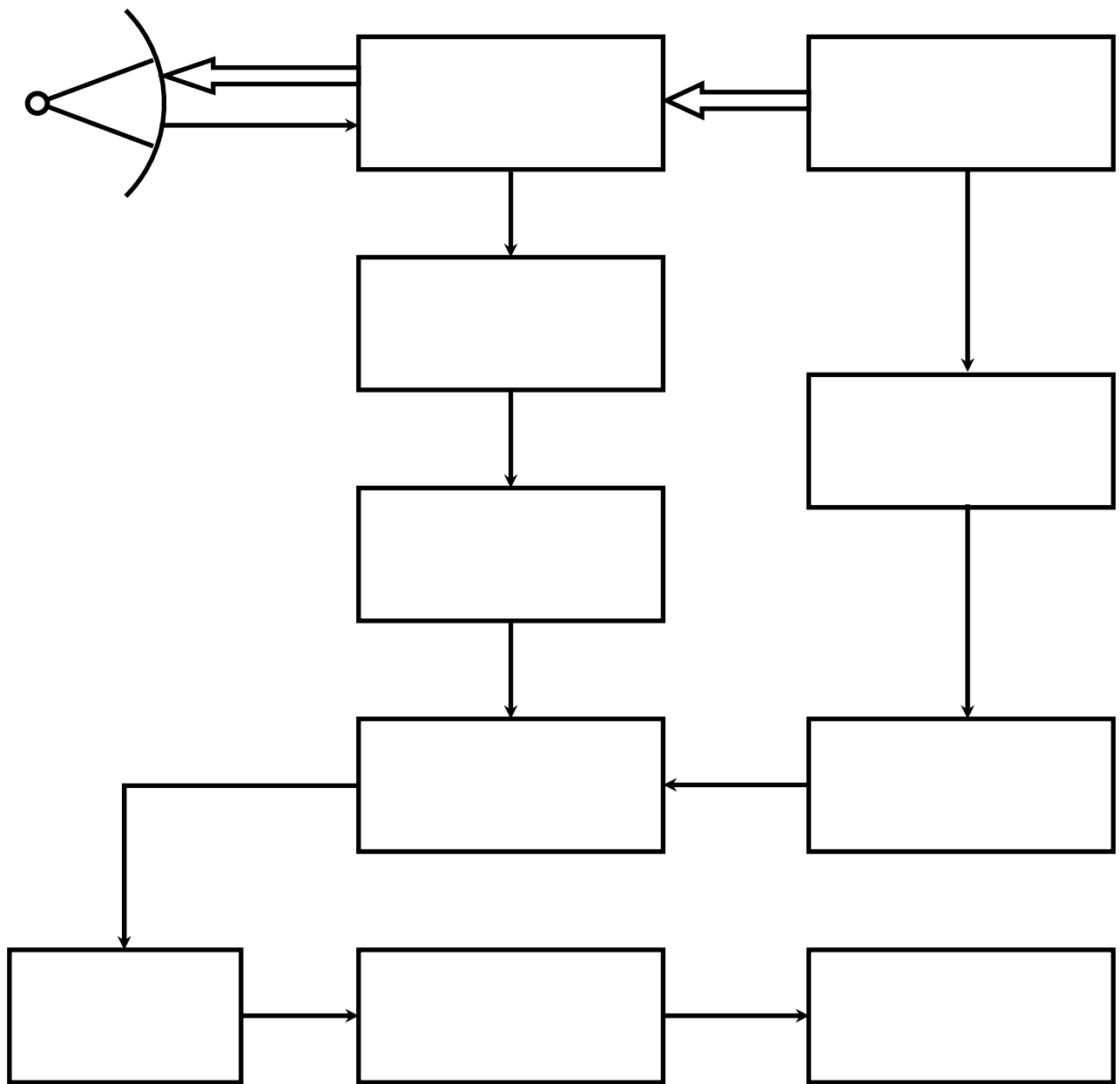


**КОМПЛЕКТ РАЗДАТОЧНЫХ МАТЕРИАЛОВ ПО ЛЕКЦИОННОМУ  
КУРСУ**

**ПОЛУПРОВОДНИКОВЫЕ ПРИБОРЫ СВЧ**

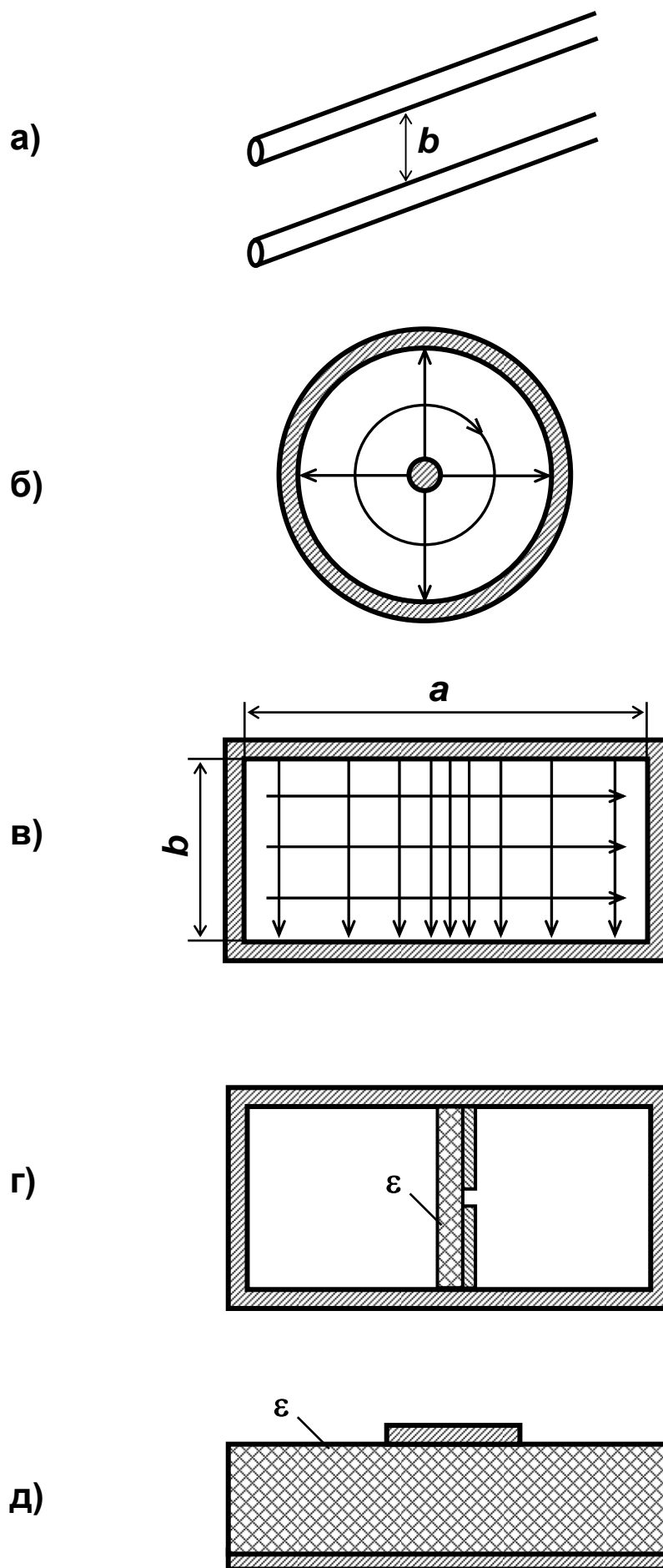


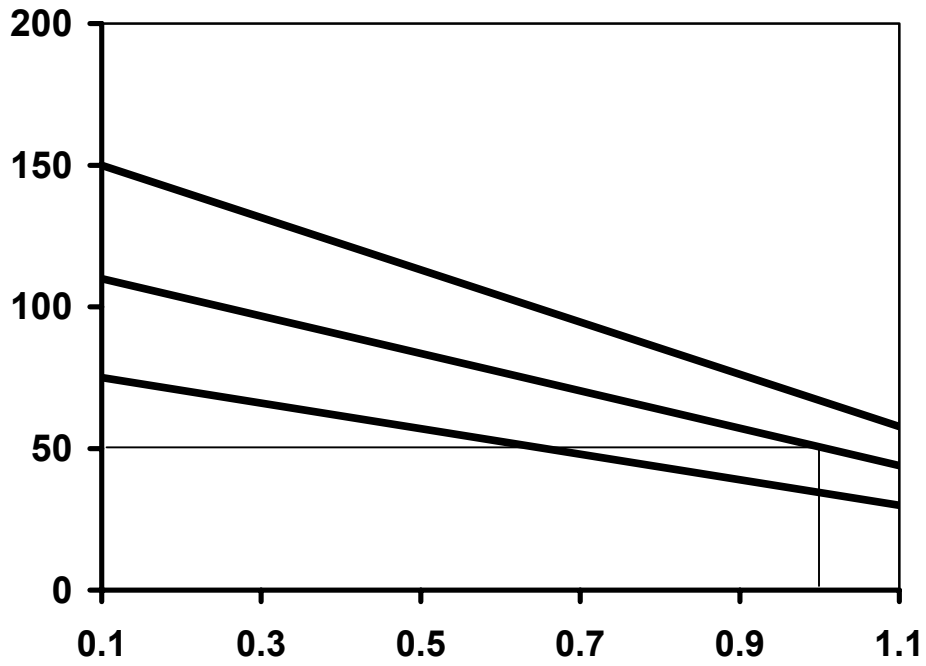
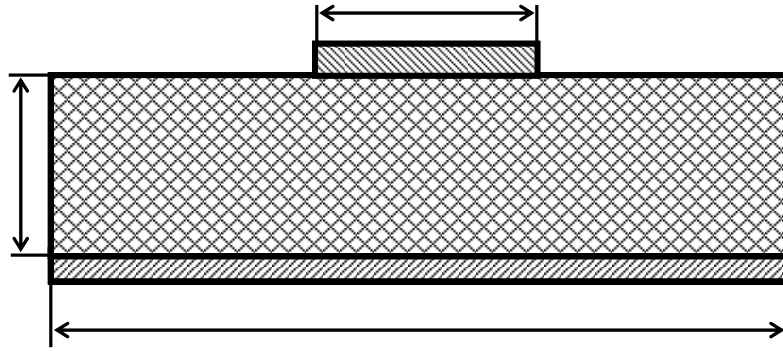
**Рис. 1**



**Рис. 2**

**Рис. 3**





$$Z_c = \frac{h}{w\sqrt{\varepsilon}} F(h/w, \varepsilon)$$

$$F = \frac{377}{1 + 0,173\varepsilon} 0,0724 (h/w)^{0,836}$$

**Рис. 4**

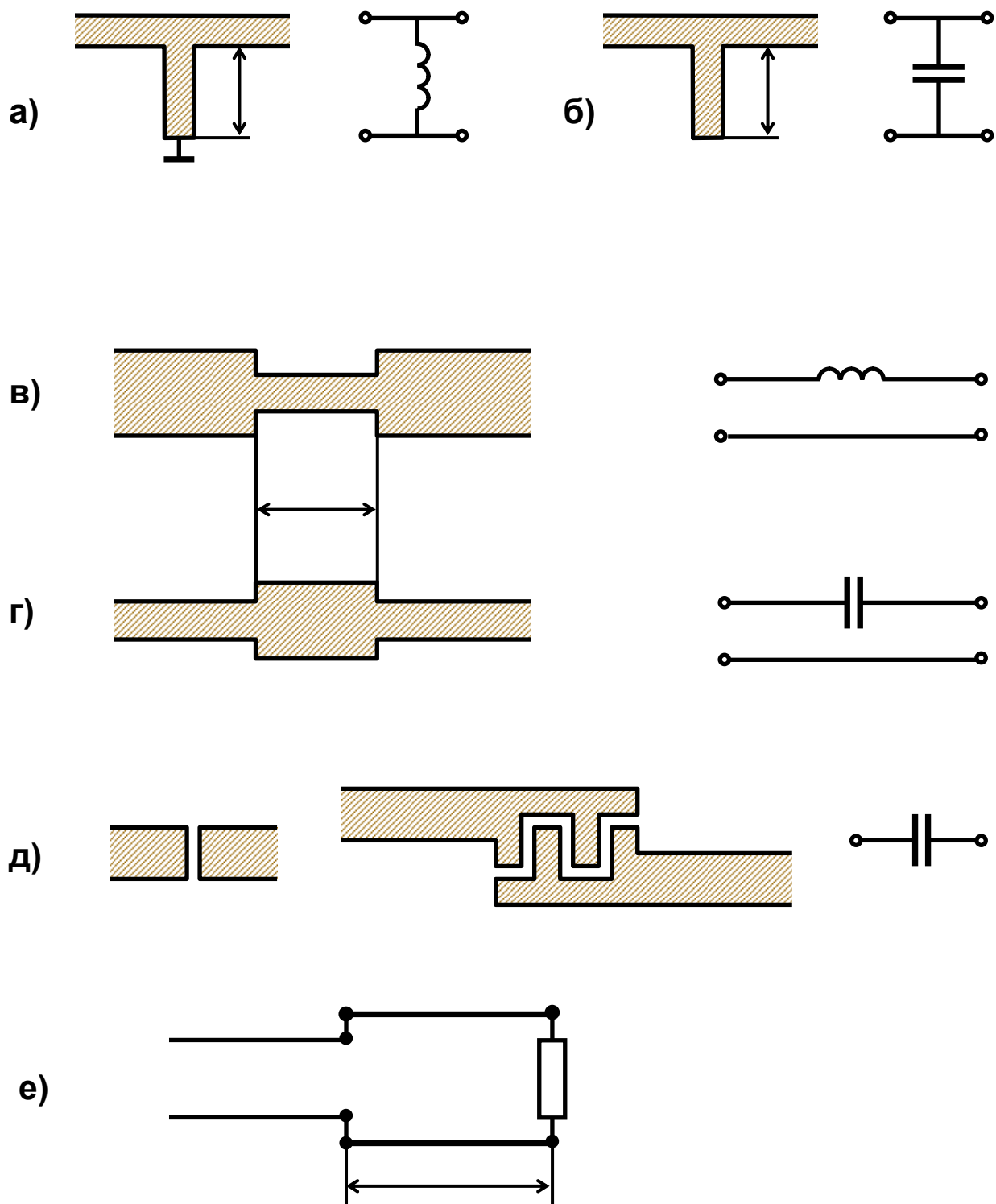


Рис. 5

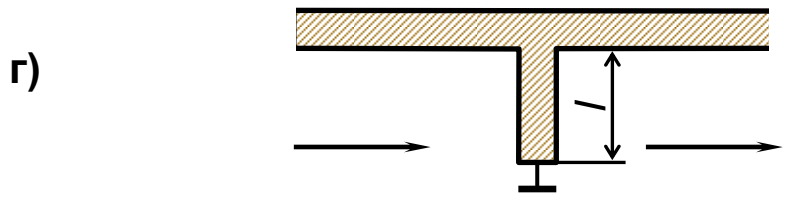
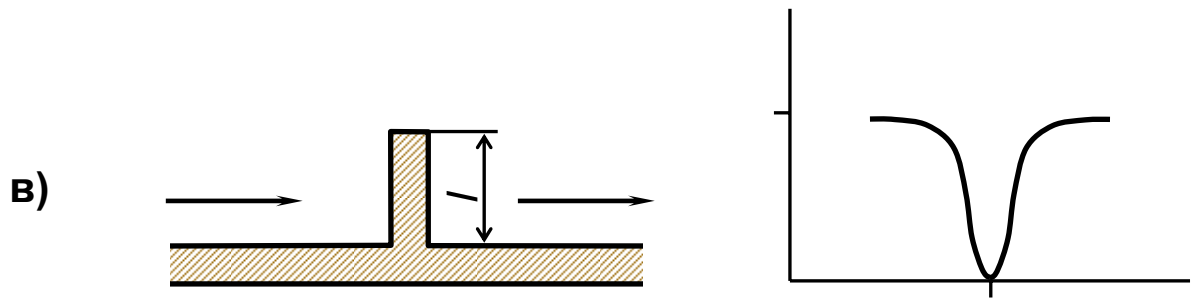
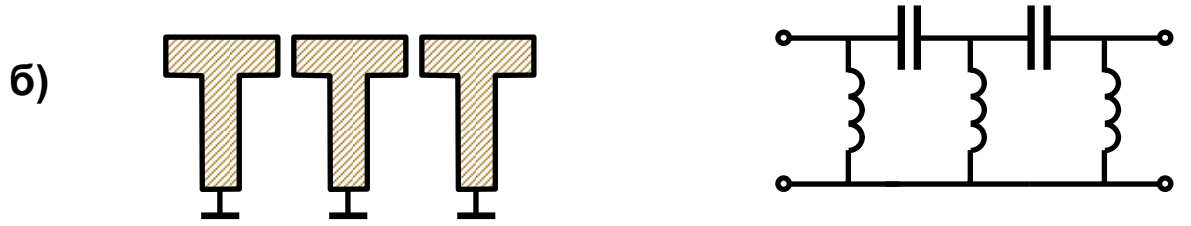
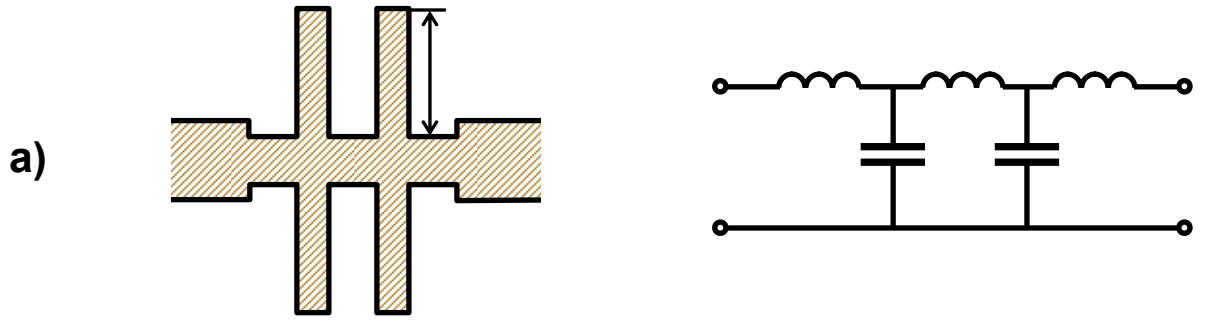
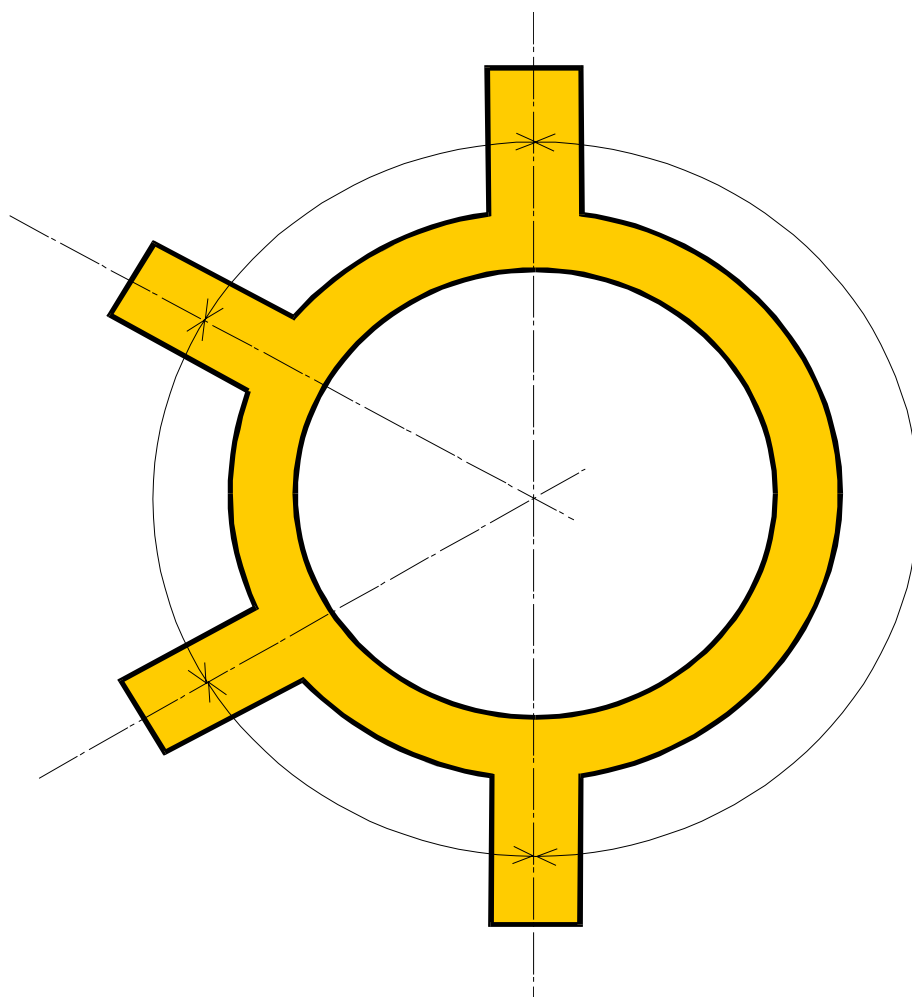
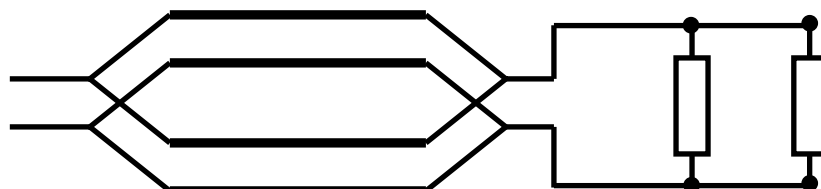


Рис. 6

a)



б)



в)



Рис. 7



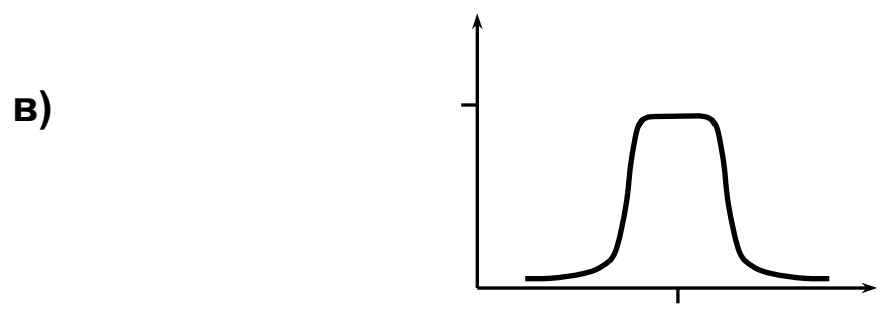
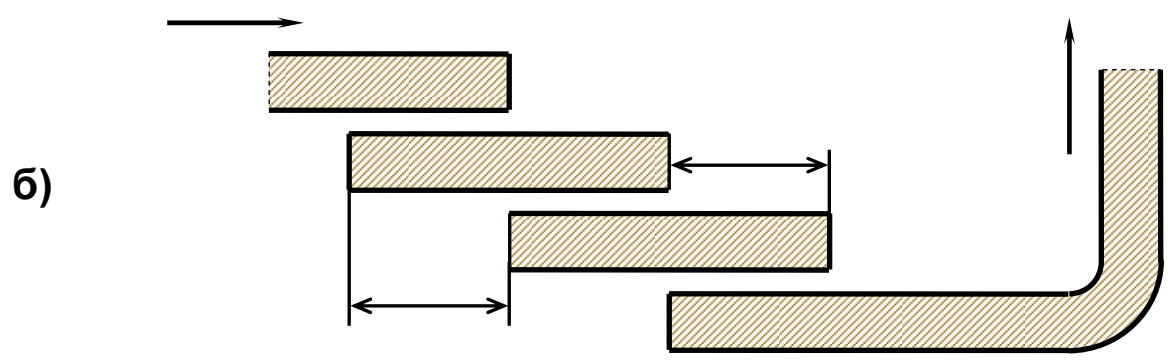
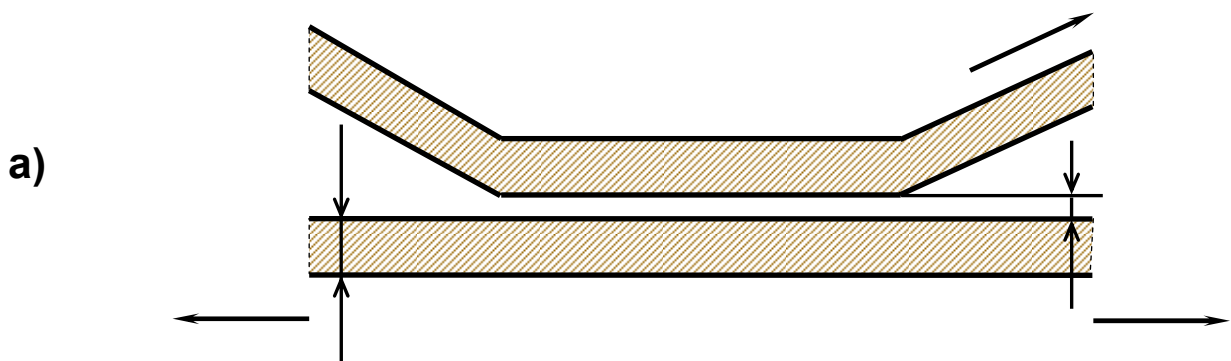


Рис. 8

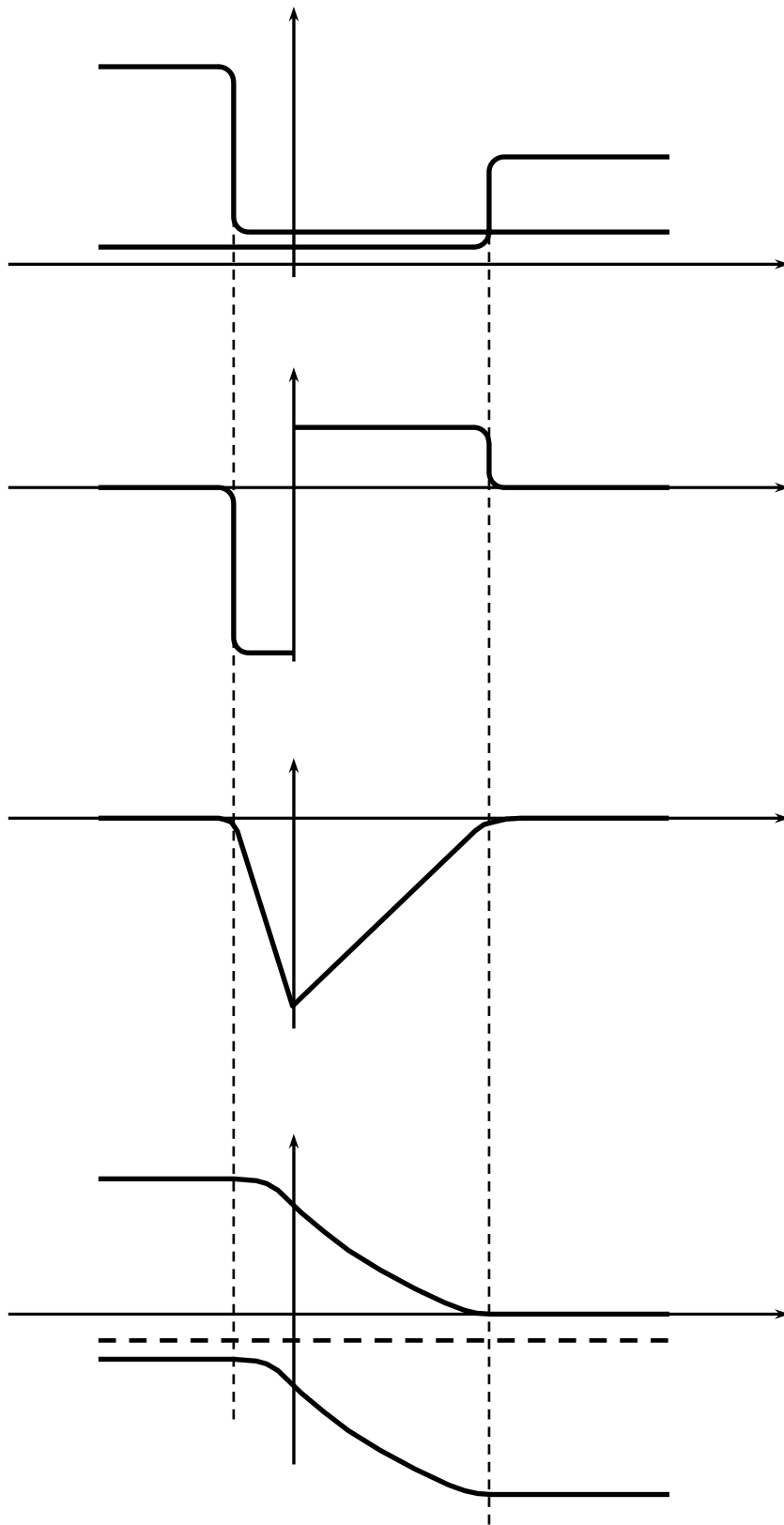
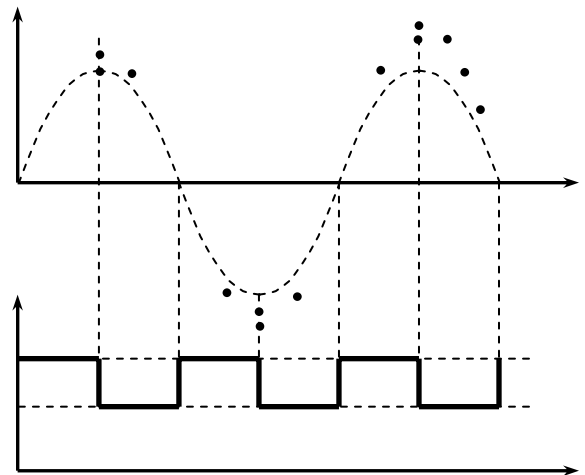
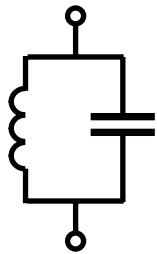
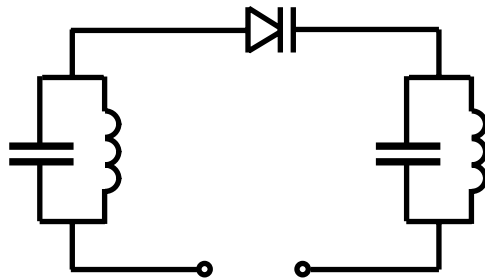


Рис. 9

a)



б)



в)

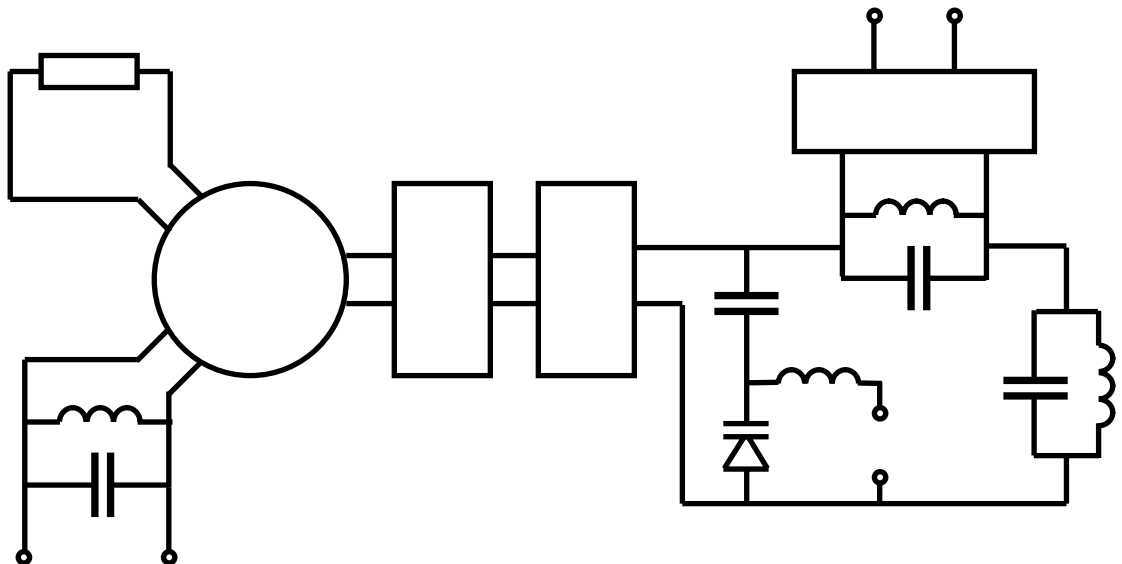


Рис. 10

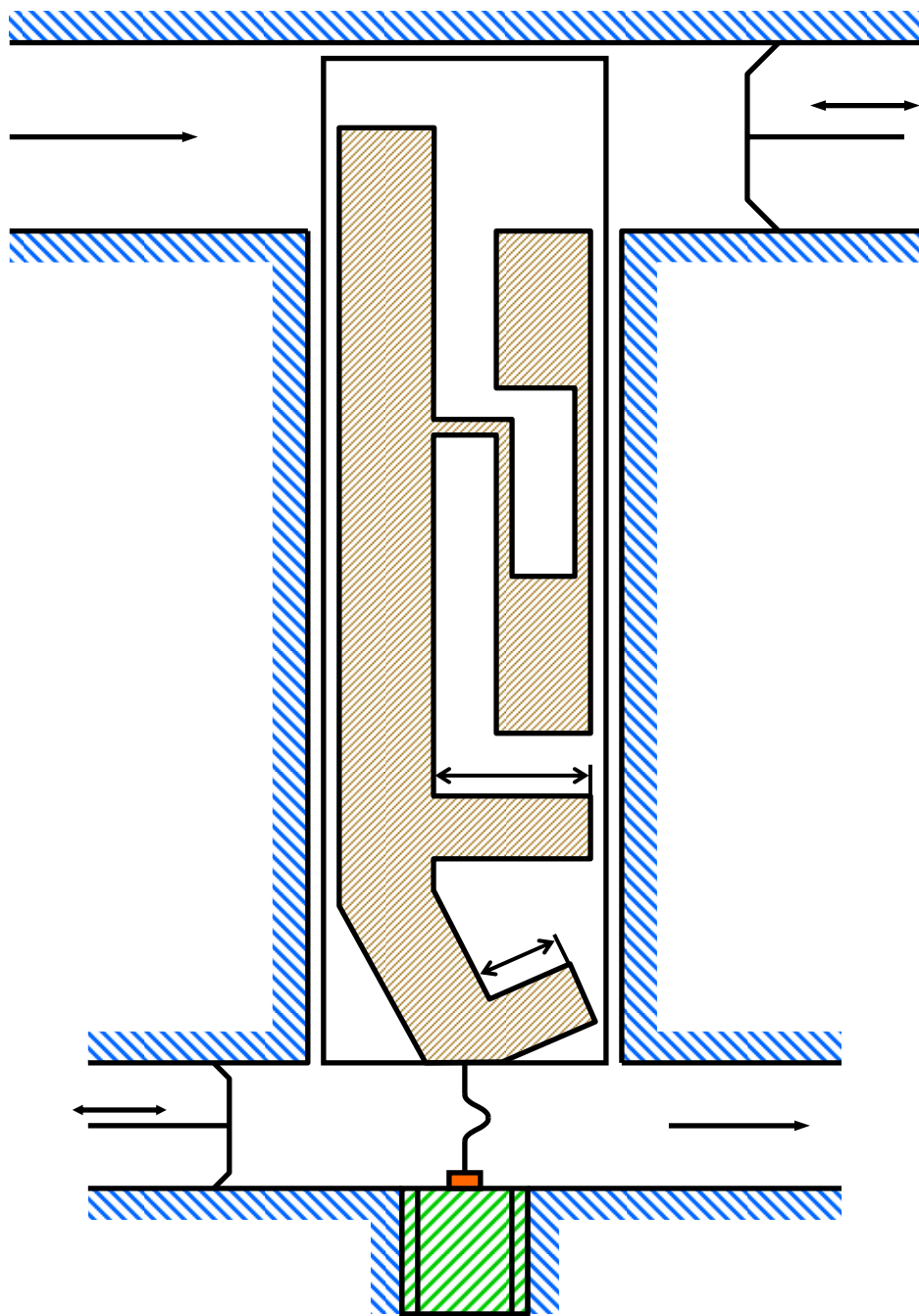


Рис. 11

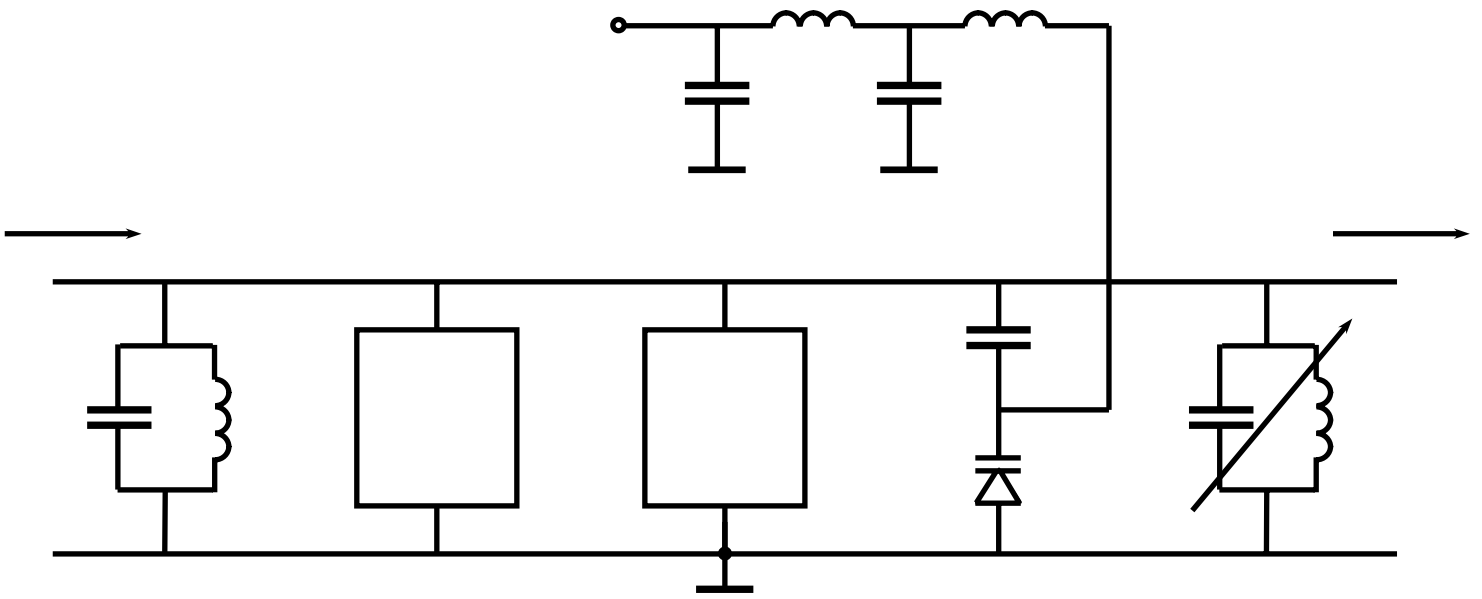
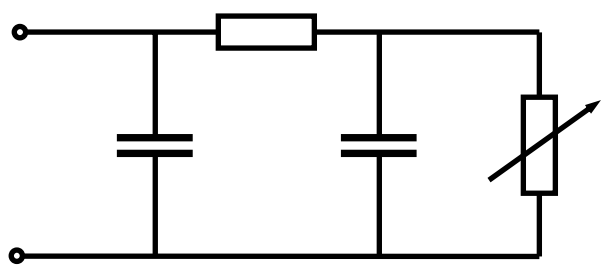


Рис. 12

a)



б)

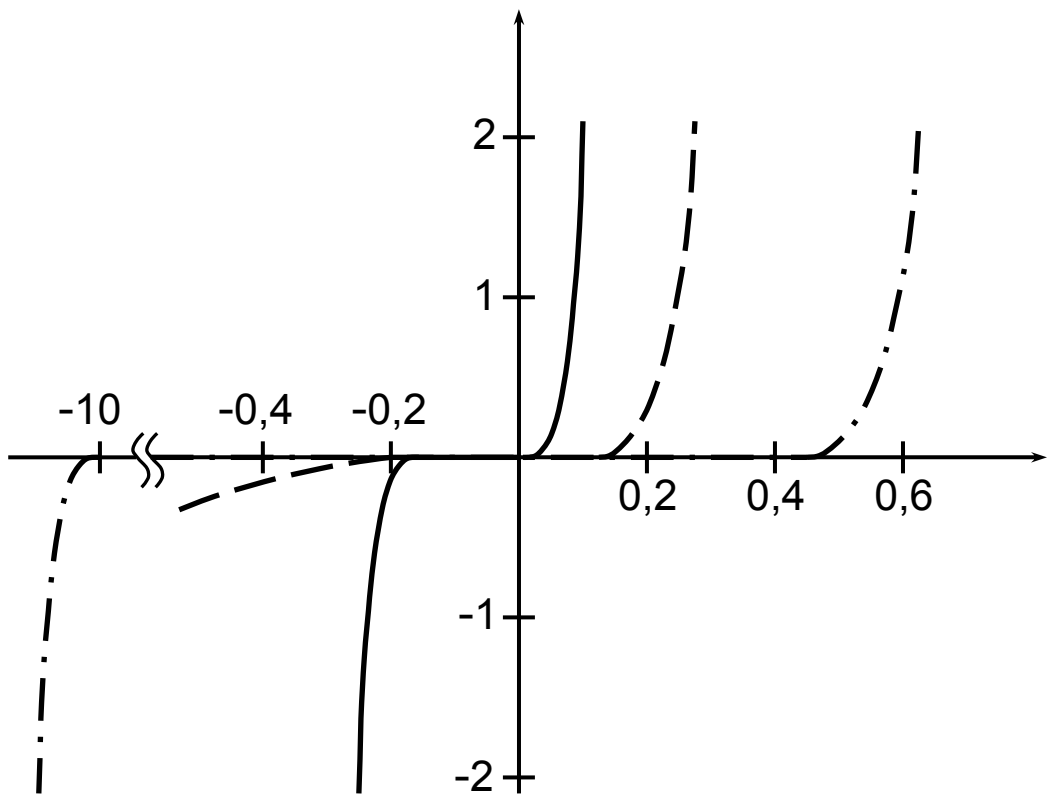
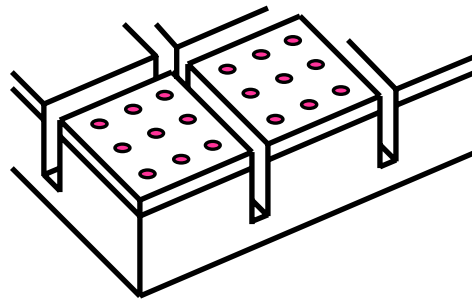
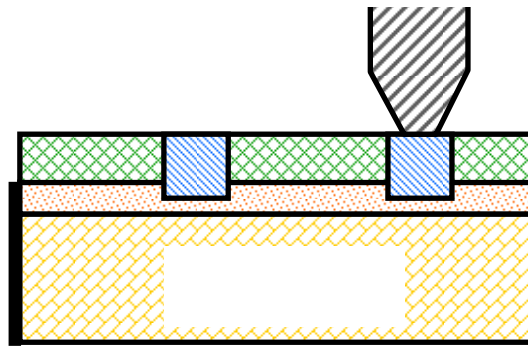


Рис. 13

a)



б)



в)

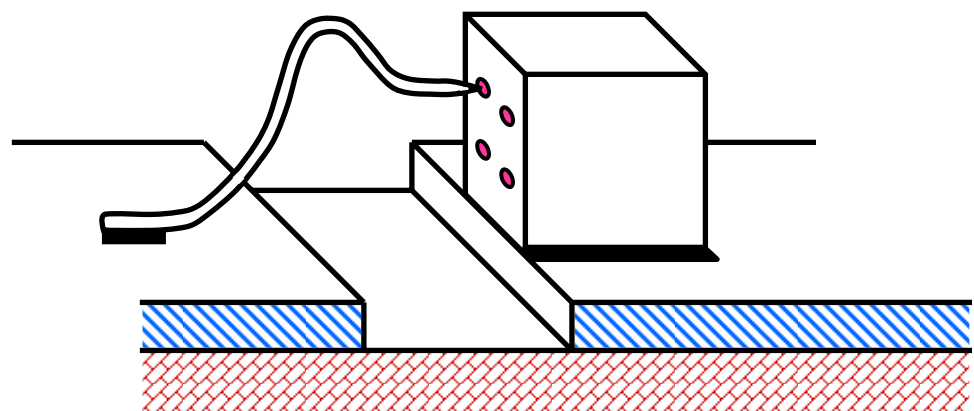


Рис. 14

# ТЕХНОЛОГИЯ СОТОВОЙ СТРУКТУРЫ



Рис. 15



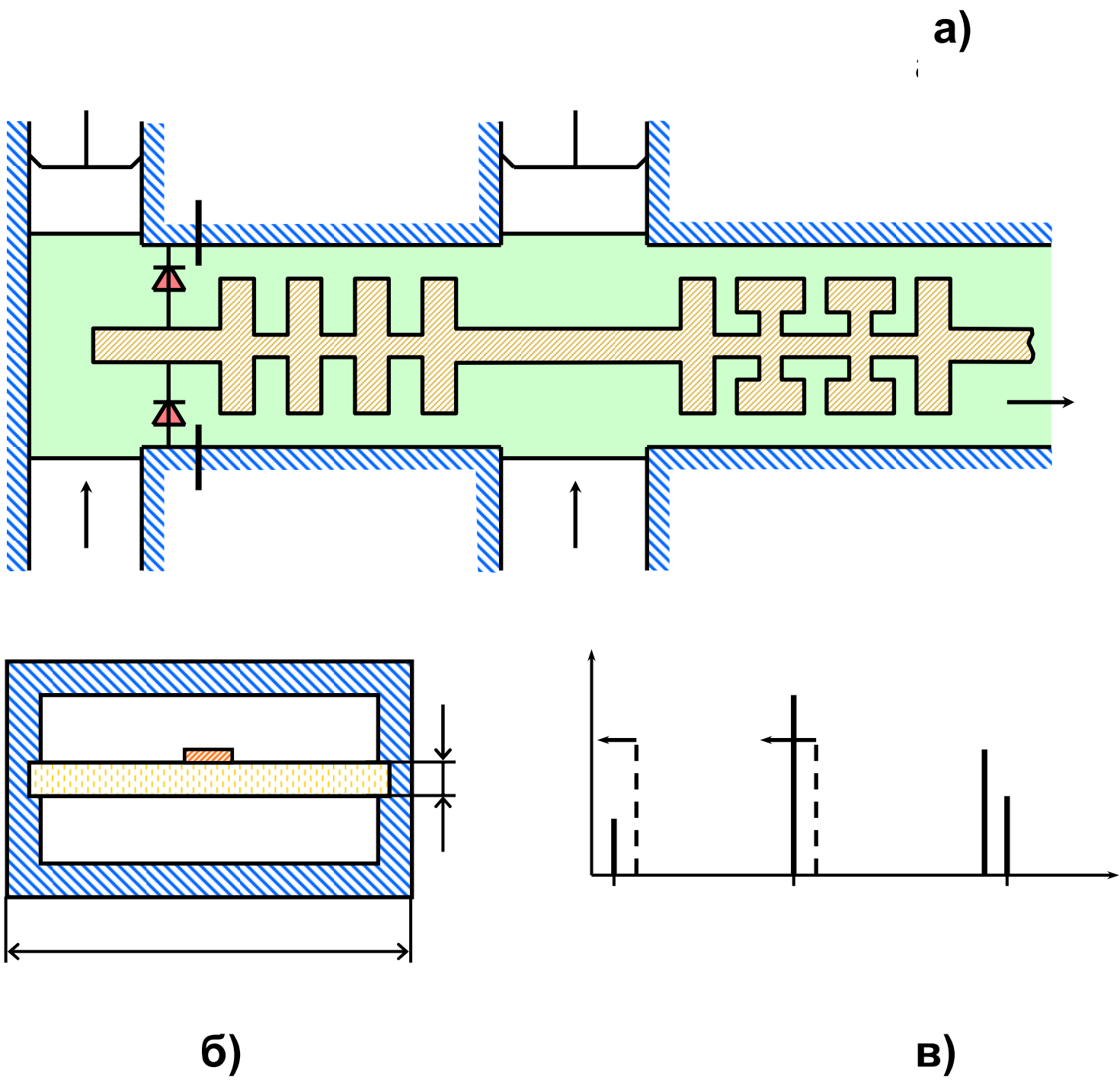


Рис. 16

## Детекторный диод [Браун, 1874 г.]

$$I = I_s \left( e^{\frac{qU}{nkT}} - 1 \right) = I_s (e^{\alpha U} - 1); \quad \alpha = \frac{q}{nkT};$$

$$u = U_0 + U_1 \cos \omega t = U_0 + u_1;$$

$$i = I_0(U_0) + \frac{\partial I}{\partial U} \Big|_{U_0} u_1 + \frac{1}{2} \frac{\partial^2 I}{\partial U^2} \Big|_{U_0} u_1^2 + \dots = I_0 + i_1 + i_2 + \dots;$$

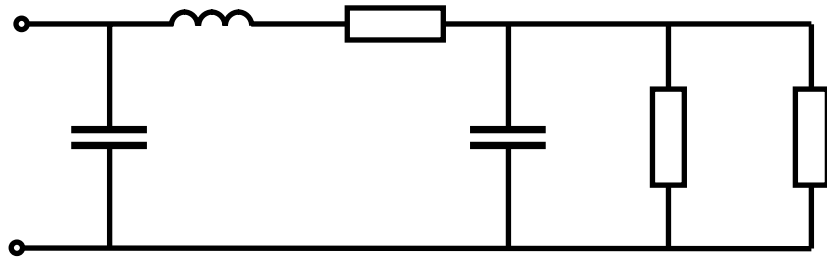
$$\frac{\partial I}{\partial U} \Big|_{U_0} = \alpha I_0 e^{\alpha U_0} = \alpha (I_0 + I_s);$$

$$i_1 = \alpha (I_0 + I_s) u_1; \quad i_2 = \frac{\alpha^2}{2} (I_0 + I_s) u_1^2;$$

$$i_2 = k_2 u_1^2 = \frac{k_2 U_1^2}{2} (1 + \cos 2\omega t) = I_d + i_2';$$

$$I_d = \frac{k_2 U_1^2}{2} = \beta P.$$

а)



б)



в)

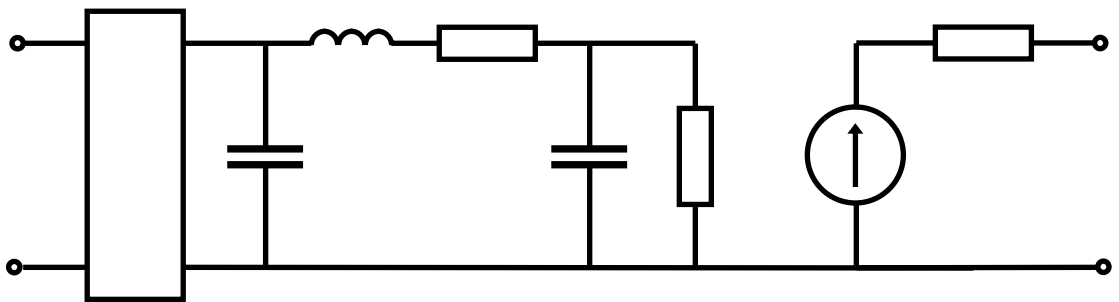


Рис. 18

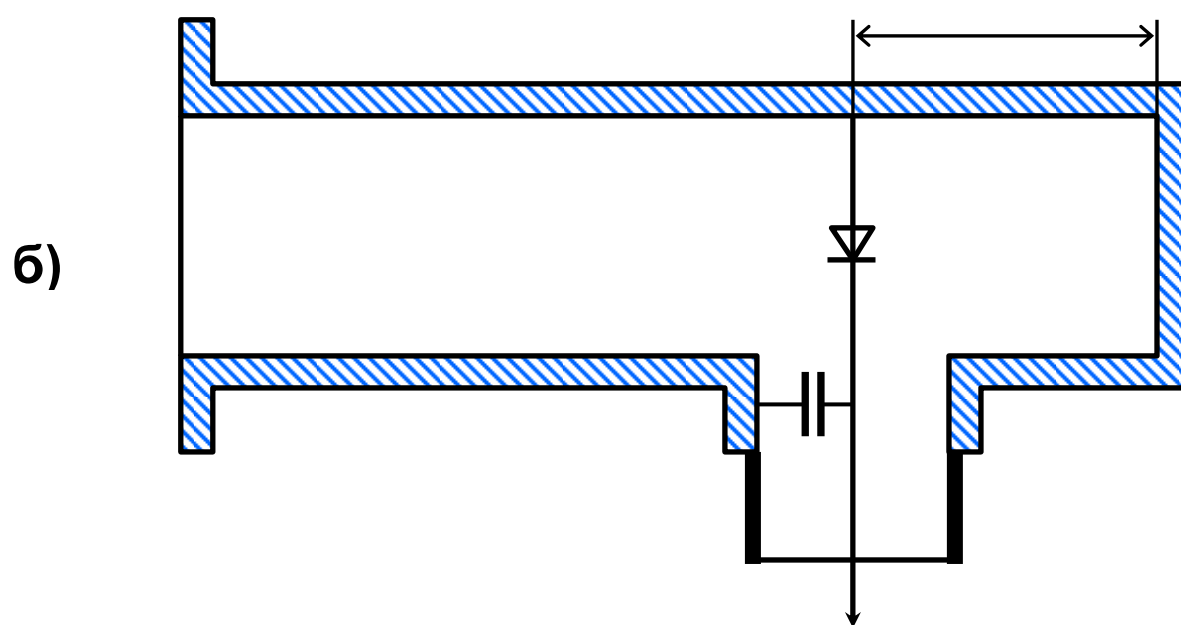
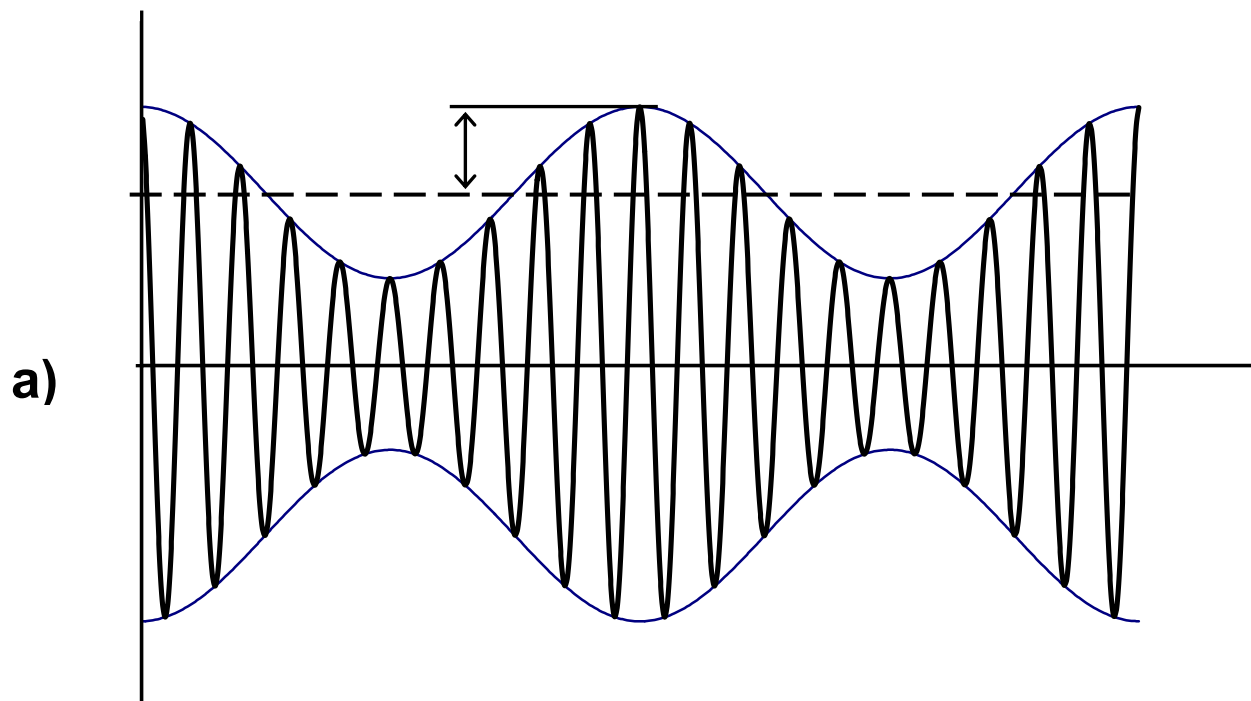
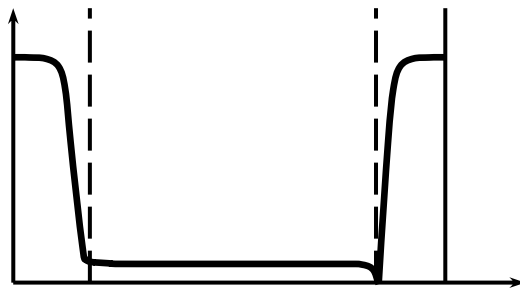
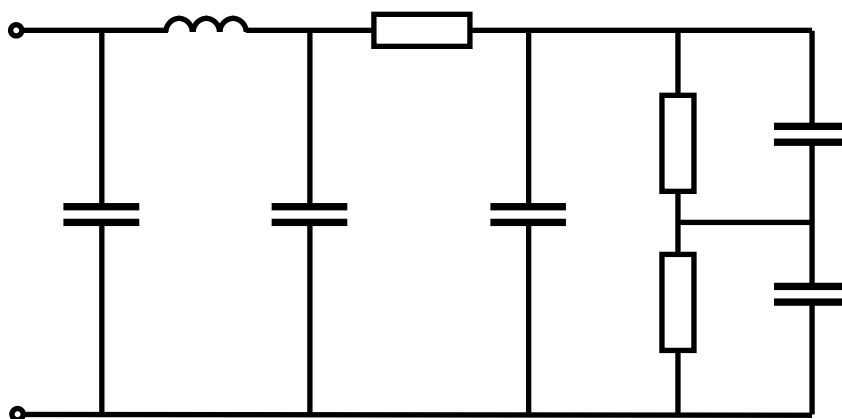


Рис. 19

a)



б)



в)

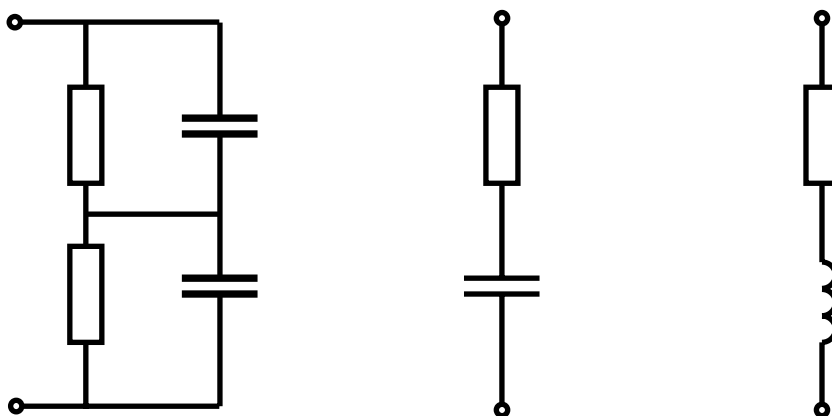


Рис. 20

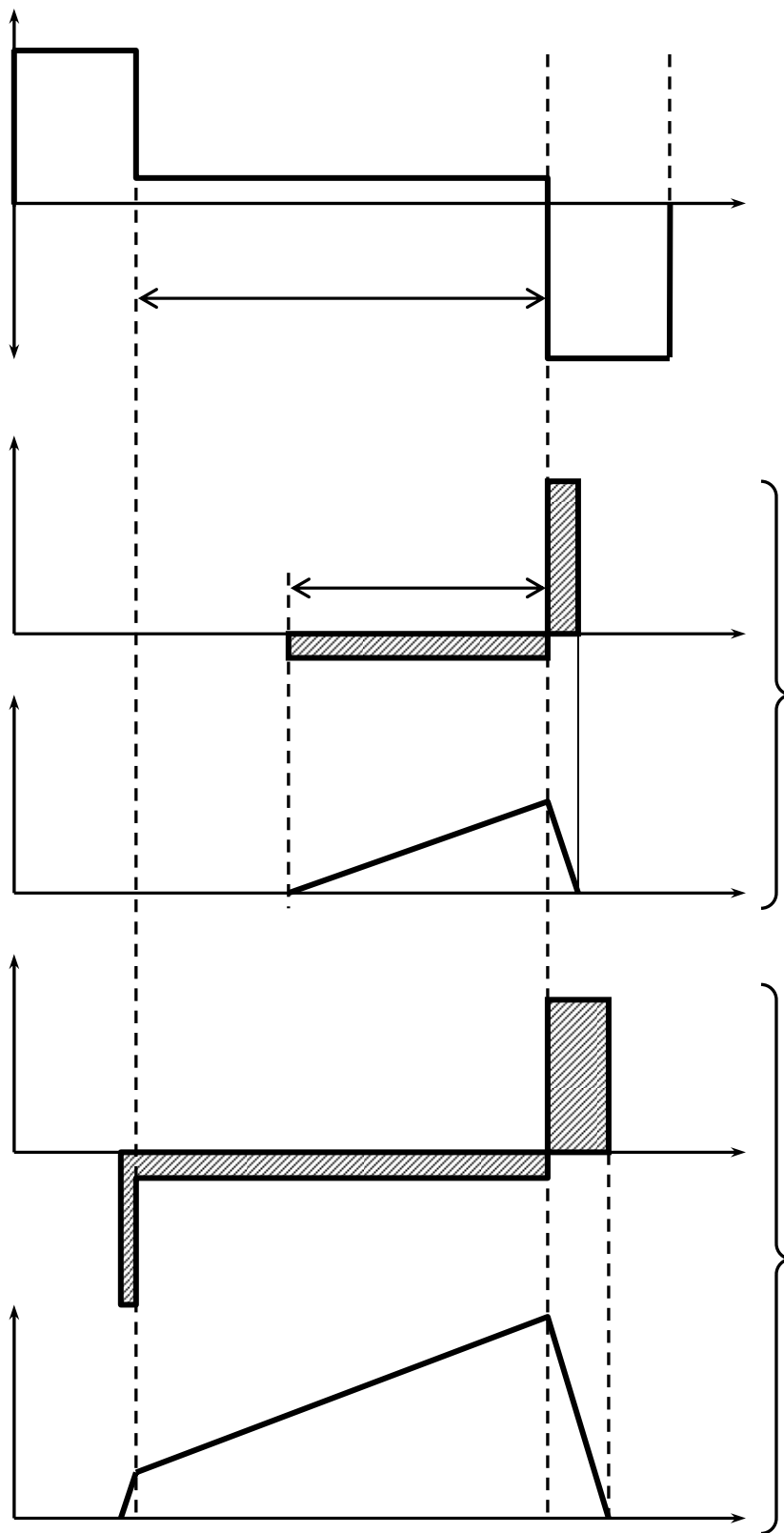
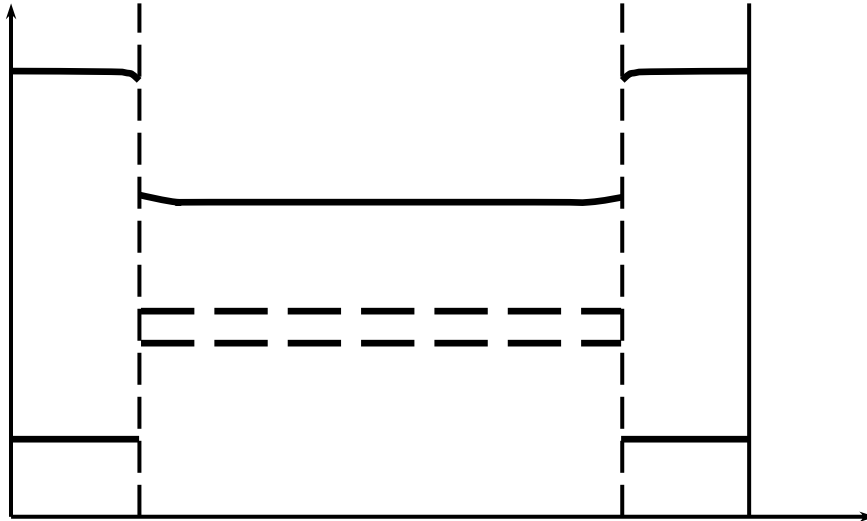


Рис. 21



$$I_0 = \frac{Q_p}{\tau_p} = \frac{Q_n}{\tau_n} = \frac{enSw}{\tau_n}$$

$$\rho_i = \frac{1}{e\mu_p p + e\mu_n n} = \frac{1}{2e\bar{\mu}n} = \frac{Sw}{2\bar{\mu}I_0\tau}$$

$$R_i = \frac{\rho_i W}{S};$$

$$R_i = \frac{w^2}{2l_0\bar{\mu}\tau}$$

**Рис. 22**

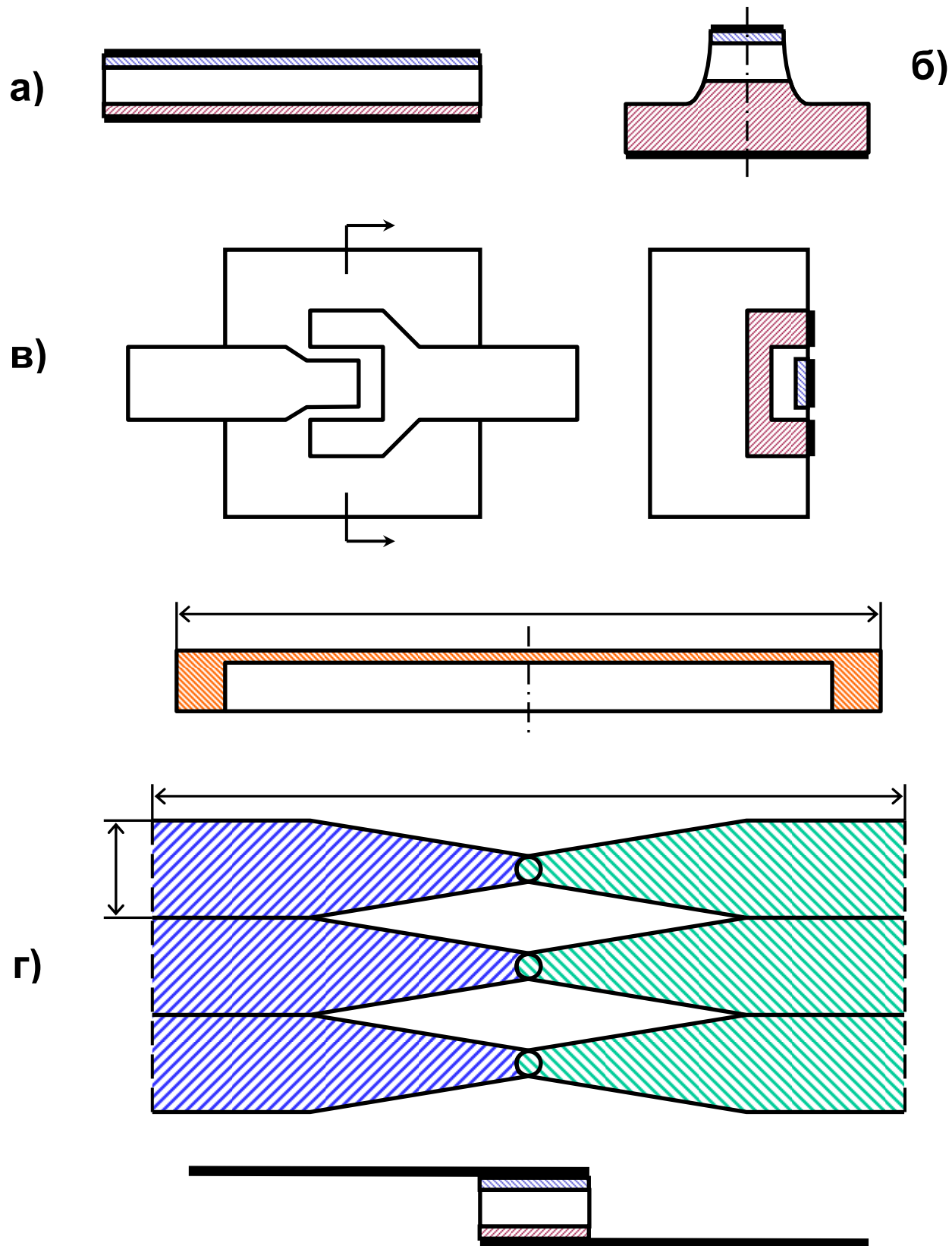


Рис. 23



# МЕМБРАННАЯ ТЕХНОЛОГИЯ (диоды типа «Самшит»)

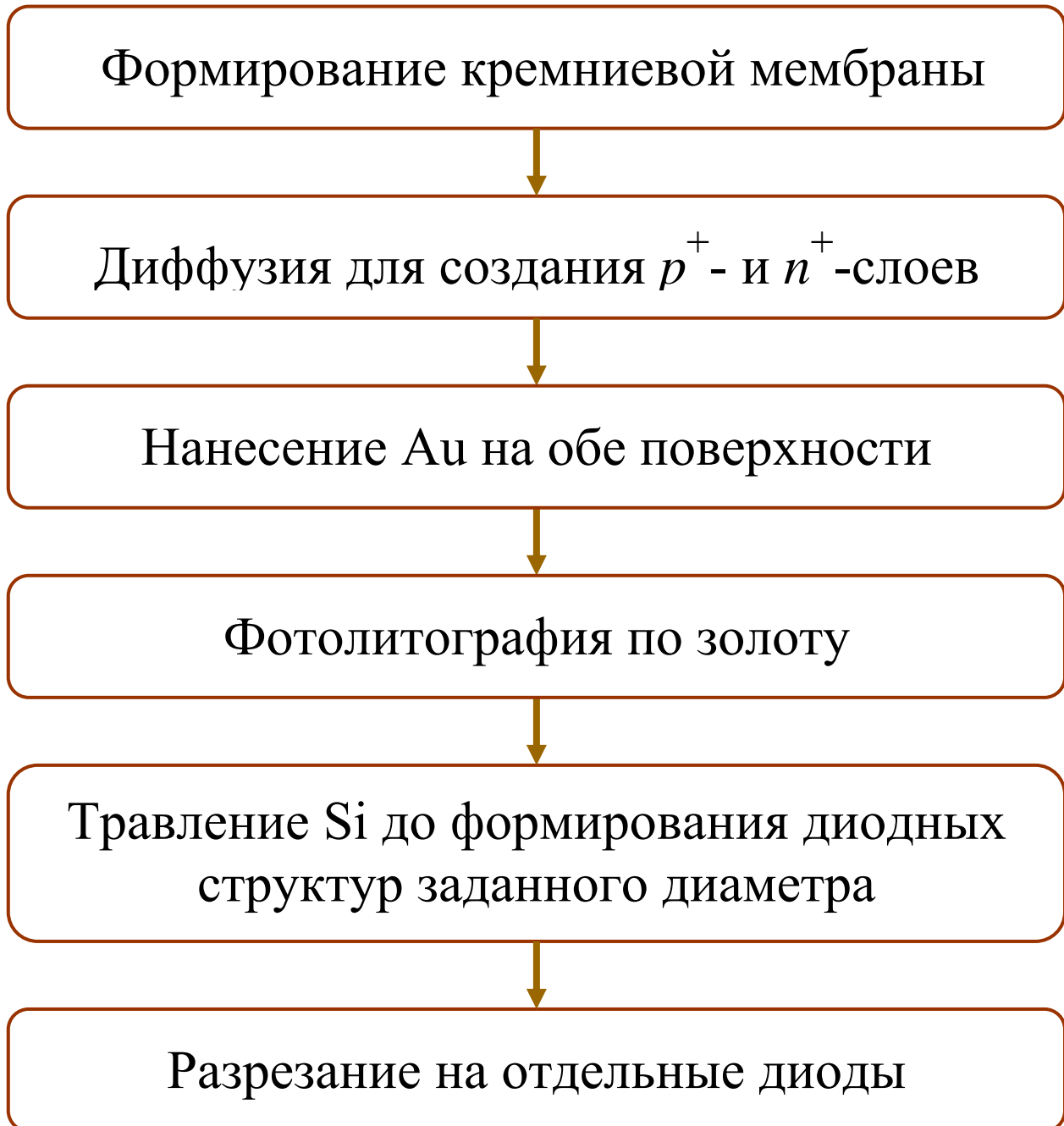
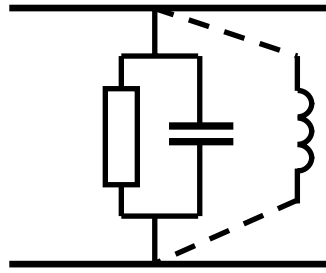
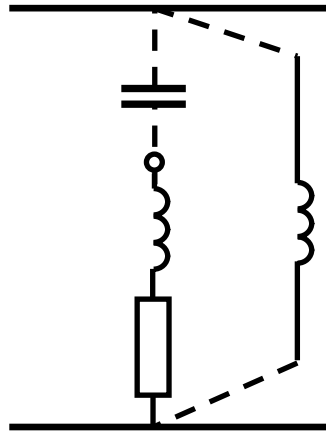


Рис. 24

a)



б)



в)

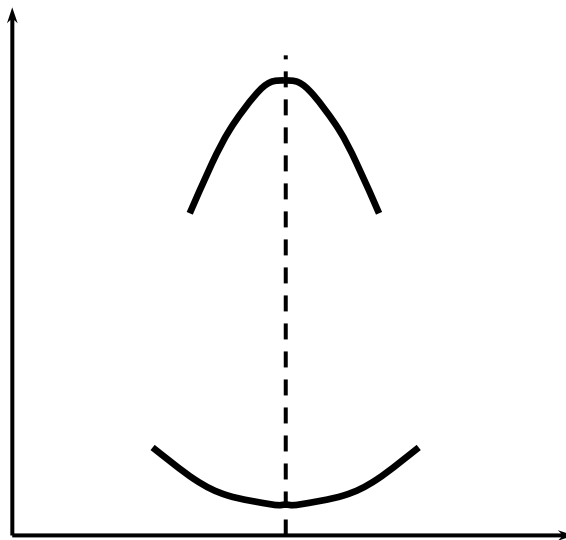
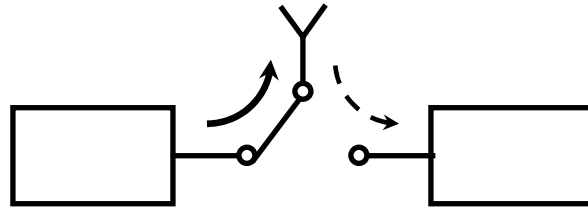
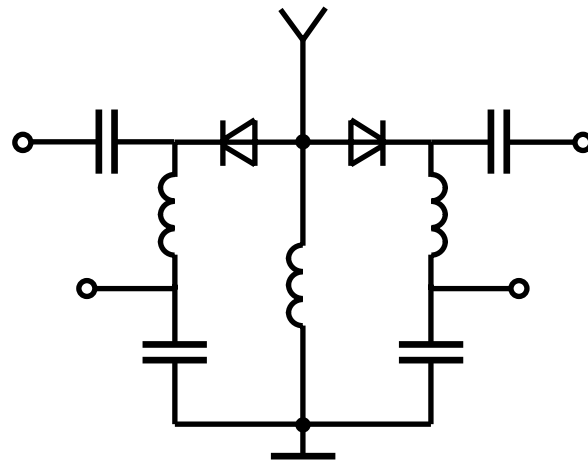


Рис. 25

a)



б)



в)

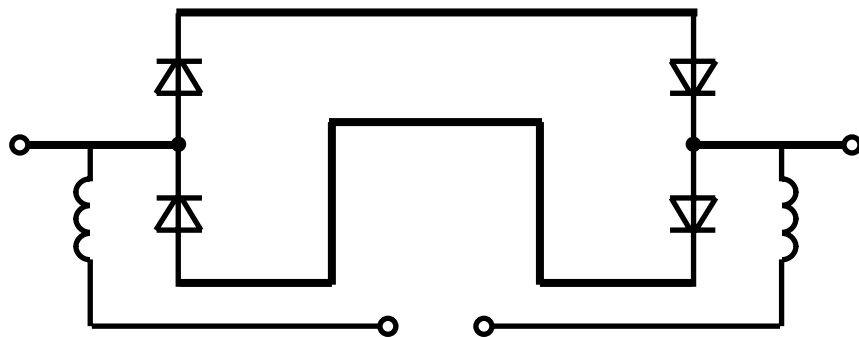
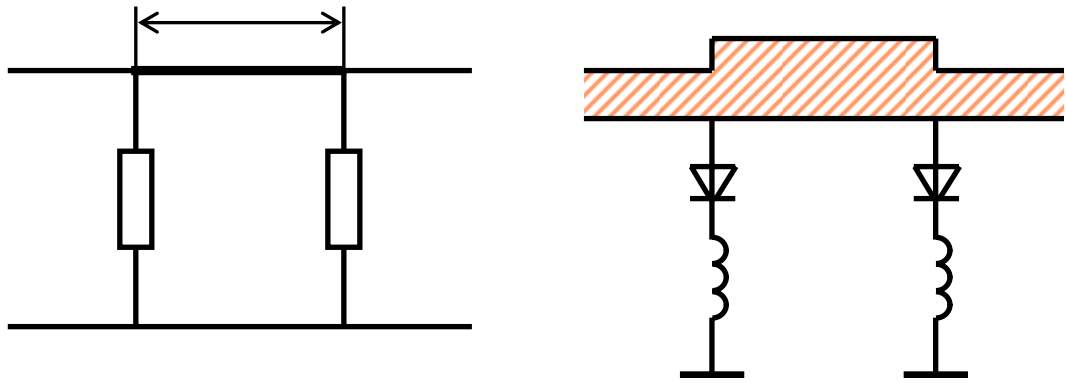
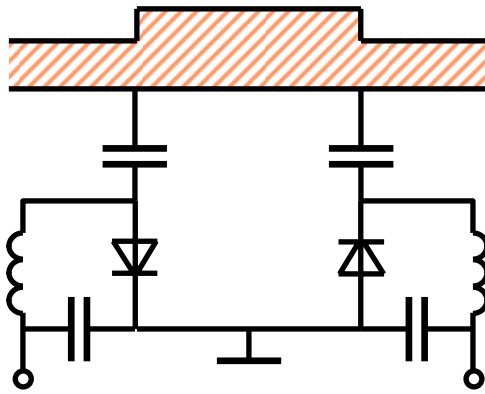


Рис. 26

a)



б)



в)

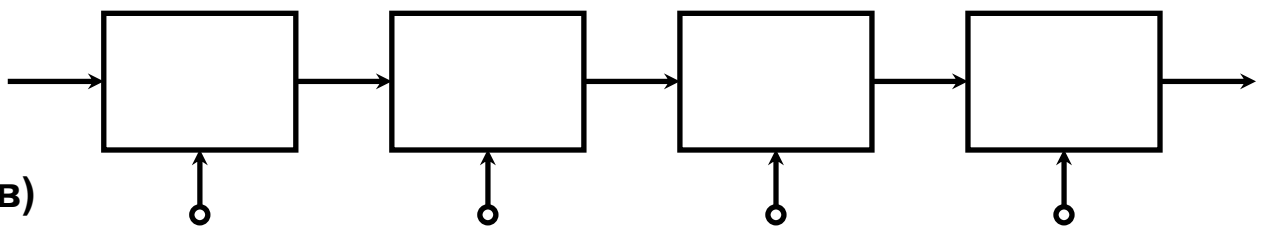
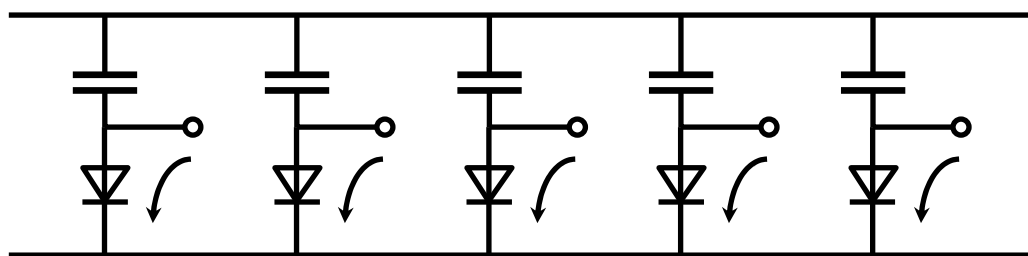
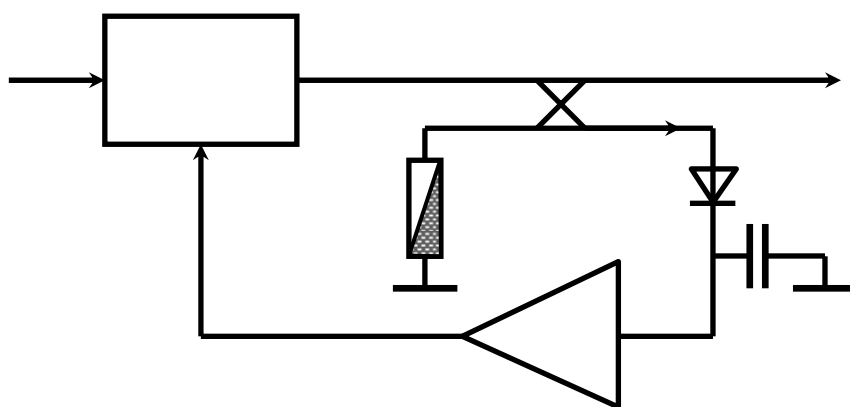


Рис. 27

a)



б)



в)

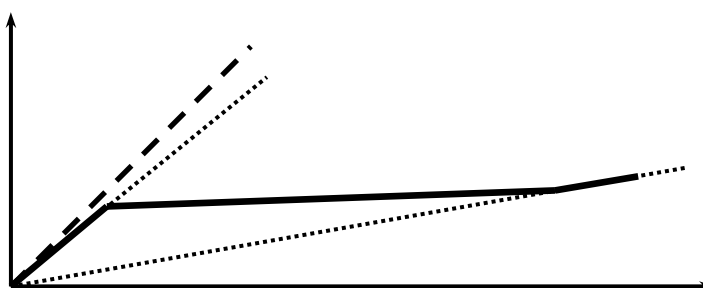
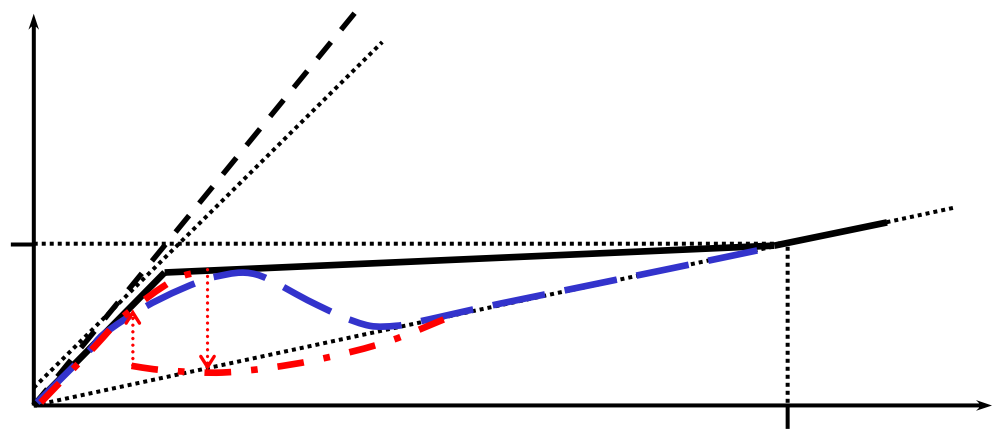
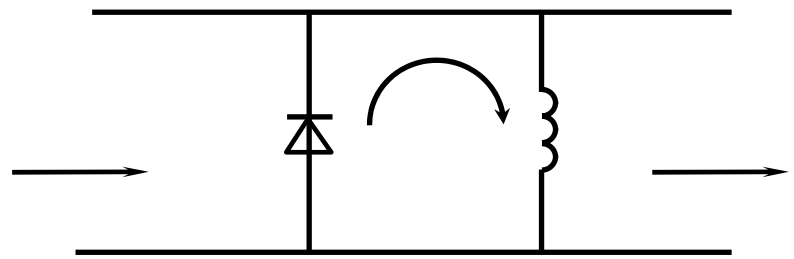


Рис. 28

а)



б)



в)

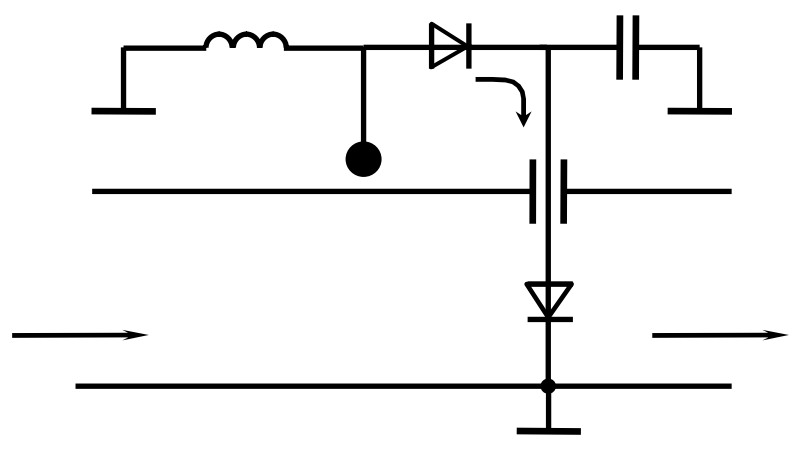


Рис. 29

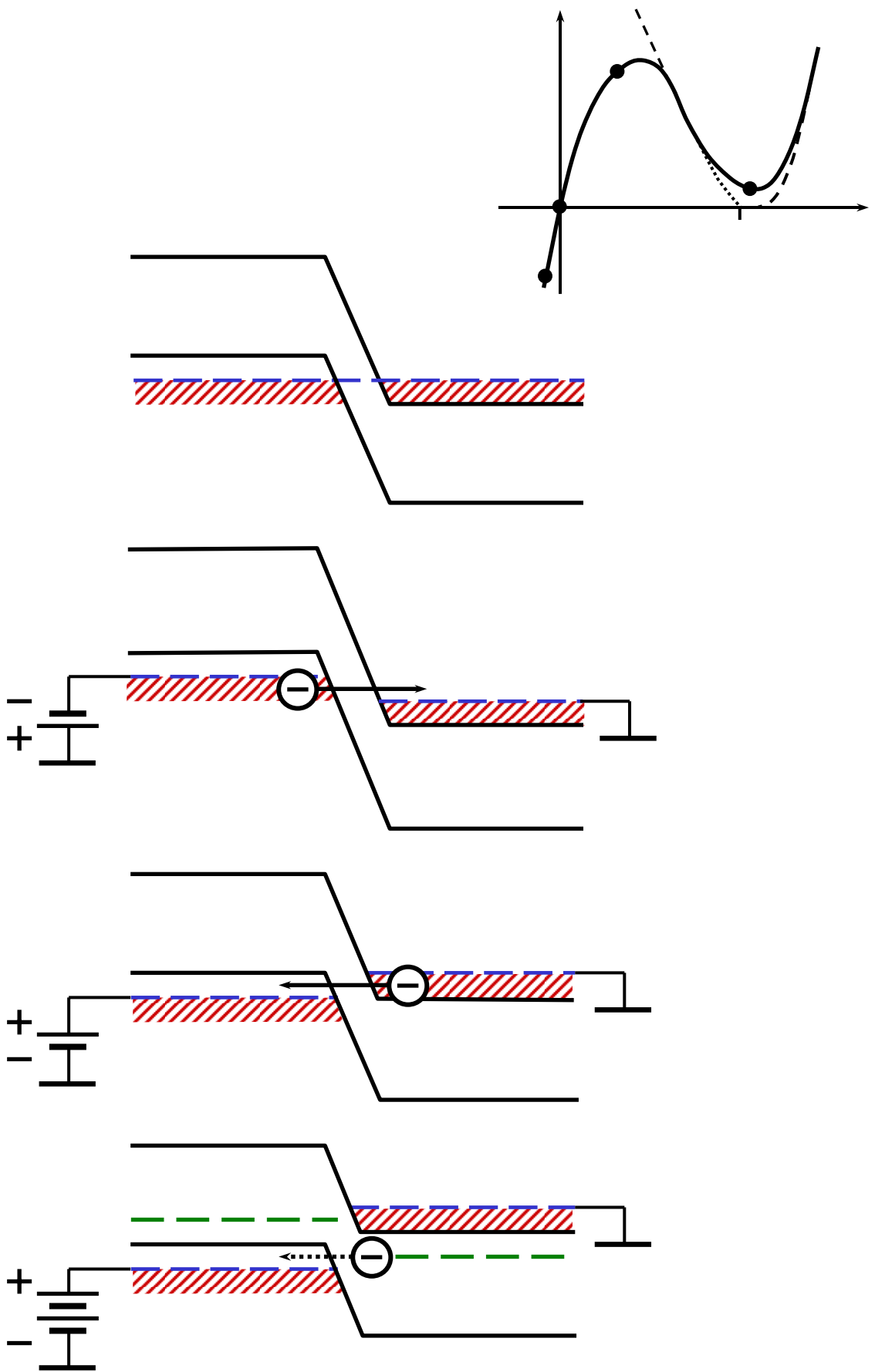
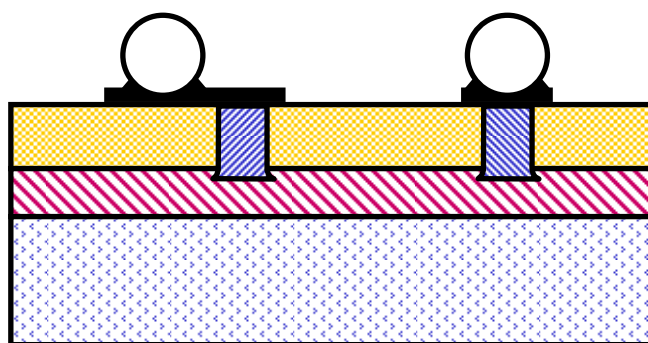


Рис. 30

a)



б)

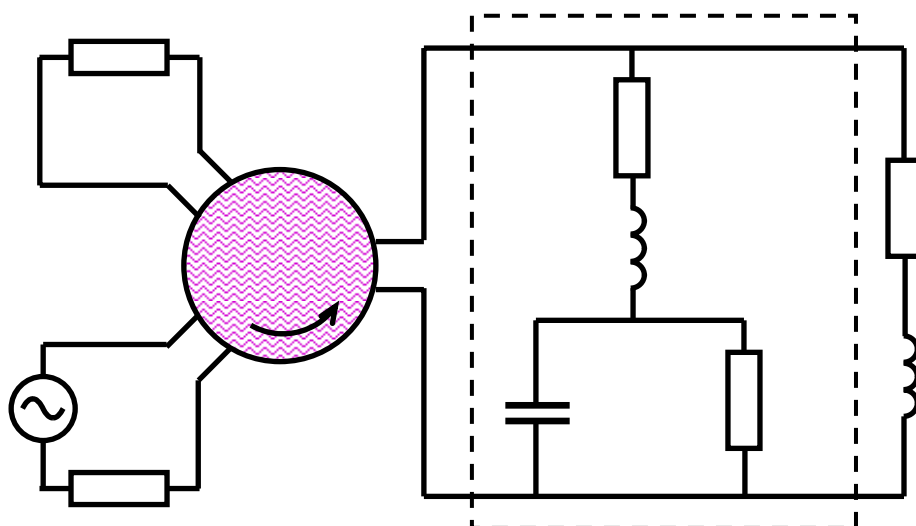


Рис. 31



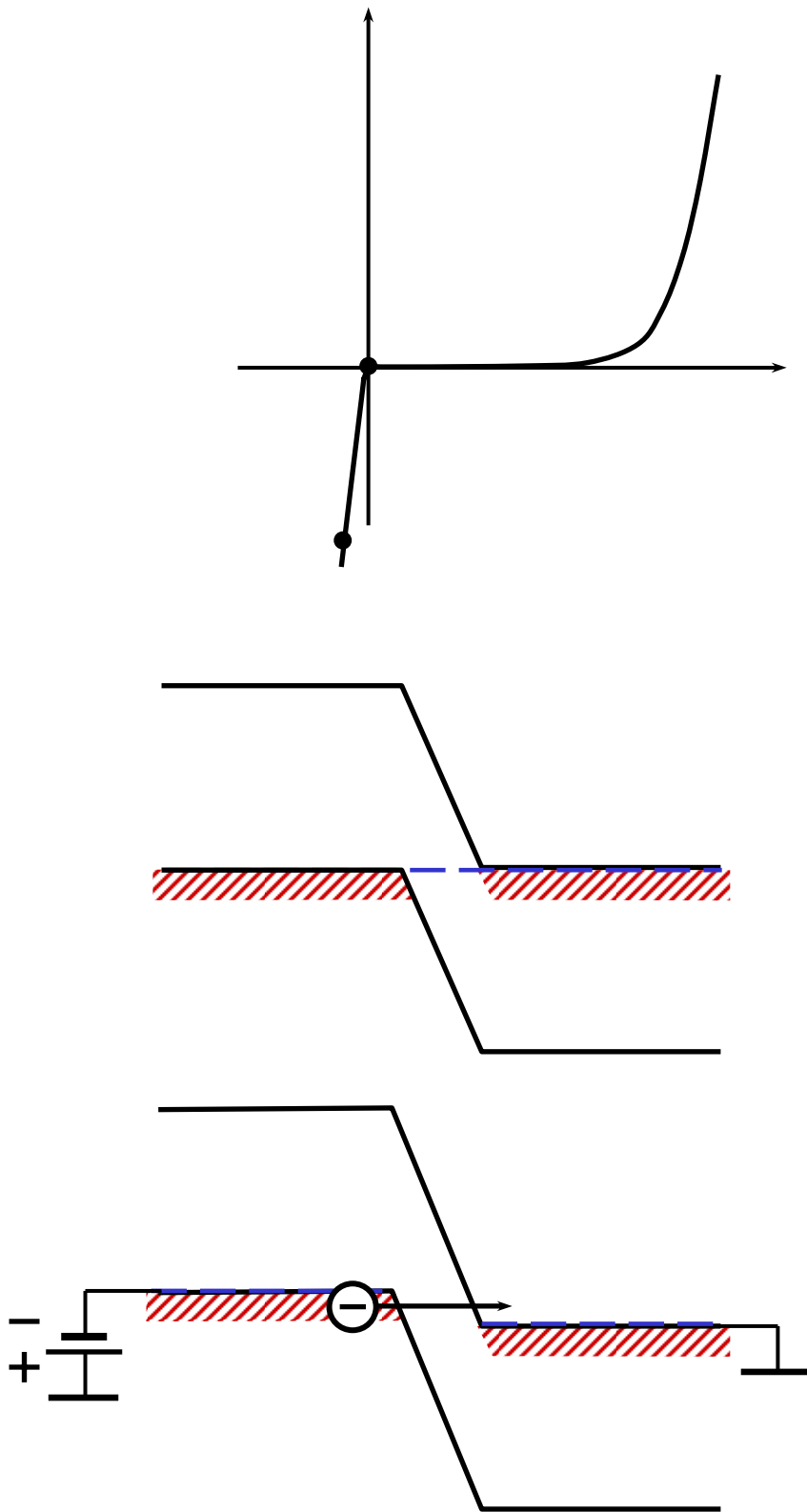
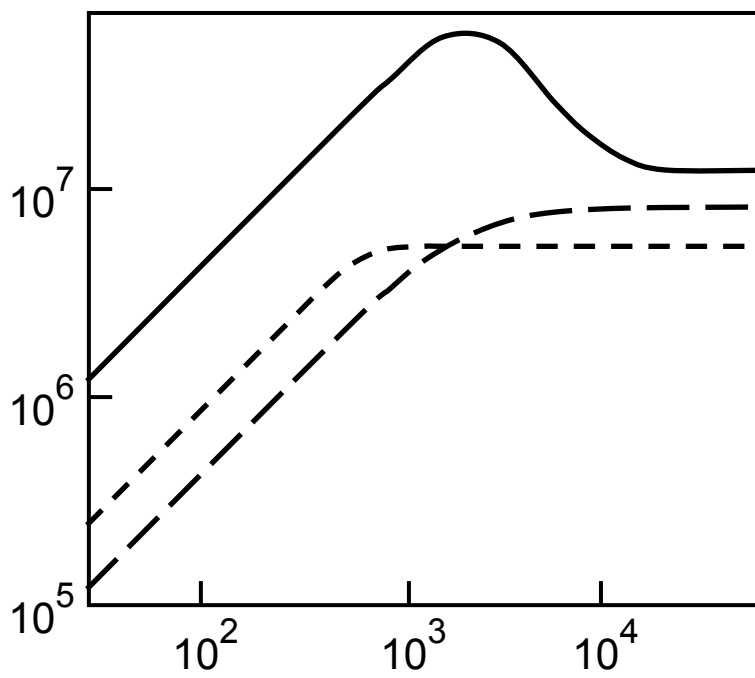


Рис. 32

a)



б)

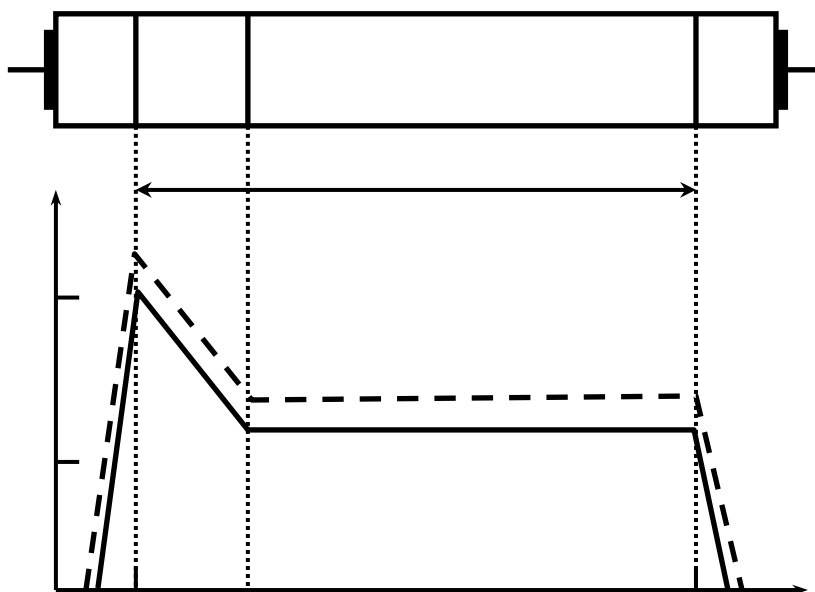
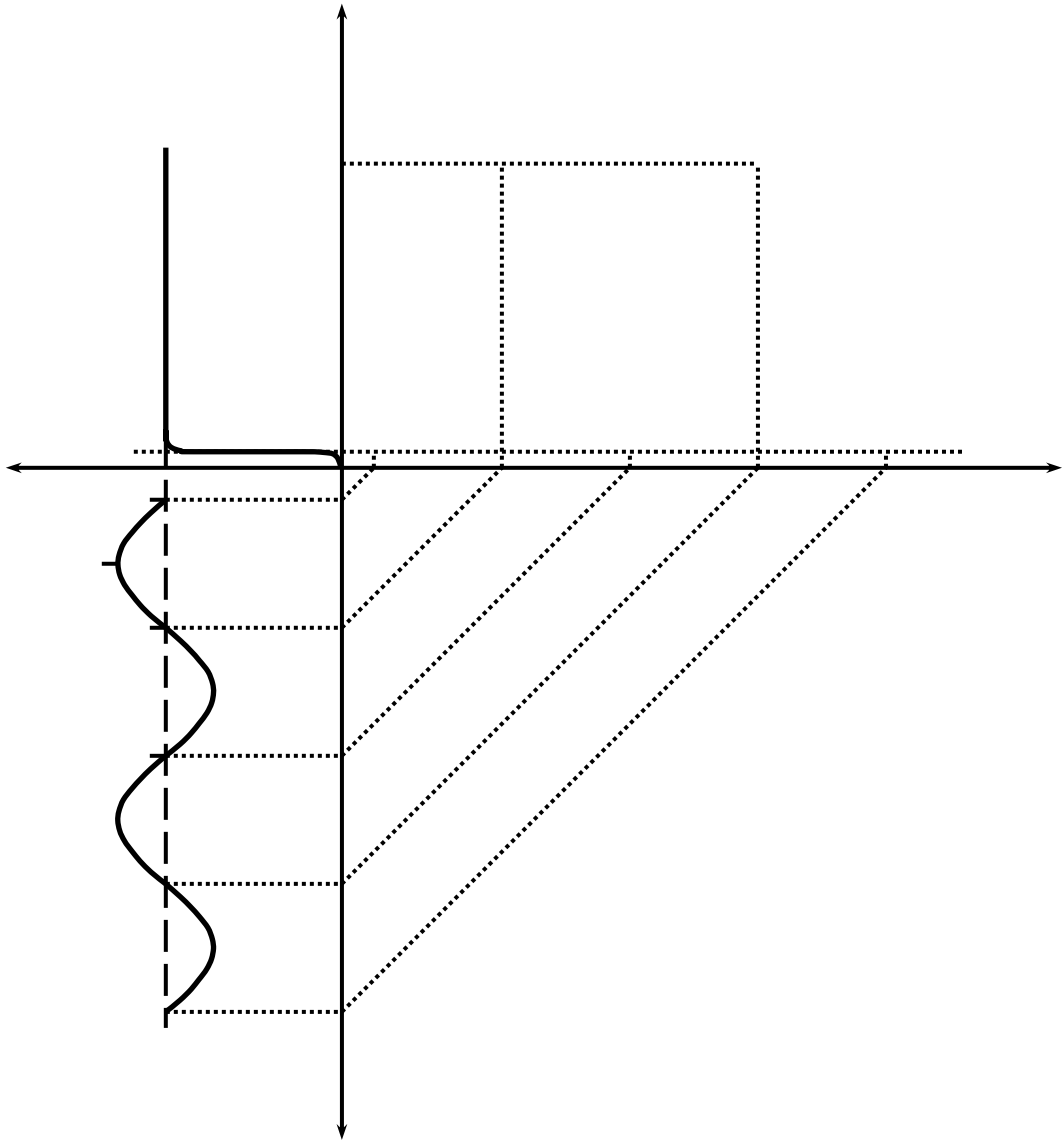
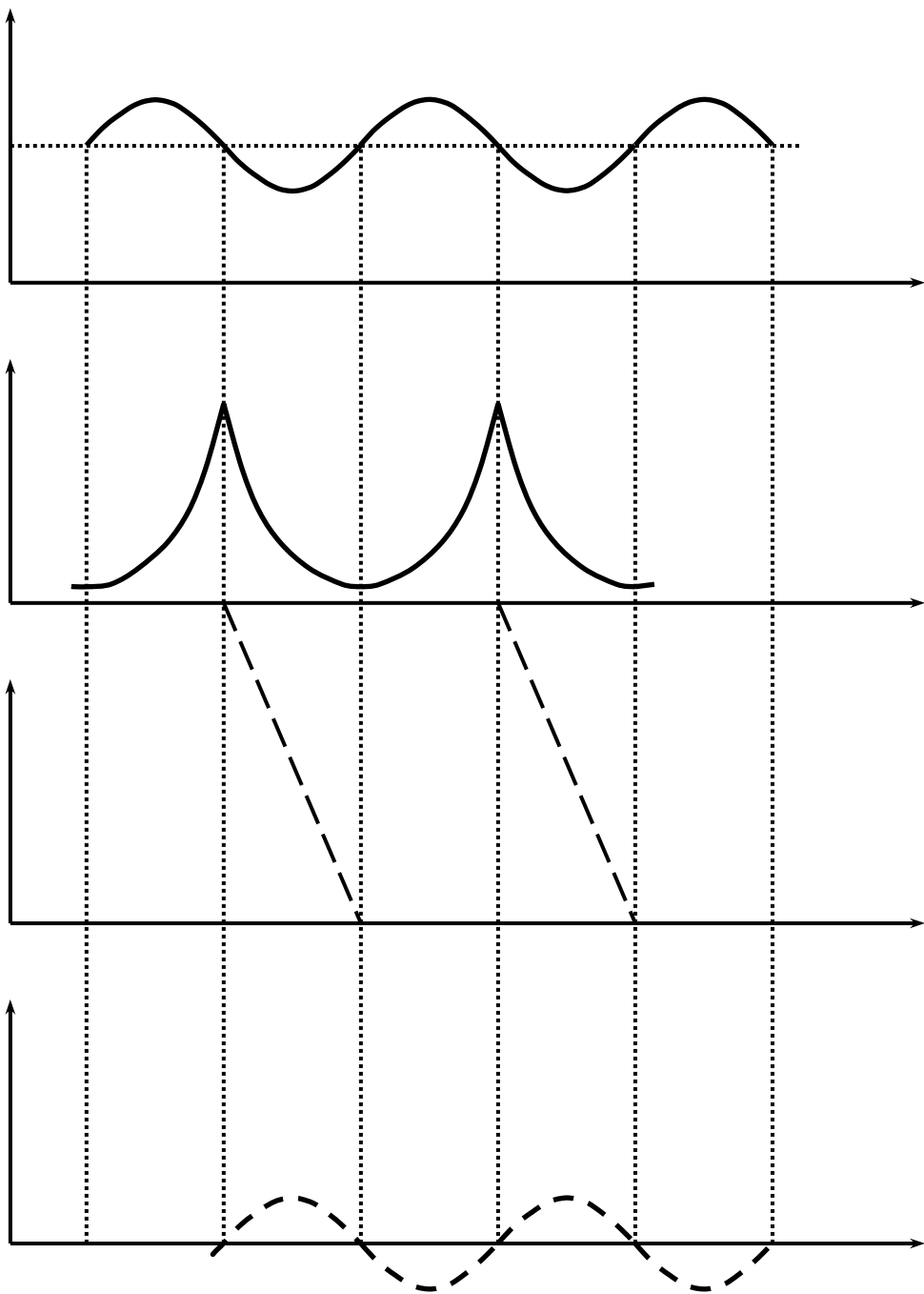


Рис. 33

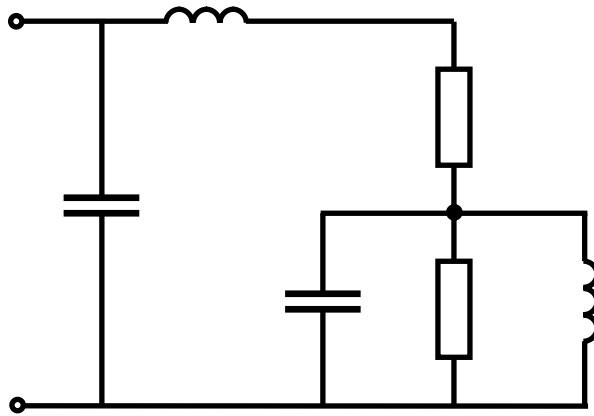


**Рис. 34**



**Рис. 35**

а)



б)

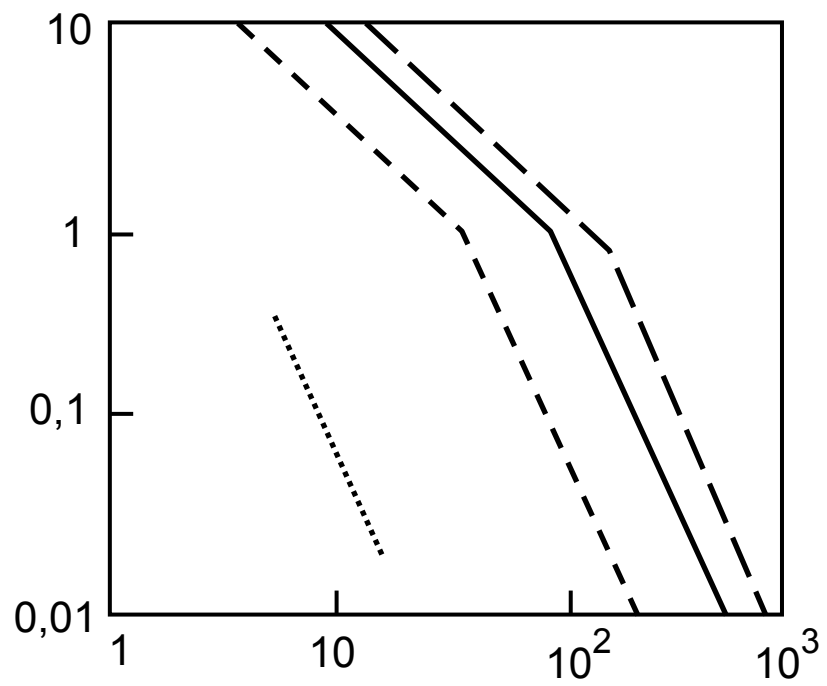
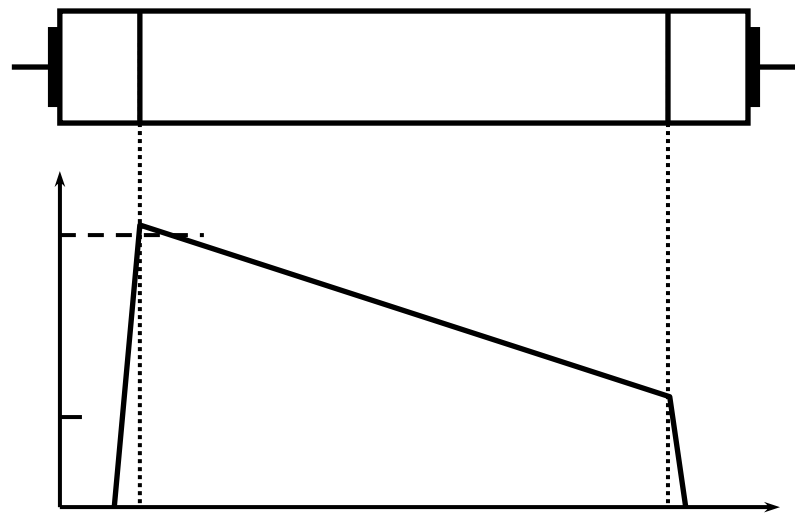
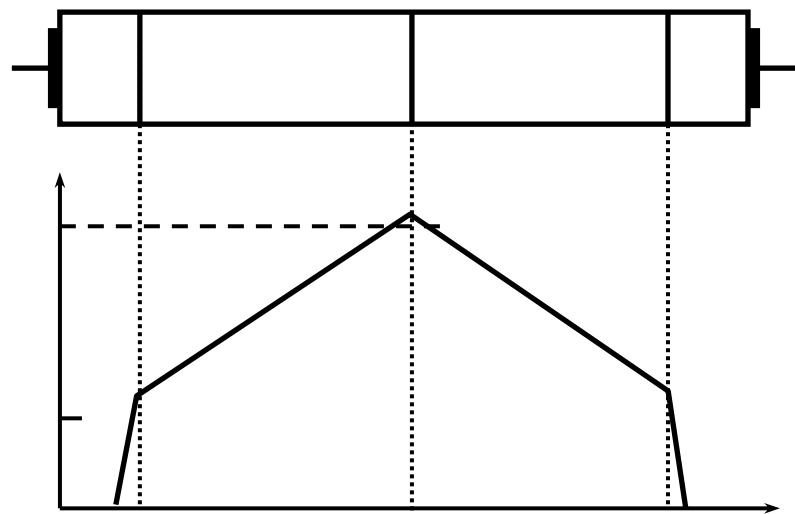


Рис. 36

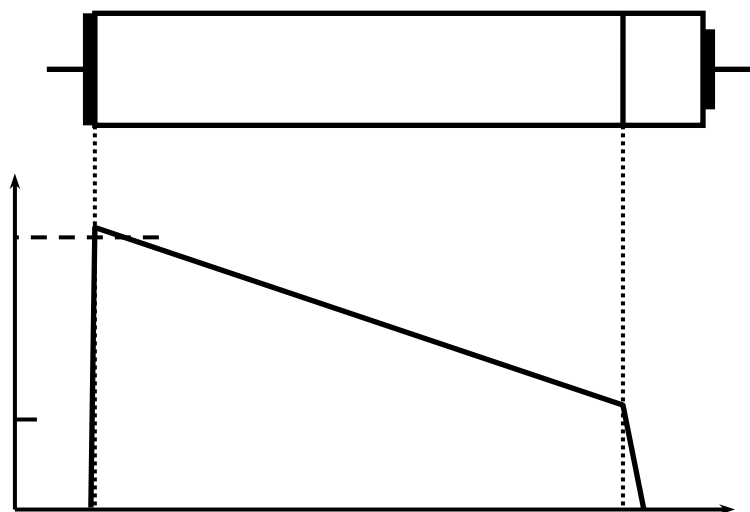
**a)**



**б)**

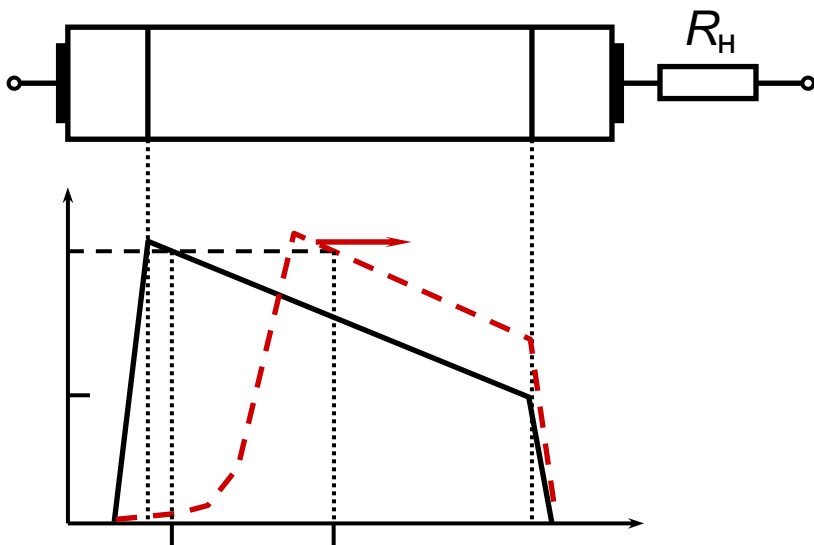


**в)**



**Рис. 37**

a)



б)

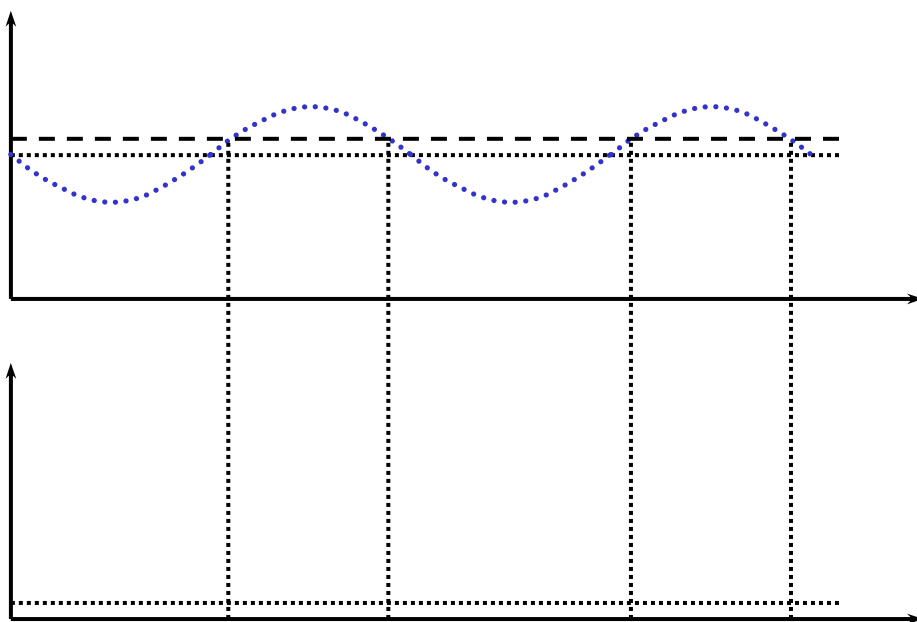
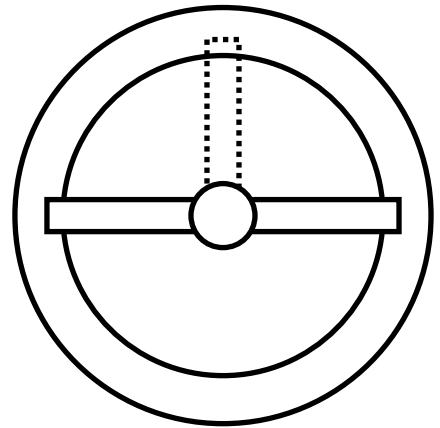
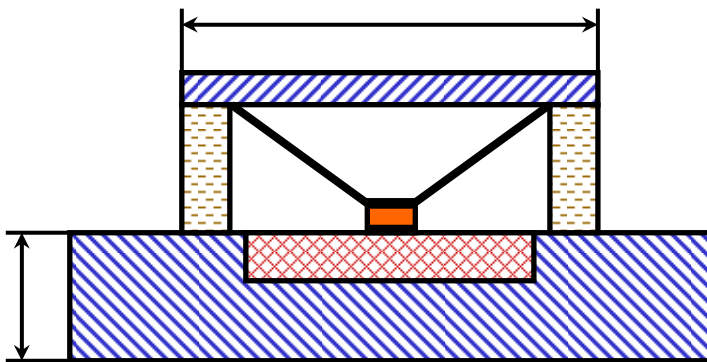


Рис. 38

a)



б)

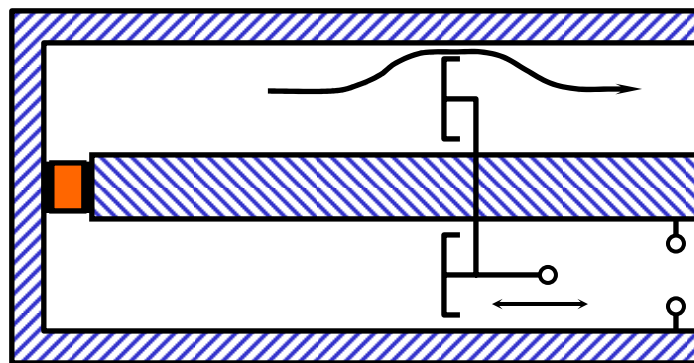
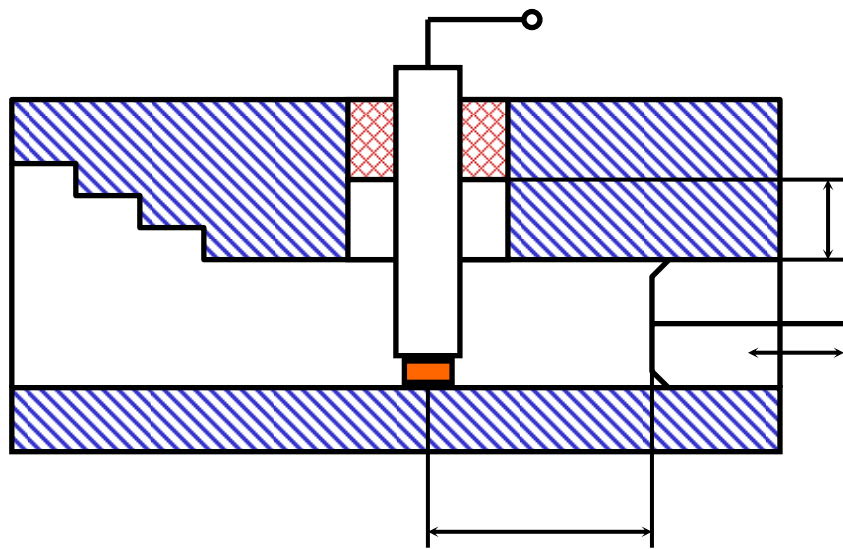


Рис. 39



a)



б)

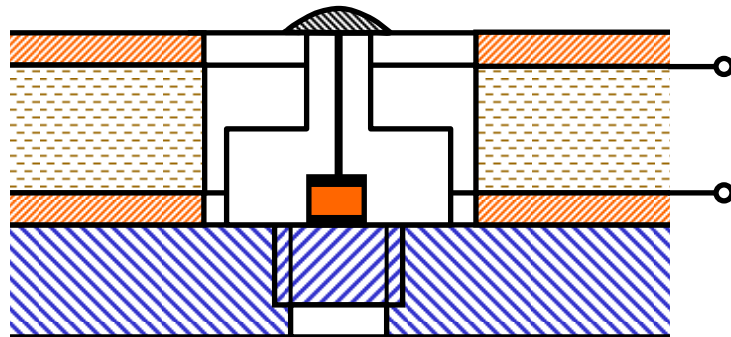
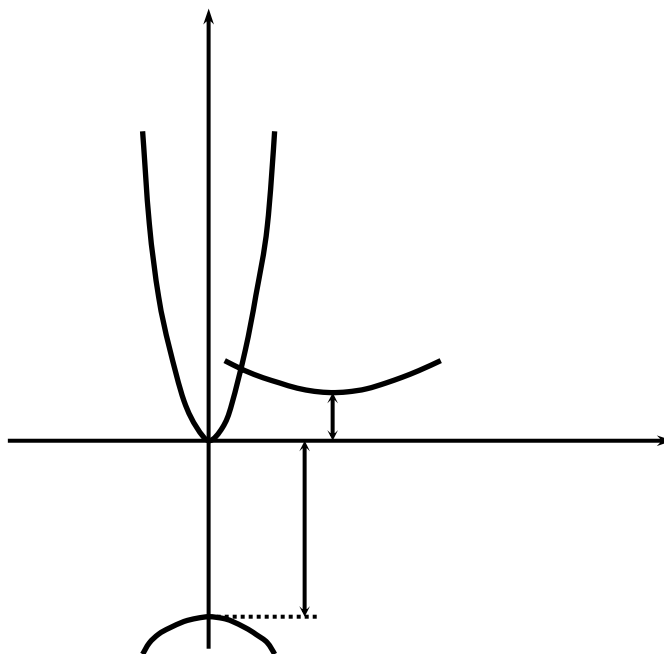


Рис. 40

a)



б)

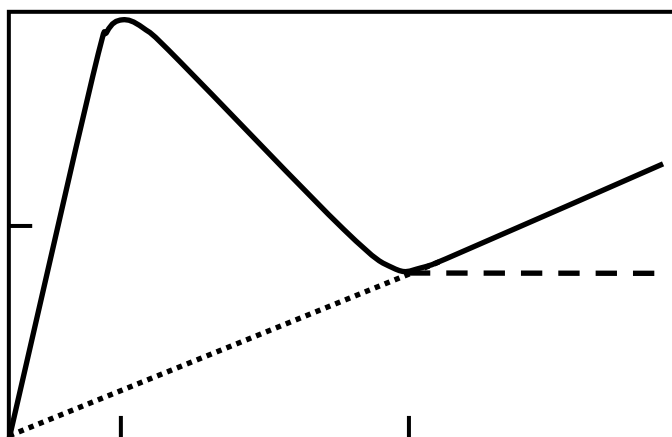


Рис. 41

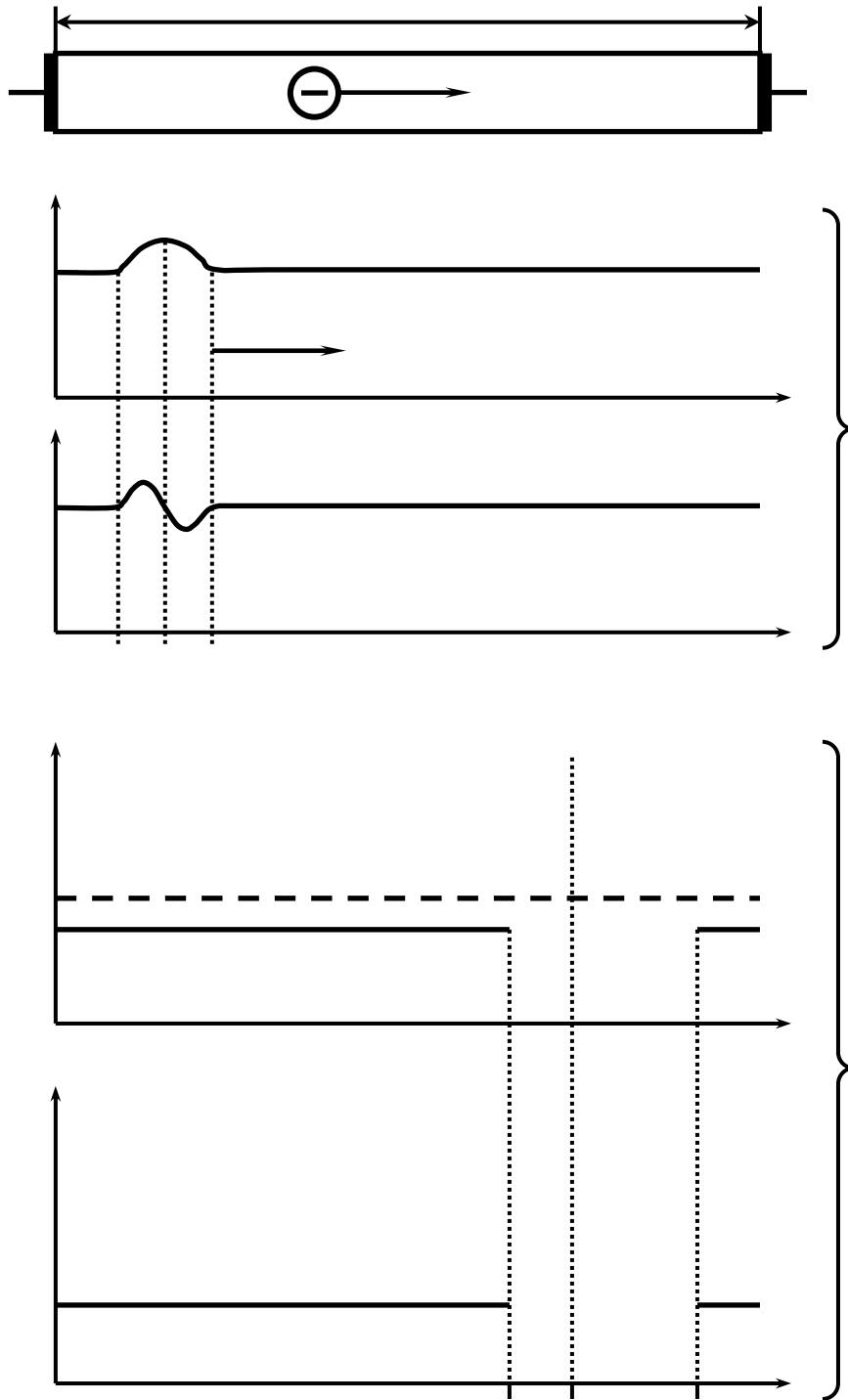
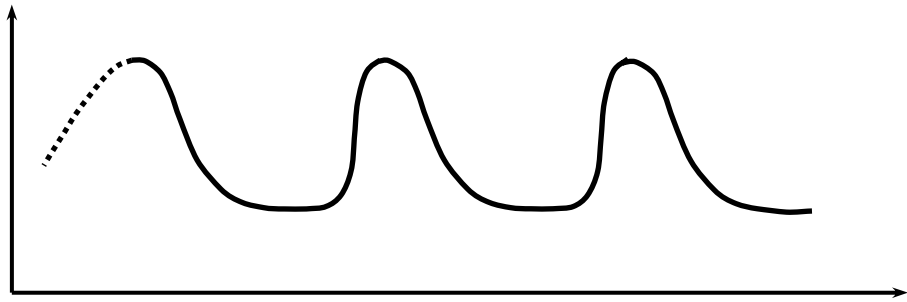


Рис. 42

a)



б)

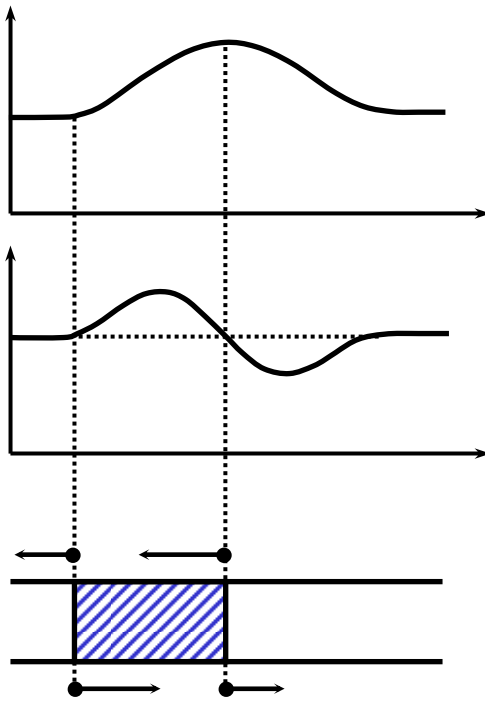
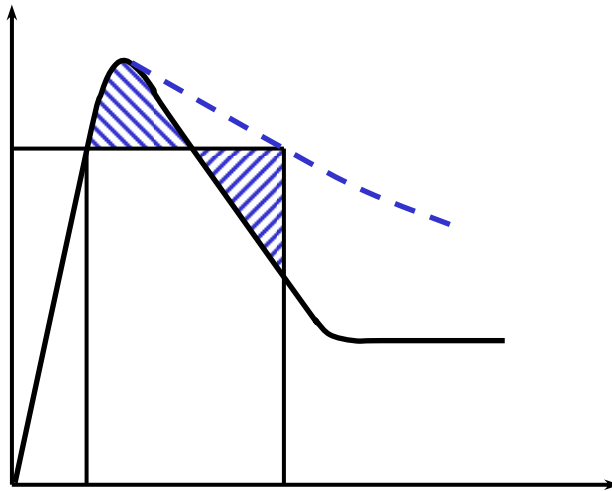


Рис. 43

a)



б)

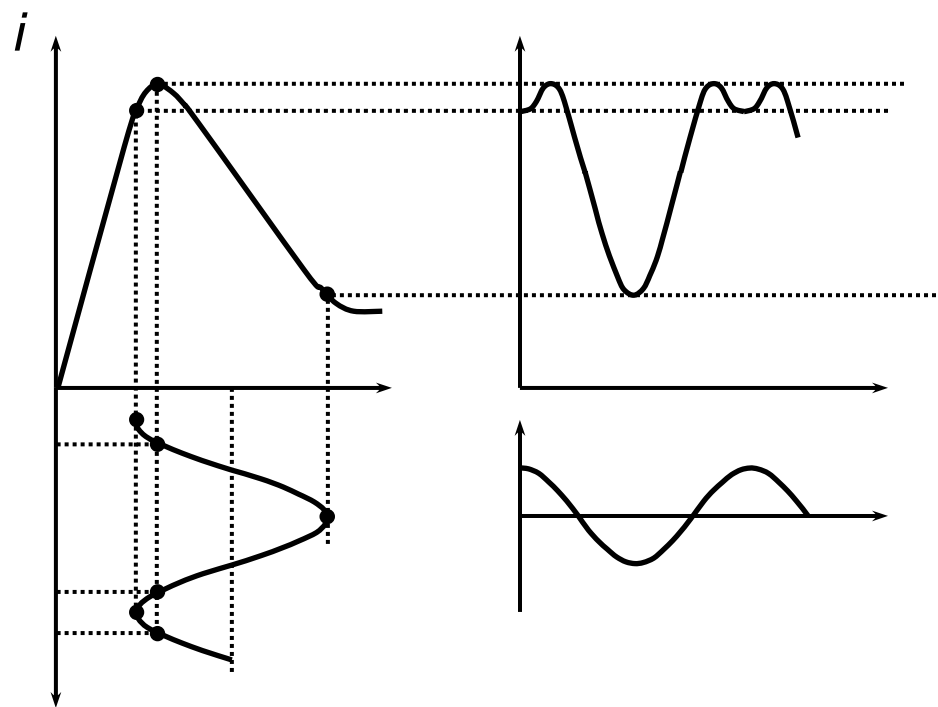
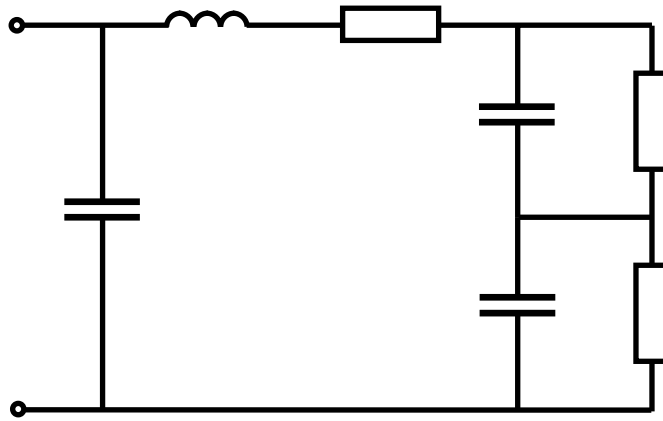
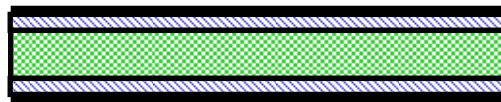


Рис. 44

a)



б)



в)

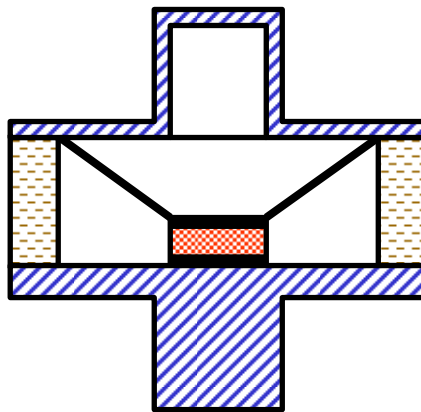


Рис. 45

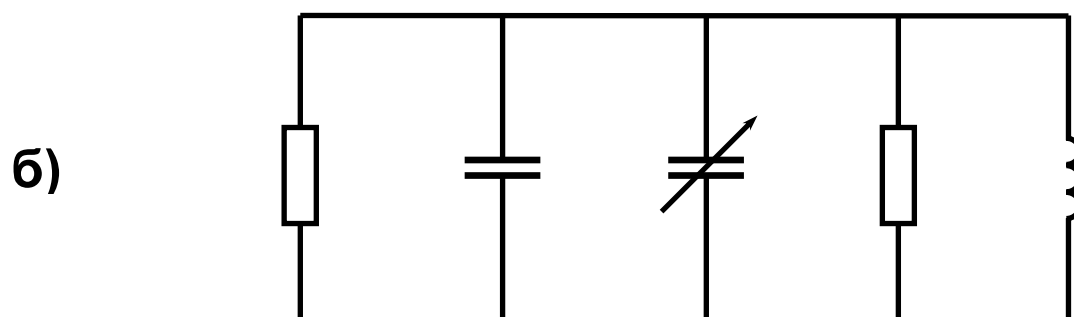
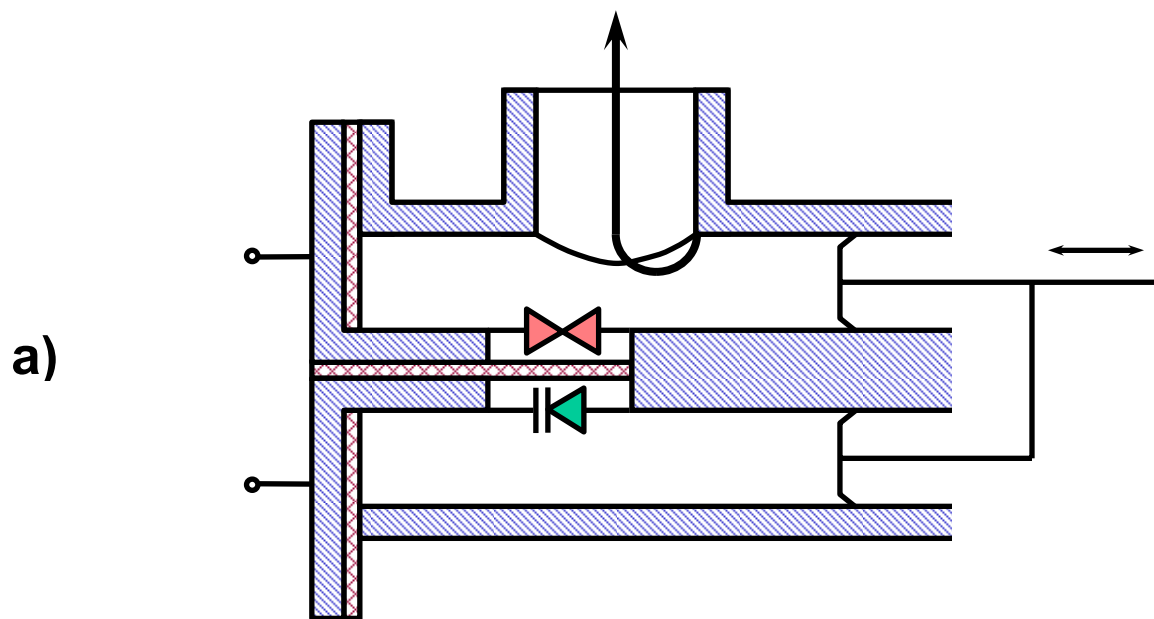


Рис. 46

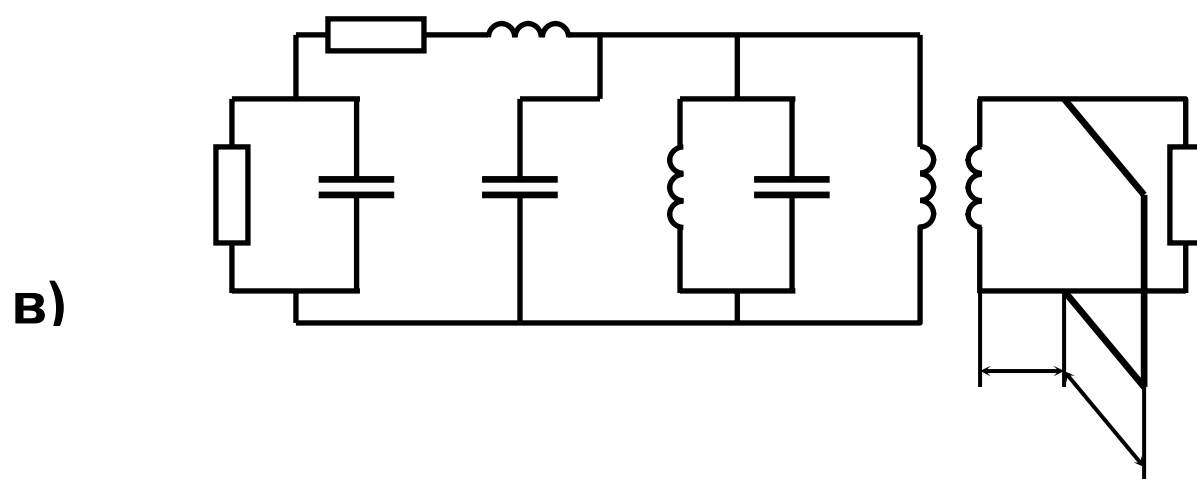
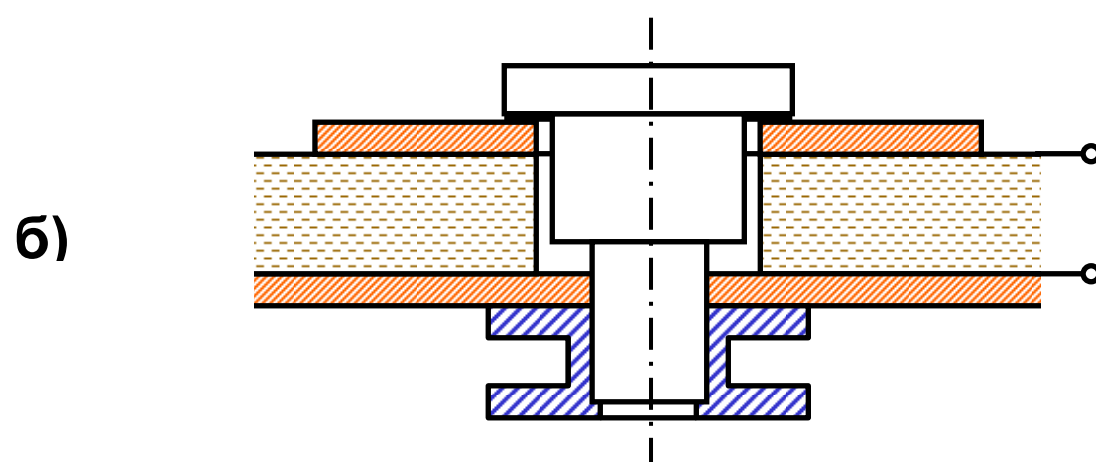
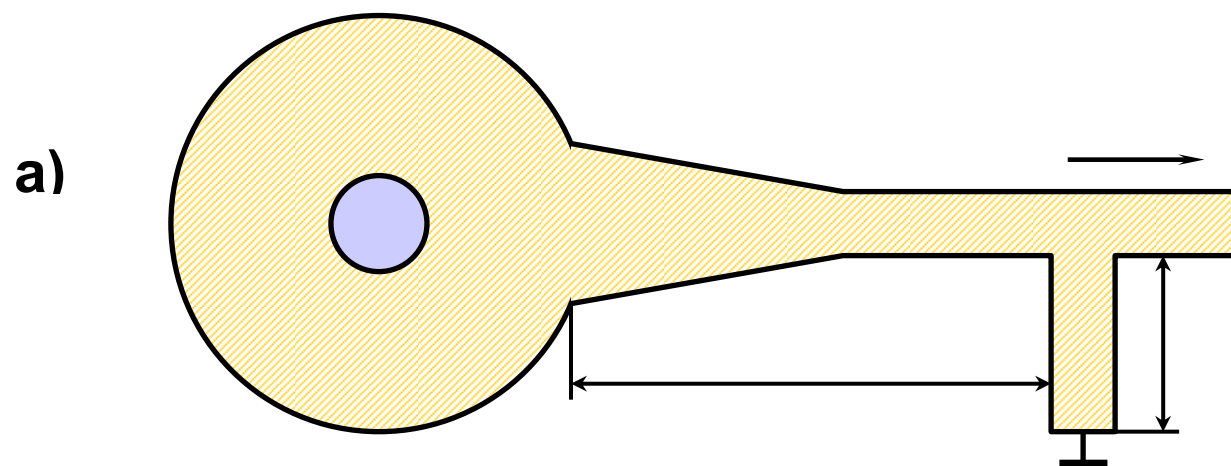


Рис. 47

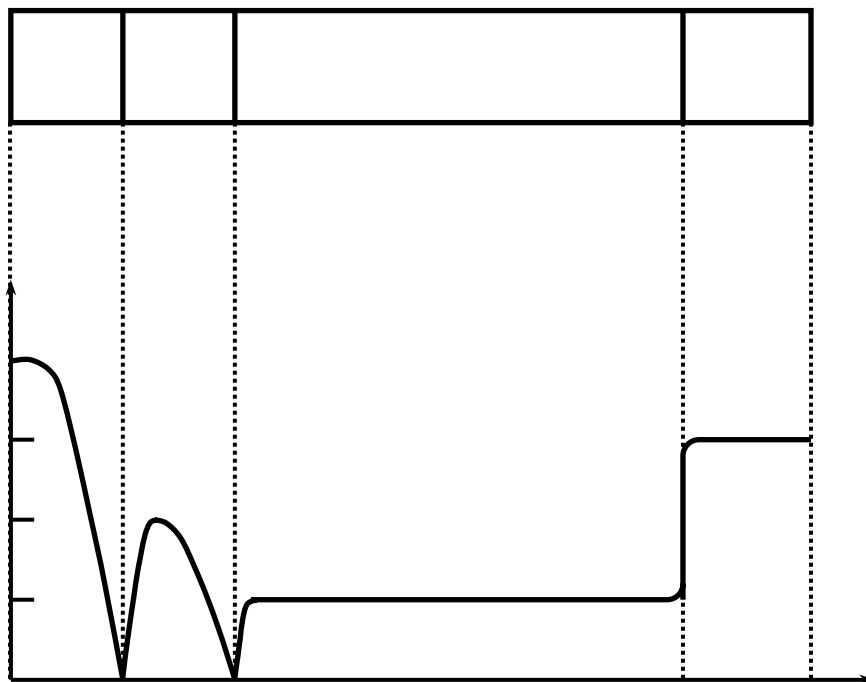


## ПАРАМЕТРЫ ДИОДОВ ГАННА (фирма RCA, США)

$f$ , ГГц	$P$ , Вт	$\eta$ , %	Кэф. заплн.	Режим
1,75	6000	15	$6 \cdot 10^{-6}$	ОНОЗ
2,0	200	29	$10^{-3}$	домен.
7,0	2000	5	$6 \cdot 10^{-6}$	ОНОЗ
8,15	60	22	$10^{-4}$	домен.
10,5	1,4	10,8	непр.	домен.
16,0	150	6	$6 \cdot 10^{-6}$	ОНОЗ
20,0	0,5	3	непр.	домен.
50,0	0,4	9	$10^{-5}$	ОНОЗ
80,0	0,02	2	непр.	ОНОЗ

Рис. 48

a)



б)

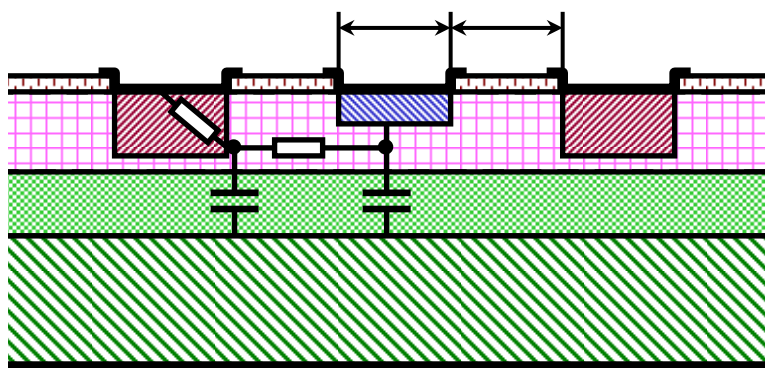
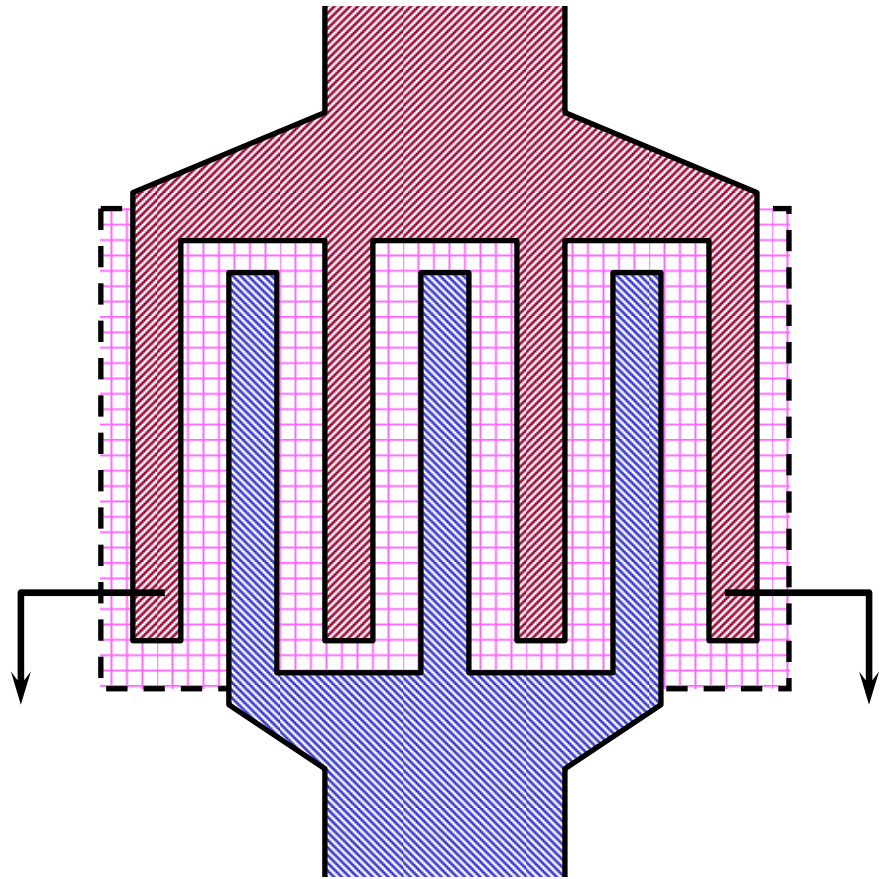


Рис. 49

a)



б)

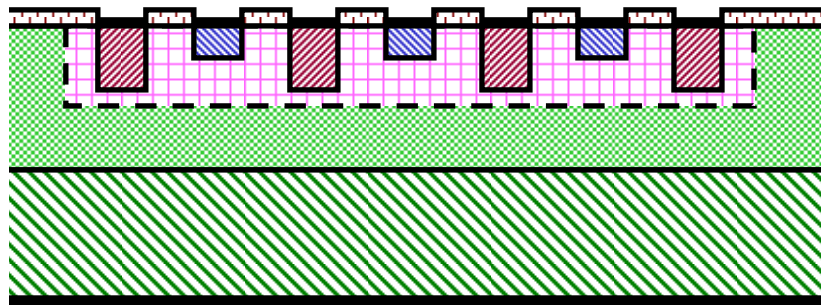
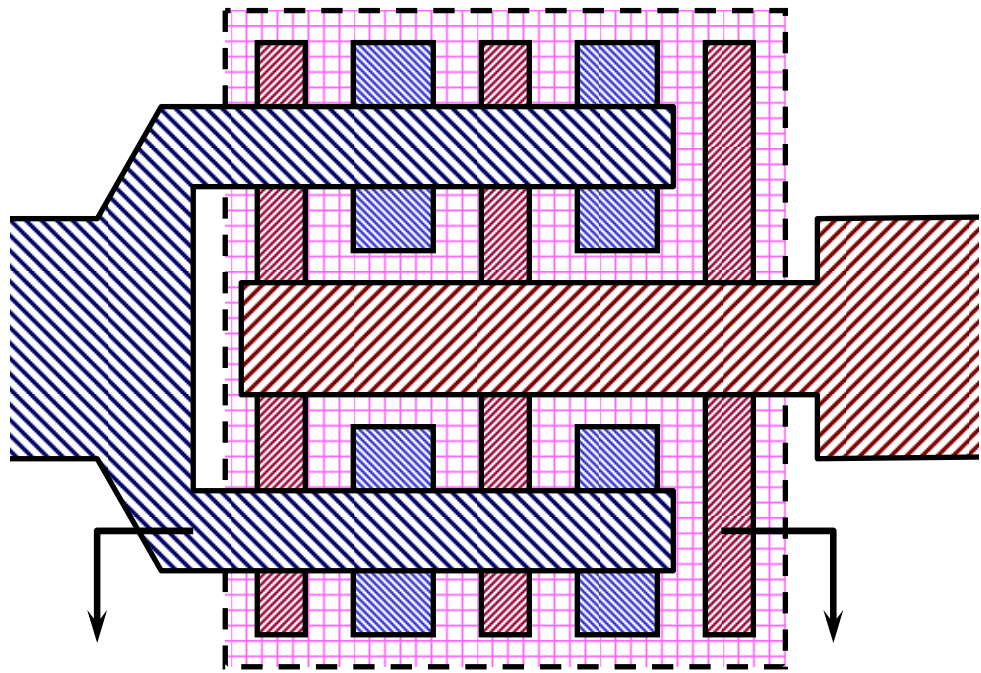


Рис. 50

a)



б)

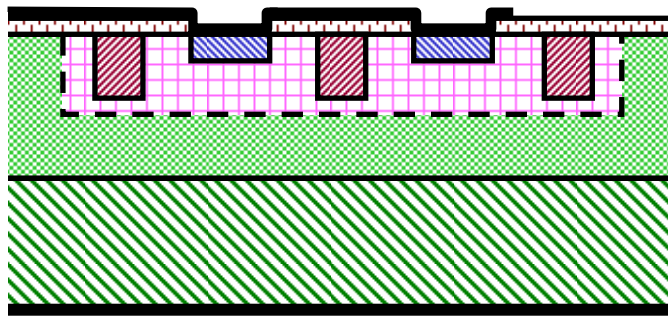
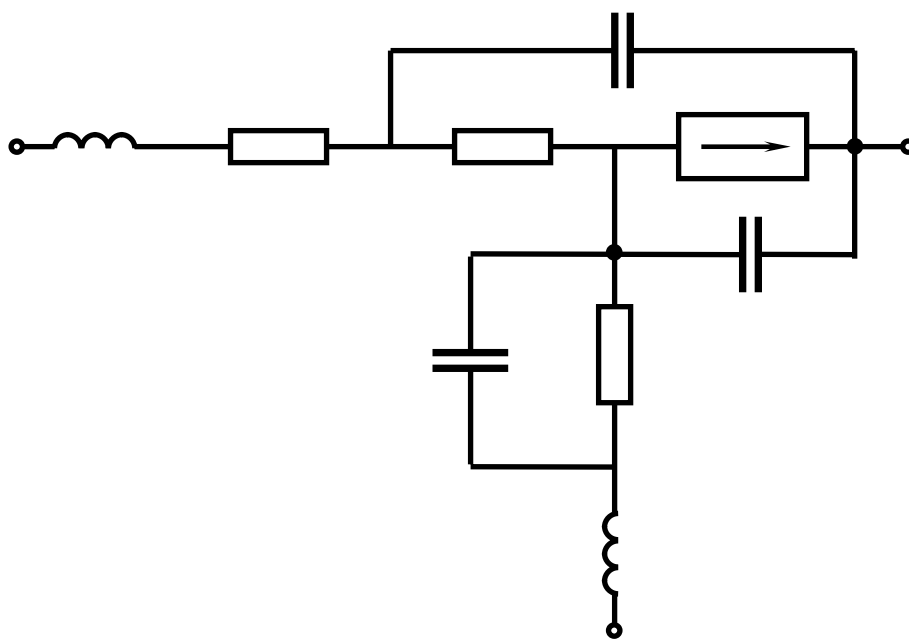


Рис. 51

a)



б)

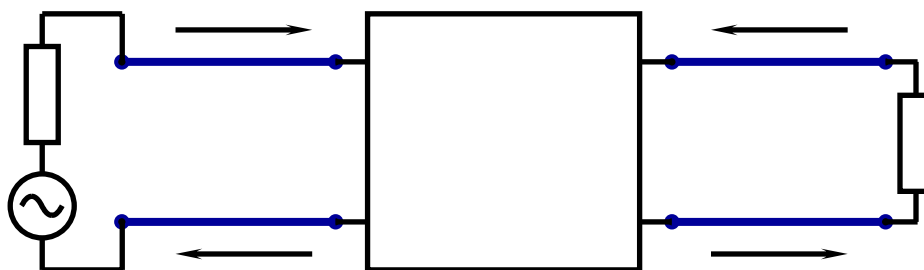


Рис. 52

## Параметры биполярных СВЧ транзисторов

	Тип	$f_t$ ГГц	$P_{к\ max}$ Вт	$U_{кб\ max}$ В	$I_{к\ max}$ А
Малая P	КТ 325 В	1,0	0,22	15	0,06
	ГТ 383 В	3,6	0,025	5	-
	КТ 391 В	6,0	0,07	15	0,01
Средняя P	КТ 606 А	0,35	2,5	60	0,4
	КТ 610 А	1,0	1,5	20	0,3
	КТ 640 А	4,0	0,6	25	0,08
Высокая P	КТ 909 В	0,5	50	60	2
	КТ 919 А	1,5	10	45	0,17
	КТ 927 А	2,5	2,0	30	0,25

**Рис. 53**

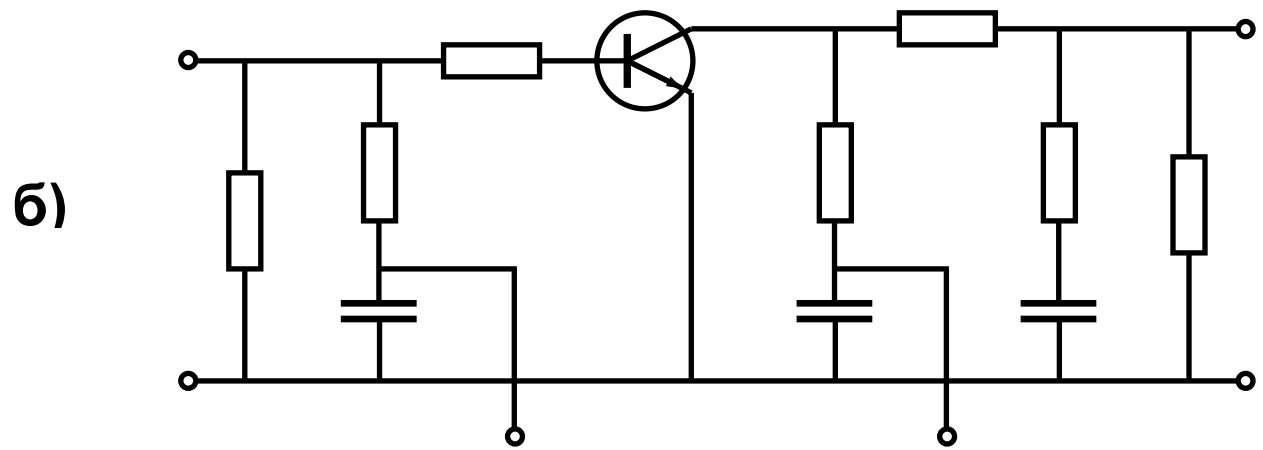
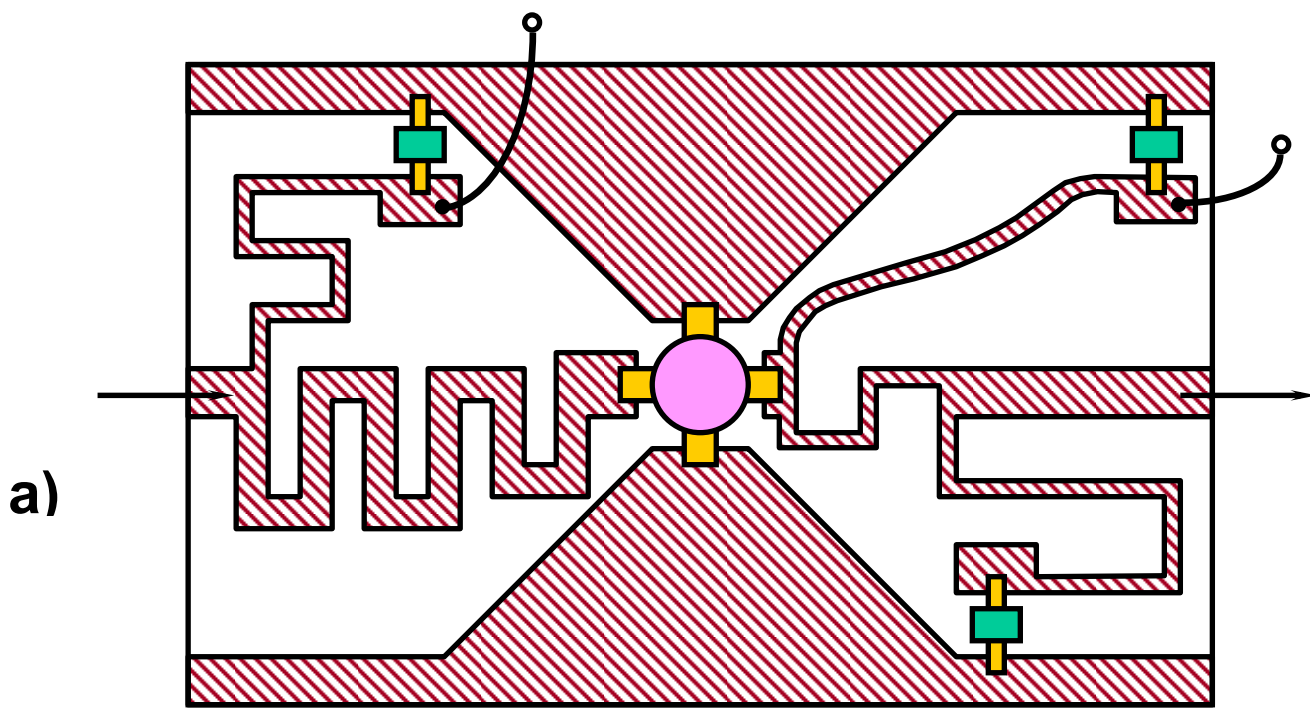


Рис. 54

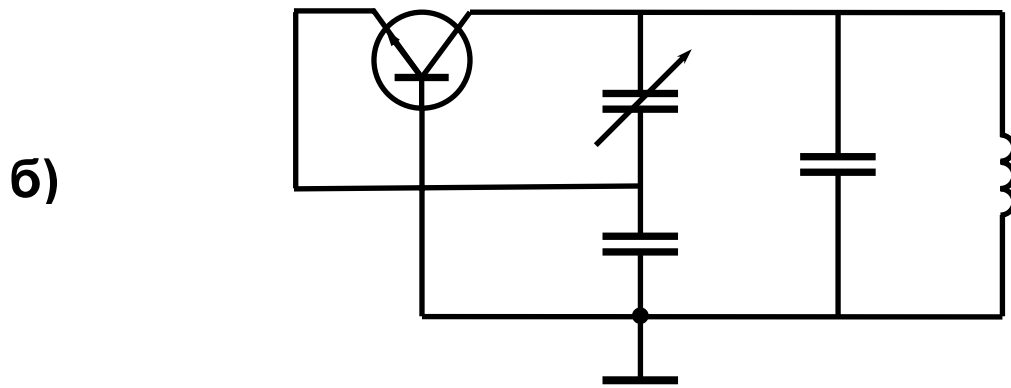
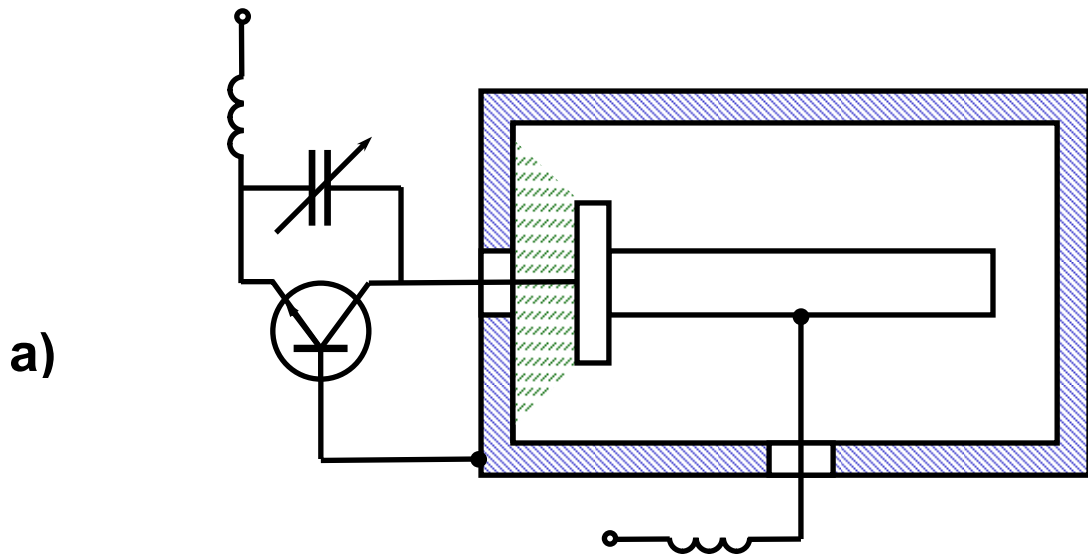
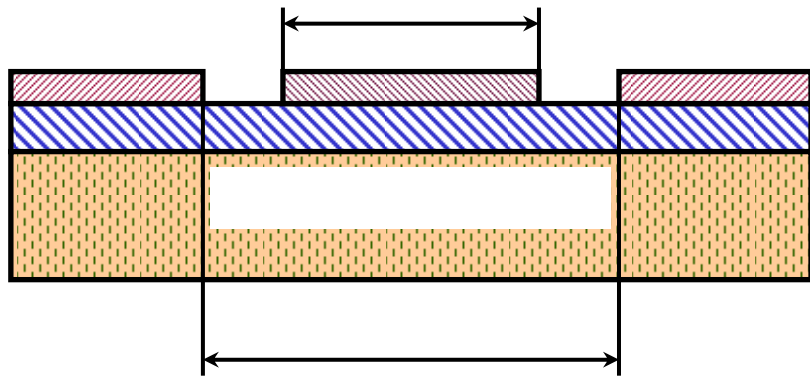


Рис. 55



a)



б)

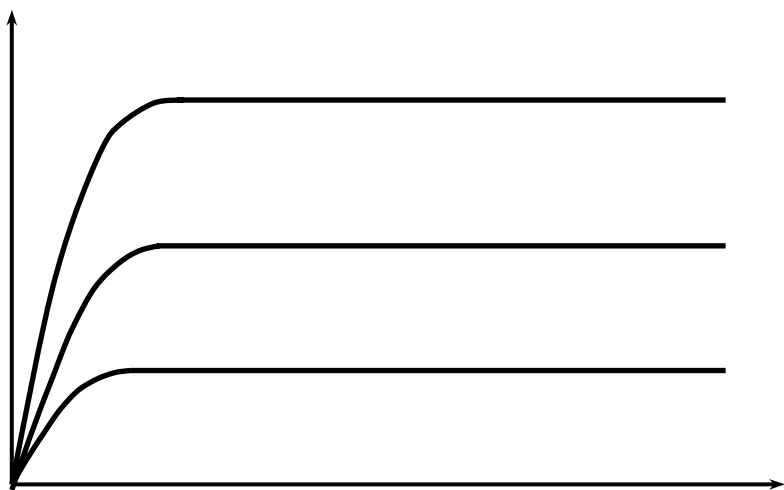
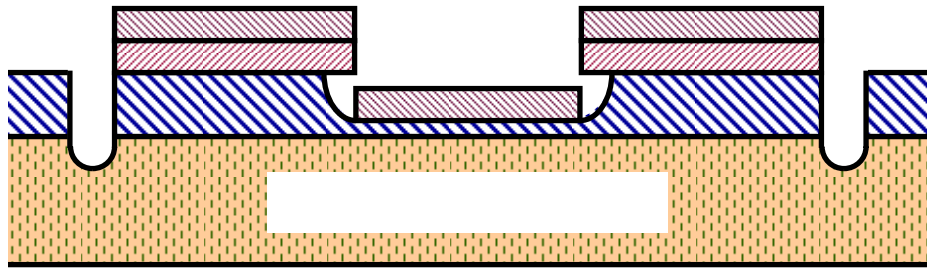
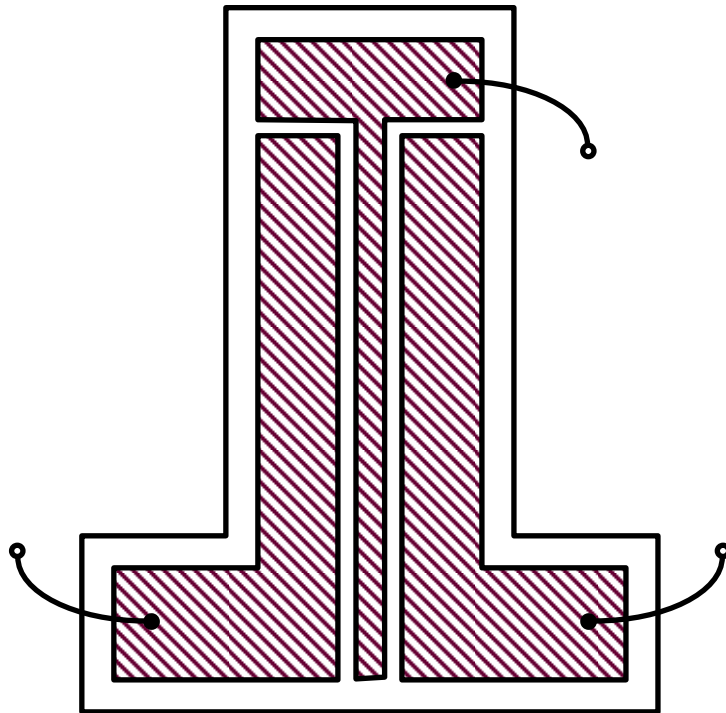


Рис. 56

a)



б)



в)

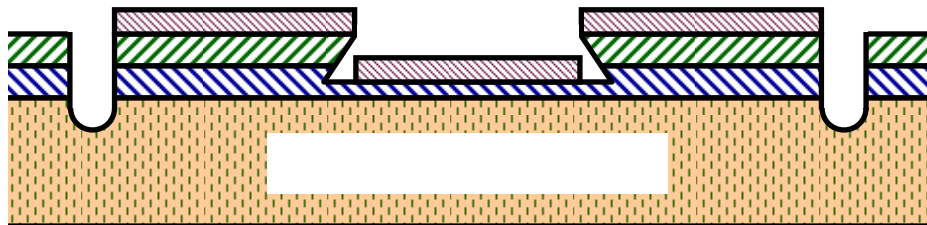
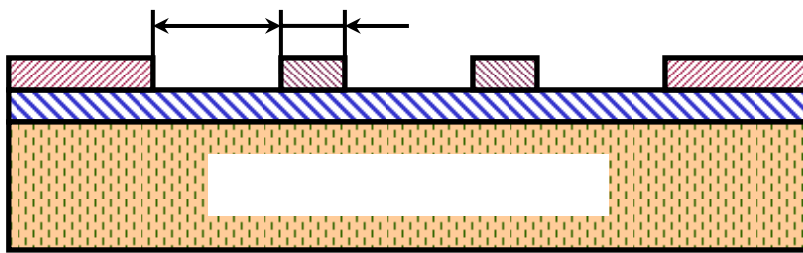
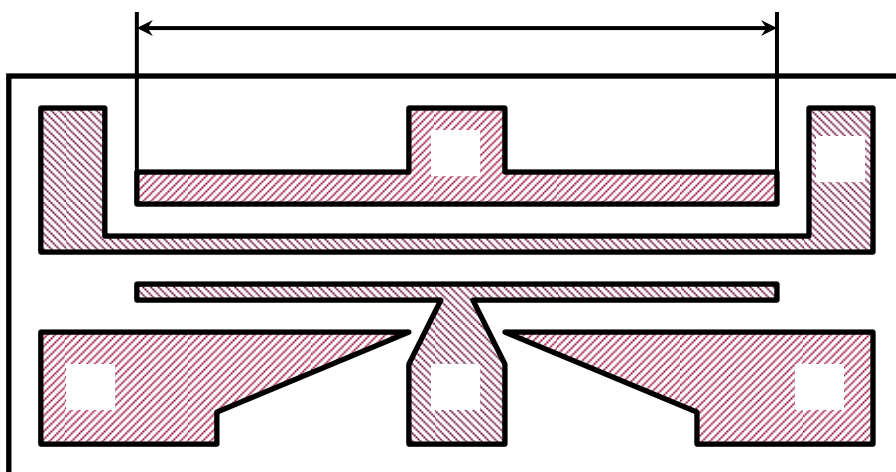


Рис. 57

a)



б)



в)

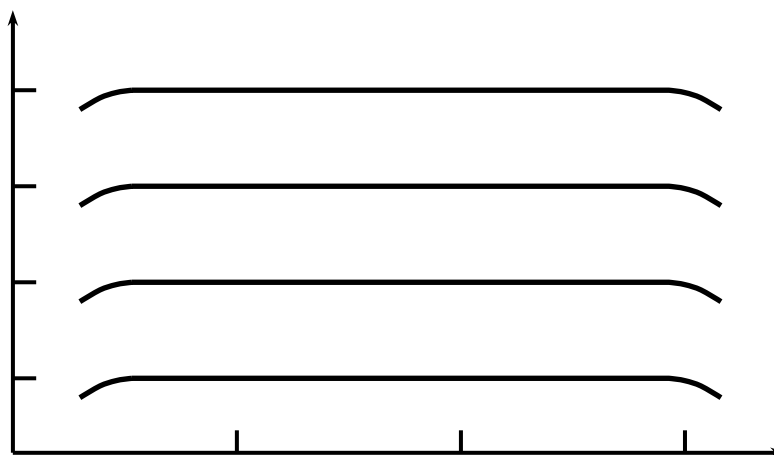
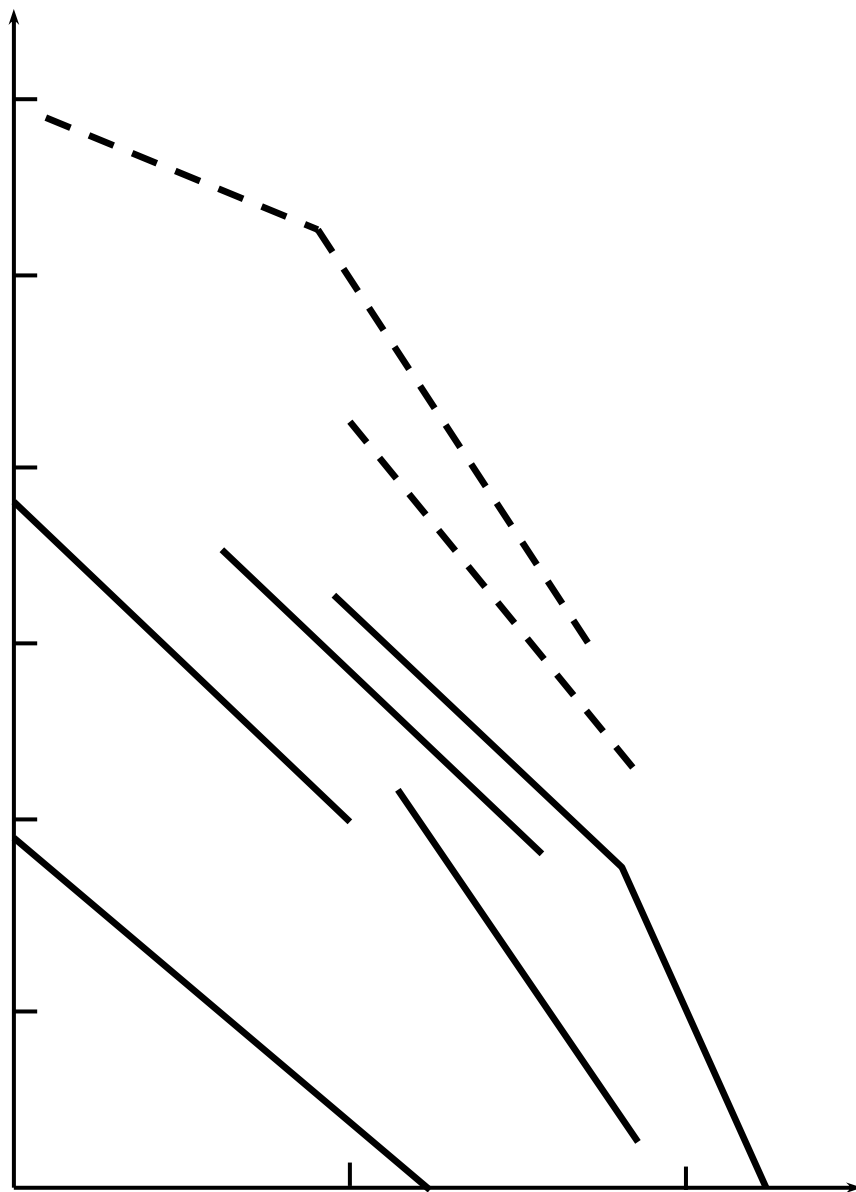


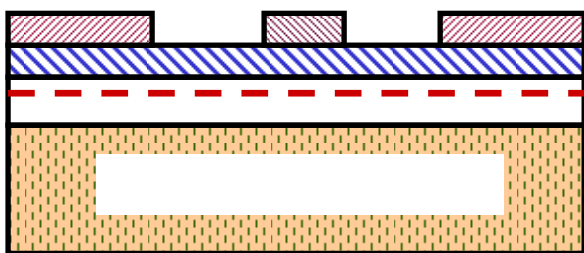
Рис. 58



**Рис. 59**



a)



б)

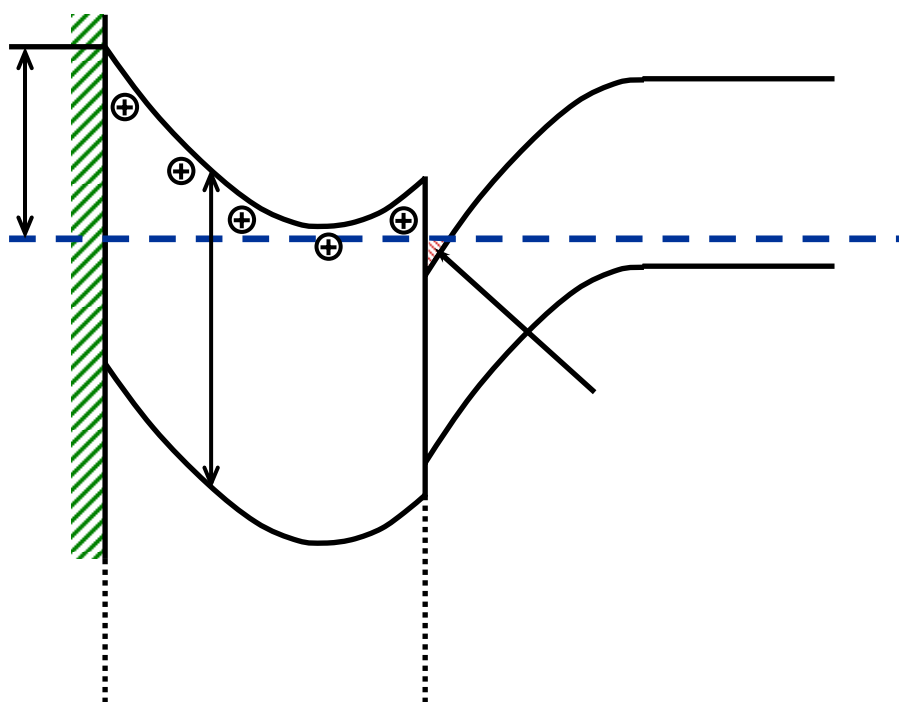


Рис. 61