



**10242—81**

|      **312—76**                  **644—77)**

Basic norms of interchangeability.  
Rack-and-pinion gear pairs. Tolerances

10242—81  
[CT 312—76  
CT 644—77]

10242—73

01.01.82

1.

1.1.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11    12.

1990

©

, 1981  
, 1990

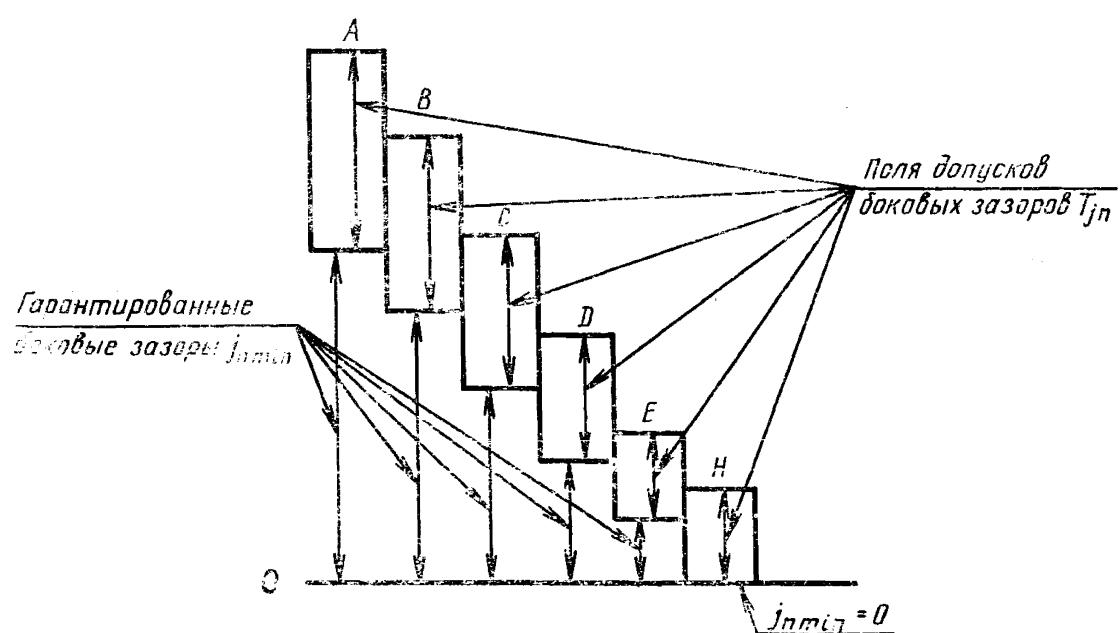
1.2.

1.3.

1.4.

1.5.

, , , D, ,  
Tjn, a, b, d, h  
( . 2).



. 1.

1

	a—is — 3—9 13—8 3—7 3—7

, 2&gt;5 .

1.6.

. 2.

2

				D	,
-				d	h

1.7.

D, , ( — III, IV, V — VI II ) .

1.8.

. 4      10242—81

7—            10242—81

1643—81,

7

7—            1643—81  
7—            10242—81

1.9.

9—8—8—

8— 7—7—            1643—81  
9— 8—8—            10242—81

1.10.

(       . 11),

/ nmin—ynmln 0,68 ([ f ]/ [ ]) >

/nmin —  
 $f$  —  
 $f'nmin \quad f'_a$  —  
 ,  
 $\#r = 450 \quad , \quad /nmin=123 \quad V($   
 $\vdots$   
 $7—Ca/fV—123 \quad 1643—81$   
 $7—Ca/V—123 \quad 10242—81$

. 11.  
 1.11. ,  
 $644—77$  , 643—77,  
 1.

2.  
 2.1. ,  
 . 3, 4, 5.  
 3

	3	4	5	6	7	8	9	10	11	12		
	x_	X	x_	x_	X							
	Fpgr, F <sub>pr</sub>	x	X	x^	x_	X						
			x	x	X	X	X	X	X	X		
	Frr						X	X	X	X		
-	F.or	X	X	X	X	X						

1643—81,

		3	4	5	6	7	8	9	10	11	12
	X	X	X	X	X	X					
	fpt » ff		X.			X					
	X			X		X	X	X	X	X	X
	fptr						X	X	X	X	X
-	f										
		X	X	X	X	X					

: 1.

1643—81,

2.

		3	4	5	6	7	8	9	10	11	12
	F3r	X	X	X	X	X	X	X	X	X	X
	f xn fyr	X	X	X		X	X	X	X	X	X
		X	X	X	X	X	X	X			

- 1. f<sub>r</sub> f<sub>yr</sub> —

2.

2.2.

6—10.

2.3.

//

F<sub>rr</sub>, F<sub>ir</sub>,, , f<sub>xr</sub> f<sub>yr</sub>,

2.4.

2.5.

2.6.

2.7.

2.

F/ior, F i , Fior, fir

( )

3.2,

10.

2.1

(        :

 $F_{ir}$ ,  $F_{pr}$ ,  $F_{pgr}$ )

		$\varepsilon$										
			32	.32 50	.50 80	.80 160	.160 315	.315 630	.630 1000	.1000 1600	.160 2500	
3	$F'i$	1 TO	$F'i = F_p + ff$									
	$F_p$		6	6,5	7	10	13	18	24	-	-	
	$F_{pg}$		$\pm 5$	$\pm 6,6$	$\pm 6$	$\pm 8$	$\pm 14$	$\pm 16$	$\pm 20$	-	-	
4	$F'i$	1 10	$F'i = F_p + ff$									
	$F_p$		10	11	12	15	•20	30	40	-.	-,	
	$F_{pg}$		$\pm 8$	$\pm 9$	$\pm 110$	$\pm 42$	$\pm 18$	$\pm 25$	$\pm 32$	$-^*$	-	
5	$F'i$	11 16	$F'i = F_{p-j} - ff$									
	$F_p$		.15	17	20	24	35	50	60	-	-	
	$F_{pg}$		$\pm 12$	$\pm 14$	$\pm 16$	$\pm 20$	$\pm 28$	$\pm 40$	$\pm 50$	-	-	
6	$F'i$	II 16	$F'j = F_{p-j} - ff$									
	$F_p$		24	27	3,0	40	55	75	95	120	135	
	$F_{pg}$		$\pm 20$	$\pm 22$	$\pm 25$	$\pm 32$	$\pm 45$	$\pm 63$	$\pm 80$	$\pm 400$	$\pm 142$	
7	$F'i$	I 25	$F'i = F_p + f,$									
	$F_p$		35	40	45	55	$t_{so}^*$	110	135	170	200	
	$F_{pg}$		$\pm 28$	$\pm 32$	$\pm 36$	$\pm 45$	$\pm 63$	$\pm 90$	$\pm 142$	$\pm 140$	+ 166	

:

1.  
 $F'^i$ —  
 $F_p$ —  
 $F_{pg}$ —  
2.

$F'j$   
, a ff —  $F_p$   
( . 9).

( **F i<sub>r</sub>** » **Frr**)

	-	m,					
		1 3,5	. 3,5 6,3	. 6,3 10	. 10 16	. 16 25	. 25 40
5	F "	22	32	38	50	—	—
6	"	318	50	60	75	—	—
7	F"	50	70	80	105	—	—
8	FT	70	105	120	150	—	—
	F <sub>r</sub>	45	65	75	90	,1,12	140
9	//	105	1 0	170	200	—	—
	F <sub>r</sub>	65	90	105	130	160	200
10	f ;	150	200	240	300	—	—
	Fr	90	130	150	180	220	300
	F <sub>i</sub>	210	300	350	420	—	
	F <sub>r</sub>	130	180	220	260	320	420
	FT	300	420	480	600	—	—
12	F <sub>r</sub>	180	260	300	370	460	600

F —

F<sub>r</sub> —

( Fior)

( )

$$F'i_0 = \{F'[\backslash + F' \underline{12}],$$

$$\begin{array}{rcl} - & .8 & = \text{---}; \\ z_2 - & & ; \\ \bar{z}_1 - & & ; \\ F'h - & 1643-81; & \\ F_{\backslash 2} - & .6. & \end{array}$$

$$Ff_0 \quad 2. \quad ( \quad ) \quad : 1. \quad ( \quad ) \quad ,$$

8

	0,25 0,50	0,50 0,75	0,75 1,00	1,00 1,25	1,25 1,50	1,50 1,75	1,75 2,00	2,00 2,25	> $\sqrt{g}$	2,50 2,75	2,75 3,00	3,00 3,25	3,25 3,50
0*57	0,60	0,64	0,67	Vj <sub>0</sub>	0,75	0,77	0,80	0,83	0,87	0,90	0,93	0,97	

(  $f_{l_r}, f_{ptr}, f_{fr}, f^{!r}$  )

		$m,$					
		1 3,5	. 3,5 6,3	. 6,3 10	. 10 16	. 16 25	. 25 40
3	-	5,5	8	9	—	—	—
	fpt	4-2,5	±3,6	±4			—
	$f_f$	3	4,5	5	—		
4	/	9	12	14	—	—	—
	fpt	±4	±5,5	±6		---	
	ff	5	7	8	—	—	
5	$f;$	14	19	22	30	—	
	fpt	±6	±9	±40	±13		—
	ff	7,5	10	12	46		—
	c	8	12	14	18		—
6		22	30	36	45	—	
	fpt	±10	±14	±46	±20	—	—
	ff	42	17	20	25	—	—
	C	,14	19	22	28	—	
7	$f^l$	,32	45	50	63	80	—
	fpt	±44	±20	±22	±28	±36	—
	ff	18	24	28	35	45	—
	c	19	26	30	40	—	
8	fpt	±20	±28	±32	±40	±50	<b>±63</b>
	C	28	40	45	55	—	

		m,					
	-	1 3,5	. 3,5 6,3	. 6,3 10	. 10 16	. 16 25	. 25 40
9	fpt	±28	±40	±45	±56	±71	±90
	f*	40	55		75		—
10	fpt	±40	±56	±63	±80	±100	±1125
	*	55	75	90	110	—	—
11	fpt	±56	±80	±90	±112	±140	±180
		80	110	125	155		—
12	fpt	±80	±112	±125	±160	±200	±250
			155	170	210	—	—

!1.  
f'i —  
±f<sub>pt</sub> —  
ft —  
' —  
2.

$$fV = |f_{pti}| + |f_{pt_2}| >$$

$f_{pti} — 1043—SI,$   
 $f — . 9.$

10

(  $F_{(3r)}$ ,  $f_{xr}$ ,  $f_{yr}$ . )

			40	. 40 100	. 100 160	. 160 250	. 250 400	. 400 630
3	I 10	$F$ , %	/		65, \			
			\		95 /			
			4,5	6	8	,10	12	14
4	1 10	$f_x$ , %	4,5	6	8		12	14
			2,5	3	4	5	6	7
			/		60, \			
5	1 16	$F$ , %	\		90 )			
			5,5	8	10	12	14	17
			5,5	8	10	12	14	17
6	1 '16	$f_y$ , %	3	4	5	6	7	9
			7	10	12	14	18	22
			7	10	112	14	18	22
7	1 25	$f_y$ , %	4	5	6	7	9	11
			/		55			
			\		30 )			
		$F$ , %	/		50, \			
			1		70 )			
			9	12	,16	20	24	28
		$f_x$ , %	9	12	16	20	24	28
			5	6	8	,10	12	14
			/		45, \			
		$f_y$ , %	\		60 /			
			11	16	20	24	28	34
			11	16	20	24	28	34
		$f_y$ , %	6	8	10	12	14	17

			40	. 40 100	. 100 160	. 160 250	. 250 400	. 400 630	
8	, %			( , 30, 1 60 )					
	1 40	F ,	1-8	25	32	38	45	55	
		fx,	18	25	32	38	45	55	
9		fy,	9	:12	1*6	19	22	30	
, %			/ \ 20, 1 2'5 J						
1 40	F ,	28	40	50	60	75	90		
	10		fx,	28	40	50	60	75	90
			fy,	14	20	25	30	35	45
	1 40	F ,	45	65	80	105	120	140	
		fx,	45	65	80	105	120	140	
		fy,	22	30	40	50	60	70	
	1 40	F ,	71	100	125	160	190	220	
		fx,	71	100	125	160	490	220	
		fy,	35	50	65	80	95	110	
12	1 40	F .	,1:12	,160	200	240	300	360	
		fx,	112	160	200	240	300	360	
		fy,	1 60	1 80	1 100	1 120	1'50	180	

$$\begin{aligned}1. \quad F_g &= \\ f_x &= \\ f_y &= \\ 2. \quad\end{aligned}$$

卷之三

10

3.

3.1. jnmin

3.2. f<sub>a</sub>(1.10),  
(1.11).

3.3. Ess

. 12 14

3.4. Ts . 13 15

3.5.

Ehs (1.12) f<sub>a</sub>. Ess (1.14);**Jnmin\***

3.

(               $f_{ar}$  —  
    in min · )

			*,																			
			80	.80	120	180	250	315	315	400	400	500	500	630	630	800	800	1000	1000	1250	1600	
					0	0,	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
				so	35	40	48		57	S3		80	90	105	125	140	165	195				
D		Jnratn	46	54	63	72	91	89	97	11 10	125											
			74	87	100	1T5		140	155	175	200	230	260	310	J70							
			120	140	160	185	210	230	250	280	320	360	420	500	600							
			)190	220	J50	290	,320	360	400	440	500	560				780	920					
,	II		±16	±18	±20	±23	±26	±28	±32	±136	±40	±45	±53	±63	±75							
"	D	III	±22	±26	±32	±36	±40	±45	±48	±55	±63	±70	±85	±100	±112							
		IV	fa	±38	±45	±50	±56	±63	±70	±75	±85	±t	±112	±130	±150	±180						
		V		±60	±70	±80	±90	±105	±112	±125	±140	±160	±180	±210	±250	±30						
		VI		+95	±110	+125	±1140	±160,	±180	+200	+220	+250	±280	±335	±400	±450						

\* ; ' = j (d+35m)

$\pm f_a$

## ( FhsO )

		1 3,5	. 3,5 6,3	. 6,3 10	. 10 16	. 16 25	. 25 40
	3—6	12	16	20	25	—	—
	7	13	18	22	28	36	—
	3—6	30	40	52	63		
	7	34	45	56	70	90	
D	3—6	48	63	80	100		
	7	52	70	90		140	.
	8	55	75	100	120	150	200
	3—6	75	4! 10	130	155	—	
	7	80		140	170	220	
	8	90	120	160	190	240	320
	9	100	130	70	200	260	340
	3—6	120	160	2,10	250		
	7	130	170	230	270	350	
	8	140	190	250	300	380	500
	9	160	200	280	320	420	560
	10	180	220	300	360	450	600
	3—6	190	250	320	400		
	7	200	280	360	440	530	
	8	220	320	380	480	600	800
	9	250	320	420	530	670	850
	10	260	340	450	600	750	950
	11	280	380	480	670	850	10)60
	12	300	420	560	710	950	1180

—

			( )					
			1 3,5	. 3,5 6 3	. 6,3 10	. 10 16	. 16 25	. 25 40
,	h	3—4 5—6 7	30 45 35	34 55 70	36 60 75	70 90	—	—
D	d	3—4 5—6 7 8	38 60 70 90	42 70 90	45 80 100 130	90 50	— 140 180	— — 220
		3—4 5—6 7 8 9	50 75 90 150	55 90 150 200	60 100 125 220	150 200 260	— 180 240 320	— — 280 400
		3—4 5—6 7 8 9 10	60 90 140 11-80 240	70 140 180 240 320	75 120 150 280 380	140 180 240 320 450	•— 240 280 400 530	— — 350 500 700
		3—4 5—6 7 8 9 10 11 12	75 410 130 160 200 280 380 500	80 130 160 200 280 360 500 710	85 140 180 240 320 420 630 800	160 200 280 380 500 710	— 280 340 450 630 850 1250	— — 400 560 800 10)60 1600

( E<sub>ss</sub>r)

		/ ,					
		1 3,5	. 3,5 6,3	. 6,3 10	. 10 (16)	. 16 25	. 25 40
	3—6	9	112	15	18	—	—
	7	10		1'6	20	26	—
	3—6	22	30	38	45	—	—
	7	25	32	40	50	67	—
D	3—6	34	45	60	70		—
	7	38	50	65	80	100	—
	6	40	55	70	90		150
	3—6	55	75	95	140		
	7	60	i80	.100	125	160	—
	8	65	85	120	140	480	240
	9	70	95	125	150	190	250
	3—6	90	110	150	160		
	7	95	125	170	200	260	—
	8	100	440	480	220	280	360
	9	120	150	200	240	300	400
	10	130	160	220	260	340	460
	3—6	140	180	240	300	—	
	7	150	200	260	320	400	—
		160	220	280	360	450	600
	9	180	240	300	380	500	630
	10	190	250	340	450	560	700
	11	200	280	360	500	630	800
	12	220	300	400	530	700	850

E<sub>ss</sub> —

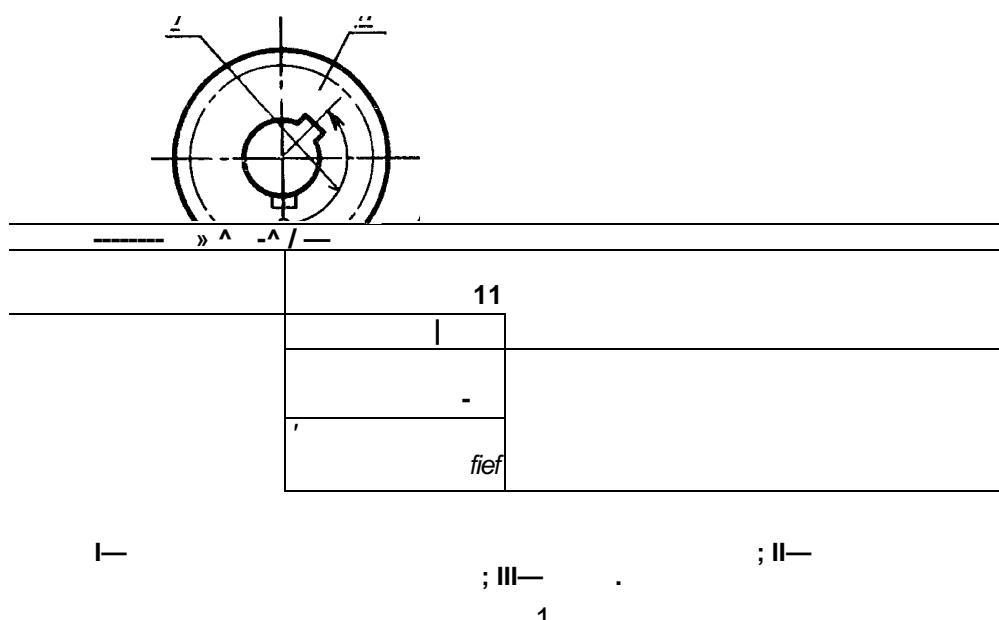
(T<sub>s</sub>— )

			1 3,5	3,5 6,3	6,3 10	10 16	16 25	25 40
					,			
,	h	3—4	22	25	26	---	—	
		5—6	32	40	45	50	—	—
		7	40	50	515	67	80	—
D	d	3—4	28	30	32		—	
		5—6	45	50	60	67	“—	—
		7	50	67	75	80	100	—
		8	67	80	95		130	160
		3—4	36	40	45	—	—	—
		5—6	55	67	7)5	80		—
		7	67	80	90		130	
		8	80		130	150	180	200
		9		150	160	180	240	300
		3—4	45	50	55	—	—	—
		5—6	67	80	85	100	—	—
		7	80	100		130	180	
		8	100	130	150	180	200	260
		9	130	180	200	240	300	380
		10	180	240	260	320	400	500
		3—4	55	60	63	—	—	—
		5—6	80	95	100	120	—	—
		7	95	120	130	160	200	—
		8	1120	150	180	200	250	300
		9	150	200	240	280	320	400
		10	200	260	300	360	450	560
		11	280	360	450	560	630	750
		12	360	500	560	750	950	1180

1.

(        )

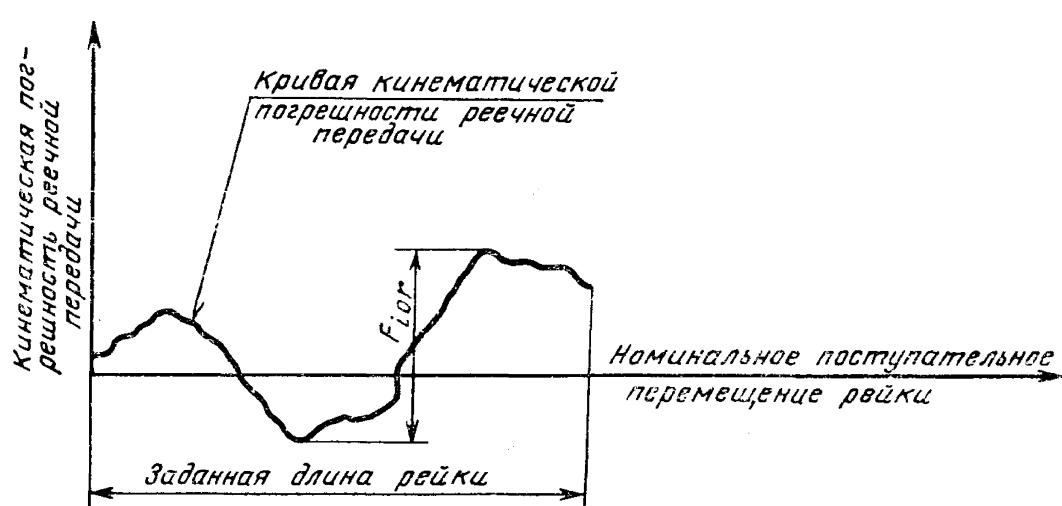
(        . 1).



1.1.

Fig.

(        . 2).



. 2

1.2.  
2.

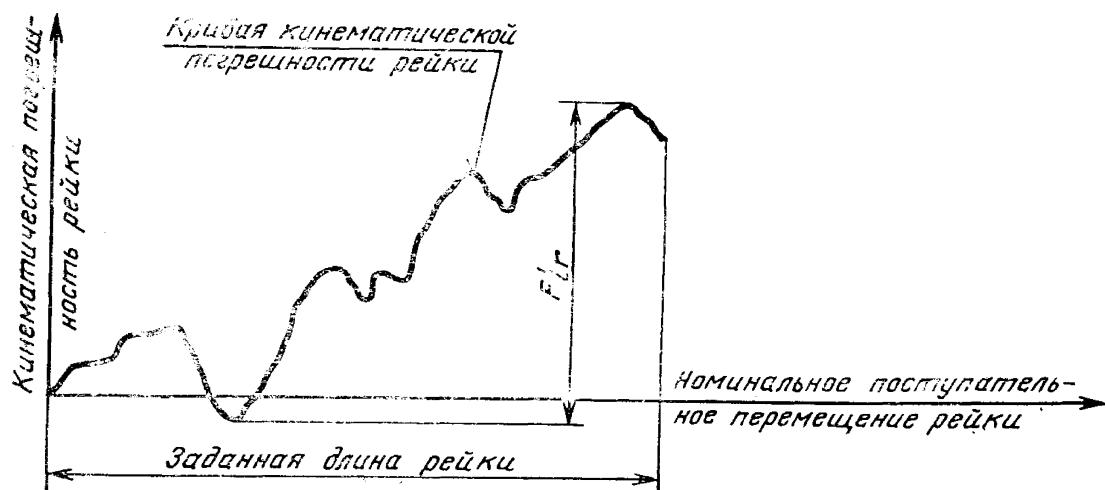
$F'_{i0}$

( )

2.1.

$F'_{ir}$

( . 3).



Черт. 3

2.2.  
|3.

$F'_{i1}$

$F_p < j_r$

2 (z—1), ( z—  
3.1.  
4.

) ( . 4).  
 $\pm F_{pg}$ .

$F_{pr}$ .

4.J1.  
i5.

) (  $k$  . 4).

2 (z—1), ( z—

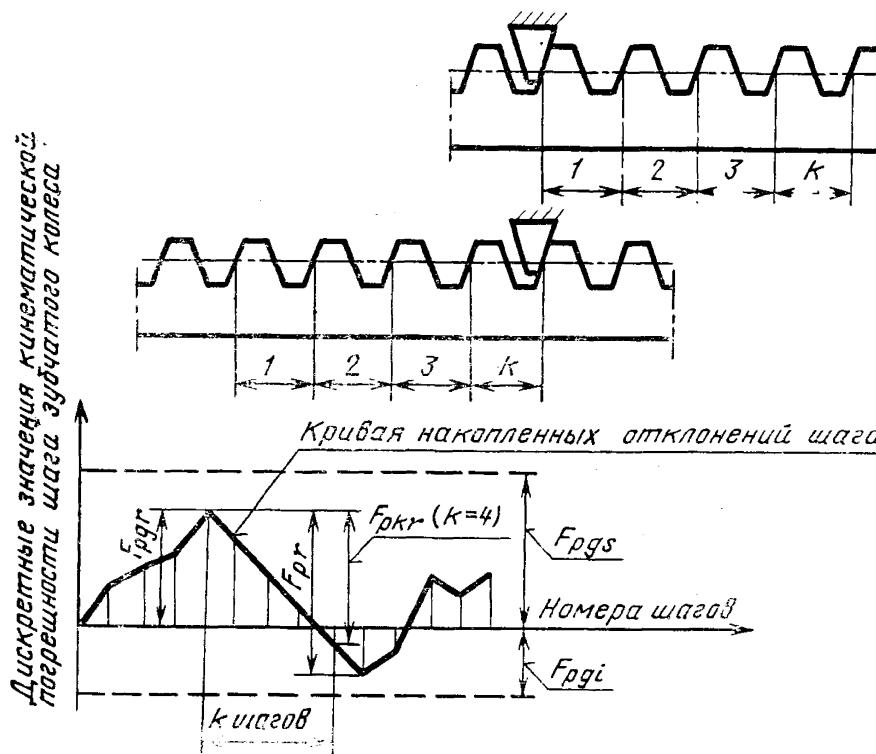
$F_p$ .  
 $F_{r1}$ .

5.1.  
6.

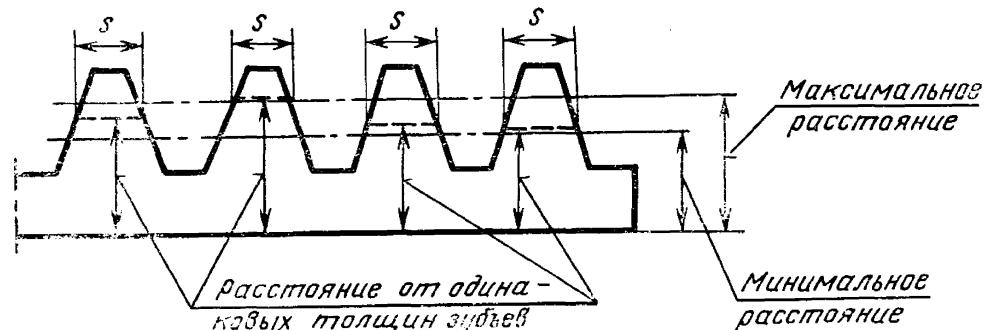
) ( . 5).

$F_r$ .

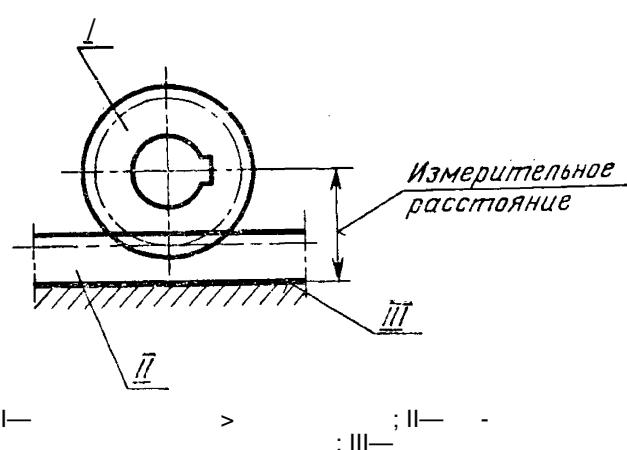
( . 6).



Черт. 4



. 5

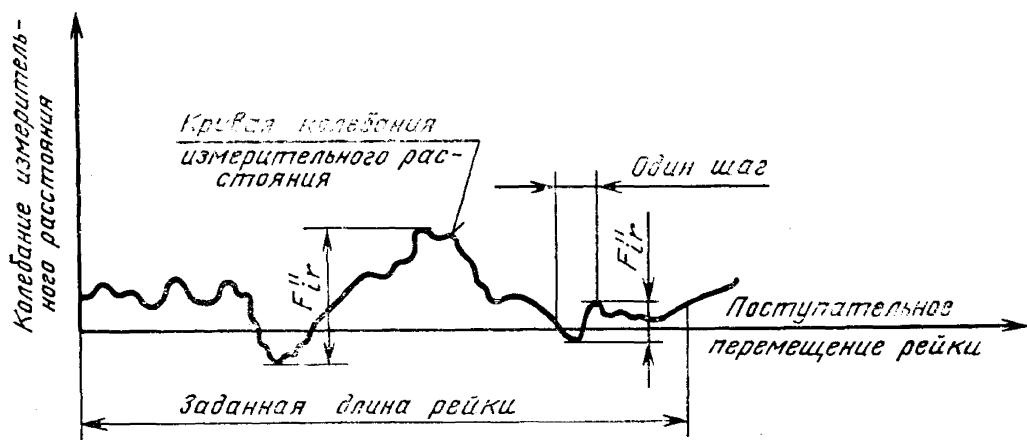


. 6

6.1.

$F_{if}$ ;

( . 7);



. 7

$f_{tr}$ :

6.2.

$F_{ir}$ ;

$i''$ .

7.

10

)

(

7.1.  
8.

$f'_{io}$   
 $f'_{ir}$

(

)

8.1.  
9.

$f_P t_r$

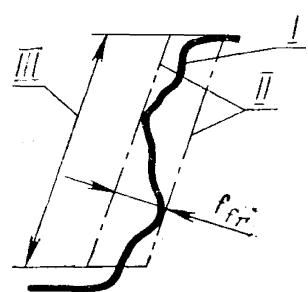
).

9.1.  
10.  
'll.

$\pm f_P t$

$\pm f_{pb}$   
 $f t_r$

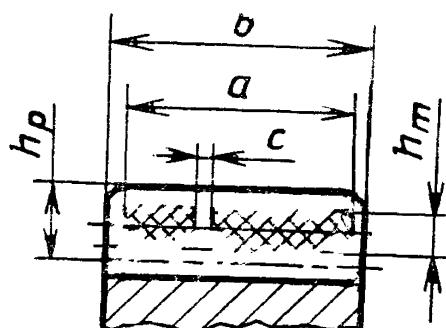
,  
( . 8).



I— ; II— ; III—  
8

12.

( . 9).



Черт. 9

—; 100%;

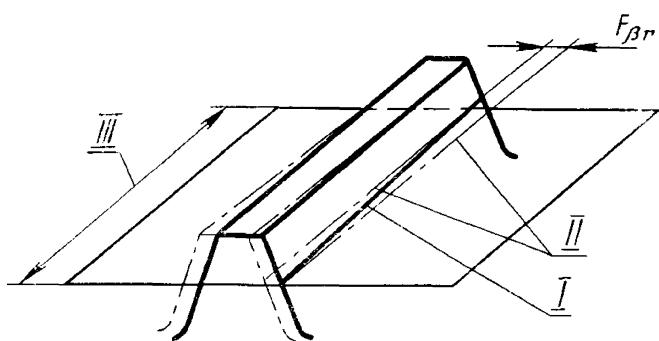
$h_p$ : —  $h_m$  —

— /tn / .

13.

 $F_{p_r}$ 

( . 10).



I— ; III—; II—

. 10

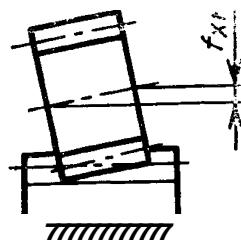
13.1.

Fg .

14.

$f_{xr}$ .

( . 1,1).



. 11

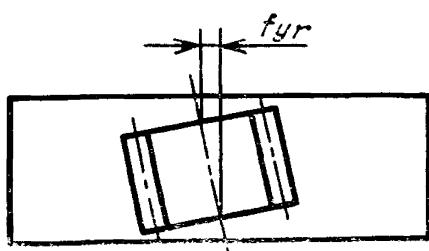
14.1.

$f_x$ .

15.

$f_{yr}$ .

сечении рейки (черт. 12).



. 12

15.1.

$f_y$ .

16.

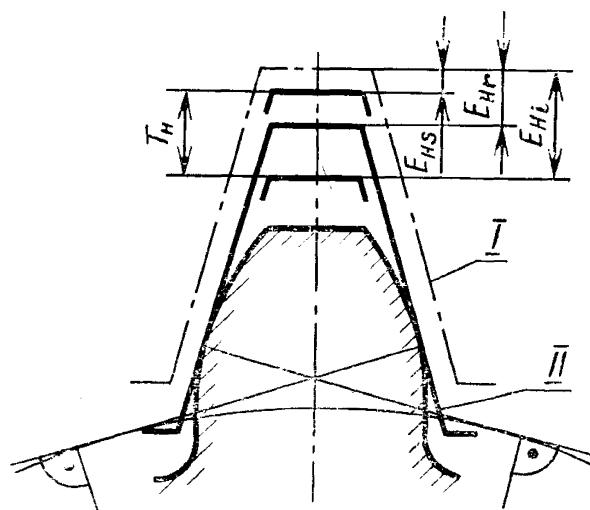
jnmin-

16., 1.

$T_{jn}$ .

17.

( . 13).



I— ; II—

. 13

18.

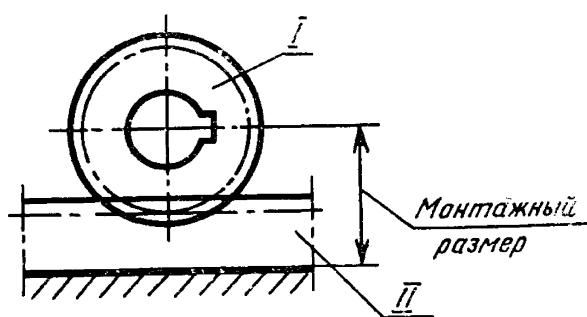
 $E_{hs}$ .

),

(

118.1.  
19.

( . 14).



I— ; II—

. 14

19.1.

 $f_{ar}$ .

19.2.

20.

20.1.

 $T_s$ . $\pm f_a$ . $E_{ss}$ .

1.

. 1.

1

	( ) -	$F'io = K(F'i_1 + F'i_2)$
-	( ) -	$F'i = Fp + ff$ 1 Fpg! = Fpk no 1643—81 $F p = 1,2 [ Fpg ]$
	-	$F_r = r \cdot t \cdot i \cdot P_t \cdot 0,84 \cdot \operatorname{tg} a$ $F'' = F_r + f;$
	-	'lo - l'pt, ' + l'P <sub>t2</sub> 1
	-	$f'i =  fpt  + f.$
	-	$f = 1,251 f_{pt}$
	-	$f_{pt} = \frac{1643^81}{cz = 3^5}$
	-	$f'' = 1fpt 1$ $M 2 - \operatorname{tg} a$
		$1643-1$ $fx=f$ $fy = 0,5 F_e$

2.

. 2.

2

				J f				
		1	1	D	J f			
jн min	-	—	0	IT7	IT8	IT9	IT10	IT.11
±fa	-		0,51 7 (II )		00	^ * * 5> —	— 3 ^ >	; —'
Ehs	-	3—6	0,4 IT7	IT7	IT8	IT9	IT10	1 1
( Ehs , %)	-	7 8 9 10 11 12	10 — — — — —	10 — — — — —	10 20 — — — —	10 20 30 .30 40 —	.10 20 .30 40 50 60	10 20 30 40 50 60
	-		UFr+20		+ —*	$U_{00}^{*}$	+	LO + — —
	-		ss — 0,73Ehs					
	-	.	$T_s = 0,73T_h$					

. 30

10242—81

3

1.

$$|\mathfrak{Ehi}| = |\mathfrak{Ehs}| +$$

2.

$$|\mathfrak{Esi}| - |\mathfrak{ss}|^{4^*} \quad \$$$

3.

$$] \quad - / \min + y" 0,5 ( \mathfrak{pj} " ^ 2 ) "l"/$$

. 05.04.90 . . . . . 05.07.90 2,0 . . . . . 2,0 . . . . . 1,73 . . . .  
. 7000 . . . . . 10 . . . . .  
« . . . . . » . . . . . , . . . . . 123557, . . . . ,  
, . . . . . , . . . . . 3. . . . . , . . . . . , 39. . . . . 691.