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: 0505 « »
: 6.050503 « »

« 6 16.12.2010 »

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___ «__» 2011 .

2011

621.75.008.001.2 (071)

“ ”

(7.090202 “ ”) / . . .

. - : ,2011. - 42 .

“ ” . -

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" /1865 - 1870/ .

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" /1893/.

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/1935-1941 /

30 .

/ 1971 - 1980 /

3

Oi

Ui

Vi

$P_i,$

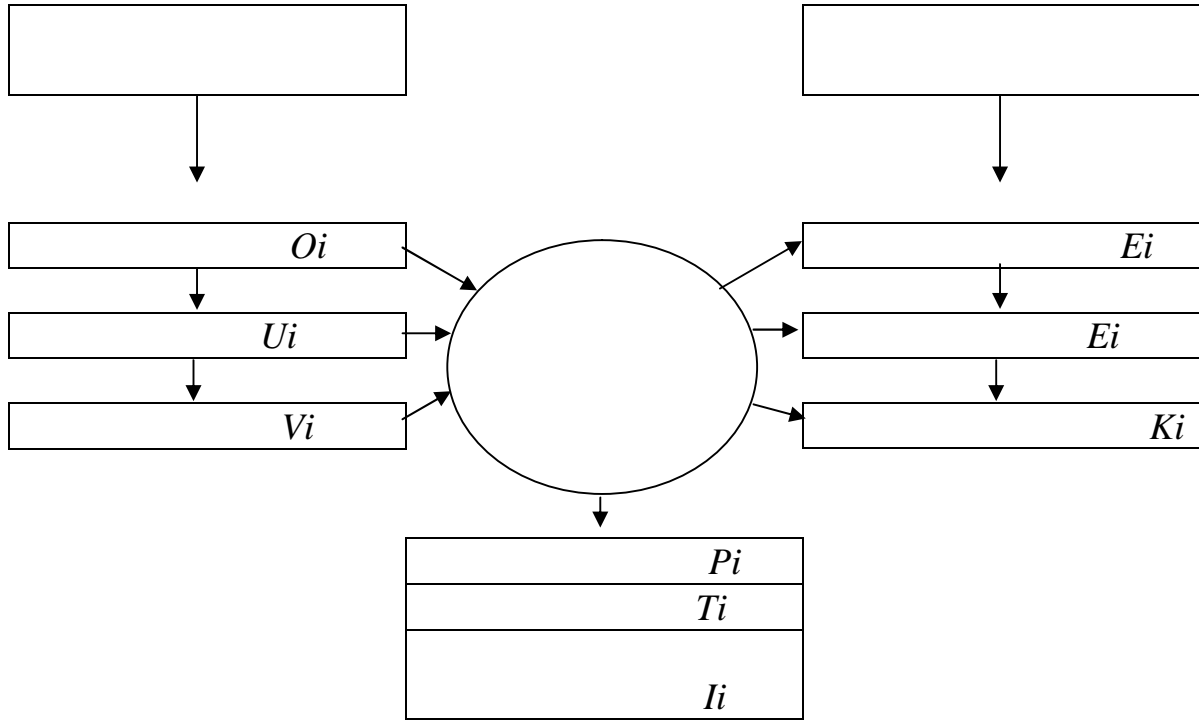
$T_i,$
 I_i

E_i

$E_i.$

$K_i,$

. 1.



1 -

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

1.

: R , σ , Θ

2.

1. 7 - 13 (-
%), σ = 2300 , R 61 - 63, Θ = 200 - 250°

2. : 5,9 , , 12.
Θ = 250- 300°, σ = 2800

3.

: W - 6 -

19% Cr - 3 - 4,6%

1. 18, 12, 9, 6 5, 6 5.
Θ = 620 ° , R 64 - 66, σ = 3000 - 3400 ,
(, ,) .

2. . (,) :

- 9 5, 9 10;
- 9 5, 12 3, 14 4;
- 10 5 5, 12 4 5, 18 5 2;
- 12 3 10 3,

12 2 5 3.

Θ = 640° , R 64 - 68, σ = 3000 - 3800 , V ≤ 1 /
(- , , ,)

4.

()

1.

3, 4, 6, 8: Θ = 800 - 850° , σ = 1500 - 2000 , RC 80 - 90.
(, - , -

(,)

2.

5 10. 15 6, 30 4: $\sigma = 1000 - 15000$, R 87 - 92 $\Theta = 850 - 900^\circ$

(-).

3.

7 12, 8 6, 20 9: $\sigma = 1300 - 600$, R 87 - 90, $\Theta = 750^\circ$

1 -

		-	3882-74	48-19-308-80
	01		30 4	101
	10		15 6	111
	15		-	-
	20		14 8	121
	25		20 9	137 2210
	30		5 10	131 1460
	40		5 10	146
	50		7 12	-
	10		8 6	211
	20		10 8-	221
	30		10-	-
	40		7 12	-
	01		3, 3	301
	05		6-	306
	10		6-	313 3210
	20		6	318, 321
	30		8, 8	-
	40		15	-

5.

1.

-1(TiC+ NbC)90%,Ni, Mo-10%),

-3(TiC+NbC)64%,Ni, Mo-36%),

-20 (TiC-79%, Ni, Mo-21%),

-16 (TiCN-74%, Ni, Mo-26%)

HR 88-92, $\theta = 850 - 1000^\circ\text{C}$, $V > 1$ /

2.

-332, -13 - () - Al_2O_3 - 99,7%, MgO - 0,3%

3, -60, -63 - : Al_2O_3 - 60%, TiC, WC, MoC - 40%
 - : Si_3N_4 ()
 -20 - : $Al_2O_3 + TiN$
 HR 92-96, $\theta=1200^\circ C$, $V>3$ /

6.

1

(92...95% Al_2O_3) - 12 , 13 , 14 , 15 , 16 .
 (98...99% Al_2O_3) - 22 , 23 , 24 , 25 .

2

- 53 , 54 , 55 .
 - 63 , 64 .

:

7

1

- ;

2 -

4 -

.

6 -

15 -

32 -

2

- Br_4N

2

:

:

:

-

01;

-

02;

-

03;

-

09;

-

10

HV60-90, $\theta=1500^\circ C$, $V>5$ /

(HRC 55...70),

∴ (,). $V -$

$n(-1),$

$$V = \pi \cdot D \cdot n / 1000,$$

$D -$

$V_s -$

$S -$

$S_o (/ .);$

$S = S_o \cdot n (/ .);$

$S_z = S_o / z (/).$

$t -$

$$t = (D - d) / 2,$$

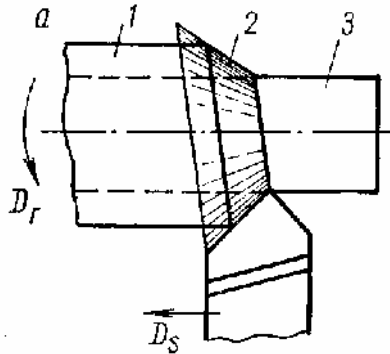
$- D -$

$; d -$

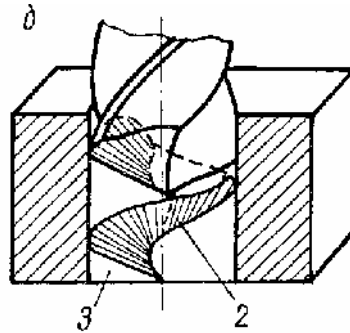
t

$b.$

(.2).



.2 -



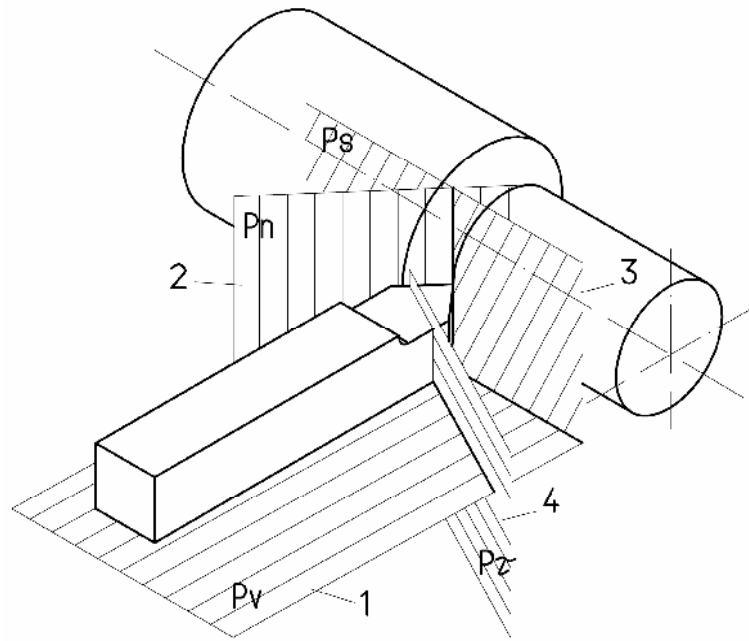
(),

(): 1 -

; 2 —

; 3 —

2



3 -

V

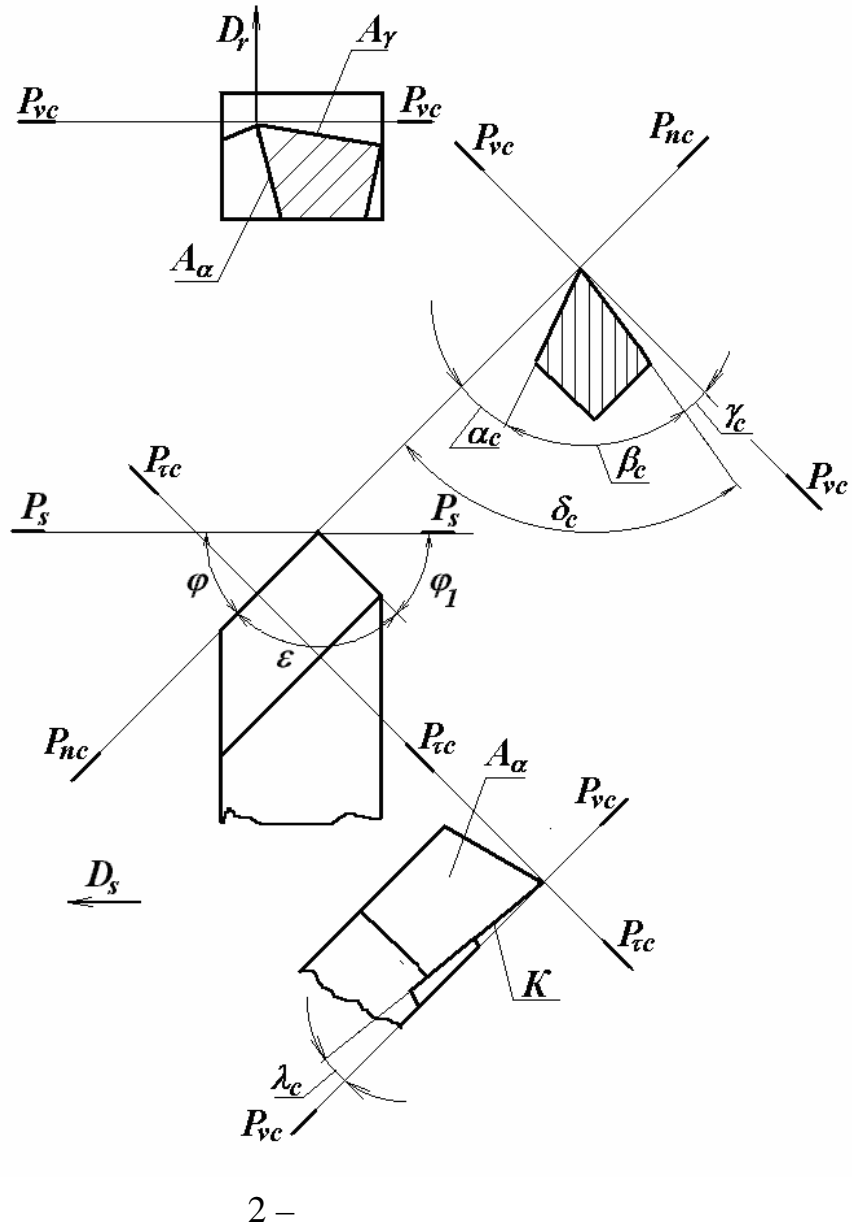
$n -$

$P_s -$

()

1

2.



1 -

$$\varphi + \varphi_1 + \varepsilon = 180^\circ$$

6

- 1
- 2
- 3

1

$S,$

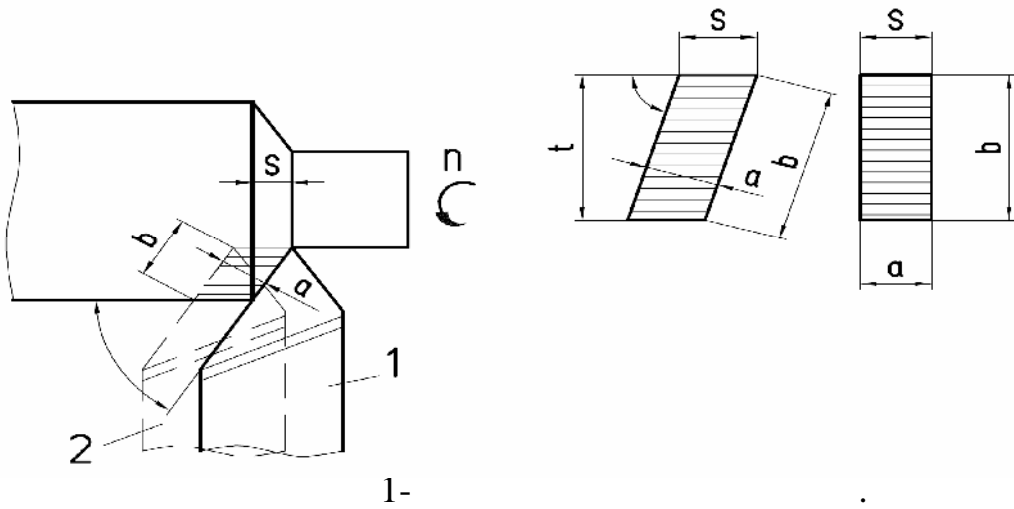
1

t

2.

S

, $t S-$



() —

() —

$b —$

() .

$\therefore = S \cdot \sin \varphi, b = t / \sin \varphi.$

- 1. $a =$,
- 2. , $t/s > \sin^2$;
- 3. , $t/s < \sin^2$

1
2
3

1

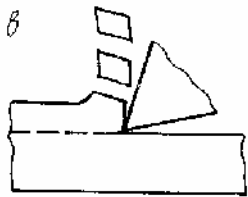
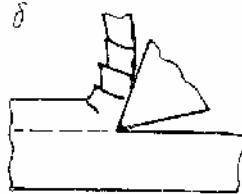
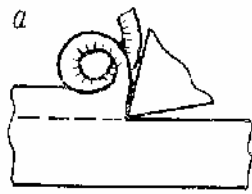
(1)
(6),

(),

,

()

:
(,).



1 -

).

,

γ

γ

2

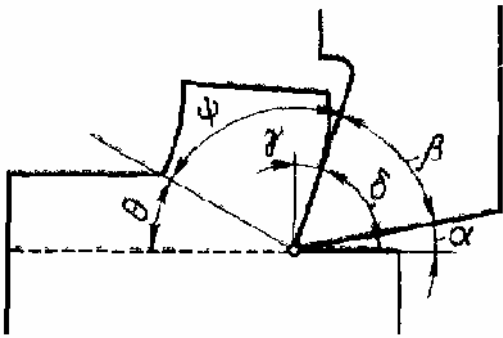
(

, . . .

. . . .

1) . . . , :

2) , ;



2

ψ

(.2).

$$\theta = 180^\circ - (\delta + \psi),$$

9 = 30... 35 .

3

(.3).

R',

()

()

I,

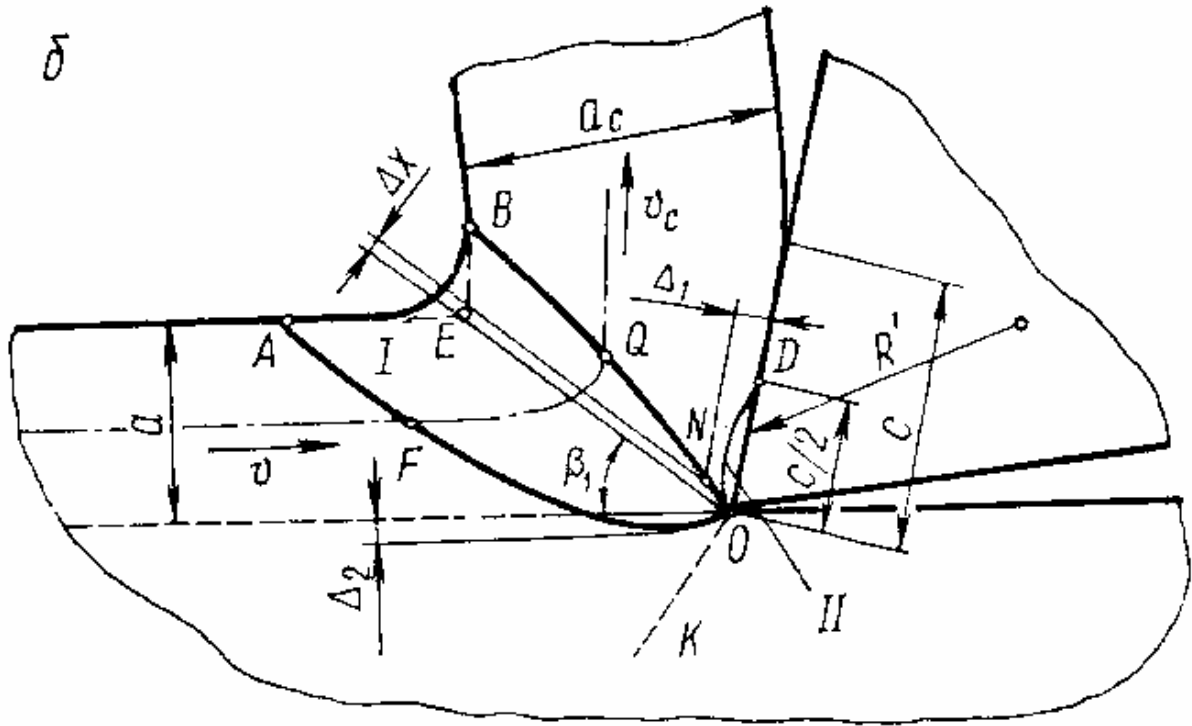
N

2—4 I

0 I.

0

—



3 -

D

II

20

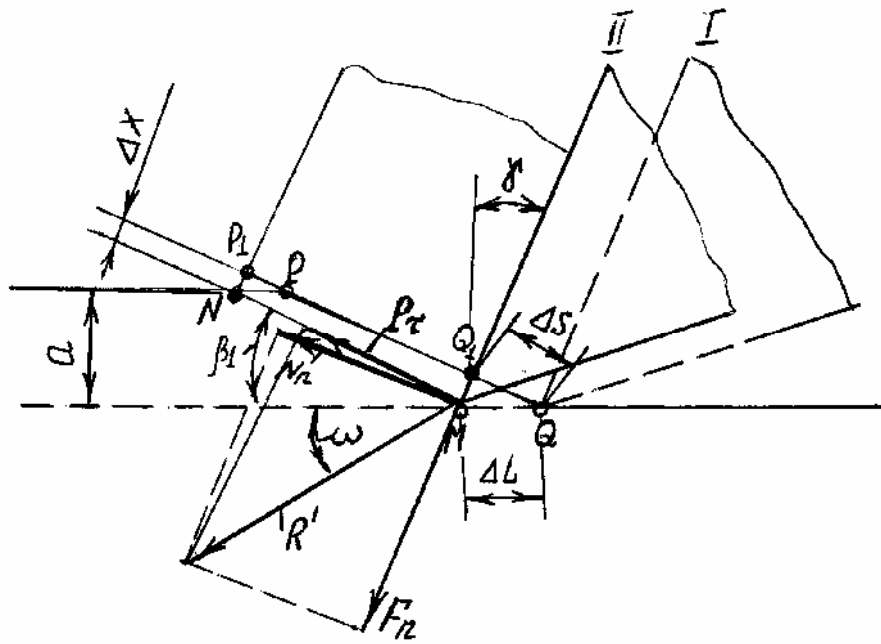
II

II

II^γ

1
2
1

l (.1). G
 MNPG, G₁,
 , b,
 .



1 -

$S,$ MNPG,
MNP₁G₁, MN
 . l
 ,
 ,
 .

S -

$N_n,$

$$F_n = N_n \cdot \mu,$$

$\mu -$ F_n N_n R' ;
 R_n, \perp MN, P,
 $P_N,$ P

$$\tau = P_\tau / (MN \cdot b),$$

b -

$$MN = a / \sin \beta_1,$$

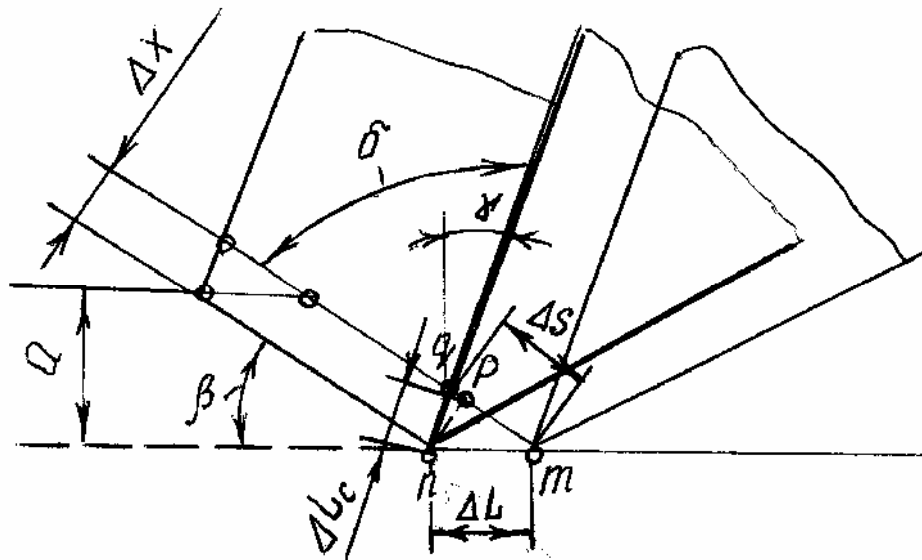
$$\tau = P_\tau \cdot \sin \beta_1 / a \cdot b$$

$$P_\tau = R' \cdot \cos(\omega + \beta_1),$$

$$\tau = \frac{R'}{a \cdot b} \cdot \cos(\omega + \beta_1) \cdot \sin \beta_1$$

2

(.2)



2-

$$\Delta S = \overline{mp} + \overline{pg}$$

$$\overline{mp} \quad \overline{gp}$$

-

:

$$\overline{mp} = \Delta x \cdot \text{ctg} \beta$$

$$\overline{pg} = \Delta x \cdot \text{ctg} \delta = \Delta x \cdot \text{ctg} [90^\circ - (\beta - \gamma)] = \Delta x \cdot \text{tg} (\beta - \gamma)$$

$$\Delta S = \Delta x [\text{ctg} \beta + \text{tg} (\beta - \gamma)]$$

$$\varepsilon = \Delta S / \Delta x,$$

$$= \text{ctg} \beta + \text{tg} (\beta - \gamma)$$

L

L . mnq :

$$\frac{\Delta L_c}{\sin \beta} = \frac{\Delta L}{\sin \delta} = \frac{\Delta L}{\cos (\beta - \gamma)}$$

$$\frac{\Delta L}{\Delta L_c} = \frac{\cos (\beta - \gamma)}{\sin \beta} = K_L \quad (\quad)$$

$$\text{tg} \beta = \frac{\cos \gamma}{K_L - \sin \gamma}$$

3

L;

$$K_L = L / L_c; \quad K_a = a_c / a; \quad K_b = b_c / b.$$

5...15 %

250...600 %

I =

1)

γ :

β .

β ,

2)

3)

4)

β .

= 0,13

$\beta = 26^\circ$,

= 2,65

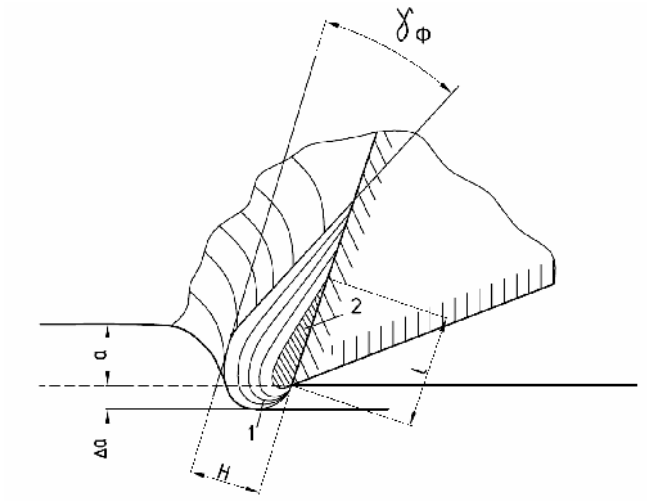
$\beta = 36^\circ$;

9

1
2.

1

2,5...3,0



1

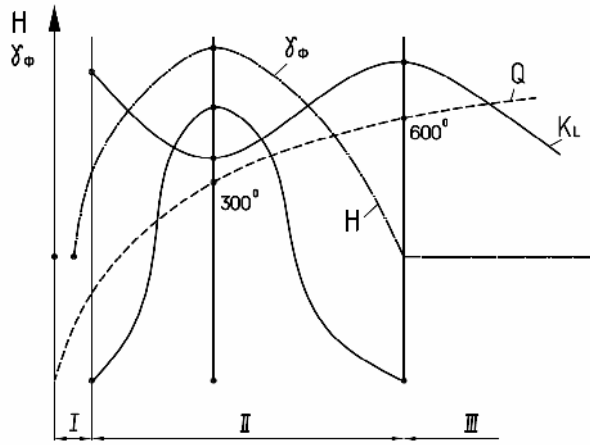
3-

l,

)

(

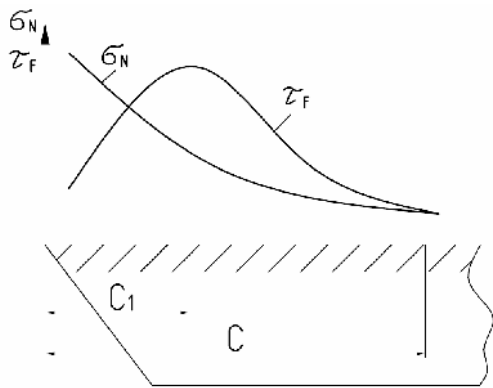
(.2).



2

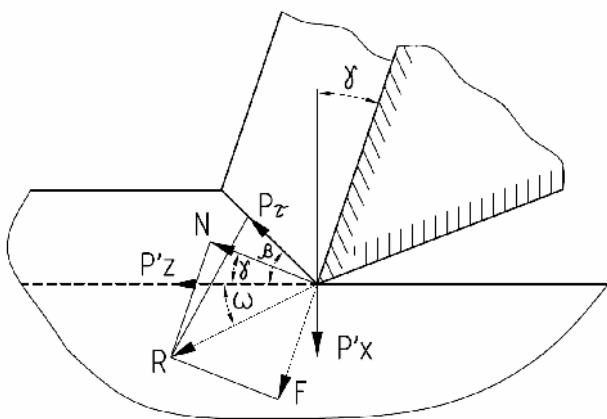
(I - $V=0,5...1$ / ; II - $V = 15...30$ / ; III - $V > 80...100$ /)
 $= 15...30$ /

2.



3 -

$$C_1 = a[K_L(1 - tg\gamma) + sec\gamma]$$



4 -

N F P'_z , P'_x , R
 (.4). P'_z P'_x

$$N = \frac{P'_z}{\cos \omega} \cdot \cos(\omega + \gamma),$$

$$F = \frac{P'_z}{\cos \omega} \cdot \sin(\omega + \gamma)$$

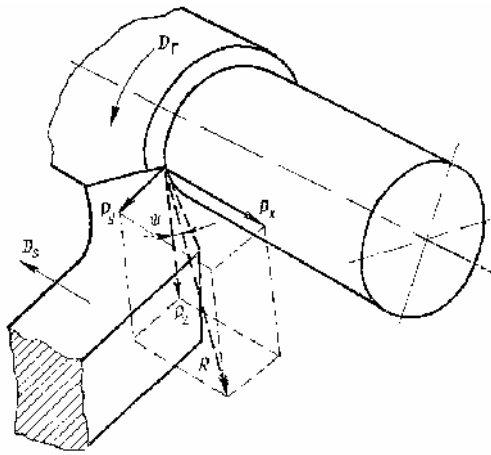
$$\mu = \frac{F}{N} = tg(\omega + \gamma);$$

$$\eta = (\omega + \gamma) -$$

1
2

1

R



1 -

(. 1):

$$R' = (P_z^2 + P_y^2)^{1/2}$$

$$\varphi = 45^\circ, \gamma = 15^\circ, \lambda = 0$$

$$P_y = (0,4 \dots 0,5) P_z;$$

$$P_x = (0,3 \dots 0,4) P_z$$

R

$$R = \sqrt{P_z^2 + P_y^2 + P_x^2}$$

2

$$E = E + +$$

1
2

1

99,5%

(/),

$$Q = \frac{P_z \cdot V}{J} = \frac{E_i}{J},$$

$P_z \cdot V (E_i) -$ (/); $J = 4200$ (/) -

(.1)

$$Q = Q + Q + Q ,$$

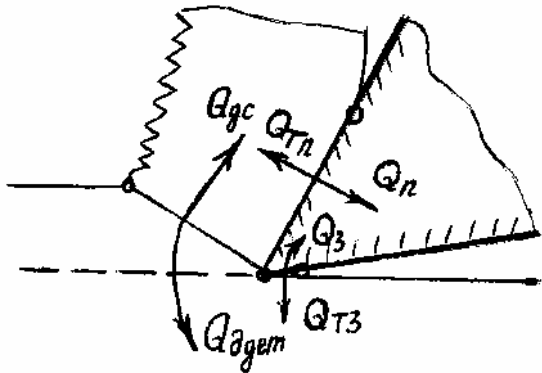
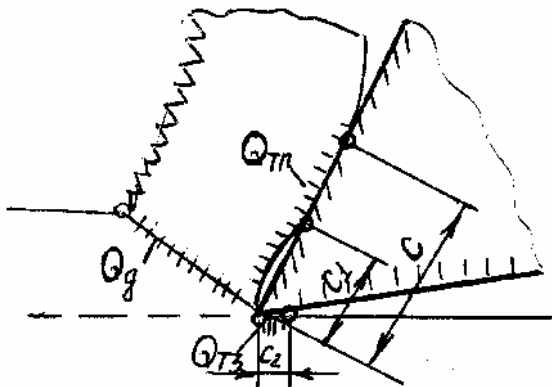
$Q -$;

; $Q -$;

; $Q -$;

2.

1 -



2 -

(.2).

Q

$$Q + Q , \quad Q - ,$$

$$Q = Q + Q - Q.$$

$$Q.$$

$$Q - Q, \quad Q -$$

$$Q = Q + Q - Q.$$

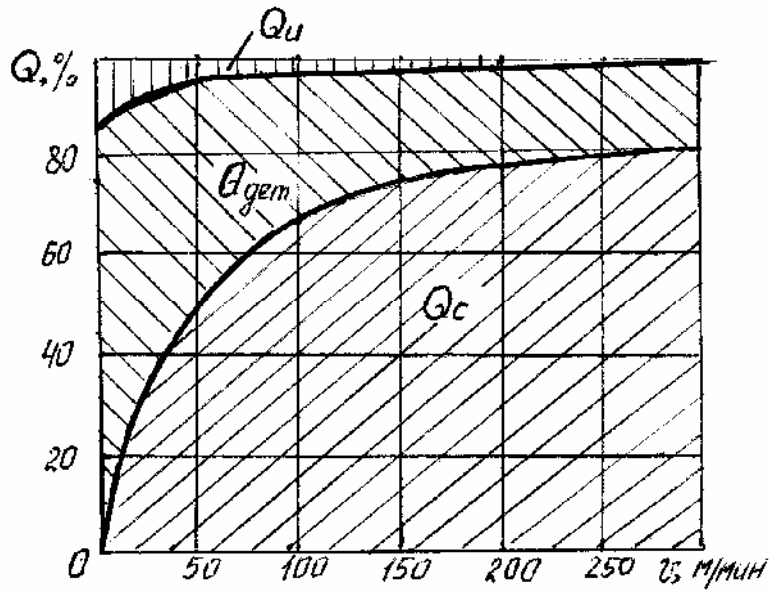
$$Q$$

$$Q = Q + Q.$$

$$Q = Q + Q + Q + Q$$

Q - ,
V

60 80%. V
(.3).

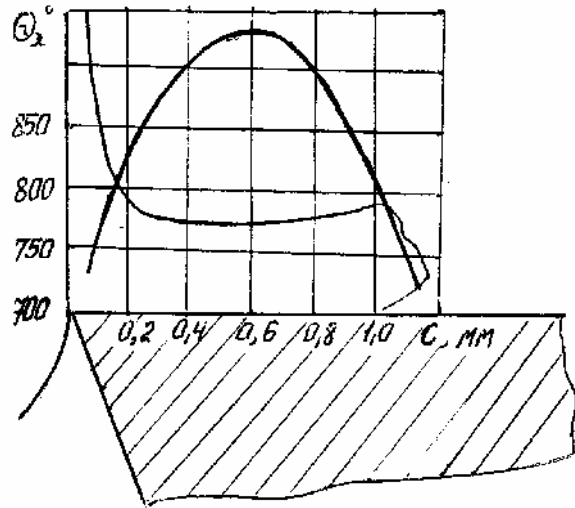


3 - Q
40

2

. 4

$$\text{Max } Q = \frac{1}{2} (\dots) \cdot Q^\circ$$



. 4 -

Q

: Q . . .

$$Q = Q + Q$$

V

Q_c

: t, S, V.

t

S -

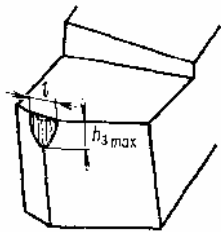
V -

> 950...1000°

700...900°

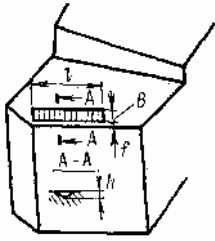
40—60

2



1 - -

(0,10)



2 - -

(>1,0).

3

$$\Sigma = (i+1),$$

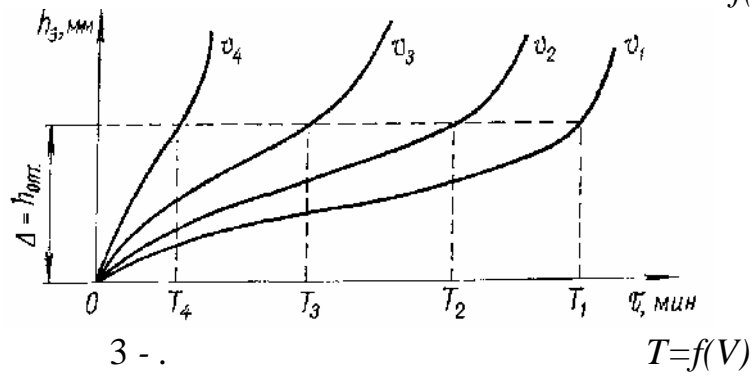
; i —

$T=f(V)$

V.

(. 3),

$T=f(V).$



$T=f(V),$

).

1
2

1

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2

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: 1)

; 2)

; 3)

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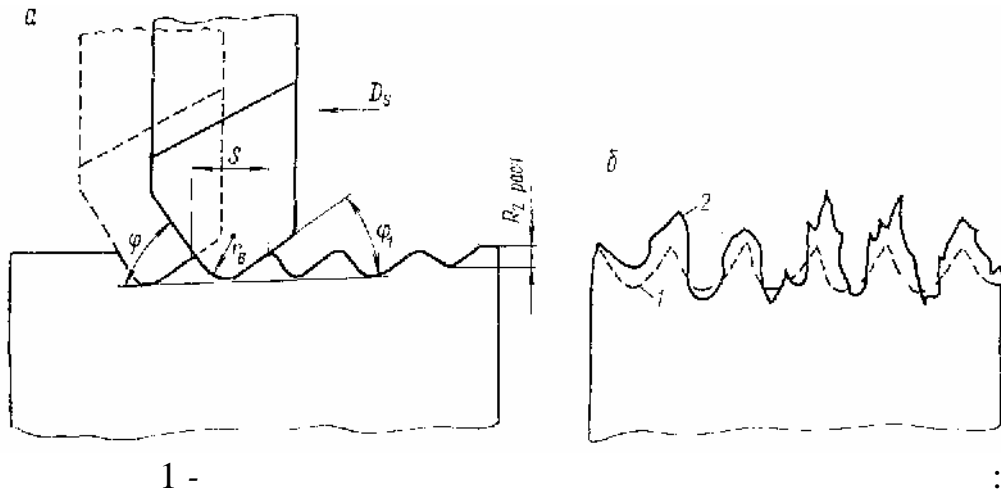
(. 1)

()

- 1;

-

- 2.



$\varphi \quad \varphi_1,$, $r \quad S.$

$$R_{zp} = S \sin \varphi \sin \varphi_1 / \sin(\varphi + \varphi_1)$$

, $r (S > r),$ -

$$R_{zp} = S^2 / 8r$$

, $S, \varphi \quad \varphi_1,$ $r,$ -
 (, .) -
 , .

: $50...60 \%,$ -
 $100...115\%,$ $35...45\%,$ -
 $30...40 \%$ $20...30\%.$ -

(,) , .

1
2

1

(2200...3100)

(7000)

1300

2000

600...700

()

7...9-

6-

$$R = 0,63...0,16$$

1)

2)

000

(22 000...31

000

400

3)

(30...70 /)

4)

(. 1).

($\rho = 8... 20$),

ρ

N .

10 100

; 4) (— , .); 3) (-
 ;) ;
 : , (-) , (-)
 , - .
 , - .
 (/)

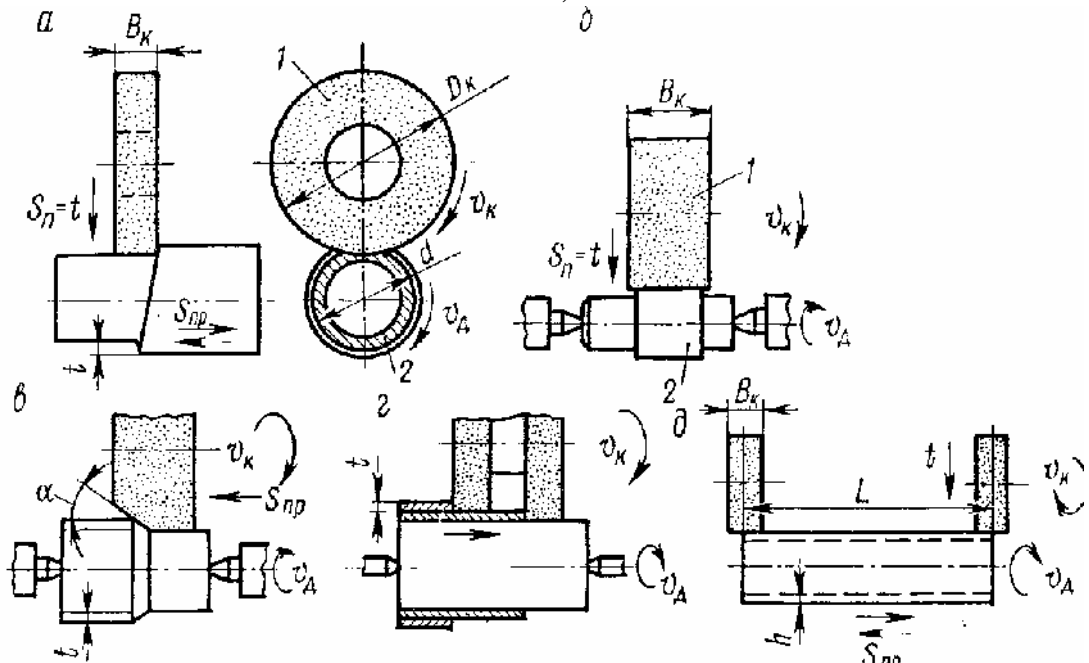
$$V = \pi D n / (1000.60),$$

D — , n ; — , / .
 V (/)

$$V = \pi D n / 1000,$$

D — , ;
 n — , / .
 S ,

S



2 -

(. 2,)

1

2.

0,002...0,005 / .

0,8...3 / .

(. 2,)
(0,4)
 $S = 1...6$

S

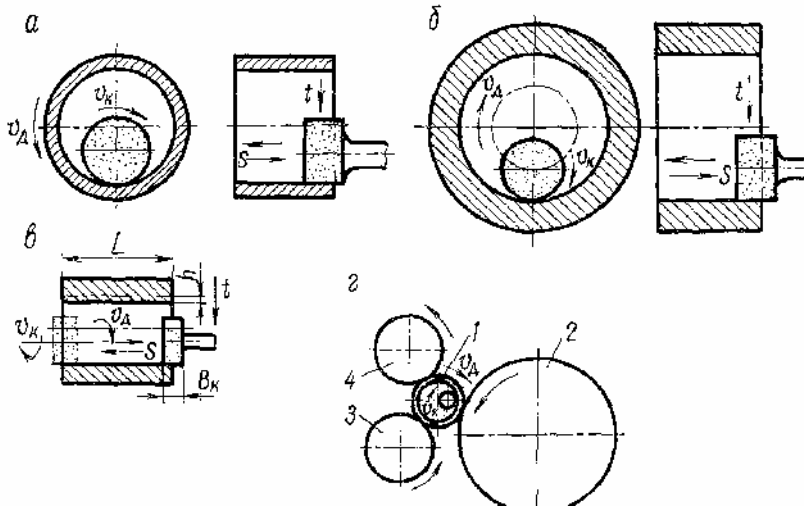
(. 3,)

(. 3, 6).

: 1)

35 / ; 2)
40...60 / ; 3)

4)
(0,008...0,02



3 -

D

d .

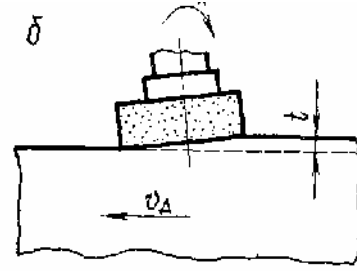
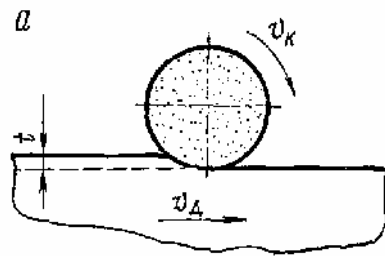
()

(. 6.4,)

(. 6.4,6).

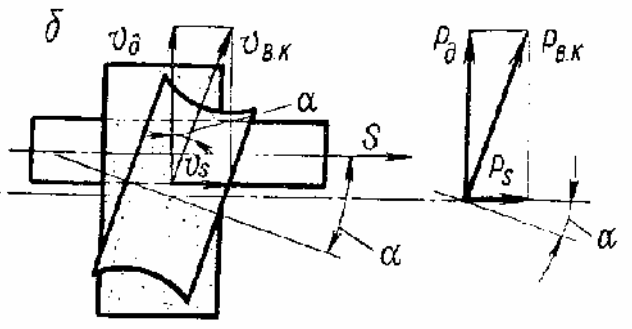
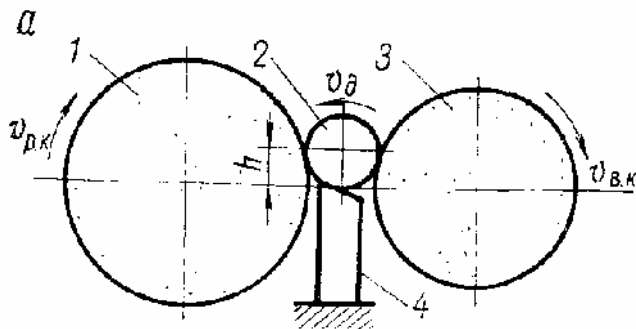
($\cong 30^\circ$).

$t=0,05 \dots 0,1$



4 -

(. 6.5,).



5 -

2

4

1 3.

1

3

$\alpha = 1 \dots 5^\circ$
 $0,3)d, \quad d -$

$h = (0,1 \dots 0,3)d$
 $30 \dots 35 /$

$15 \dots 30 /$

10...12

2— 1.

1
2

1

()

1)

2)

3)

4)

5)

6)

150 /

2

1)

2)

() ,

75...80 °

1 .

(

. .),

1,5—2 .

« » , . .

()

5...20 .
30...50 %

1,5—3 . R

1. :
.- ∴ ,1985.-304 .
2. - ∴
 , 1974.- 597 .
3. -
,1975.-344 .
4. -
 , 1990.-512 .
5. 1989.-
- ∴ 1989.-
296 .
6. 2- - ∴ (-
 . -) ,1973.-496 .
7. ,1975.-232 .
8. / -
∴ ,1980.-263 .
9.
- ∴ ,1976,-136 .
10. -
 . ∴ , 1982. - 320 .
11. -
- ∴ ,1973.- 346 .
12. -
, 1975. - 176 .
13. ∴
/ , - ∴ ∴ ,1991.
- 240 .
14. : 2- 2 / .
 - ∴ , 1986. - 496 .
15.
 . - - ∴ , 1977.-
391 .
16. “
” (-
 7.090202) / - ∴ ∴ , 1995. - 39 .