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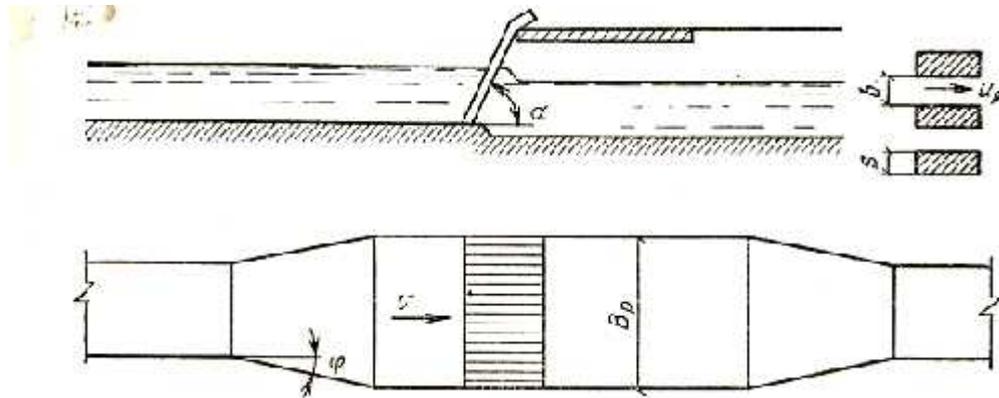
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II-32-74

$$b = 16 \div 19$$

$$r = 60 \div 70$$

0,1³



1-

h

$$h = \frac{q_{maxc}}{bh_1} R_3$$

· q -

h₁ -

, ^ -

1 /

$$R_3 = 1.05$$

$$B = s(n-1) + bh$$

· s -

N

$$B_1 = B_p / N$$

· < = 0.08, g = 9.81 / ²

$$h = p < ^2 / (2g)$$

< -

-0.08, € -

: g -

-9.81 / ²:

p -

,

$$< = s(s /)^{4/3} \sin r$$

: s -

2.42,

1,72

$$b = 16 \div 20$$

1 1

8

750 / ³

3-4-

3-

							/
		-	-	-	,		
-9	996	1200	1040	16 32 48	33 - -	8 8 8	320-510
-10	1152	2000	1200	16 32 48	39 - -	8 8 8	910-1050
-11	1152	1600	1200	16 32 48	39 - -	8 8 8	700-800
-12	1746	2000	1790	16 32 48	64 - -	8 8 8	1100-1370

4-

	16	20	25	30	40	50	70	90	100	120
1	$\frac{6}{5}$	$\frac{5}{4}$	$\frac{3.5}{3}$	$\frac{3}{2.5}$	$\frac{2.5}{2}$	$\frac{2.0}{1.5}$	$\frac{1.5}{-}$	$\frac{1.2}{-}$	$\frac{1.1}{-}$	$\frac{1}{-}$

:

I- $Q = 120000 \text{ }^3 /$

$$q = Q / (24 * 3600) = 120000 / 86400 = 1,39 \text{ }^3 /$$

$$K = 1,47$$

$$q_{maks} = q * K = 1,39 * 1,47 = 2,04 \text{ }^3 /$$

$$h = 1,5 \text{ ,}$$

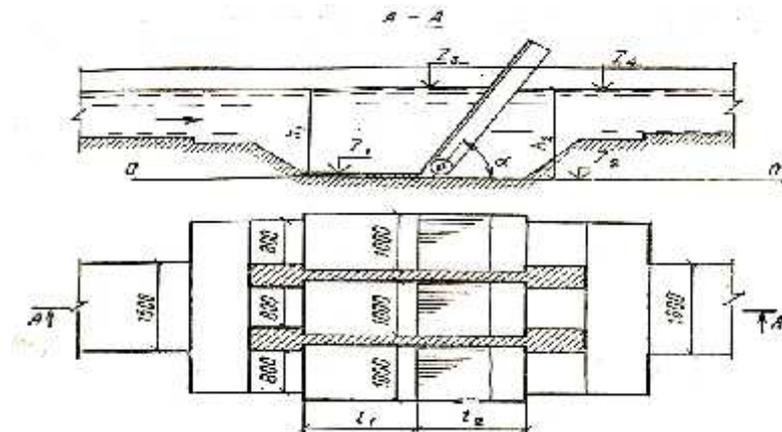
$$\hat{p} = 1 \text{ /}$$

$$b = 0,016$$

$$n = \frac{2,04 * 1,05}{0,016 * 1,5 * 1} = 89$$

$$s = 0,008$$

$$B_p = 0,008(89 - 1) + 0,016 * 89 = 2,13$$



2-

$$B_1 = 2.13/2 = 1.065$$

10

:

$$B \ H = 1000 \times 2000$$

$$n=39:$$

$$r = 60^\circ$$

$$Z_1 - Z_2 = 0.1 \quad .$$

$$\hat{p} = \frac{qR_3}{Nbh_1n} = \frac{2.04 * 1.05}{2 * 0.016 * 1.5 * 39} = 1.14 \quad /$$

$$l_p = l_1 + l_2 = 1.2 + 0.8 = 2$$

$$Z_3 = Z_1 + h_1 = 0.1 + 1.5 = 1.6$$

 Z_4

$$Z_1 + \frac{P_1}{\gamma} + \frac{\hat{h}_1^2}{2g} = Z_2 + \frac{P_2}{\gamma} + \frac{\hat{h}_2^2}{2g} + h$$

 $h_m -$

$$h = P / \gamma + \frac{\hat{h}^2}{2g}$$

$$h = 3$$

$$Z_1 = 0.1 \quad : Z_2 = 0 \quad : P_1 / \gamma = h_1 = 1.5 \quad : P_2 / \gamma = h_2$$

$$\hat{h}_1 = \frac{q}{NB_k h_2} = \frac{2.04}{2 * 1 * 1.5} = 0.58 \quad /$$

$$\hat{h}_2 = \frac{q}{NB_k h_2} = \frac{2.04}{2 * 1 * h_2} = \frac{1.02}{h_2}$$

$$\langle p \rangle = 2.42(0.008/0.016)^{4/3} \sqrt{3/2} = 0.836 \quad .$$

$$0.1 + 1.5 + \frac{0.58^2}{19.6^2} = h_2 + \left(\frac{1.02}{h_2}\right)^2 * \frac{1}{19.6^2} + 0.836 \frac{0.58^2 * 3}{19.6^2} \quad h_2^3 - 1.57h_2^2 + 0.053 = 0$$

$$h_2 = 1.55 \quad Z_n = 1.55$$

$$(\quad) \quad b = 16 \quad 1 \quad 8$$

$$) \quad h = 250 \quad (\quad)$$

$$N_{np} Q \quad / \quad = 120000 * 1000 / 250 = 480000$$

$$V = \frac{N_{np} 8}{1000 * 365} = \frac{480000 * 8}{1000 * 365} = 10.52 \quad ^3 /$$

$$\dots = 750 \quad / \quad ^3 \quad = 10,52 * 0,75 = 7,89T /$$

2-

$$Q = 15000 \quad ^3 /$$

:

$$q = Q \quad / (24 * 3600) = 15000 / 86400 = 0.174 \quad ^3 /$$

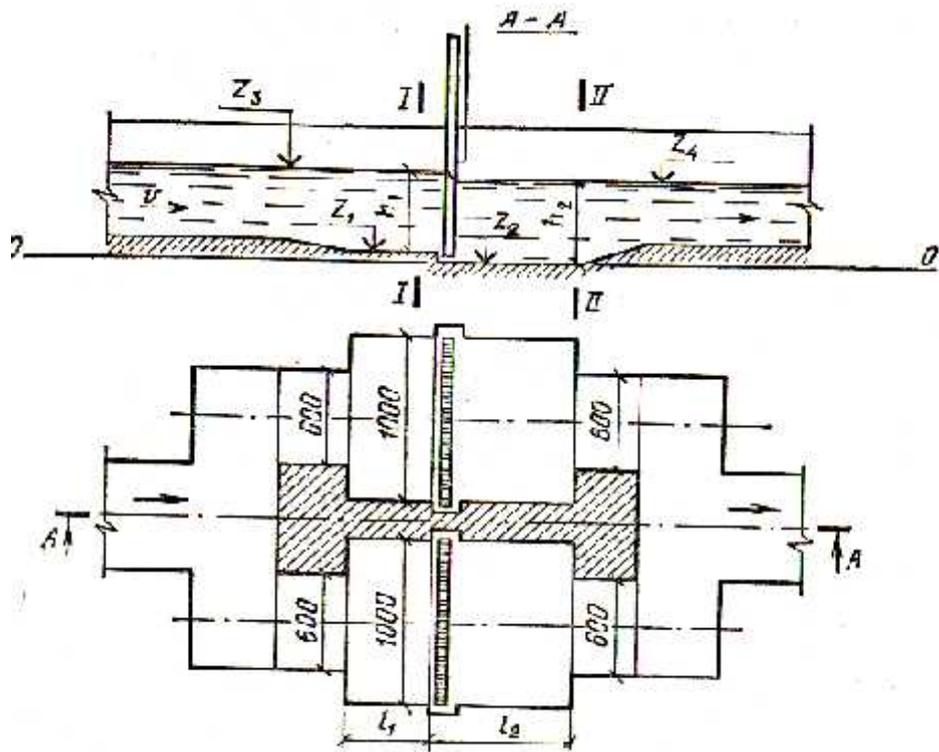
$$K = 1.58$$

:

$$q = q \quad K = 0.174 * 1.58 = 0.275 \quad ^3 /$$

$$h=0.5 \quad ,$$

$$= 1 \quad /$$



3-

$$b=0.016$$

$$n = 0.275 \cdot 1.05 / 0.016 \cdot 0.5 \cdot 1 = 36$$

$$s = 0.006$$

$$B_p = 0.006 (36-1) + 0.016 \cdot 36 = 0.79$$

-2 (9)

× =

1000×1000

$$= q \cdot R_3 / b \cdot h_1 \cdot n = 0.275 \cdot 1.05 / 0.016 \cdot 0.5 \cdot 39 = 0.93 \quad /$$

$$l_{\dots} = l_1 + l_2 = 1.0 + 0.8 = 1.8 \quad .$$

$$Z_3 = Z_1 + h_1 = 0.1 + 0.5 = 0.6 \quad . Z-$$

$$Z_1 = p_1/\rho + v_1^2/(2g) = Z_2 + p_2/\rho + v_2^2/(2g) + h$$

: h - h =

$$Z_1 = 0.1 \quad ; Z_2 = 0 \quad ; v_1 = h_1 = 0.5 \quad .$$

$$p_2/\rho = h_2 \quad v_1 = q/B_k h_1 = 0.275/1 \cdot 0.5 = 0.55 \quad /$$

$$v_2 = q/B_k h_2 = 0.275/1 \cdot h_2 = 0.275/h_2 \quad /$$

$$= 2.42 (0.006 / 0.016)^{4/3} = 0.655$$

$$0.1 + 0.5 + 0.5^2/19.62 = h_2 + (0.25/h)^2 \cdot 1/19.62 + 0.655 \cdot 0.55^2/19.62 \cdot 3$$

$$h^3 - 0.585 \cdot h^2 + 0.0038 = 0$$

$$h_2 = 0.57 \quad , Z_4 = 0.57$$

$$b = 16$$

1

8 /

$$n = 250 \quad / (\quad)$$

:

$$N = Q \quad . \quad /n = 15000 \cdot 1000/250 = 75000$$

$$V = N \cdot 8 / 1000 \cdot 365 = 75000 \cdot 8 / 1000 \cdot 365 = 1,64 \quad ^3/$$

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 10 000 ³/_h
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 70000 ³/_h ,
 50000 ³/_h
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 : L = V · t · 60
 ; t =
 :
 = Q / V
 :
 n = / b · h
 : n = ; b =
 , ; h =
 h = 0.5-1.2 ; b = 0.6-1.6
 4-6
 .

0.15 /

h_2

:

$$W = N \cdot p \cdot T / 1000$$

: N -

; p -

;

T -

2 - 4

$$h_2 = W / L \cdot b \cdot n$$

:

$$N = Q / \cdot / W$$

: Q / -

; -

, W- -

$$N = N \cdot N$$

:

1.5 - 2

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:

$$H_c = h + h_1 + h_2$$

: h -

0.2 - 0.4

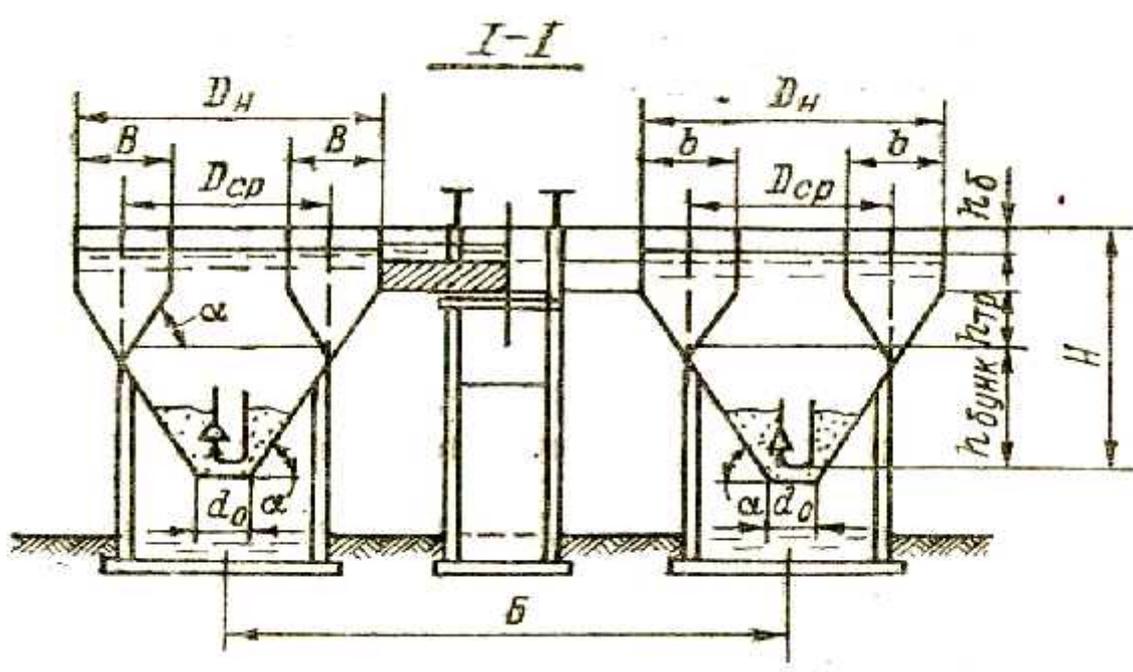
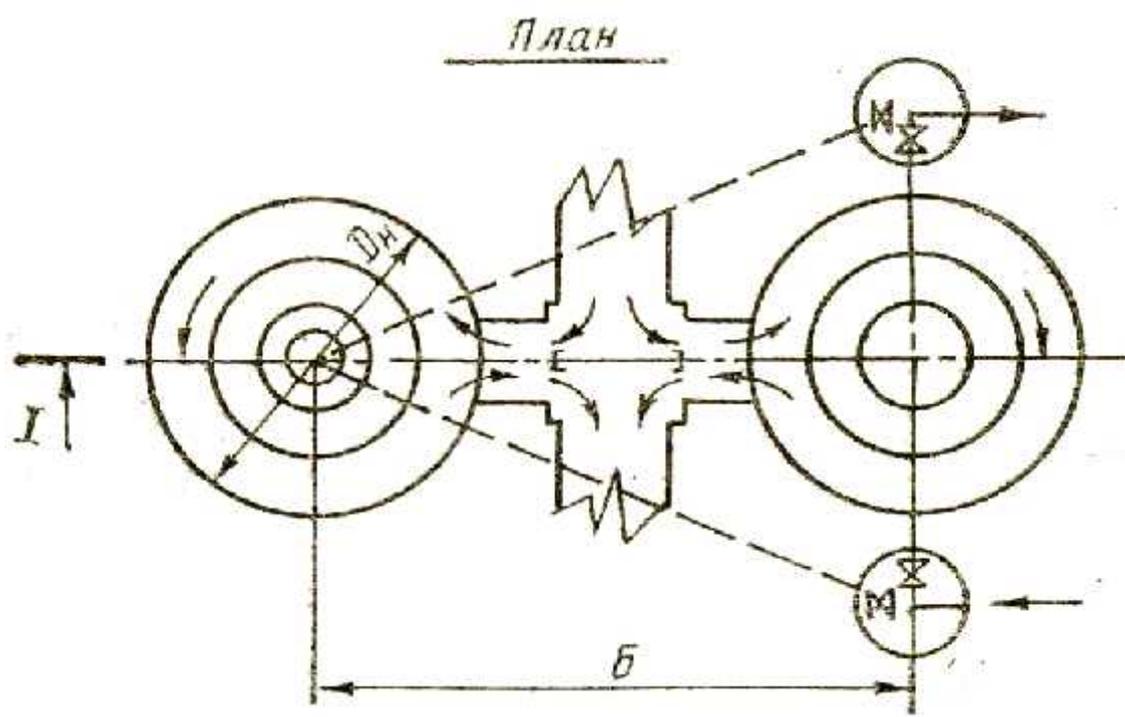
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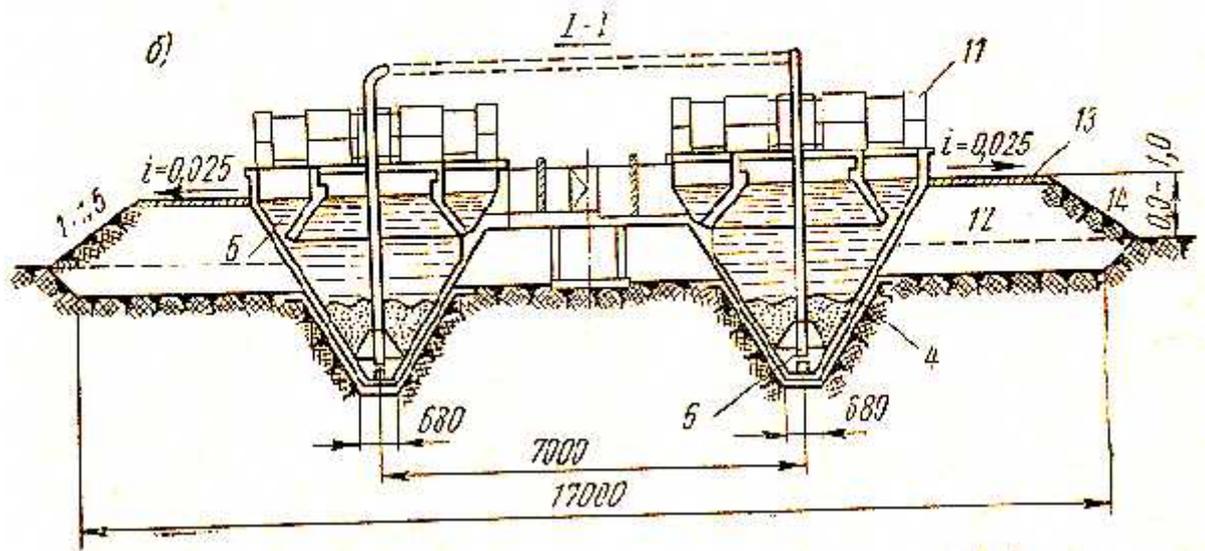
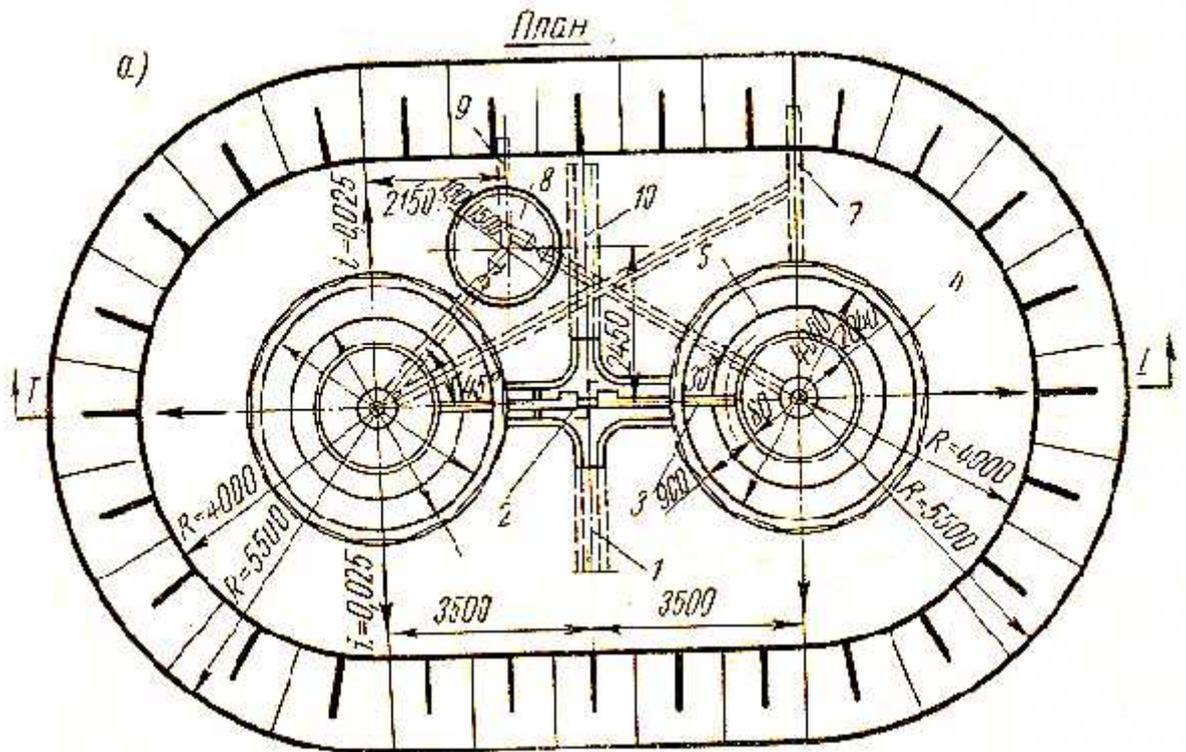
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		,				,			
25	2	400	500	3000	3500	600	500	450	950
50	2	400	500	3000	3500	600	500	450	950
75	2	400	500	3000	3500	600	500	450	950
100	2	400	500	3000	3500	600	500	450	950
150	2	400	500	3000	3500	900	500	700	1200
200	2	400	500	3000	3500	900	500	700	1200



5-



6 -

q, 3/

q

D_H

b

n 7.33

n 2

$$= q/(n);$$

: - , =0.3 /

$$h = b \operatorname{tg} / 2$$

, 60

$$= b h / 2 = b^2 \operatorname{tg} / 4$$

$$= - :$$

$$h = /$$

$$h = h + h$$

$$h = \frac{(- b) - d_0}{2} \operatorname{tg} \Gamma.$$

-d-

$$d_0 = 0.4 \div 0.5$$

$$h = 0.3$$

H :

$$H = h + h + h$$

$$t = L/\hat{=} = \frac{f(D_n - b)}{\hat{=}}$$

t = 30

$W = 3,$

$W = AN/1000$

$:-$

$= 0.02 / N-$

1

$80000^3 /$

$$q = Q / (24 \cdot 3600) = 80000 / 86400 = 0,926^3 /$$

$= 1,47$

$$q = q \cdot K = 0,926 \cdot 1,47 = 1,36^3 /$$

$$\check{S} = \frac{1,36}{0,3 \cdot 4} = 1,133^2$$

$h_1 = 0,6$

$$= \check{S} / h_1 = 1,133 / 0,6 = 1,89$$

$= 2$

$$h_1 = \check{S} / B = \frac{1,133}{2} = 0,57$$

$d = 0,2$

$U_0 = 18,7 /$

$R = 1,7 (-)$

23

2.1

$$L=1,7 \cdot 0,57 \cdot 0,3 / 0,0187 = 15,5$$

$$= 2$$

$$l = L - 2 = 15,5 - 2 = 13,5$$

$$n = 250 / (\cdot)$$

$$N = 80000 \cdot 1000 / 25 = 320000$$

$$V = N \cdot 0,02 / 1000 = 32000 \cdot 0,02 / 1000 = 6,4$$

$$1$$

$$h_0 = \frac{v \cdot 0,7}{nlB} = \frac{6,4 \cdot 0,7}{4 \cdot 13,5 \cdot 2,0} = 0,0041$$

$$l = 0,1$$

$$h = k_r h_0 (l + 1) = 1,5 \cdot 0,0041 (0,1 + 1) \approx 0,07$$

$$h = 0,2$$

$$h = 0,2$$

$$d = 0,05 ; \quad 28^0$$

$$\mu = 0,0084 / (\cdot)$$

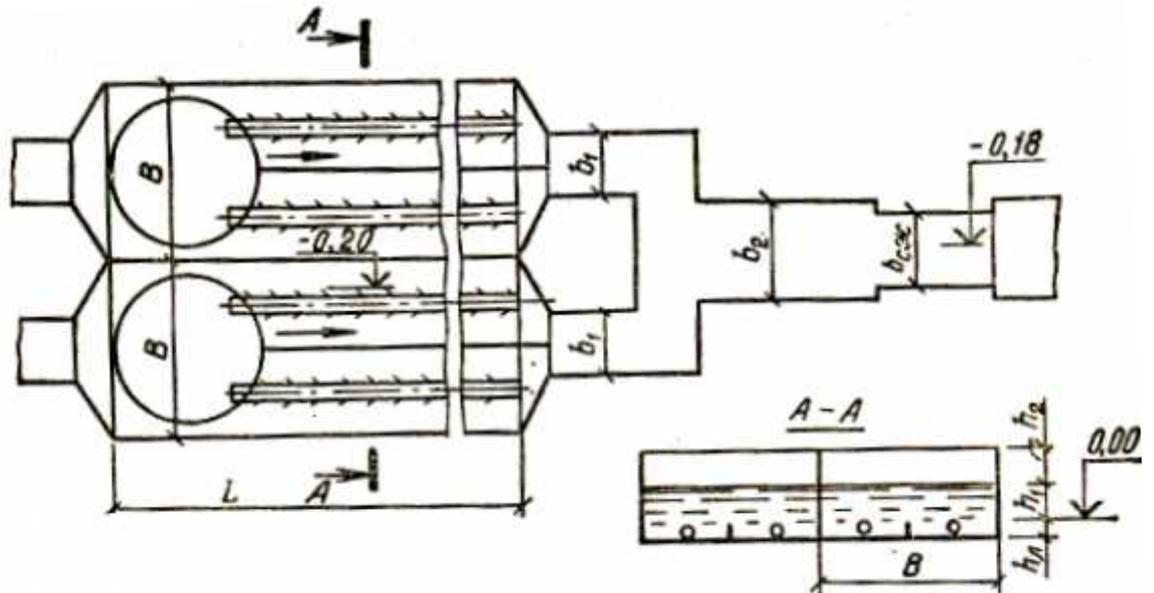
$$v = 10 \cdot 0,05^{1,31} (0,7 \cdot 0,1 + 0,17) / 0,0084^{0,54} = 0,63 /$$

:

$$ql = 0,0063 \cdot 2 \cdot 13,5 / 2 = 0,085$$

$$v = 3,0 /$$

$$d = \sqrt{\frac{4qt}{fv_T}} = \sqrt{\frac{4 \cdot 0,085}{9,14 \cdot 3}} = 0,19$$



7-

$$d = 200 \quad ,$$

:

$$v_T = \frac{4ql}{fd_T^2} = \frac{4 \cdot 0,85}{3,14 \cdot 0,2^2} = 2,71 \quad /c$$

:

$$H_0 = 5,6 \cdot 0,2 + 5,4 \cdot 2,71^2 / (2 \cdot 9,81) = 3,14 \quad .$$

$$Z = 0,5$$

;

$$N = 2l/z = 2 \cdot 13,5 / 0,5 = 54$$

$$d_{cr} = \sqrt{\frac{4 \cdot 0,85}{3,14 \cdot 54 \cdot 0,82 \sqrt{2 \cdot 9,81 \cdot 3,14}}} = 0,018 \quad .$$

$$v=0,3 \text{ /}$$

$$=0,69.$$

$$q = q = 0,926 \cdot 0,69 = 0,639 \text{ }^3/$$

$$h = \frac{q}{nBv} = \frac{0,639}{4 \cdot 2 \cdot 0,3} = 0,27 \text{ .}$$

$$R_q = q / q = 1,36 / 0,639 = 2,13$$

$$p = \frac{0,57 - 2,13^{2/3} \cdot 0,27}{2,13^{2/3} - 1} = 0,18 \text{ .}$$

$$B_c = \frac{1,36}{2 \cdot 0,36 \sqrt{2 \cdot 9,81(0,18 + 0,57)^{2/3}}} = 0,66 \text{ .}$$

$$q_1 = q / h = 1,36 / 4 = 0,34 \text{ }^3/$$

$$q_2 = 2 \cdot q_1 = 2 \cdot 0,34 = 0,68 \text{ }^3/ \text{ .}$$

$$q'_1 = q_1 \cdot 1,4 = 0,34 \cdot 1,4 = 4,8 \text{ }^3/$$

$$q'_2 = q_2 \cdot 1,4 = 0,68 \cdot 1,4 = 0,95 \text{ }^3/$$

$$p_1 = 800 \quad i_1 = 0,0012$$

$$p_2 = 1000 \quad i_2 = 0,0008$$

$$\begin{aligned}
h_1 &= 0,48 \quad , \quad v_1 = 0,91 \quad / \\
h_2 &= 0,75 \quad , \quad v_2 = 0,92 \quad / \\
h'_1 &= 0,62 \quad , \quad v'_1 = 0,97 \quad / \\
h'_2 &= 0,98 \quad , \quad v'_2 = 0,98 \quad /
\end{aligned}$$

$$= 2^- .$$

2-

$$140000 \quad ^3/$$

:

$$\begin{aligned}
q &= Q \quad / (24*3600) = 140000 / 86400 = 1.62 \quad ^2/ . \\
&= 1.58
\end{aligned}$$

$$q = q * \quad = 1.62*1.58 = 2.56 \quad ^3/$$

$$w = 2.56 / 0.3*3 = 2.84 \quad ^2$$

$$h_1 = 0.7$$

:

$$B = w / h_1 = 2.84 / 0.7 = 4.06$$

$$B = 4$$

:

$$h_1 = w / B = 2.84 / 4 = 0.71$$

$$d = 0.2 \quad , \quad u_o = 18.7 \quad / ,$$

$$R = 1.7$$

:

$$L = 1.7 * 0.71 * 0.3 / 0.0187 = 19.4$$

n

$$= 300 / (\quad * \quad)$$

:

$$N = 140000 * 1000 / 300 = 466667$$

:

$$V = N * 0.02 / 1000 = 466667 * 0.02 / 1000 = 9.33 \text{ } ^3/$$

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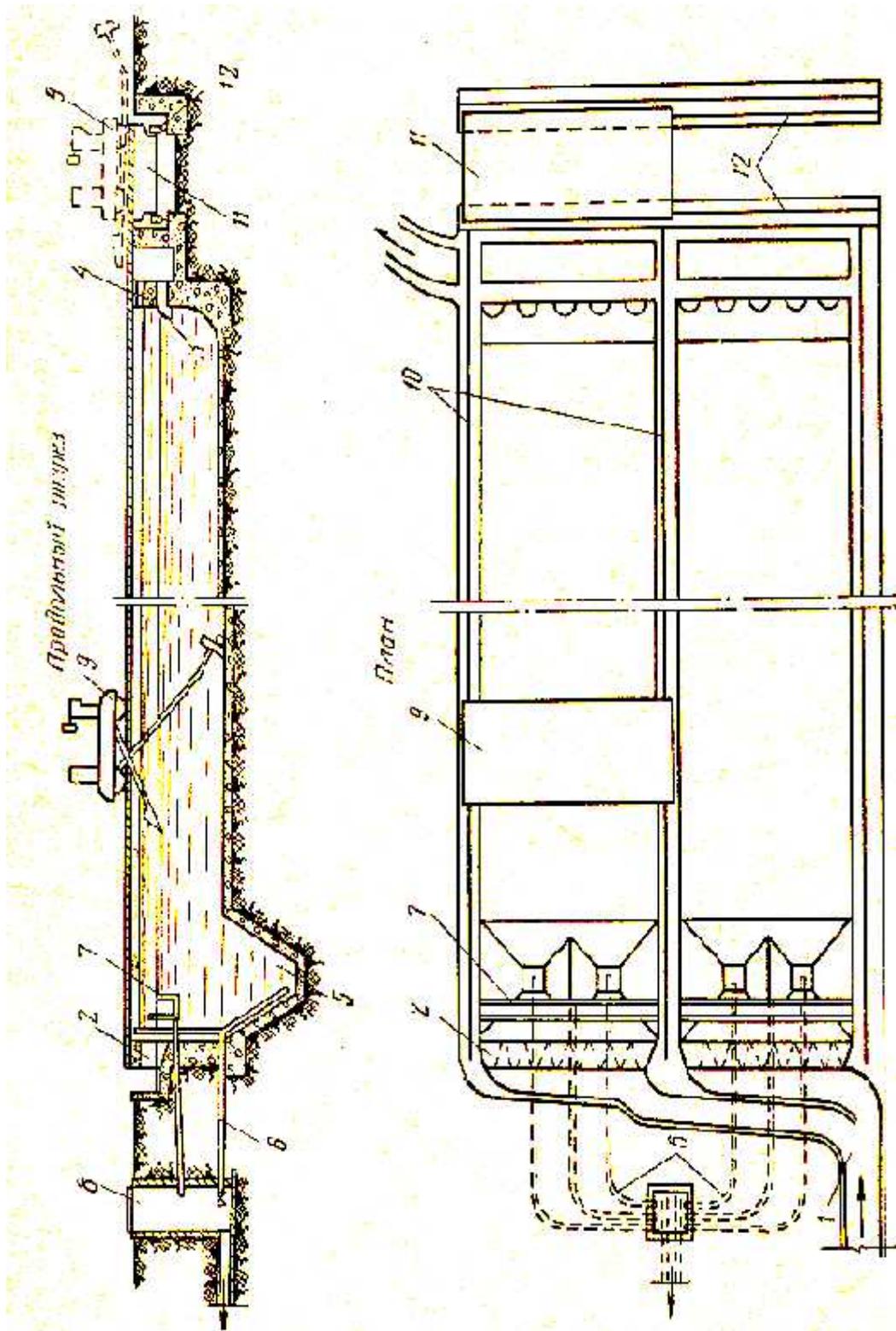
— — , 15000 ^{3/}
; 20000 ^{3/}

1:4

4

0,5-1

0,5 – 1



1-

$$\circ = 200 \quad / ,$$

$$= 45\% \quad 40000 \quad ^3/$$

·
:
·

$$q = Q \quad / (24 \cdot 3600) = 40000 / 86400 = 0,463 \quad ^3/ .$$

$$= 1,51 \quad ,$$

$$q = Q \quad : \quad = 0,463 \cdot 1,51 = 0,699 \quad ^3/ .$$

$$V = 5 \quad /$$

$$_1 = 2,5 \quad 6$$

$$= \frac{0,699}{6 \cdot 2,5 \cdot 0,005} = 9,32$$

$$= 9$$

:

$$\hat{=} = \frac{q}{nBh \quad _1} = \frac{0,699}{6 \cdot 9 \cdot 2,5} = 0,0052 \quad /$$

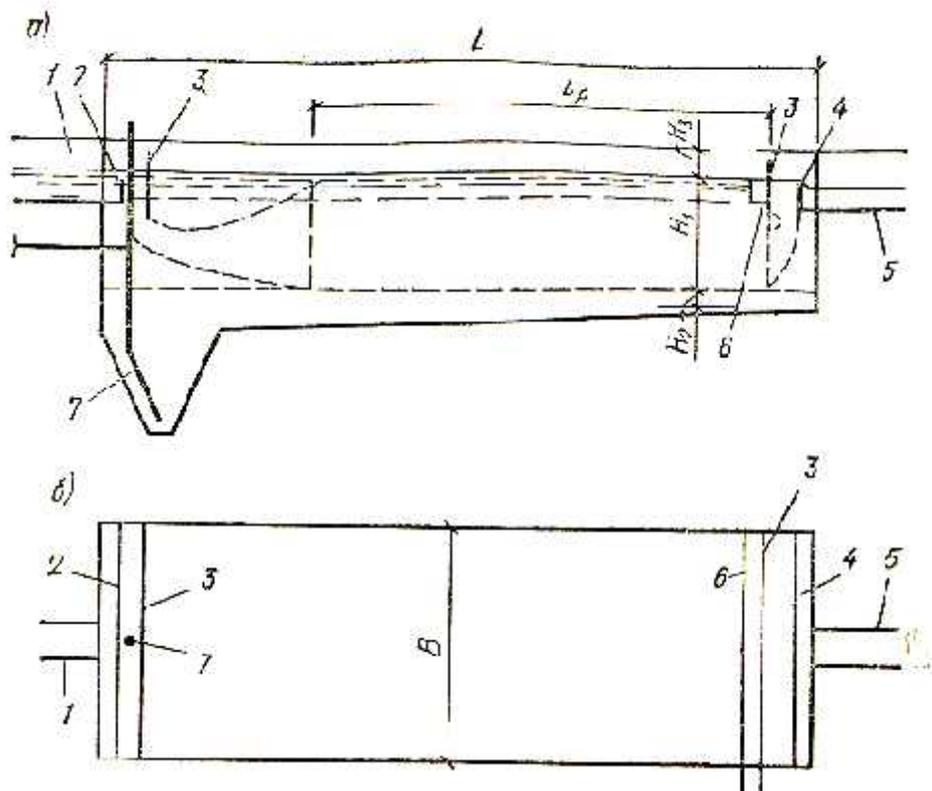
$$_1 = 2,5 \quad t=25^\circ$$

$$h_1 = 500$$

$$: t_1 = 775$$

$$n = 0,3$$

$$u = \frac{H_1}{t_1(H_1/h_1)^n} = \frac{2,5}{775(2,5/0,5)^{0,3}} = 0,00199 \quad /$$



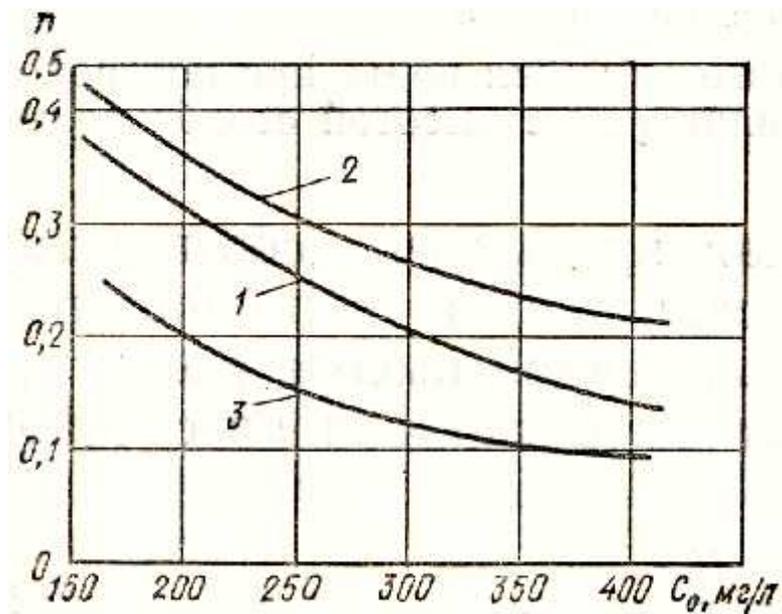
11 - ; 3- ; 4- ; 7- ; - ; - ; 1- ; 2- ; 5- ; 6-

4-

t=20°

%	/			
	100	200	300	400
20	600	300	-	-
30	900	540	320	260
40	1320	650	450	390
50	1900	900	640	450
60	3800	1200	870	680
70	-	3600	2600	1830
80	-	-	-	-

	, R	, H _i	, ,	/		.
	0.5	1.5-4	(2-5) H	5-10	0.005	-
	0.45	1.5-5	-	5-10	0.05	-
	0.35	2.7-3.8	-	-	-	-



12-

1- = 50% 2- = 60% 3- = 70%

t=10°

μ_n= 0,0101

μ_n=

0,0131

$$u_0 = \mu_0 \cdot \mu_n = 0,0101 \cdot 0,00199 / 0,0131 = 0,00153 /$$

:

$$= 0,5 \cdot 0,0052 = 0,00026 /$$

:

$$L = \frac{VH_1}{R(U_0 - \tilde{S})} = \frac{0,0052 \cdot 2,5}{0,5(0,00153 - 0,00026)} = 20,5$$

$$V = nBH_1L = 6 \cdot 9 \cdot 2,5 \cdot 20,5 = 2767,5 \text{ }^3$$

$$G = \frac{C_0 \cdot Q}{1000 \cdot 1000} = \frac{200 \cdot 0,45 \cdot 1,2 \cdot 40000}{1000 \cdot 1000} = 4,32 \text{ } /$$

$$W = 95 \% \quad = 1 \text{ } / \text{ }^3$$

$$V = \frac{100 \cdot G}{(100 - W) \dots} = \frac{100 \cdot 4,32}{(100 - 95) \cdot 1} = 86,4 \text{ }^3 /$$

$$= 1 + 2 + 3 = 2,5 + 0,3 + 0,5 = 3,3$$

2- :

$$Q = 250 \text{ } /$$

$$= 50\% \quad 80000 \text{ }^3$$

$$q = Q \cdot / (24 \cdot 3600) = 80000 / 86400 = 0,926 \text{ }^3 /$$

$$= 1,47$$

$$q = q \cdot K \cdot = 0,926 \cdot 1,47 = 1,36 \text{ }^3 /$$

$$4 \quad 1 = 3,1$$

$$h = 500$$

$$: t_1 = 770 \text{ } -$$

$$. n = 0,25 \text{ } -$$

$$U = \frac{1000 \cdot 3,1}{770(3,1/0,5)^{0,25}} = 2,55 \quad /$$

$$t=10^\circ$$

$$U_0 = 0,0101 \cdot 2,55/0,0131 = 1,97 \quad /$$

$$V = 3 \quad / \quad W = 0,05 \cdot 3 = 0,15 \quad /$$

$$D = \sqrt{\frac{4q}{nRf(U_0 - W)}} = \sqrt{\frac{4 \cdot 1,36 \cdot 100}{4 \cdot 0,45 \cdot 3,14(1,97 - 0,15)}} = 23$$

$$R - \quad \quad \quad 4 -$$

$$\hat{\quad} = \frac{2q}{nfDH_1} = \frac{2 \cdot 1,36}{4 \cdot 3,14 \cdot 23 \cdot 3,1} = 0,00304 \quad / \quad = 3,04 \quad / .$$

$$t = nV/q = nfD^2H_1/(4q) = 4 \cdot 3,14 \cdot 23^2 \cdot 3,1/(4 \cdot 1,36) = 3786 = 1,05$$

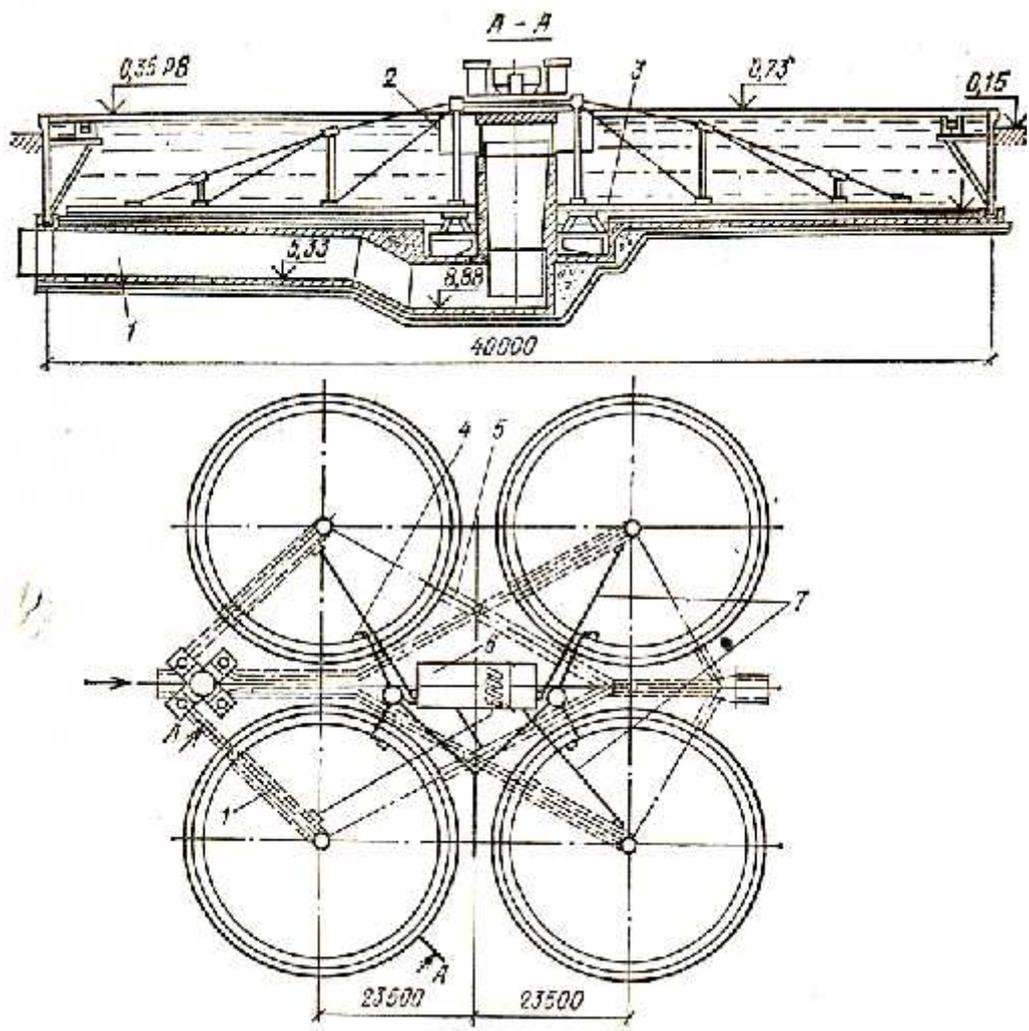
$$G = \frac{C_o RQ}{1000 \cdot 1000} = \frac{250 \cdot 0,5 \cdot 1,2 \cdot 80000}{1000 \cdot 1000} = 12 \quad /$$

$$W = 95\% \quad \dots = 1 / 3$$

$$V = \frac{100G}{(100 - W) \dots} = \frac{100 \cdot 12}{(100 - 95) \cdot 1} = 240 \quad 3/$$

$$2 = 0,3 \quad ; \quad 3 = 0,5$$

$$= 1 + 2 + 3 = 3,1 + 0,3 + 0,5 = 3,9$$



13- . :
 1- ; 2- ; 3- ; 4-
 ; 5- ; 6- ; 7-

$$q' = q / h = 1,36 / 4 = 0,34 \text{ } ^3/$$

1 /

$$V = 4q' / (fd^2) = 4 \cdot 0,34 / (3,14 \cdot 0,7^2) = 0,88 \text{ } /$$

b = 0,5 i = 0,001

$$q = q' / 2 = 0,34 / 2 = 0,17 \text{ } ^3/$$

:

$$h_{kp} = \sqrt[3]{q_n^2 / (gb^2)} = \sqrt[3]{0,17^2 / (9,81 \cdot 0,5^2)} = 0,23$$

()

:

$$h = h \sqrt{3} = 0,23\sqrt{3} = 0,4$$

- . - 0.001 . , , , . : , . : - 10 / 3, - 3 / 3; - 5 / 3;

12-1400 ^{3/}

“ ”

30-

6-

10

	0,99	0,7
20 ⁰ 40	0,9	2
800	4,7	3 - 4
40 ³	77	2 - 3

1- :

$$20000 \text{ } ^3 /$$

.

:

:

$$q = Q \cdot / (24 * 3600) = 20000 / 86400 = 0,231 \text{ } ^3 /$$

$$= 1,57$$

$$Q = Q \cdot / 24 = 20000 * 1,57 / 24 = 1308 \text{ } ^3 /$$

$$D = 3 / 3$$

$$q_t = Q / 1000 = 3 * 1308 / 1000 = 3.92 /$$

$$q^1 = \frac{Q}{2} / 1000 = \frac{3 * 20000}{1000} = 60 /$$

$$y = q / S = 3.92 / 0.7 = 6$$

$$S = 0.7 / -$$

6 -

40 , 50

-500- ()

6

$$60:50=1,2$$

$$12 \quad 12:1,2 = 10 \quad =$$

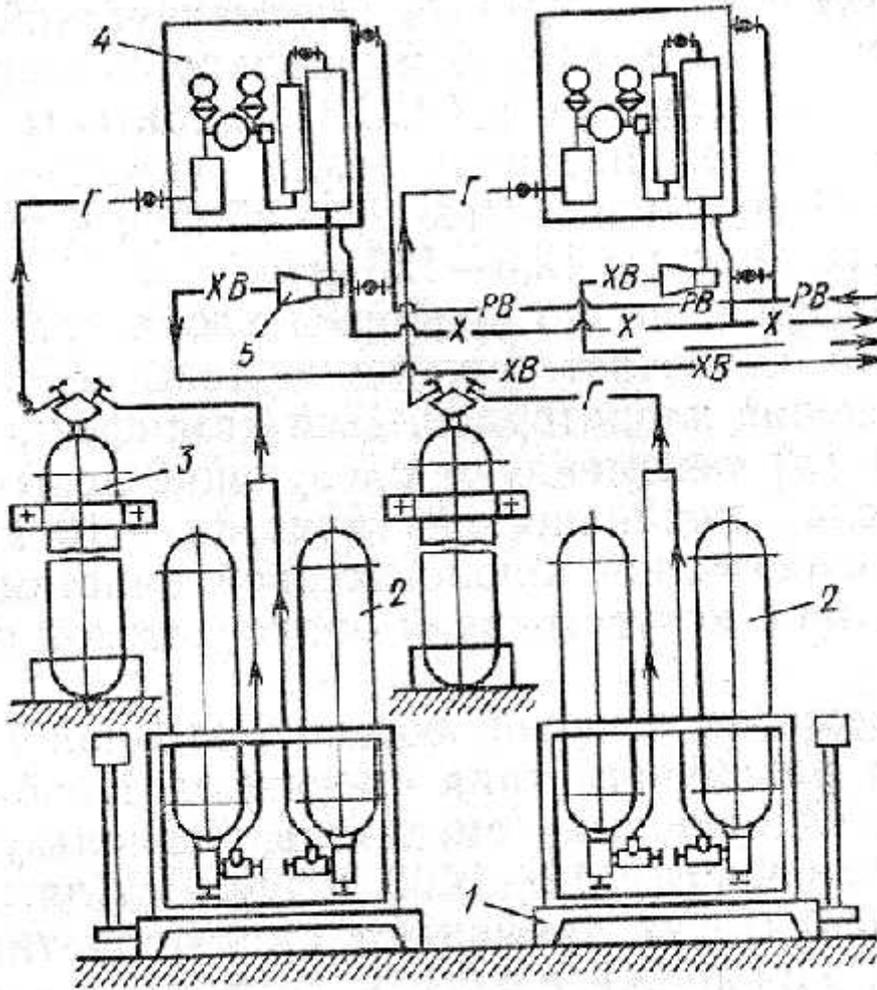
5-

5-

0.4

$$Q = q * q = 3,92 * 0,4 = 1,57 \quad 3/$$

$$: q = 0.4 \quad 3/ \quad 1$$



14-

1- ; 2- ; 3- ; 4- ; 5-

“ ”

$$V = Q \cdot T / 60 = 1308 \cdot 30 / 60 = 654 \text{ }^3$$

$$= 30 \text{ -}$$

$$= 10 \text{ /}$$

$$L = \dots * T = 10 * 30 * 60 / 1000 = 18$$

:

$$= V_{\dots} / L = 654 / 18 = 36,3 \text{ } ^2$$

$$H = 2,8$$

$$b = 6$$

:

$$n = \dots / (b * H) = 36.3 / (6 * 2.8) = 2.16$$

$$T = V_{\dots} / Q = n * b * H * L / Q = 2 * 6 * 2.8 * 18 / 1308 = 0.46 = 28$$

	1	2	3	4	4	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Q-	124	103	113	120	115	117	122	119	112	114	15	17	18	27	20	22	25	27	30
^{3/}	000	800	000	200	000	000	800	000	100	000	00	00	00	00	00	00	00	00	00
											0	0	0	0	0	0	0	0	0
	200	300	400	100	200	300	400	100	200	300	40	10	20	30	40	10	20	30	40
											0	0	0	0	0	0	0	0	0
	50	60	70	50	60	70	50	60	70	50	60	70	50	60	70	50	60	70	50
/	5	10	15	8	6	18	6	10	12	18	13	15	16	18	19	10	8	6	5