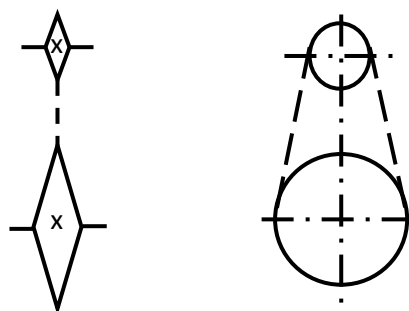
Elektro dvigatel  Mufta 

Tasmali uzatmalar



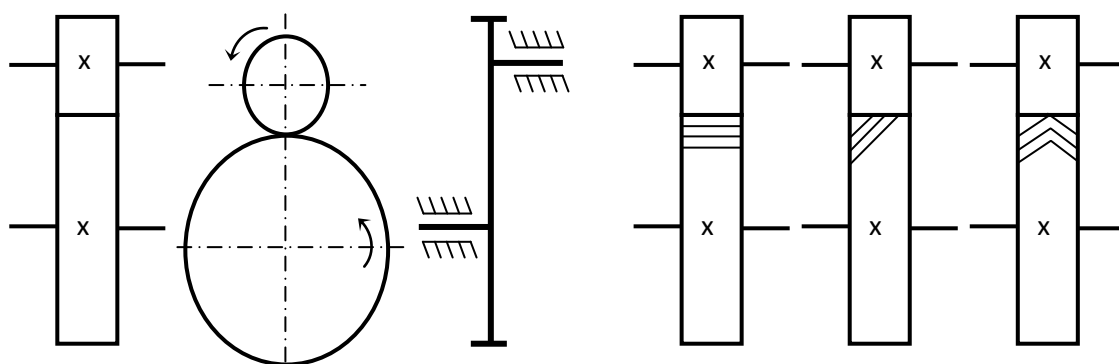
Yassi TU Ponasimon TU

Zanjirli uzatma



Tishli uzatmalar

TSilindrsimon ochiq uzatma



I. YURITMANING KINEMATIK XISOBI

1. Talab etilgan quvvat

$$P_{tal} = \frac{P_{i.v.}}{\eta_{um}}, kVt$$

Bu yerda η_{um} – yuritmaning umumiy FIK (S.A.Chernavskiy 5 bet)

η_1 – Chilindrsimon reduktorning FIK, $\eta_1 = 0,97 \div 0,98$ gacha

η_2 – Cilindrsimon uchiq uzatmaning FIK, $\eta_2 = 0,95 \div 0,96$ gacha

η_{podsh} – Bir juft dumalash podshibniklarining FIK $\eta_{podsh} = 0,99$

$$\eta_{um} = \eta_1 \cdot \eta_2 \cdot \eta_{podsh}^3 = 0,97 \cdot 0,95 \cdot 0,99^3 = 0,894$$

2. Ishchi valdagi quvvat

$$P_{i.v.} = F \cdot v = 1,7 \cdot 1,65 = 2,805 kVt$$

3. Ishchi valdagi aylanishlar soni

$$n_{i.v.} = \frac{60 \cdot v}{\pi \cdot D} = \frac{60 \cdot 1,65}{3,14 \cdot 0,2} = 157 \text{ ayl/min}$$

$$P_{tal} = \frac{P_{i.v}}{\eta_{o\delta u}} = \frac{2,805}{0,894} = 3,13 \text{ kBm}$$

4. Elektrodvigatel tanlab olamiz $P_{dv} \geq P_{tal}$. (S.A.Chernavskiy 390 bet)

$P_{dv} = 4,0 \text{ kVt}$ sinhron aylanishlar soni n_s va siljish koeffisienti s , % tanlab dvigatelni xaqiqiy aylanishlar sonini hisoblaymiz. (2-jadvalga qaralsin)

$$\boxed{n_s = 3000 \text{ ayl/min};} \quad n_s = 1500 \text{ ayl/min}; \quad n_s = 1000 \text{ ayl/min};$$

$$n_s = 750 \text{ ayl/min};$$

$$s = 3,3\%; \quad s = 4,7\%; \quad s = 5,1\%; \quad s = 4,1\%.$$

$$n_{dv} = n_s (1-s), \text{ ayl/min}$$

$$\boxed{n_{dv} = 3000 (1-0,033) = 2901 \text{ ayl/min}}$$

$$n_{dv} = 1500 (1-0,047) = 1429,5 \text{ ayl/min}$$

$$n_{dv} = 1000 (1-0,051) = 949 \text{ ayl/min}$$

$$n_{dv} = 750 (1-0,041) = 719 \text{ ayl/min}$$

5. Yuritmaning umumiy uzatish sonini

$$u_{um} = \frac{n_{dv}}{n_{i.v}}$$

$$\boxed{u_{um} = \frac{2901}{157} = 18,5;}$$

$$u_{um} = \frac{949}{157} = 6,0;$$

$$u_{um} = \frac{1429}{157} = 9,1;$$

$$u_{o\delta u} = \frac{719}{157} = 4,6.$$

6. Yuritmaning uzatish sonini aniqlash va pog'onalariga taqsimlash (4-jadvalga qaralsin)

$$u_{um} = u_1 \cdot u_2$$

u_1 – reduktorning uzatis soni $3 \div 6$;

u_2 – silindrsimon ochiq uzatmaning uzatis soni reduktorning uzatish sonidan kichik bo'lishi kerak $3 \div 6$.

$u_1 = 5$ deb qabulqilamiz va i_2 ni hisoblaymiz

$$u_2 = \frac{u_{um}}{u_1};$$

$$u_2 = \frac{18,5}{5} = 3,7;$$

$$u_2 = \frac{6}{5} = 1,2;$$

$$u_2 = \frac{9,1}{5} = 1,82;$$

$$u_2 = \frac{4,6}{5} = 0,92;$$

Bu to'rtta qiymatlarda 1- qiymat bizga mos keladi.

$u_2 = 3,7$ deb qabul qilamiz.

7. Xarbir val uchun quvvat (P), aylanishlar soni (n), burovchi moment (T) hamda burchak tezlik (ω) qiymatlarini hisoblaymiz.

I val.

$$P_1 = P_{\text{tal}} = 3,13 \text{ kVt}$$

$$n_1 = n_{dv} = 2901 \text{ ayl/min}$$

$$T_1 = 9550 \cdot \frac{P_1}{n_1} = 9550 \cdot \frac{3,13}{2901} = 10,3 \text{ N} \cdot \text{m}$$

$$\omega_1 = \frac{\pi \cdot n_1}{30} = \frac{3,14 \cdot 2901}{30} = 303,6 \text{ rad/s}$$

II val.

$$P_2 = P_1 \cdot \eta_1 = 3,13 \cdot 0,97 = 3,03 \text{ kVt}$$

$$n_2 = \frac{n_1}{u_1} = \frac{2901}{5} = 580,2 \text{ ayl/min}$$

$$T_2 = 9550 \cdot \frac{P_2}{n_2} = 9550 \cdot \frac{3,03}{580,2} = 49,9 \text{ N} \cdot \text{m}$$

$$\omega_2 = \frac{\pi \cdot n_2}{30} = \frac{3,14 \cdot 580,2}{30} = 53,19 \text{ rad/s}$$

III val.

$$P_3 = P_2 \cdot \eta_2 = 3,03 \cdot 0,95 = 2,87 \text{ kVt}$$

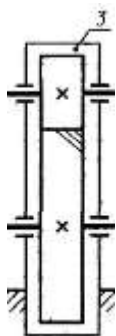
$$n_3 = \frac{n_2}{u_2} = \frac{580,2}{3,7} = 156,8 \text{ ayl/min}$$

$$T_3 = 9550 \cdot \frac{P_3}{n_3} = 9550 \cdot \frac{2,87}{156,8} = 175,7 \text{ N} \cdot \text{m}$$

$$\omega_3 = \frac{\pi \cdot n_3}{30} = \frac{3,14 \cdot 156,8}{30} = 16,4 \text{ rad/s}$$

Aniqlangan P_1 quvvat bo'yicha 2-jadvaldan 4A100S2 markali elektrodvigatel tanlanib, eskiz chizmasi chiziladi o'lchamlari 3-jadvaldan olinadi.

II. BIR POG'ONALI QIYA TISHLI TSILINDRSIMON REDUKTORNING XISOBI

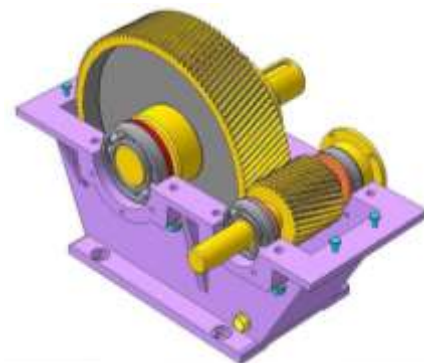


$$T_2 = 49,9 \text{ N}\cdot\text{m}$$

$$T_3 = 175,7 \text{ N}\cdot\text{m}$$

$$\omega_2 = 53,19$$

$$u_1 = 5$$



1. Tishli g'ildirak uchun material tanlash (S.A.Chernavskiy 34 bet). G'ildirak tishlariga qancha ishlov bersak shuncha mustaxkamlashadi va gabarit o'lchamlari kichiklashadi.

Tishli g'ildirak uchun

Marka: Po'lat 45

ishlov berish yahshilangan
material qattiqligi HB 200

Shesterny uchun

Marka: Po'lat 45

ishlov berish yahshilangan
material qattiqligi HB 230

2. Ruhsat etilgan kontakt kuchlanishni xisoblaymiz.

$$[\sigma_H] = \frac{\sigma_{Hlimb} \cdot K_{HI}}{[S_H]}; \text{ MPa}$$

bu yerda:

σ_{Hlimb} – kontakt kuchlanishning chidamlilik chegarasi

$$\sigma_{Hlimb} = 2HB + 70 \text{ MPa (S.A.Chernavskiy 34 bet 3.2-jadval)}$$

K_{HI} - uzoq muddat ishlashni xisobga oluvchi koeffitsent (S.A.Chernavskiy 33 bet.) $K_{HI} = 1$. $[S_H]$ – havfsizlik koeffitsenti $S_H = 1.1 \div 1.2$

Shesternya uchun

$$[\sigma_{H1}] = \frac{(2HB_1 + 70) \cdot K_{Hl}}{[S_H]} = \frac{(2 \cdot 230 + 70) \cdot 1}{1,1} \approx 482 \text{ MPa}$$

Tishli g'ildirak uchun

$$[\sigma_{H2}] = \frac{(2HB_2 + 70) \cdot K_{Hl}}{[S_H]} = \frac{(2 \cdot 200 + 70) \cdot 1}{1,1} \approx 428 \text{ MPa}$$

kegingi ishlarda kontakt kuchlanishning hisobiy qiymati ishlatiladi.

$$[\sigma_H] = 0,45([\sigma_{H1}] + [\sigma_{H2}]) = 0,45(482 + 428) = 410 \text{ MPa}$$

3. O'qlar aro masofani xisoblash

$$a_\omega = K_a (u_1 + 1) \sqrt[3]{\frac{T_2 \cdot K_{H\beta}}{[\sigma]^2 \cdot u_1^2 \cdot \psi_{bo}}}$$

K_a – o'qlar aro masofa koefitsenti

qiya tishli uzatmalar uchun $K_a = 43$

to'g'ri tishli uzatmalar uchun $K_a = 49,5$ (S.A.Chernavskiy 332

bet)

u_1 – reduktorning uzatish soni $u_1 = 5$

T_2 – uzatmadagi ikkinchi valning burovchi moment $T_2 = 49,9$

$K_{H\beta}$ – qiyalik burchagini ko'rsatuvchi koefitsent (S.A.Chernavskiy 32 bet. 3.1 jadval)

$$K_{H\beta} = 1,0 \div 1,15$$

ψ_{ba} – g'ildirak enini o'qlar aro masofaga nisbatini ko'rsatuvchi koefitsent (S.A.Chernavskiy 36 bet standart)

qiya tish uchun

to'g'ri tish uchun

$$\psi_{bo} = \frac{b}{a_\omega} = 0,4$$

$$\psi_{bo} = \frac{b}{a_\omega} = 0,25$$

$$a_\omega = K_a (u_1 + 1) \sqrt[3]{\frac{T_2 \cdot K_{H\beta}}{[\sigma]^2 \cdot u_1^2 \cdot \psi_{bo}}} = 43(5 + 1) \sqrt[3]{\frac{49,9 \cdot 1,15 \cdot 10^3}{410^2 \cdot 5^2 \cdot 0,4}} = 176,3 \text{ mm}$$

GOST 2185-66 dan $a_\omega = 180 \text{ mm}$ deb qabul qilamiz.

(S.A.Chernavskiy 36 bet)

Ilashmada normal modul tanlash

$$m_n = (0,01 \div 0,02) a_\omega = (0,01 \div 0,02) \cdot 180 = 1,8 \div 3,6 \text{ mm}$$

GOST 9563-60 dan $m_n = 3 \text{ mm}$ deb qabul qilamiz.

(S.A.Chernavskiy 36 bet)

4. Tishli g'ildiraklarning geometrik o'lchamlari.

a) Shesternya va g'ildiraklarning tishlar soni

$$z_1 = \frac{2a_\omega \cdot \cos \beta}{(u+1) \cdot m_n}$$

tishning qiyalik burchagining dastlabki qiymati $\beta = 10^\circ$

$$z_1 = \frac{2a_\omega \cdot \cos \beta}{(u+1) \cdot m_n} = \frac{2 \cdot 180 \cdot \cos 10^\circ}{(5+1) \cdot 3} = \frac{360 \cdot 0.987}{18} = 19,74 \quad z_1 = 19$$

$$z_2 = z_1 \cdot u = 19 \cdot 5 = 95$$

Tishning qiyalik burchagining aniq qiymatini xisoblaymiz.

$$\cos \beta = \frac{(z_1 + z_2) \cdot m_n}{2a_\omega} = \frac{(19 + 95) \cdot 3}{2 \cdot 180} = \frac{342}{360} = 0,95$$

$$\beta = 18^\circ 12'$$

b) G'ildiraklarning bo'luvchi aylana diametri

Shesternya uchun

$$d_1 = \frac{m_n \cdot z_1}{\cos \beta} = \frac{3 \cdot 19}{0.95} = 60 \text{ mm}$$

G'ildirak uchun

$$d_2 = \frac{m_n \cdot z_2}{\cos \beta} = \frac{3 \cdot 95}{0.95} = 300 \text{ mm}$$

v) Tish ustidan o'tgan aylana diametri

$$\text{Shesternya uchun } d_{a1} = d_1 + 2 \cdot m_n = 60 + 2 \cdot 3 = 66 \text{ mm}$$

$$\text{G'ildirak uchun } d_{a2} = d_2 + 2 \cdot m_n = 300 + 2 \cdot 3 = 306 \text{ mm}$$

g) Tish ostidan o'tgan aylana diametri

$$\text{Shesternya uchun } d_{f1} = d_1 - 2,5 \cdot m_n = 60 - 2,5 \cdot 3 = 52,5 \text{ mm}$$

$$\text{G'ildirak uchun } d_{f2} = d_2 - 2,5 \cdot m_n = 300 - 2,5 \cdot 3 = 292,5 \text{ mm}$$

d) O'qlar aro masofani tekshirish

$$a_\omega = \frac{d_1 + d_2}{2} = \frac{60 + 300}{2} = 180 \text{ mm}$$

e) G'ildirak eni

$$b_2 = \psi_{ba} \cdot a_\omega = 0,4 \cdot 180 = 70 \text{ mm}$$

$$b_1 = b_2 + (4 \div 10) = 70 + 10 = 80 \text{ mm}$$

G'ildirak eni koeffitsentini bo'luvchi diametr orqali xisoblaymiz

$$\psi_{bd} = \frac{b_1}{d_1} = \frac{80}{60} = 1,3$$

Aylanma tezlik

$$v = \frac{\omega_1 \cdot d_1}{2} = \frac{303,6 \cdot 60}{2 \cdot 10^3} = 9,1 \text{ m/s}$$

d_1 – mm da bo'lganligi uchun 1000 ga bo'lib yubordik

Qiya tishlik uzatmalarda aniqlik darajasi 8 ga teng

(S.A.Chernavskiy 32 bet)

5. Kontakt kuchlanishga tekshirish.

$$\sigma_H = \frac{270}{a_\omega} \sqrt{\frac{T_2 \cdot K_H \cdot (u+1)^3}{b_2 \cdot u^2}}; \text{ MPa}$$

bu yerda: K_H – yuklanish koefitsenti

$$K_H = K_{H\beta} \cdot K_{H\alpha} \cdot K_{Hv}$$

$K_{H\beta}$ – tish uzunligini notekisligini xisobga oluvchi koefitsent

$$K_{H\beta} = 1,06 \text{ (S.A.Chernavskiy 39 bet, 3.5 jad.)}$$

$K_{H\alpha}$ – tishlar orasiga tushadigan yuklanishni xisobga oluvchi koefitsent $K_{H\alpha} = 1,13$ (S.A.Chernavskiy 39 bet, 3.4 jad.)

K_{Hv} – dinamik yuklanish koefitsent $K_{Hv} = 1,0$

(S.A.Chernavskiy 40 bet, 3.6 jad.)

$$K_H = K_{H\beta} \cdot K_{H\alpha} \cdot K_{Hv} = 1,06 \cdot 1,13 \cdot 1 = 1,1978$$

$$\sigma_H = \frac{270}{a_\omega} \sqrt{\frac{T_2 \cdot K_H \cdot (u+1)^3}{b_2 \cdot u^2}} = \frac{270}{180} \sqrt{\frac{49,9 \cdot 10^3 \cdot 1,19 \cdot (5+1)^3}{70 \cdot 5^2}} \cong 128,4 \text{ N/mm}^2$$

$$\sigma_H < [\sigma_H]$$

6. Ilashmada xosil bo'ladigan kuchlar

a) aylanma kuch

$$F_t = \frac{2 \cdot T_1}{d_1} = \frac{2 \cdot 10,3 \cdot 10^3}{60} = 343,3 \text{ N}$$

b) radial kuch

$$F_r = \frac{F_t \cdot \operatorname{tg} \alpha}{\cos \beta} = \frac{343,3 \cdot 0,364}{0,95} = 131,5 \text{ N}$$

α – ilashish burchagi har doim 20°

v) o'q bo'ylab yo'nalgan kuch

$$F_a = F_t \cdot \operatorname{tg} \beta = 343,3 \cdot 0,3288 = 113 \text{ N}$$

7. Tishlarni egilishdagi kuchlanish bo'yicha tekshirish.

$$\sigma_F = \frac{F_t \cdot K_F \cdot Y_F \cdot Y_\beta \cdot K_{F\alpha}}{b \cdot m_n} \leq [\sigma_F]$$

bu yerda:

K_F – yuklanish koeffitsenti

$$K_F = K_{F\beta} \cdot K_{Fv} = 1,12 \cdot 1,3 = 1,456$$

$K_{F\beta} = 1,15$; (S.A.Chernavskiy 43 bet, 3.7 jad.)

$K_{Fv} = 1,4$; (S.A.Chernavskiy 43 bet, 3.8 jad.)

$K_{F\alpha} = 0,92$. (S.A.Chernavskiy 47 bet)

Ekvivalent tishlar sonini xisoblaymiz.

$$z_{v1} = \frac{z_1}{\cos^3 \beta} = \frac{19}{0,95^3} \cong 22,16; \quad z_{v2} = \frac{z_2}{\cos^3 \beta} = \frac{95}{0,95^3} \cong 110,8;$$

Tish fo'rmasining koeffitsentini z_v ga qarab tanlaymiz (S.A.Chernavskiy 42 bet)

$$Y_{F1} = 4,05$$

$$Y_{F2} = 3,60$$

Ruxsat etilgan egilishdagi kuchlanish

$$[\sigma_F] = \frac{\sigma_{F\text{limb}}^0}{[S_F]}; \text{ MPa}$$

bu yerda: $\sigma_{F\text{limb}}^0 = 1,8 \cdot \text{HB}$;

$$\sigma_{F\text{limb}1}^0 = 1,8 \cdot 230 = 415 \text{ MPa};$$

$$\sigma_{F\text{limb}2}^0 = 1,8 \cdot 200 = 360;$$

$$[S_F] = [S_F]' \cdot [S_F]'' = 1,75 \cdot 1 = 1,75$$

$$[S_F]' = 1,75 \text{ (S.A.Chernavskiy 44 bet);}$$

$$[S_F]'' = 1. \text{ shtampovka bilan g'ildiraklar ishlab}$$

chiqarilgan.

$$[\sigma_{F1}] = \frac{415}{1,75} = 237 \text{ MPa};$$

$$[\sigma_{F2}] = \frac{360}{1,75} = 206 \text{ MPa};$$

Nisbatni topamiz:

$$\frac{[\sigma_{F1}]}{Y_{F1}} = \frac{237}{4,05} = 58,51 \text{ MPa}; \quad \frac{[\sigma_{F2}]}{Y_{F2}} = \frac{206}{3,6} = 57,2 \text{ MPa};$$

$$\frac{[\sigma_{F1}]}{Y_{F1}} > \frac{[\sigma_{F2}]}{Y_{F2}}.$$

Kichik chiqqan qiymatni kegingi qiymatlar bo'yicha xisoblaymiz.

Y_{β} - tish qiyaligini xisobga oluvchi koeffitsient

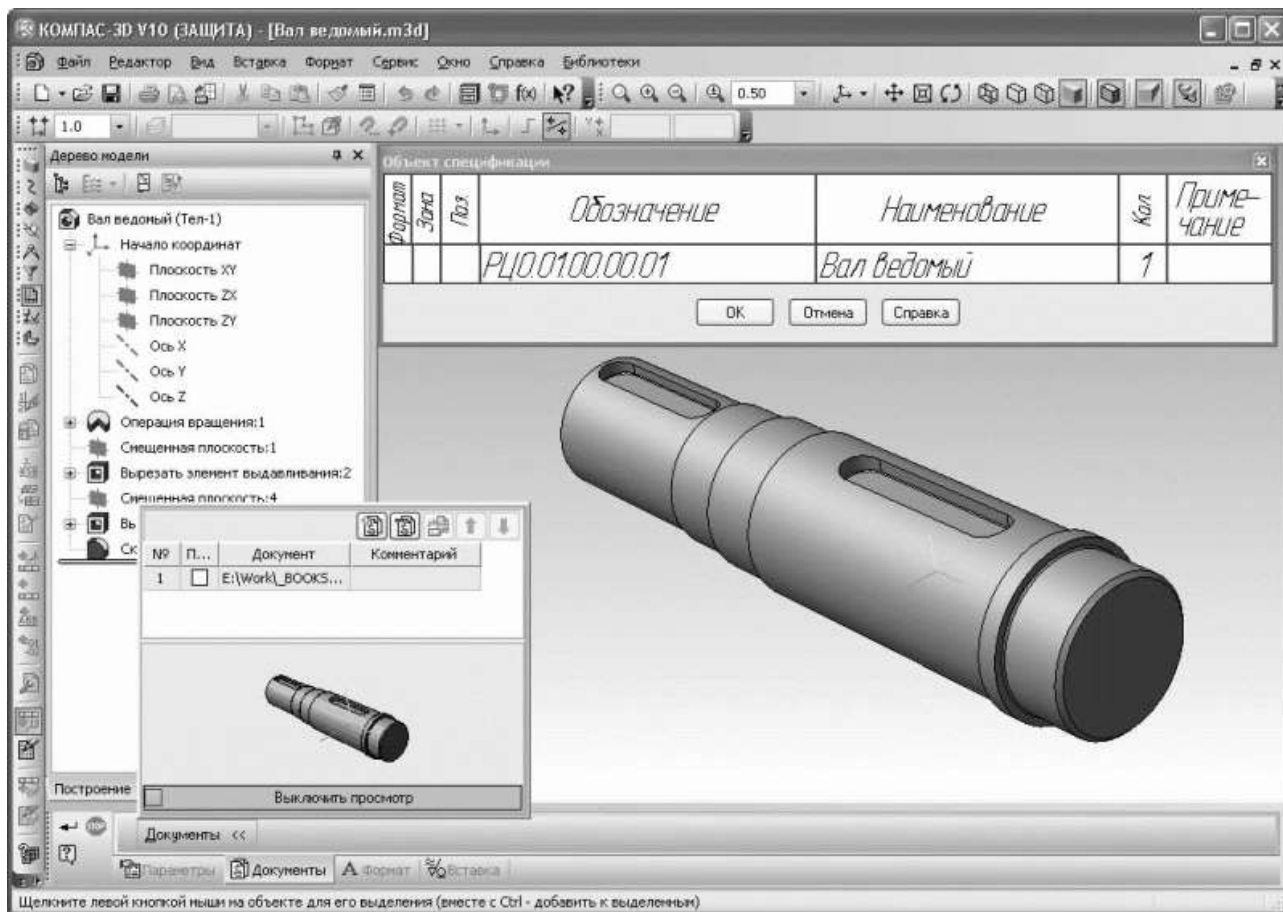
$$Y_{\beta} = 1 - \frac{\beta^{\circ}}{140} = 1 - \frac{18,12}{140} = 0,871$$

$$\sigma_{F2} = \frac{343,3 \cdot 1,456 \cdot 3,6 \cdot 0,871 \cdot 0,92}{70 \cdot 3} = 6,866 \text{ MPa}$$

$$\sigma_{F2} \leq [\sigma_F]; \quad 6,866 \leq 206 \text{ MPa}$$

Shart bajarildi

III. VALLARNING TAXMINIY XISOBI



1. Yetaklovchi val xisobini burovchi moment bo'yicha xisoblaymiz.

Val uchining diametrini ruxsat etilgan urinma kuchlanish

$$d_{val1} = \sqrt[3]{\frac{T_1}{0,2 \cdot [\tau_K]}} = \sqrt[3]{\frac{10,3 \cdot 10^3}{0,2 \cdot 20}} \cong 13,7 \text{ mm}$$

$$[\tau_K] = 20 \text{ MPa}$$

Bu qiymatni elektrodvigatel (ED) valining qiymatini

$$d_{val1} = (0,8 \div 1,2) \cdot d_{dv} = (0,8 \div 1,2) \cdot 28 = (22,4 \div 33,6)$$

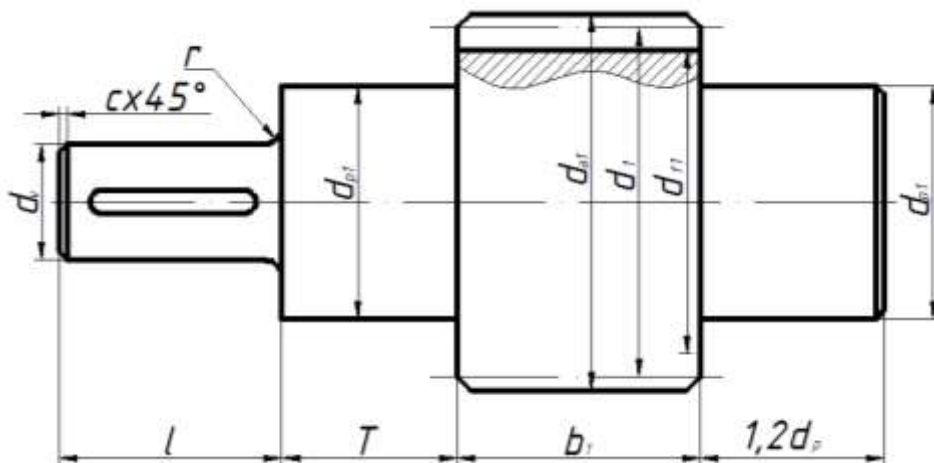
$d_{val1} = 22 \text{ mm}$ qilib olish mumkin. (161-162 betlar)

qachonki $d_{val2} > d_{val1}$ dan bo'lsa.

ED valining diametri $d = 28 \text{ mm}$. $d_{val1} = 22$

Podshibnik o'rnatiladigan val diametri

$$d_{pod1} = d_{val1} + 5 \dots 10 = 22 + 8 = 30$$



Yetaklanuvchi val

$$d_{val2} = \sqrt[3]{\frac{T_2}{0,2 \cdot [\tau_K]}} = \sqrt[3]{\frac{49,9 \cdot 10^3}{0,2 \cdot 20}} \cong 23,2 \text{ mm}$$

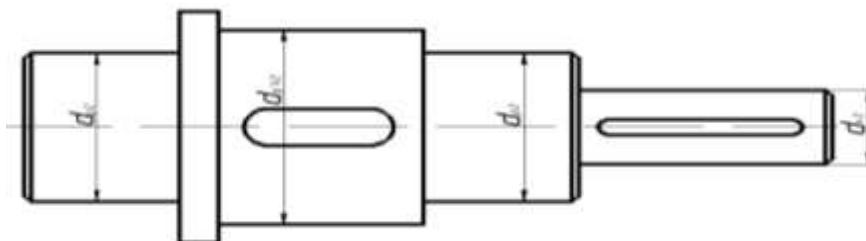
$d_{val2} = 24 \text{ mm}$. deb qabul qilamiz. (161-162 betlar)

Podshibnik o'rnatiladigan val diametri

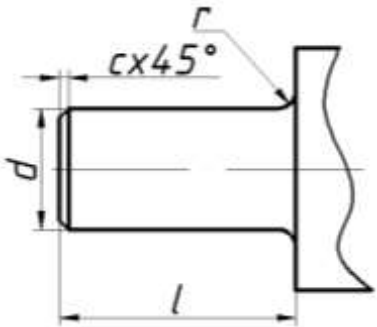
$$d_{pod2} = d_{val2} + 5 \dots 10 = 24 + 6 = 30 \text{ mm}$$

Tishli g'ildirak o'rnatiladigan val diametri

$$d_{g'il2} = d_{pod2} + 5 \dots 10 = 30 + 10 = 40 \text{ mm}$$

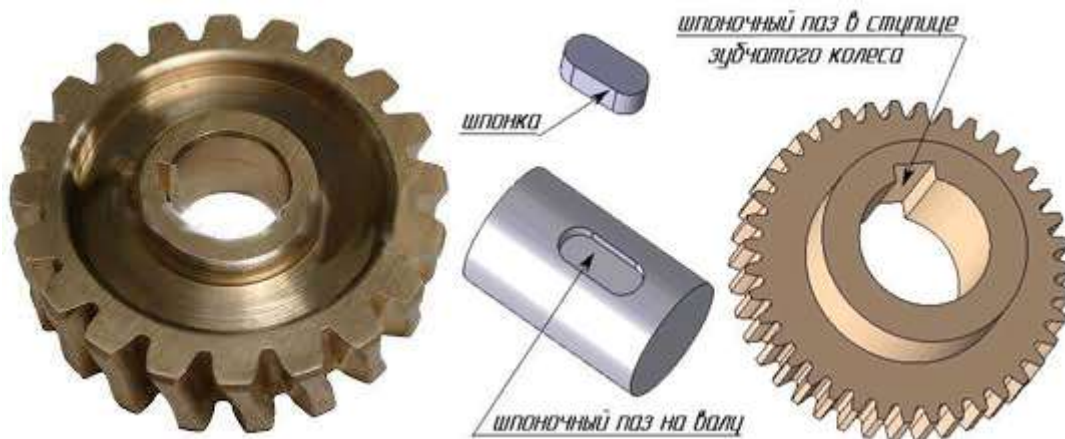


5-jadval

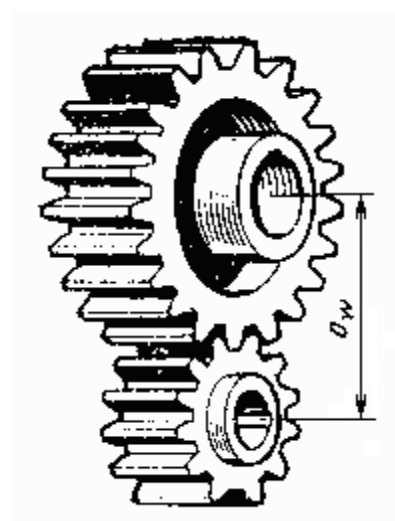
	<i>d</i>	<i>l</i>	<i>r</i>	<i>c</i>	<i>d</i>	<i>l</i>	<i>r</i>	<i>c</i>
		20	36	1,6	1,0	45	82	2,0
	22	30	1,6	1,0	50	82	2,5	2,0
	25	42	1,6	1,0	55	82	2,5	2,0
	28	42	1,6	1,0	60	105	2,5	2,0
	32	58	2,0	1,0	70	105	2,5	2,0
	36	58	2,0	1,0	80	130	3,0	2,5
	40	82	2,0	1,0	90	130	3,0	2,5

(P.F.Dunayev 7.1. jadval 115 bet)

IV. SHESTERNYA VA TISHLI G'ILDIRAK



Shesternya	G'ildirak
$d_1 = 60 \text{ mm}$	$d_2 = 300 \text{ mm}$
$d_{a1} = 66 \text{ mm}$	$d_{a2} = 306 \text{ mm}$
$d_{f1} = 52,5$ mm	$d_{f2} = 292,5$ mm
$b_1 = 80 \text{ mm}$	$b_2 = 70 \text{ mm}$



Gupchak (stupitsa) diametri

$$d_{gub} = 1,6 \cdot d_{g'il} = 1,6 \cdot 40 = 64 \text{ mm}$$

Gupchak (stupitsa) uzunligi

$$l_{gub} = (1,2 \dots 1,5) \cdot d_{g'il} = (1,2 \dots 1,5) \cdot 40 = 48 \dots 60 \text{ mm}$$

$$l_{gub} = 50 \text{ mm deb qabul qilamiz}$$

Gardish (obodo) qalinligi

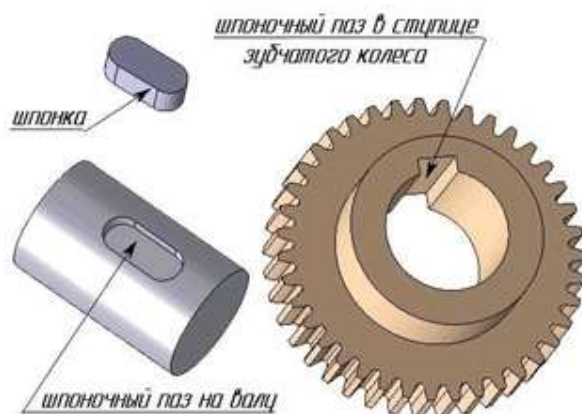
$$\delta_o = (2,5 \dots 5) \cdot m_n = (2,5 \dots 4) \cdot 3 = 7,5 \dots 12 \text{ mm}$$

$$\delta_o = 10 \text{ mm deb qabul qilamiz}$$

Disk qalinligi

$$S = 0,3 \cdot b_2 = 0,3 \cdot 70 = 21 \text{ mm}$$

V. SHPONKA TANLASH VA ULARNING MUSTAXKAMLIKGA XISOBI

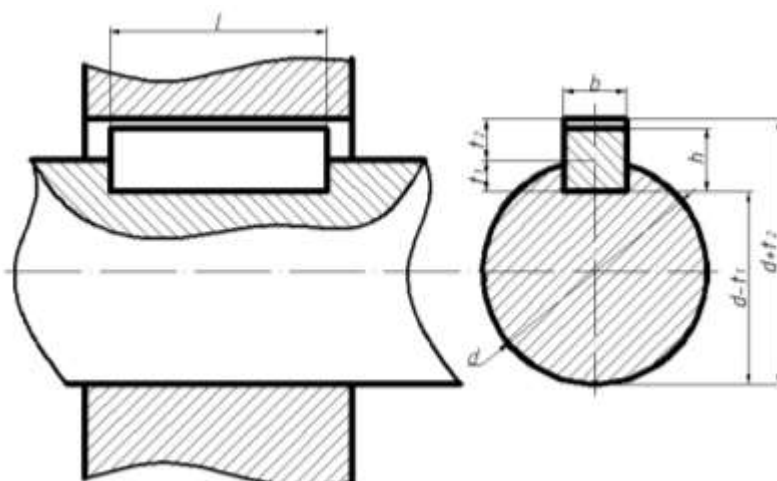


2 – valdagi shponkaning o'lchamlarini GOST 23360 – 78 standartdan tanlab olamiz.

Shponkaning materiali Po'lat 45 ishlov berish yahshilangan.

Ezilishga tekshirish

$$\sigma_{ez} = \frac{2 \cdot T_2}{d \cdot (h - t_1) \cdot (l - b)} \leq [\sigma_{ez}] \text{ MPa}$$



σ_{ez} – ezilishdagi kuchlanish

$[\sigma_{ez}]$ – ruhsat etilgan ezilishdagi kuchlanish $[\sigma_{ez}] \leq 100 \text{ MPa}$

bu yerda (169 bet)

$d = d_{g'il2} = 40 \text{ mm}$

$b \times h = 12 \times 8 \text{ mm}$

$t_1 = 5 \text{ mm}$

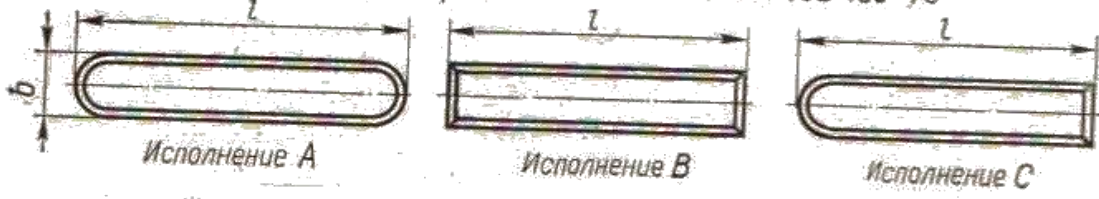
$l = 70 \text{ mm}$

$$\sigma_{ez} = \frac{2 \cdot 49,9 \cdot 10^3}{40 \cdot (8 - 5) \cdot (70 - 8)} = \frac{99800}{7440} = 13,4 \text{ MPa}$$

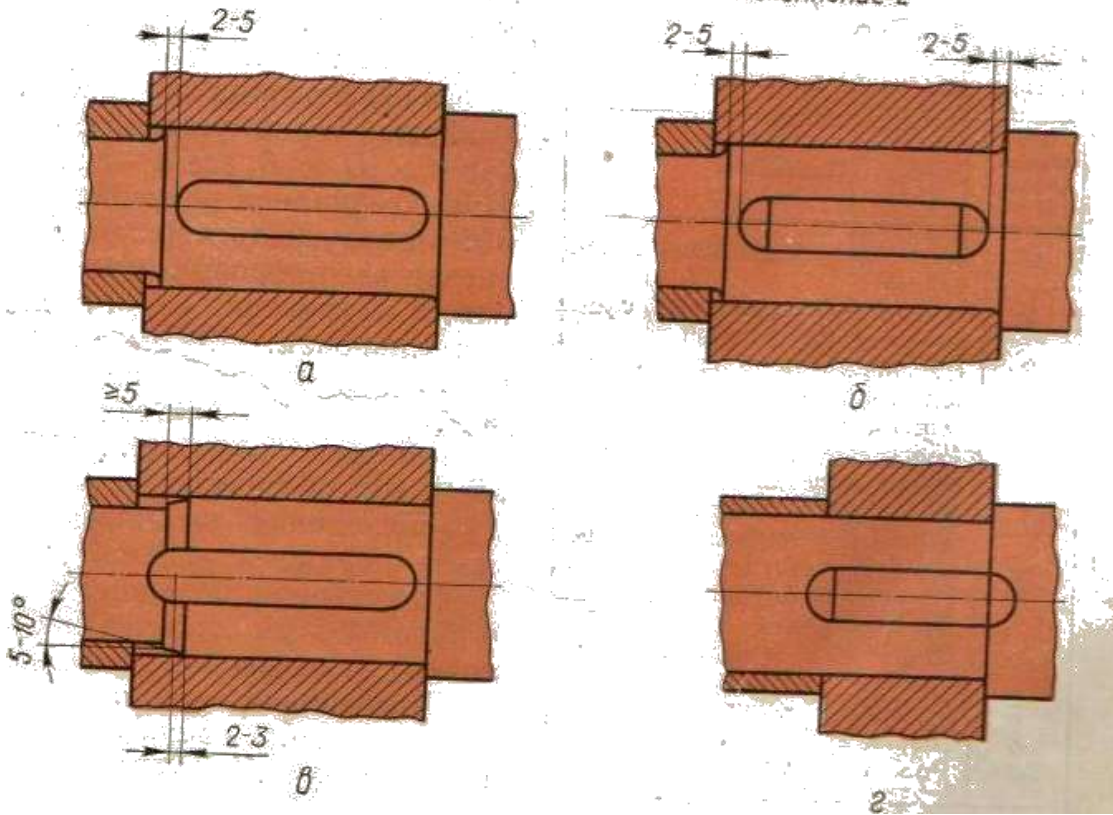
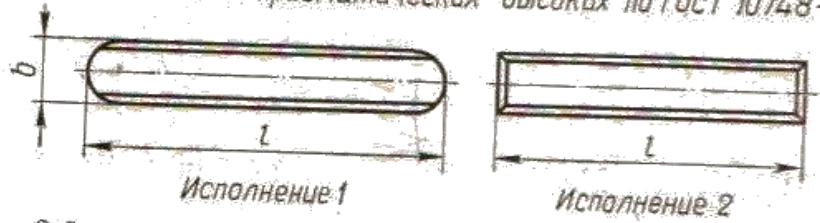
Шпонки

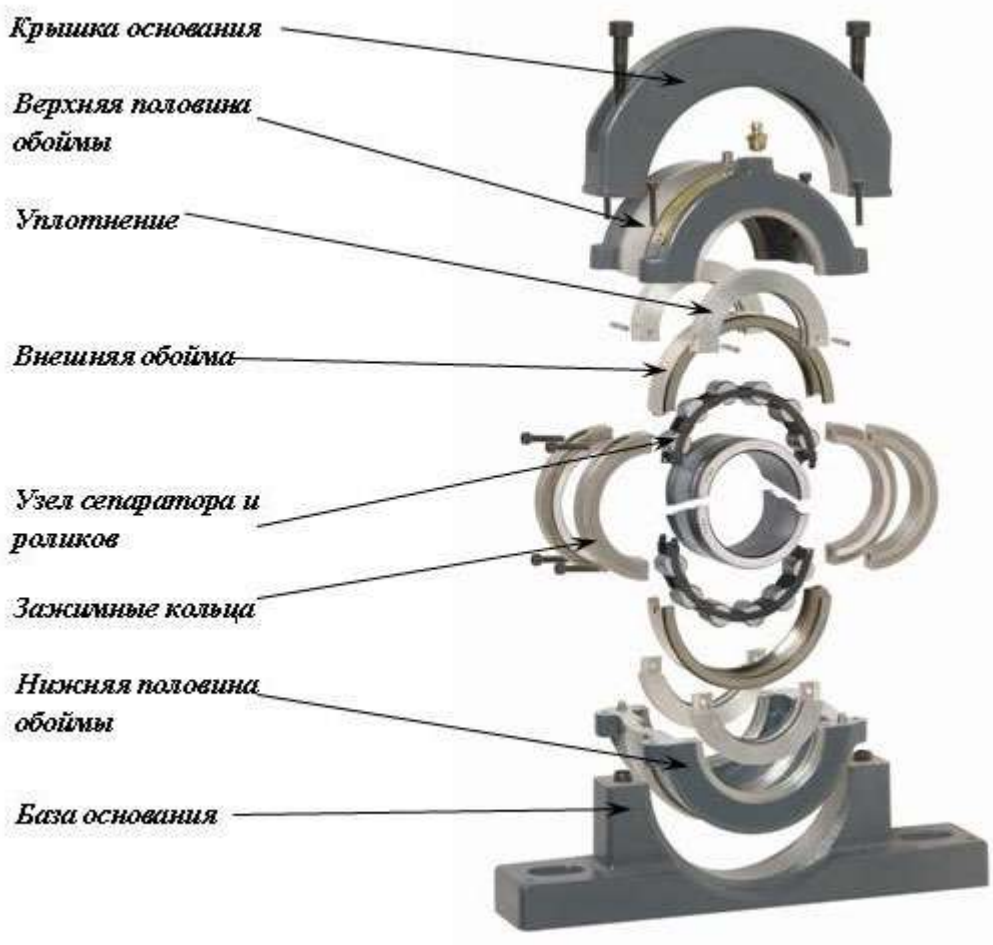
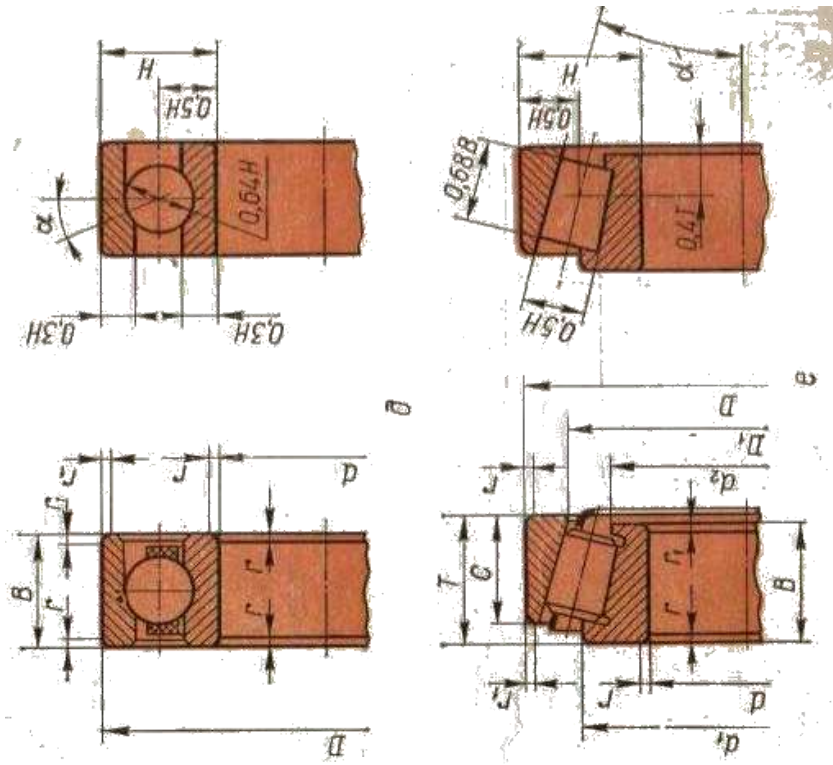


Исполнения шпонок призматических по СТ СЭВ 189-75

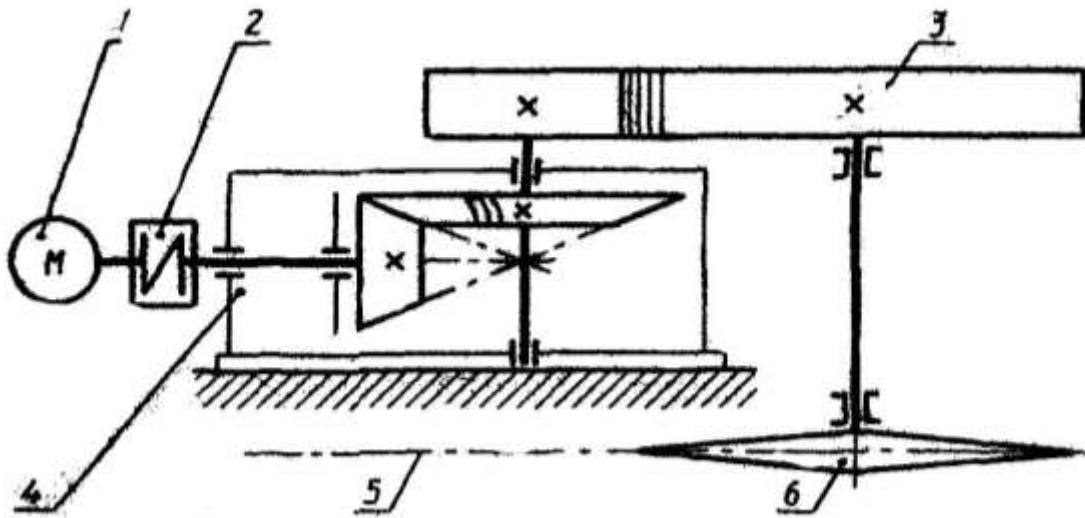


Исполнения шпонок призматических высоких по ГОСТ 10748-68





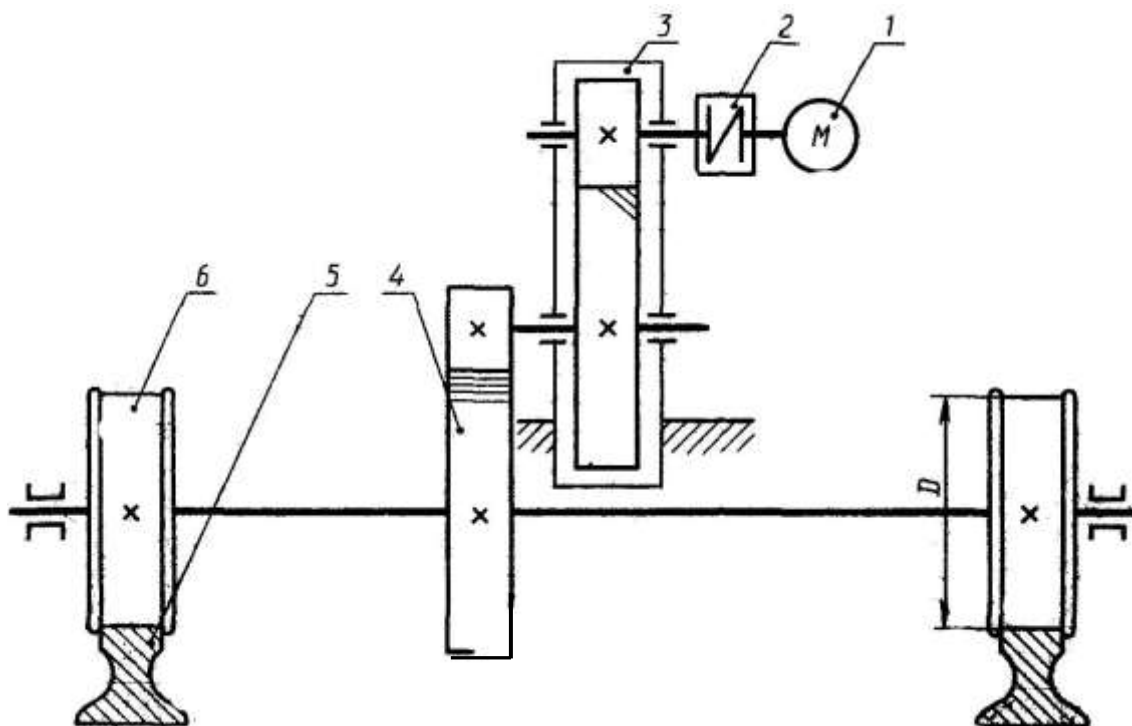
Texnik topshiriq №1
Osma konveyr yuritmasi



1 - dvigatel; 2 – elastiksimon yulduzchali mufta; 3 – tsilindrsimon tishli g'ildirak;
 4 – konussimon yopiq uzatma; 5 - zanjir; 6 – yulduzcha

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Aylanma kuch F , kN	3,2	3,6	4,0	4,2	4,4	4,8	5,0	5,2	5,4	5,7
Zanjirning tezligi v , m/s	0,85	0,90	0,75	0,80	0,75	0,85	0,80	0,85	0,75	0,83
Yulduzcha tishining qadami r , mm	80	80	100	80	100	80	80	100	80	100
Yulduzcha tishlari soni z	7	9	8	7	9	8	8	9	7	8

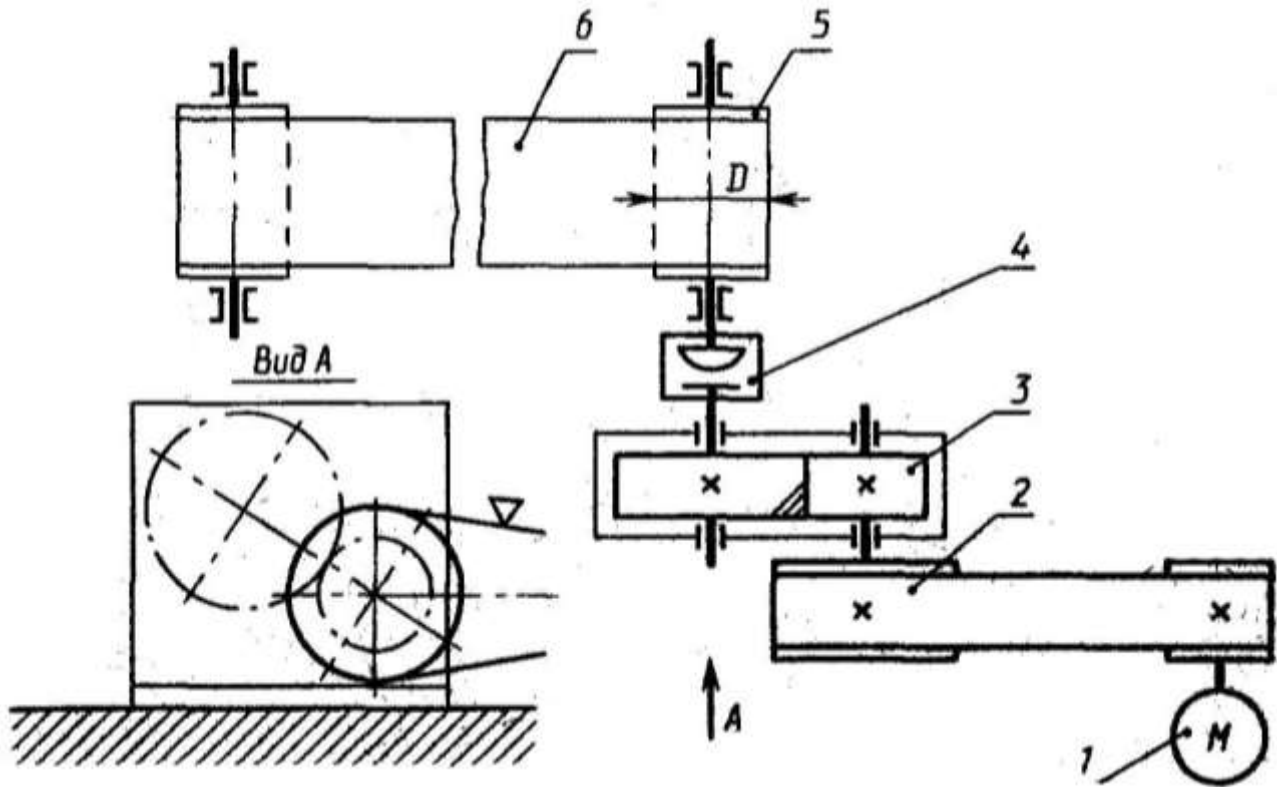
Texnik topshiriq №2
Ko'priqli kran yuritmasi



1-dvigatel; 2-mufta; 3-tsilindrsimon yopiq uzatma; 4-ochiq tsilindrsimon uzatma; 5-rels;
 6-g'ildirak

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Ko'priqli xarakatiga qarshilik kuch F , kN	1,7	2,2	2,7	3,3	2,4	2,8	1,8	2,7	2,7	3,7
Ko'priqli tezligi v , m/s	1,65	1,75	1,95	1,35	2,20	1,25	1,85	2,25	1,35	1,45
Fildirak diametri D , mm	200	300	400	300	500	400	600	700	400	500

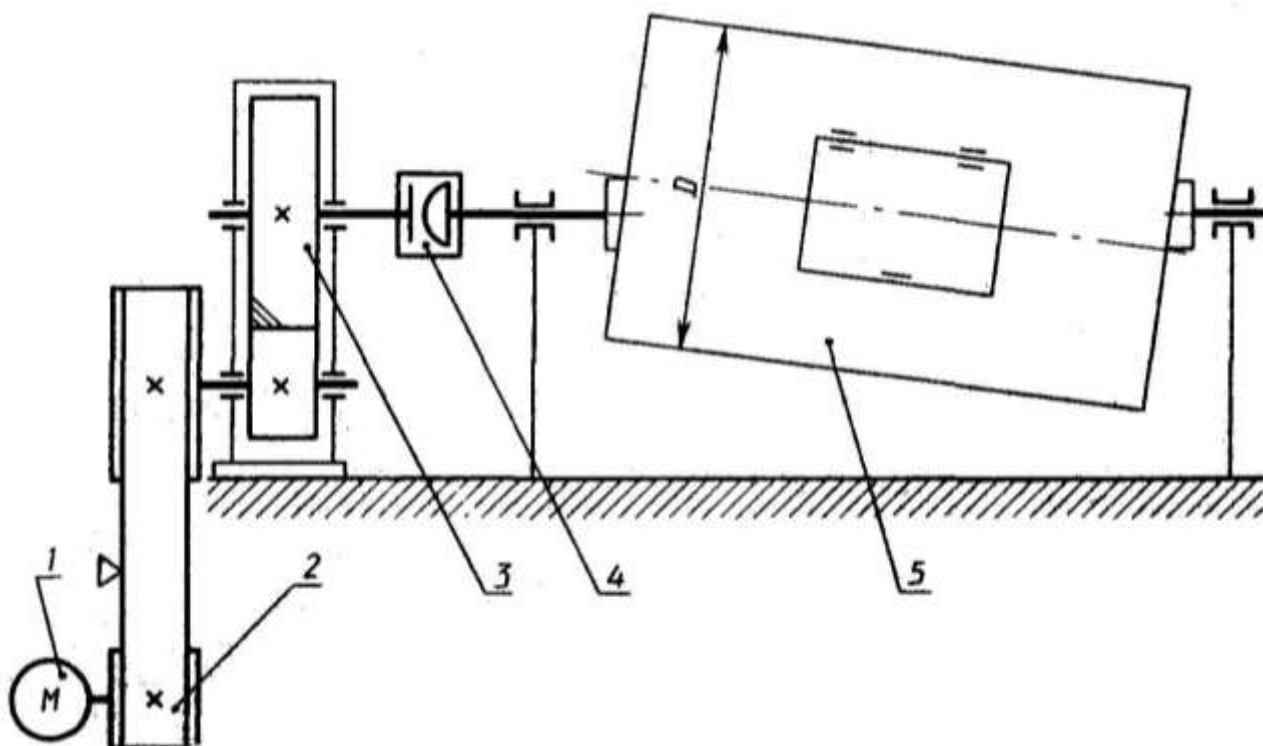
Texnik topshiriq №3
Lentali konveyr yuritmasi



1-dvigatel; 2-tasmali uzatma; 3-tsilindsimon reduktor;
4-zanjirli mufta; 5-baraban; 6-konveyr lentalasi.

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Lentali aylanma kuch F , kN	1,8	1,9	2,0	2,4	2,6	2,8	3,0	3,2	3,4	3,6
Yuk ko'tarish tezligi v , m/s	1,2	1,4	1,6	1,8	1,6	1,5	1,7	1,8	1,9	2,2
Diametr barabana D , mm	200	200	225	225	250	250	275	275	250	290

Texnik topshiriq №4
Shtampovkadan keyin detallarni qirralarni tozalash barabani yuritmasi

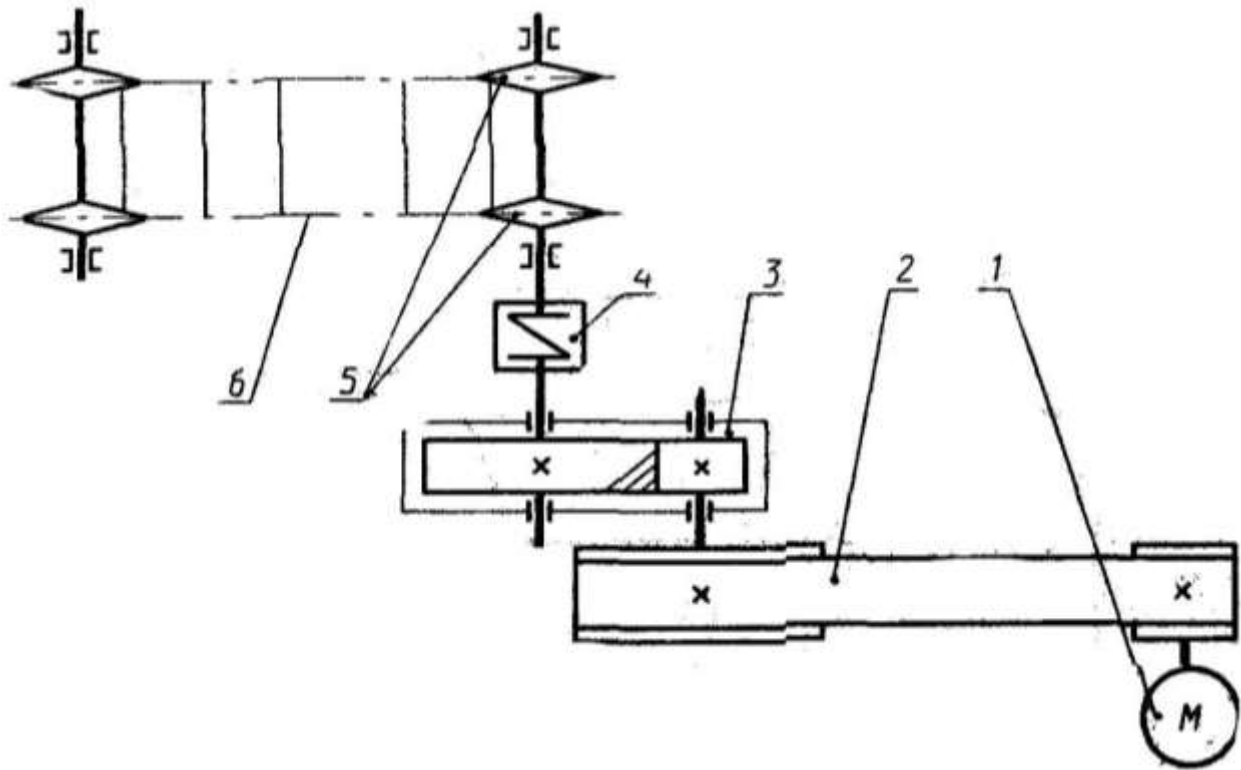


1 – dvigatel; 2 – yarim ponali tasmali uzatma; 3 – qiya tishli tsilindsimon reduktor;
4 – zanjirli mufta; 5 – baraban

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Barabandagi aylanma kuch F , kN	1,55	1,85	2,05	2,07	1,75	1,85	2,1	2,3	2,35	1,65
Baraban tezligi v , m/s	2,2	2,7	2,3	2,6	3,7	3,3	3,2	2,85	2,15	3,25
Baraban tezligi D , mm	400	400	600	600	800	860	900	900	800	800

Texnik topshiriq №5

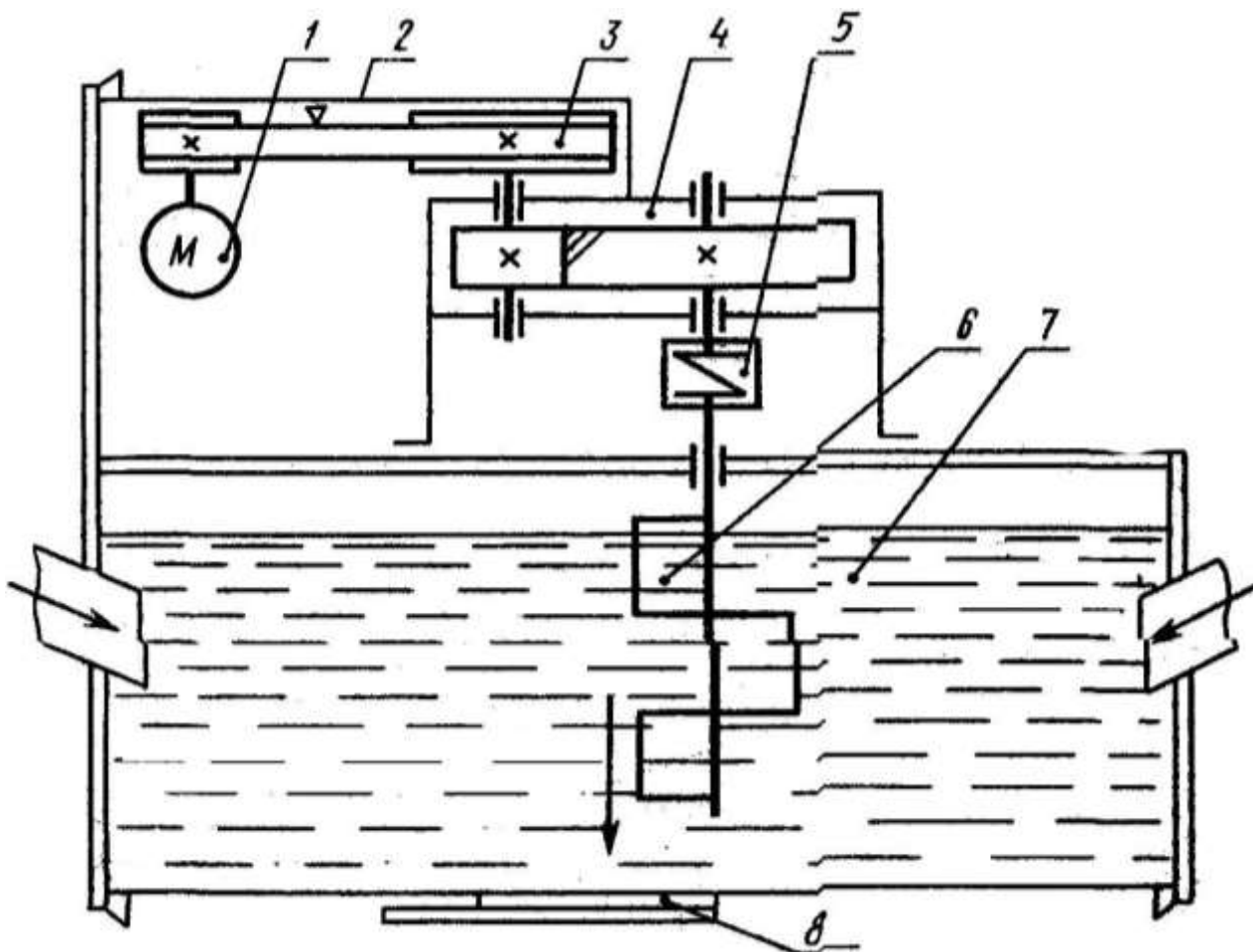
Konveyr yuritmasi



1 – dvigatel; 2 – yassi tasmali uzatma; 3 – qiya tishli tsilindrsimon reduktor; 4 – mufta; 5– konveyrni etaklovchi yulduzchasi; 6- konveyr zanjiri

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Zanjirli konveyrdagi aylanma kuch F , kN	2,5	2,9	3,1	3,3	3,5	4,0	4,2	4,5	4,9	5,3
Zanjirli konveyr tezligi v , m/s	0,50	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95
Zanjir qadami r , mm	80	100	100	80	80	100	80	80	100	80
Yulduzcha tishlari soni z	7	8	7	8	9	7	9	7	7	8

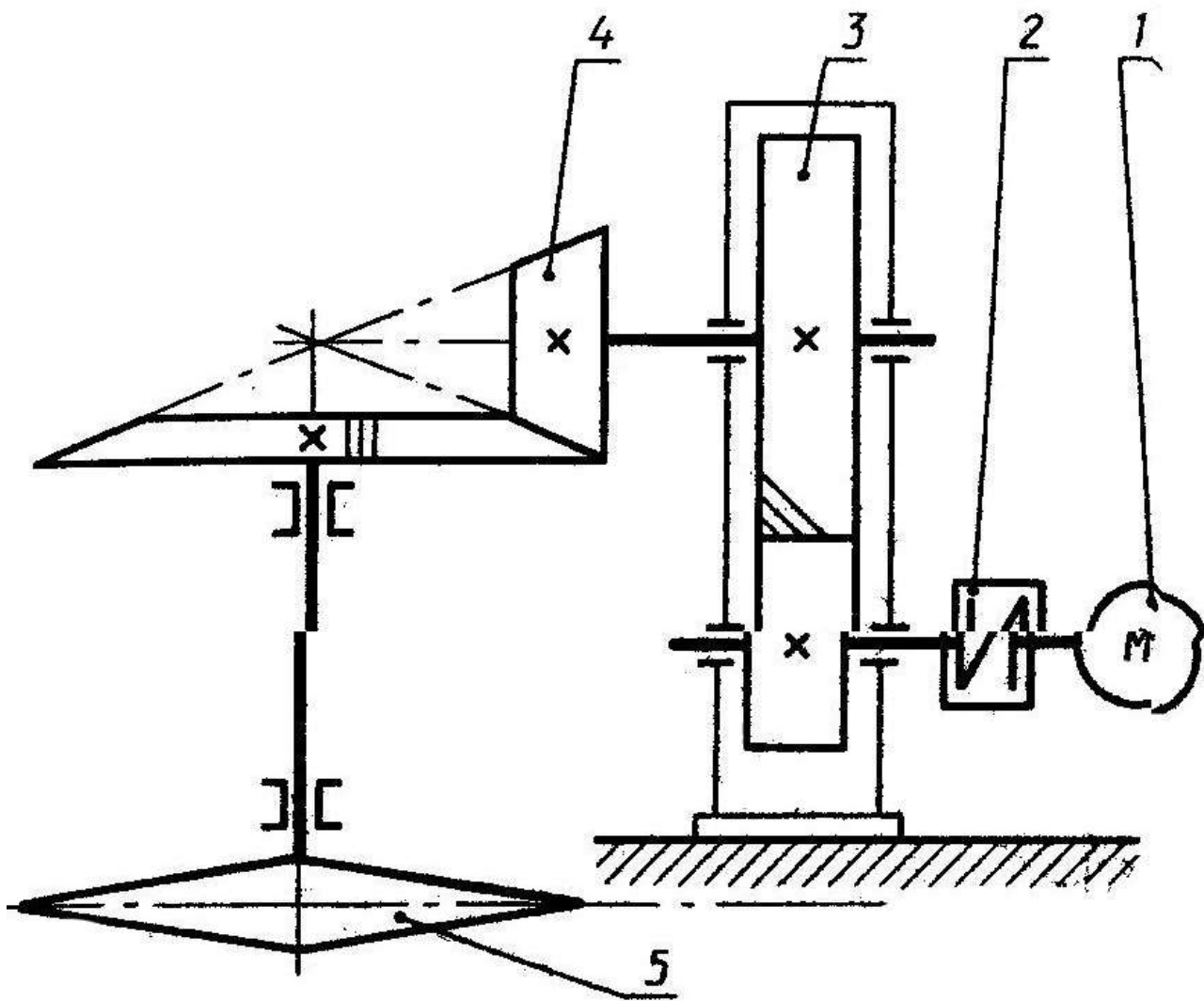
Korishmani xarakatlantiruvchi mexanizm yuritmasi



1- dvigatel; 2 – to'siq; 3– ponasimon tasmali uzatma; 4 – qiya tishli tsilindrsimon reduktor; 5- mufta; 6- qorishtiruvchi; 7-qorishma; 8-siljituvchi

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Aylanma qarshilik momenti T , kN m	0,25	0,28	0,30	0,35	0,37	0,40	0,42	0,44	0,48	0,56
Aylanuvchi elementni aylanish soni n , ob/min	70	75	80	85	90	80	75	70	80	90

Texnik topshiriq №7
Osma konveyr yuritmasi



1-dvigatel; 2-mufta; 3-tsilindrsimon reduktor; 4-ochiq konussimon uzatma;
5-konveyr yulduzchasi.

Berilgan qiymatlari	Variantlar									
	1	2	3	4	5	6	7	8	9	10
Zanjirdagi aylanma kuch F , kN	2,5	3,5	3,5	4,5	5,5	6,0	6,5	7,0	7,5	8,0
Zanjirli konveyr tezligi v , m/s	0,85	0,75	0,85	0,90	0,60	0,85	0,70	0,75	0,95	0,90
Zanjir qadami r , mm	80	80	100	100	125	80	125	100	100	80
Yulduzchani tishlar soni z	7	8	9	8	8	9	7	7	9	7

FOYDALANILGAN ADABIYOTLAR

1. Дунаев П.Ф., Леликов О.П. «Детали машин курсовое проектирование», учебное пособие, М.: Высшая школа, 1990 г. ст. 399
2. Шейнблит А.Е. «Курсовое проектирование деталей машин», учебное пособие, «Высшая школа» - 1991 г. ст. 431
3. Tojiboev R.N., Shukurov M.M. «Mashina detallarini loyixalash», o'quv qo'llanma, T.: Fan, 1997 y. 313 bet
4. Atlas konstruksiy podyomno – transportnix mashin. Pod redaksiyey Aleksandrova M.P., Reshetova M. D. –Moskva: Mashinostroyeniye, 1987.–326 s.
5. Detali mashin: Atlas konstrkusiy: Pod.red. D.N.Reshetova. –Moskva: Mashinostroyeniye, 1992. – 189 s.
6. Reshetov D. N. Detali mashin. – Moskva: Mashinostroyeniye, 1989. – 459 s.
7. Rogov P.A. Gruzopodyemniye i transportiruyushiye mashini. – Toshkent: O'qituvchi, 1989 g. – 224 s.
8. Chernavskiy S.A., Itskovich G. M., Bokov K.N. Kursovoye proyektirovaniye detaley mashin. – Moskva: Mashinostroyeniye, 1988. – 416 s.