H. Eléctricos

LÁMINAS

116
7ª

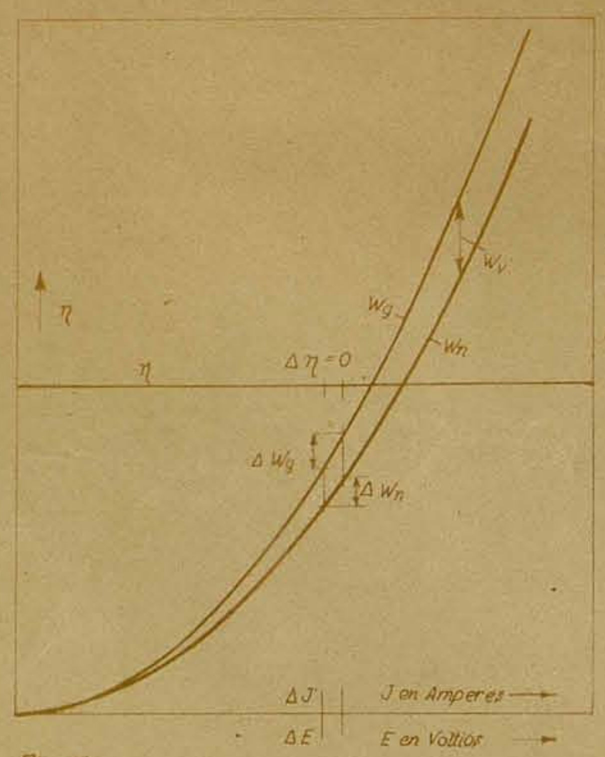


Fig. 1ª.

W_g = potencia total.
W_n = " útil = $J^2 R_n$
W_v = " de pérdidas = $J^2 R_v$
$\left.\right\} W_g = W_n + W_v$
$\eta = \frac{W_n}{W_g}$

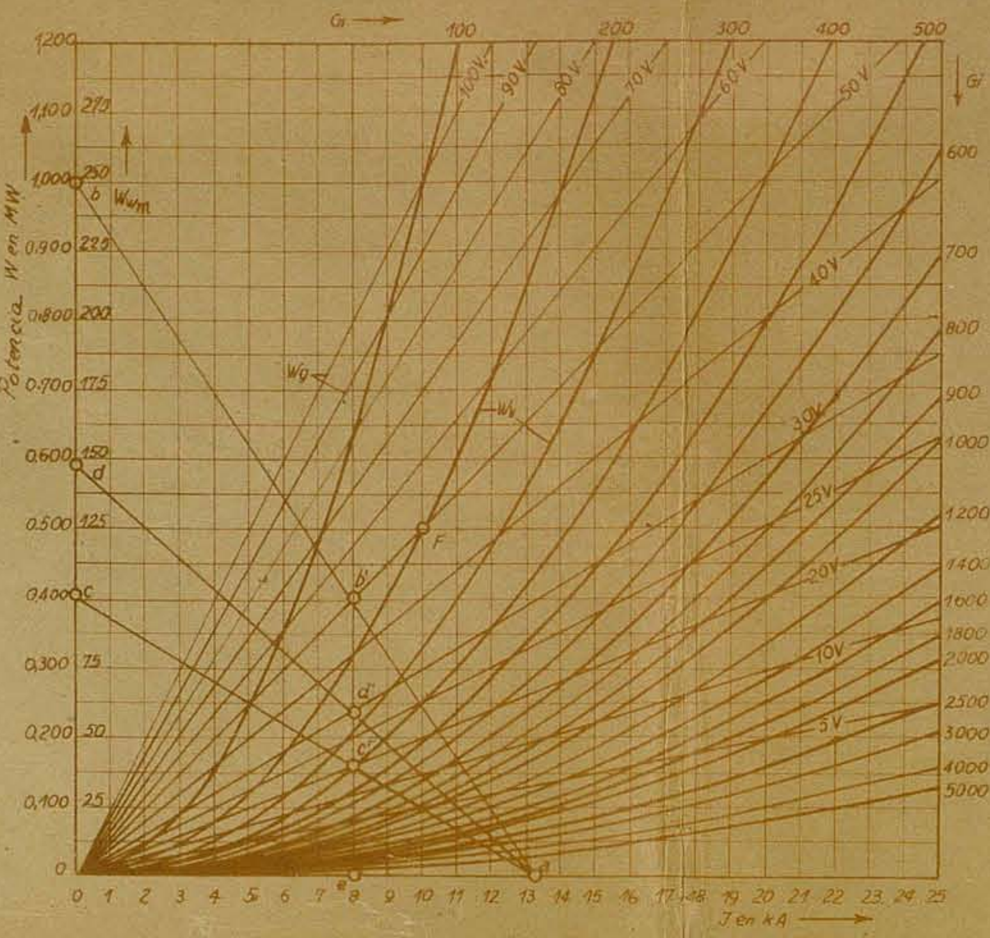


Fig. 3. Gráfico de funcionamiento para hornos de c. continua con diferentes cifras características y tensiones

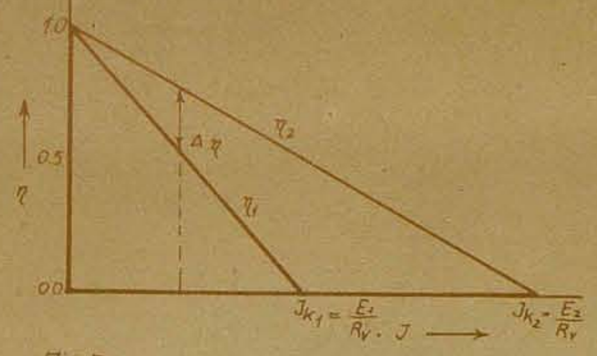


Fig. 5.

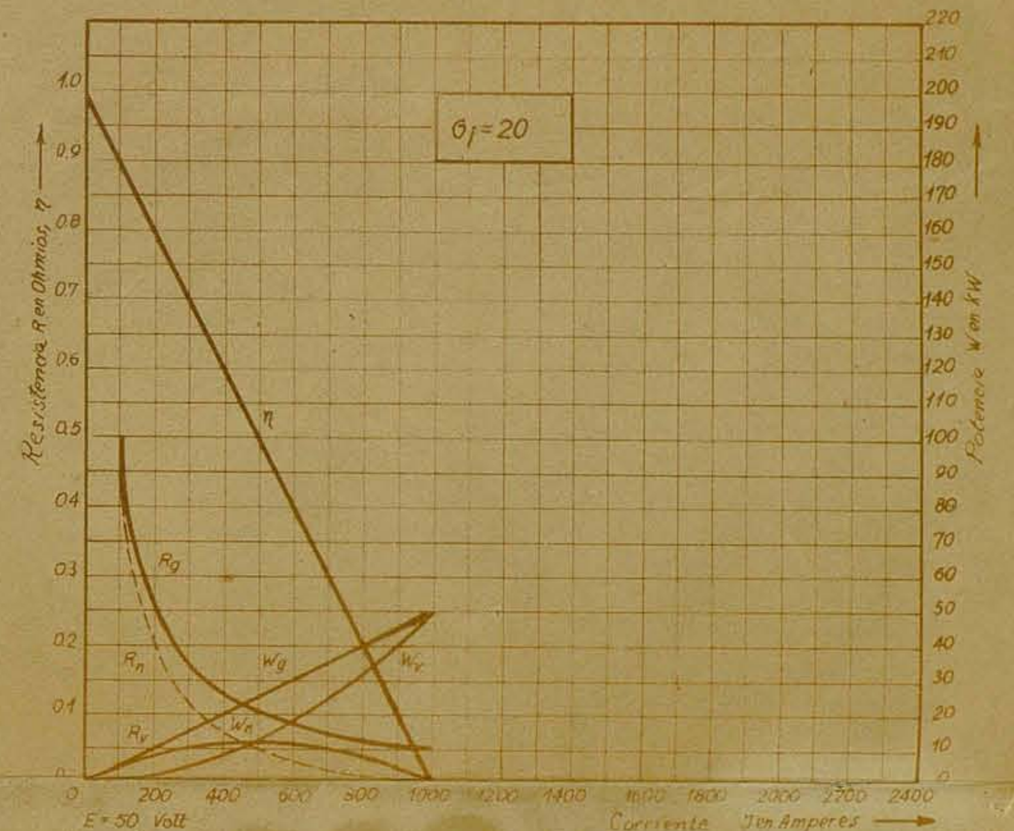


Fig. 6. Características de un horno de c. continua (G_l = 20 E = 50 Volt)

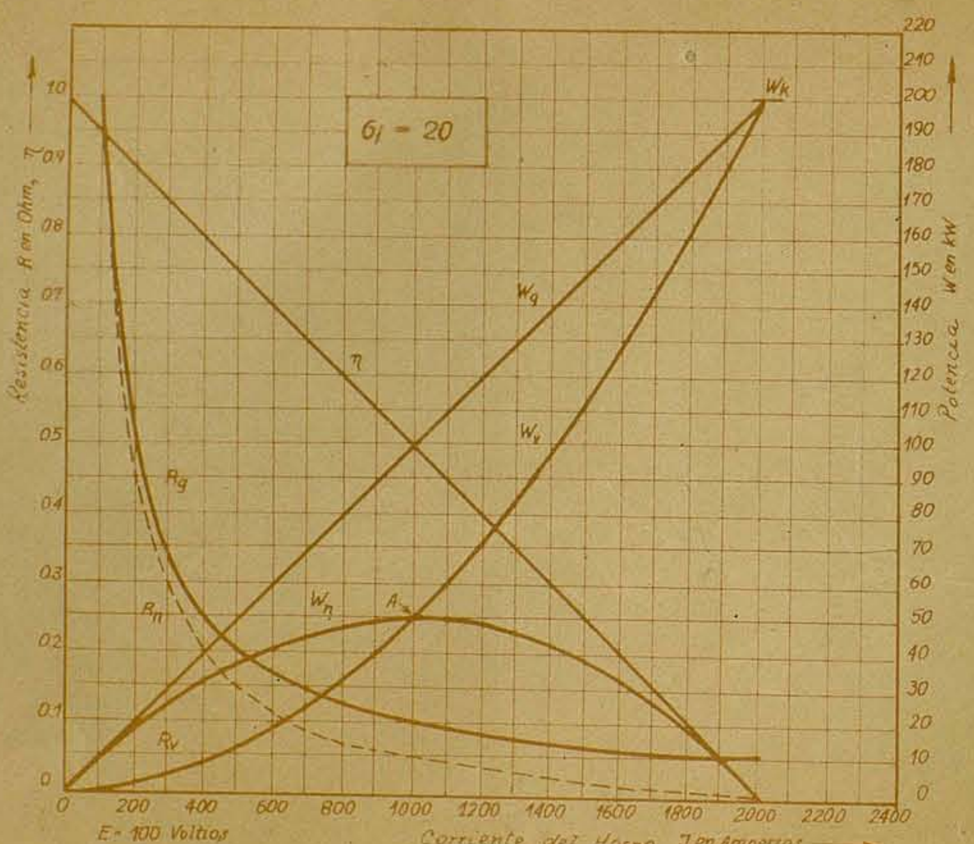


Fig. 2. Líneas características de un horno de arco para c. continua

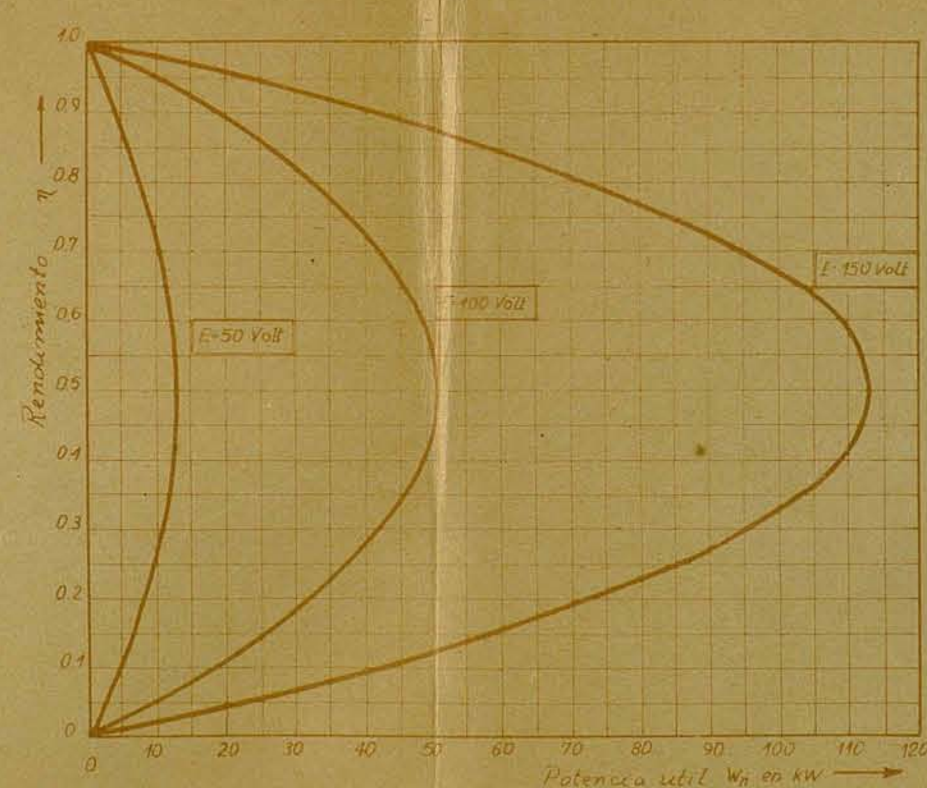


Fig. 4.

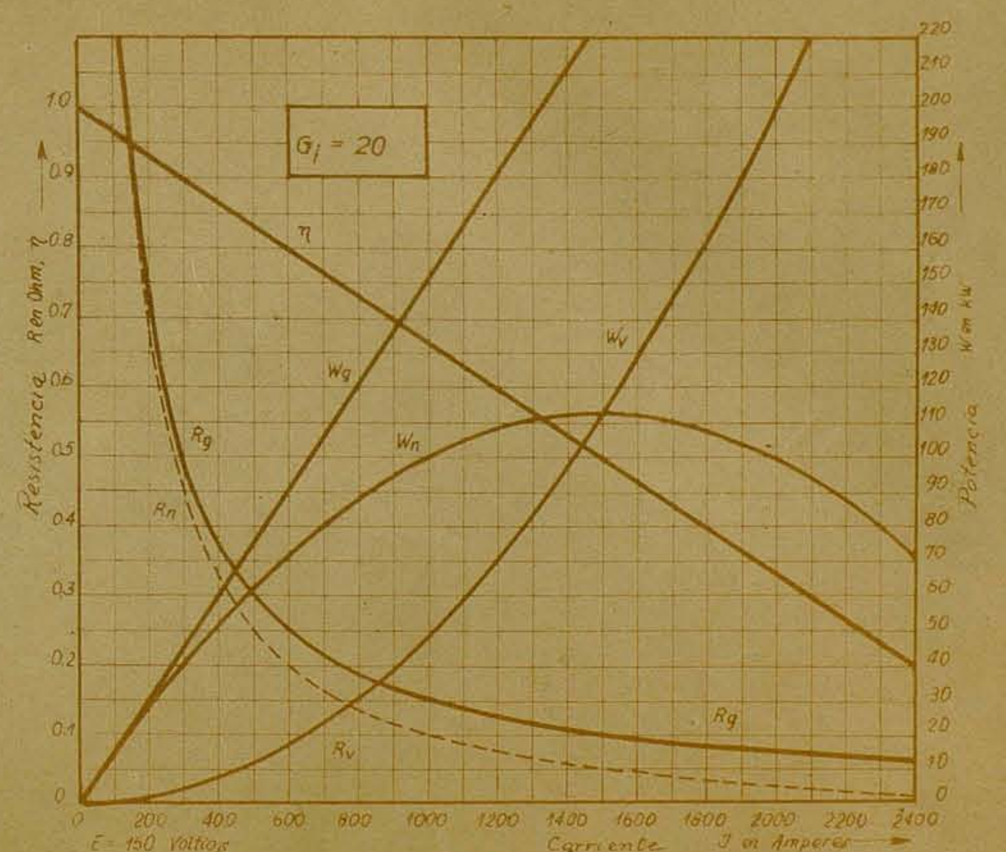


Fig. 7. Características de un horno de c. continua (G_l = 20 E = 150 Volt)

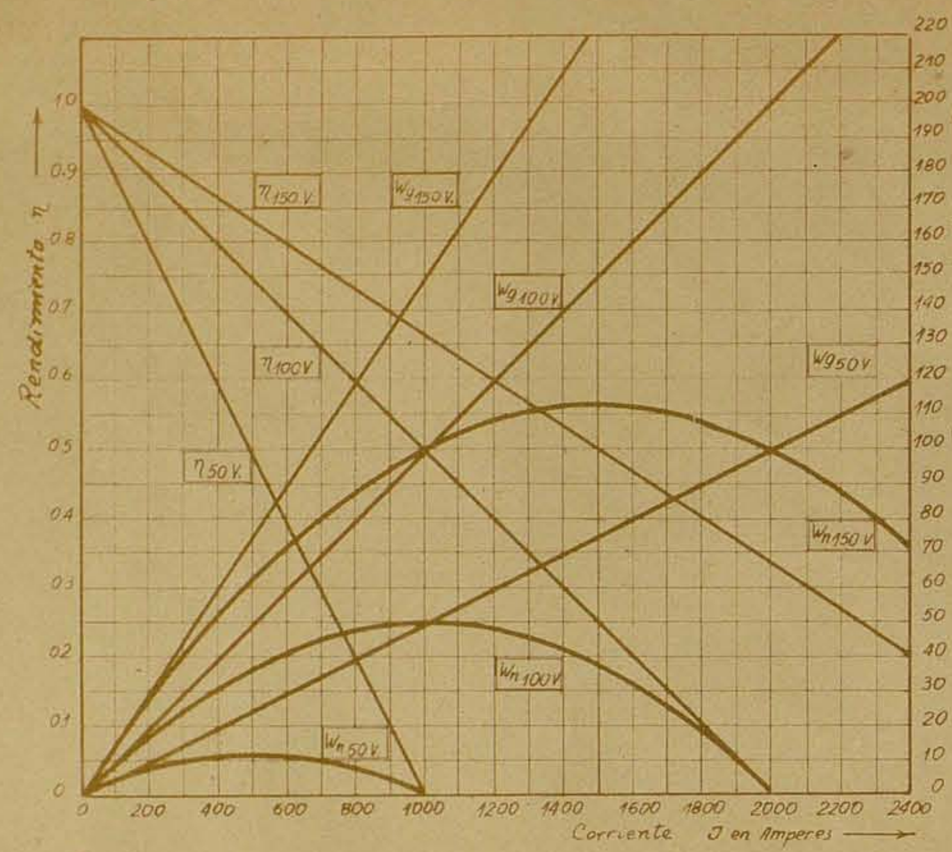


Fig. 8.

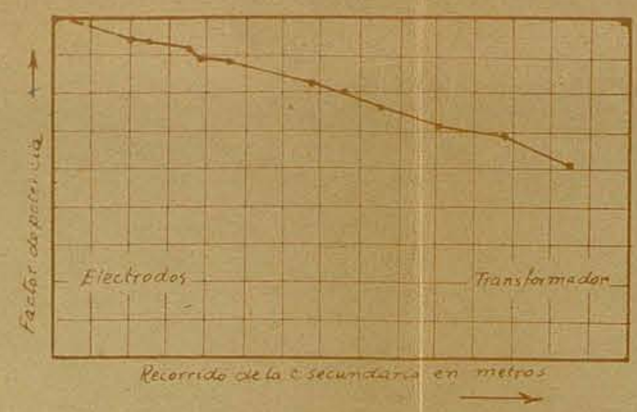


Fig. 10.

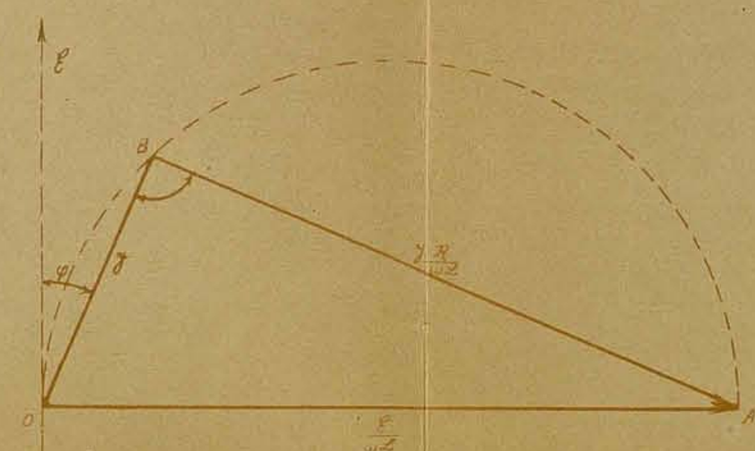


Fig. 11. Diagrama de círculo

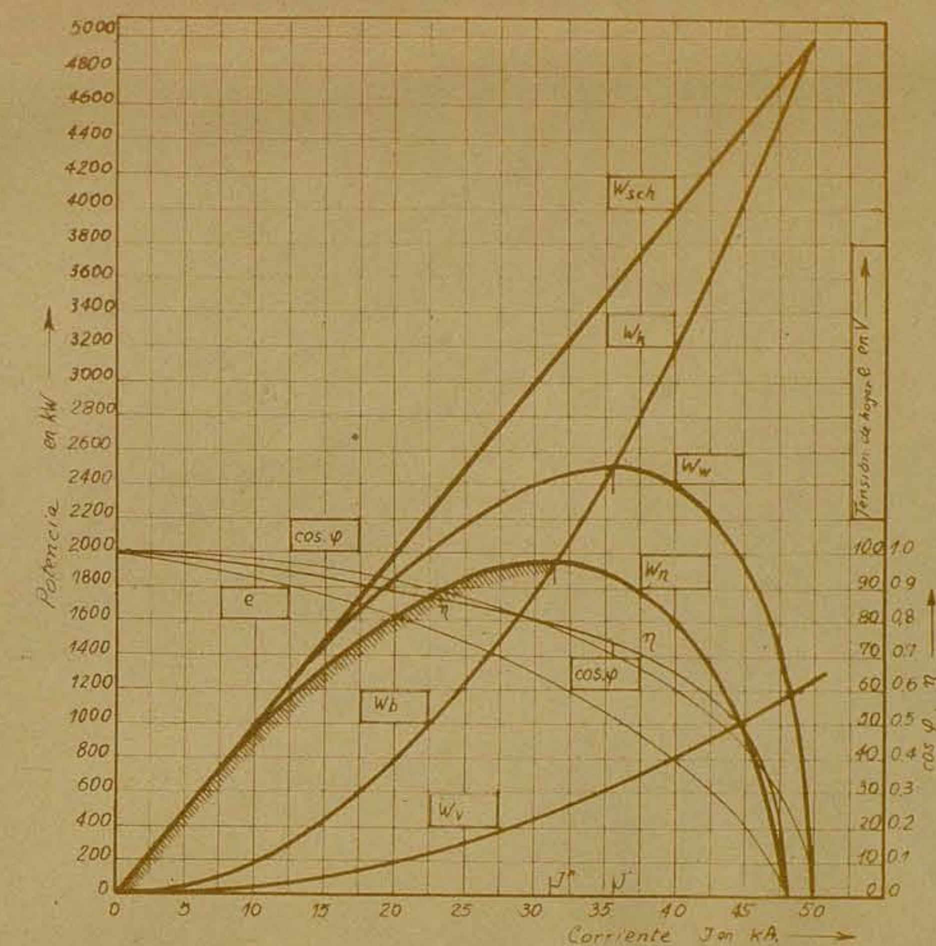


Fig. 13.

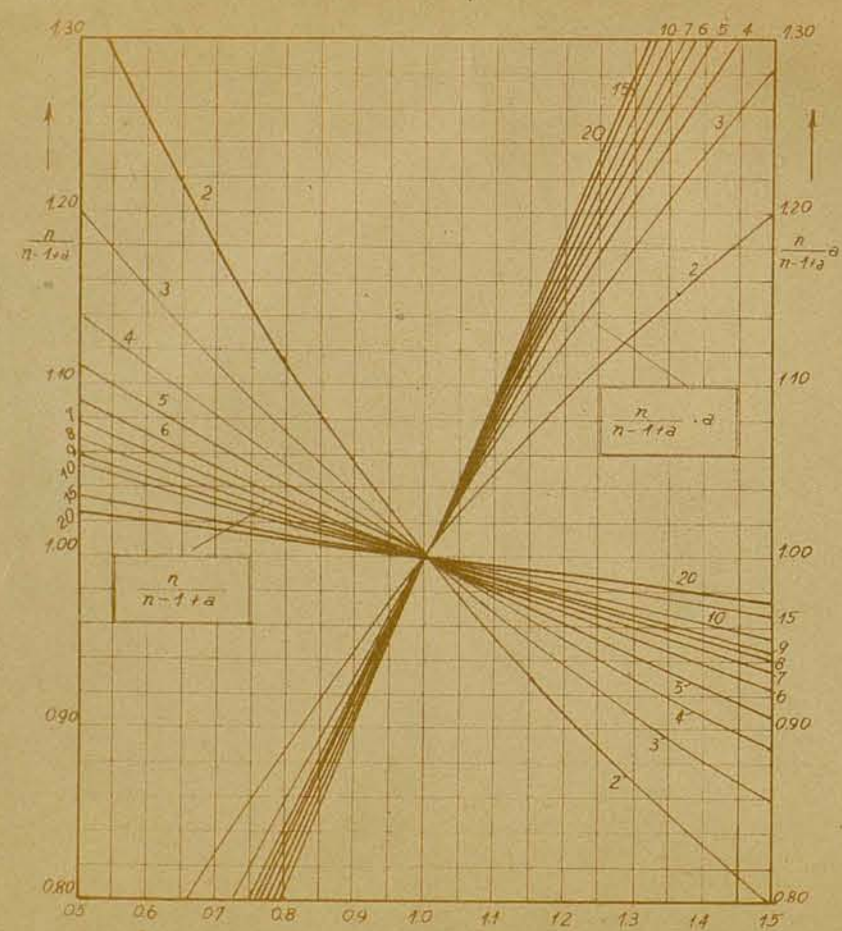
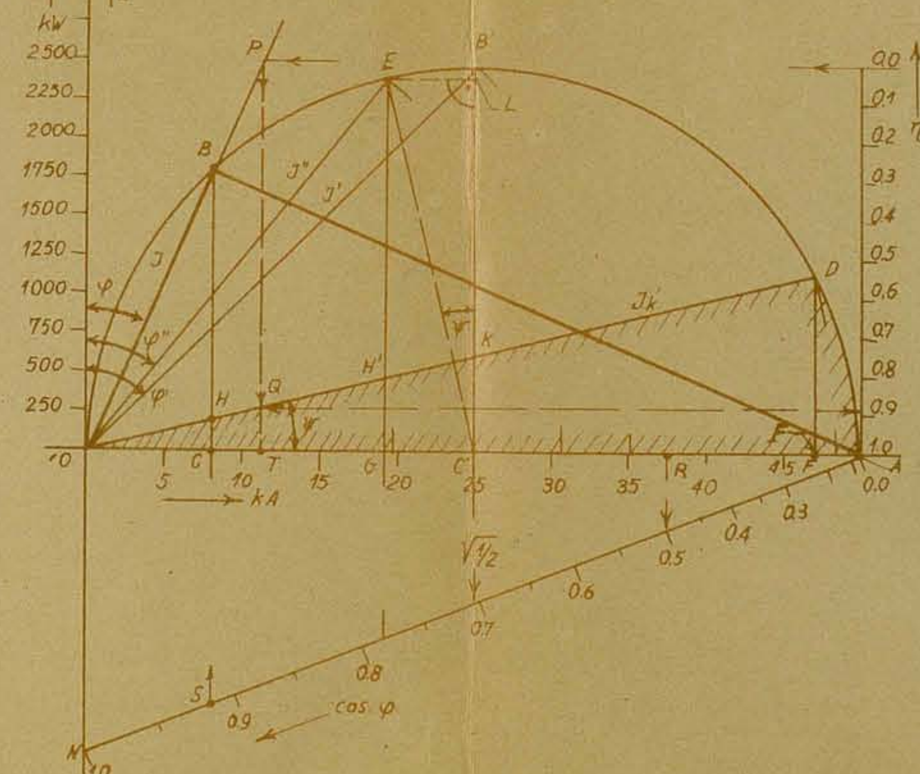


Fig. 9. Gráfico para la conexión en serie de varios hornos de c. continua



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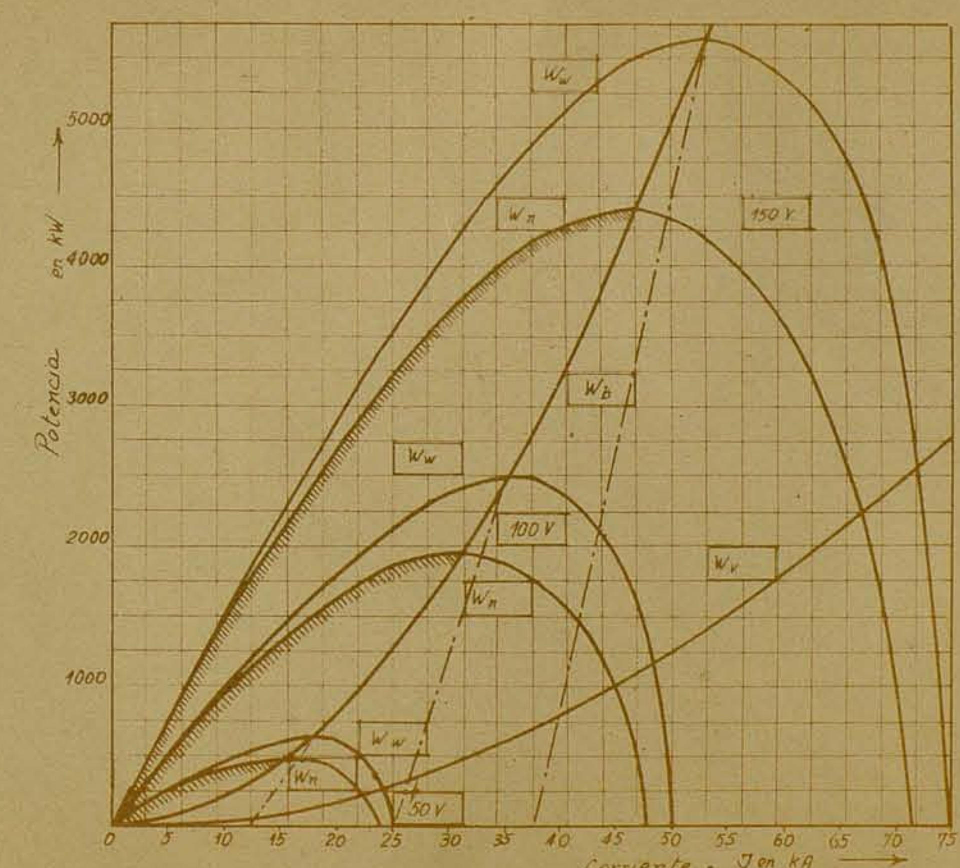
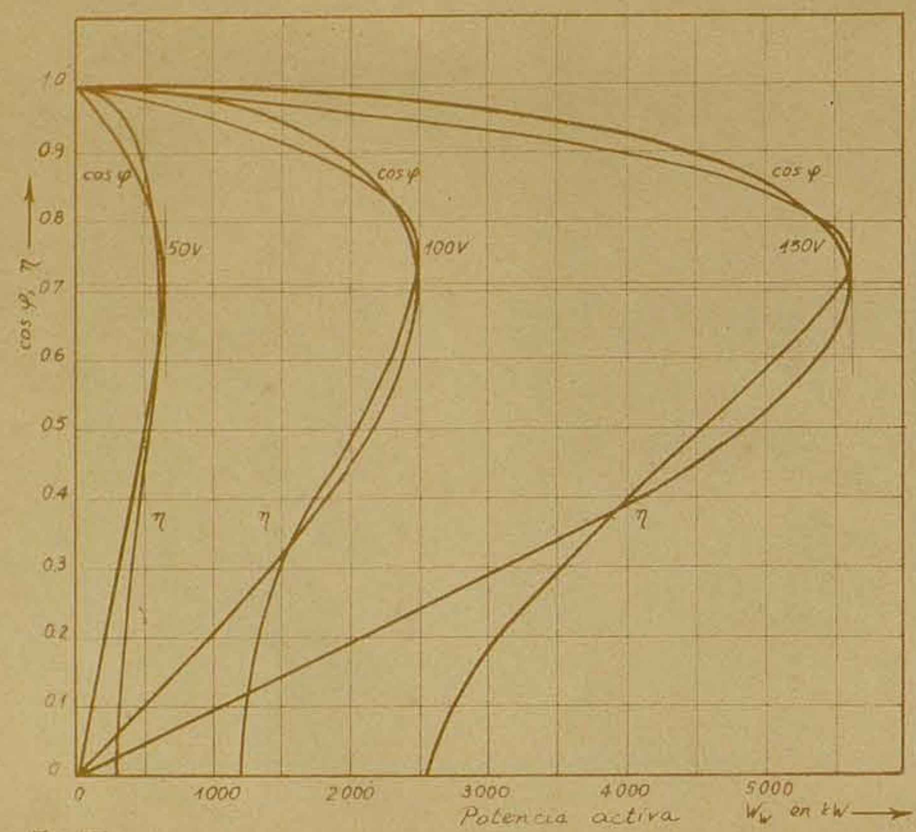


Fig. 14.



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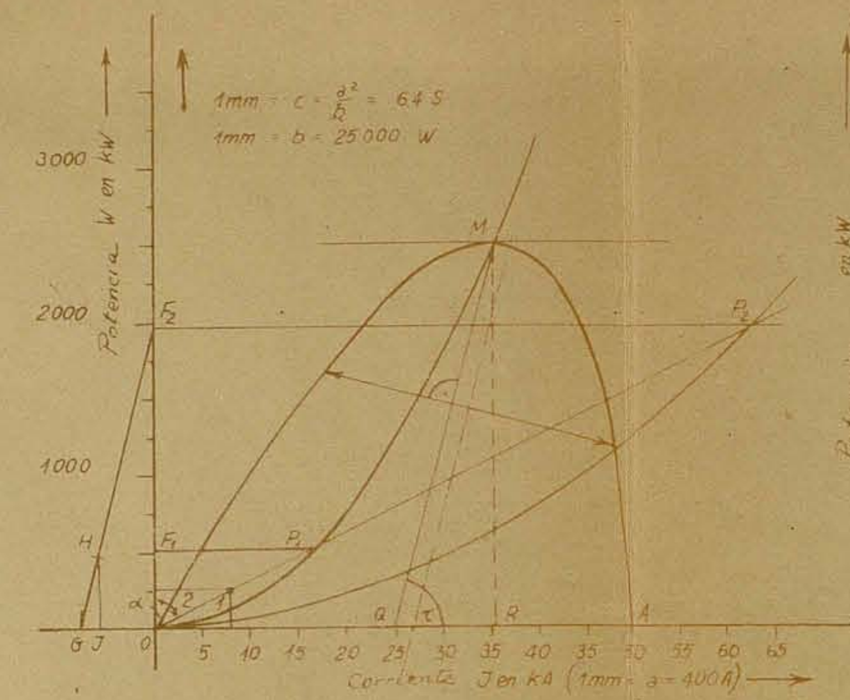


Fig. 17.

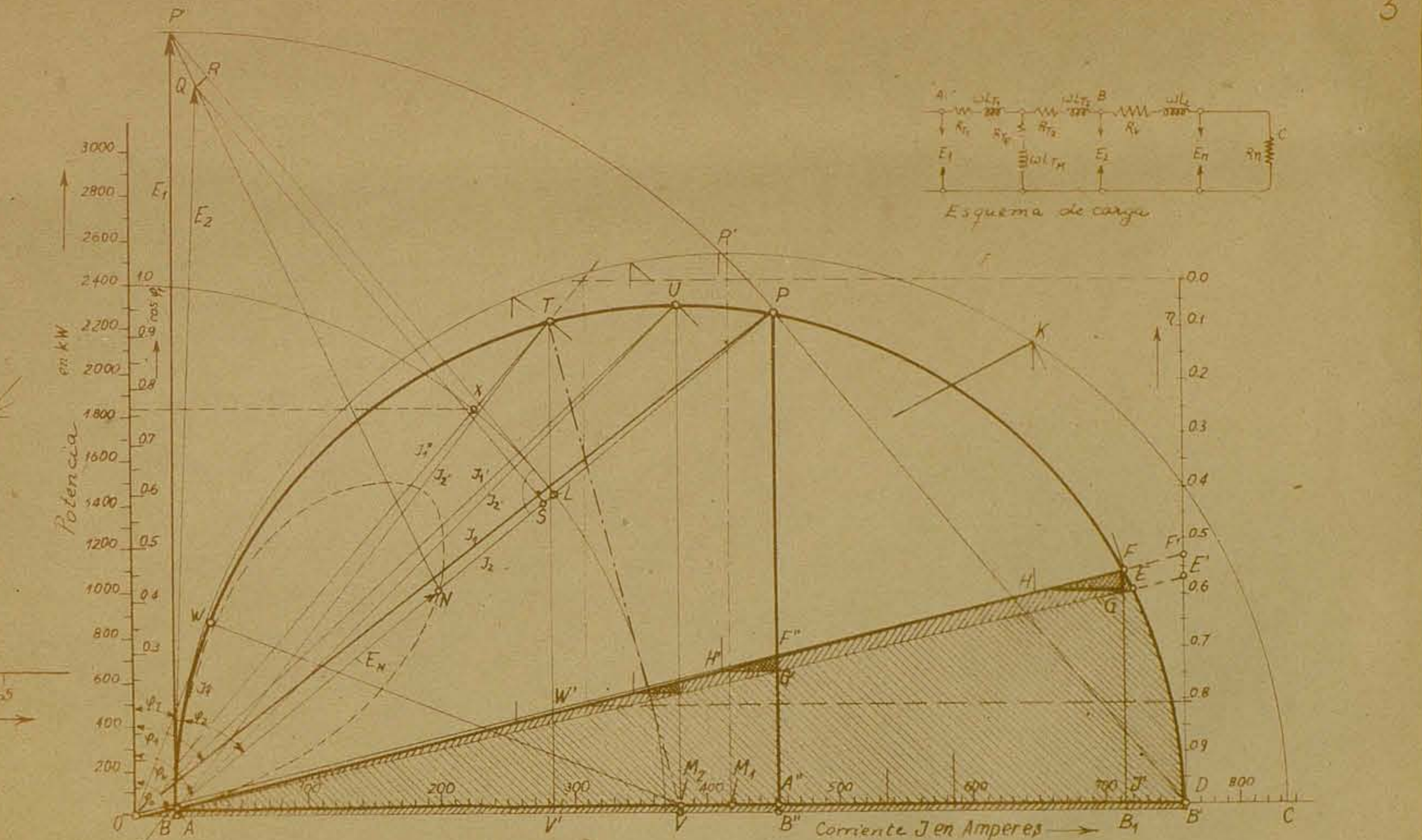


Fig. 20 Diagrama general de circulo del Horno de c. alterna teniendo en cuenta la influencia del transformador

$$\left[\begin{array}{llll} AC = I_{k_1}, & AB' = I_{kT_1}, & AF = I_{k_2}, & OF = I_{k_3} \quad \text{(Escala de corrientes)} \\ FG = I_{k_2}^2 \cdot RT, & GI' = I_{k_2}^2 \cdot R_L, & FI' = I_{k_3}^2 \cdot Rv_3, & OB'' = W_{b_1}, \quad AB'' = W_{b_1}, \quad UV = W_{w_1 m} \\ = W_{V_T} & = W_{V_L} & = W_V & J'B_1 = W_{V_e}, \quad FB_1 = W_{V\,ges.} \end{array}\right]$$

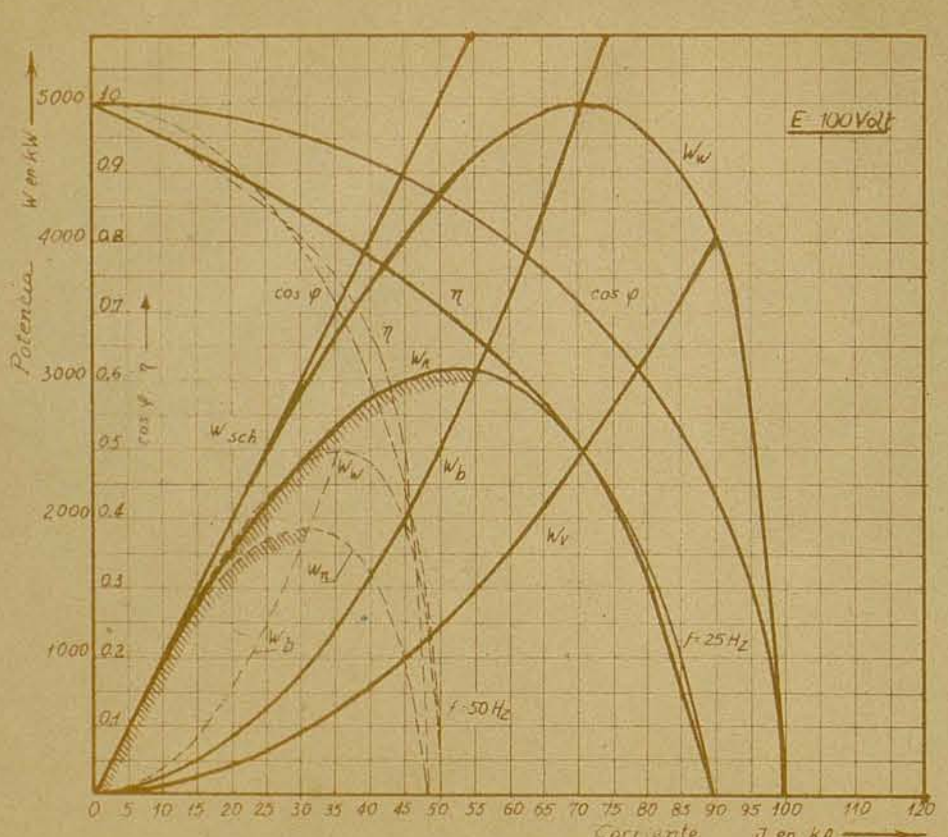


Fig. 16.

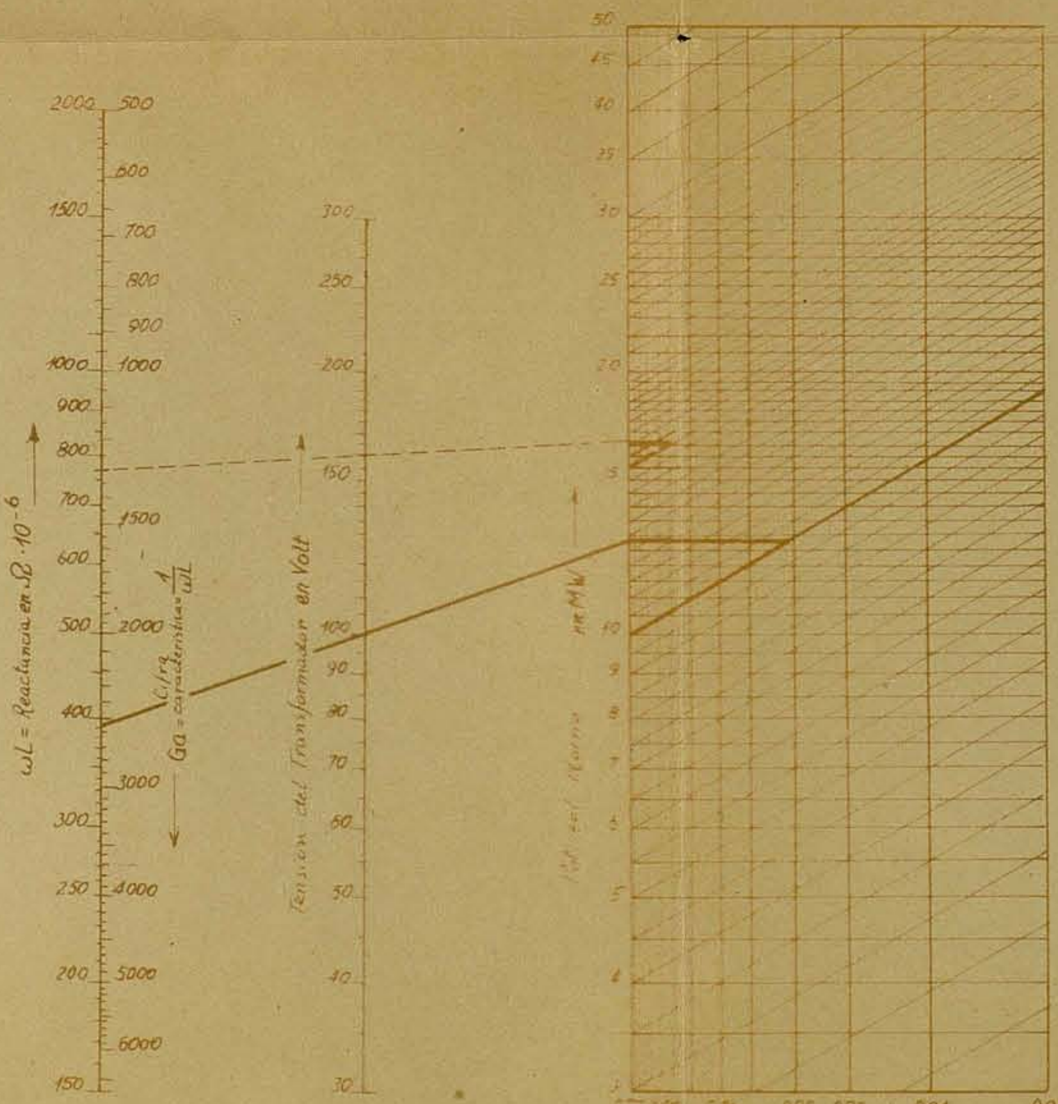


Fig. 19. Abaco para la determinación de la pot. activa, partiendo de la cifra característica, la tensión del transformador y el factor de potencia.

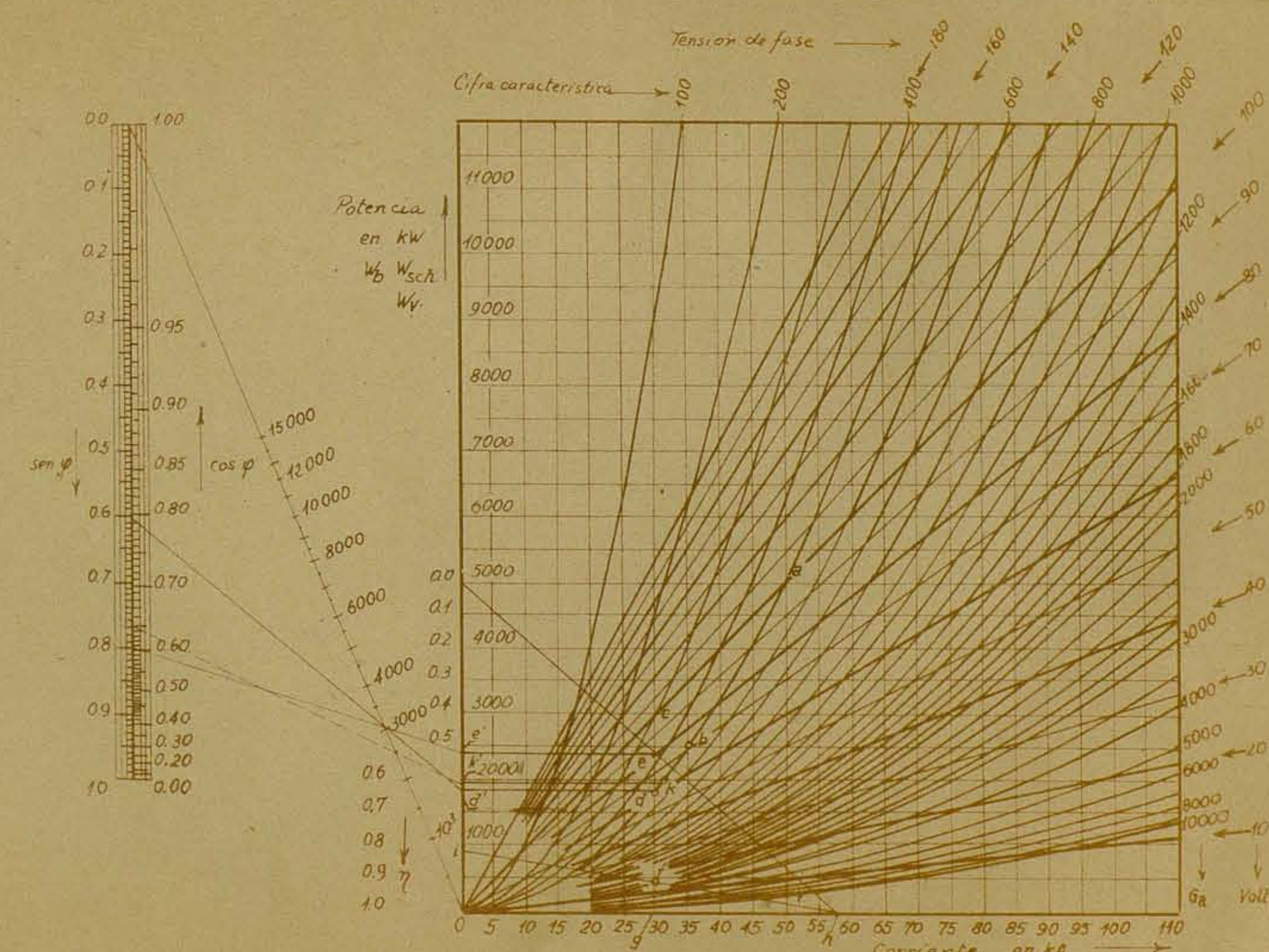


Fig. 18. Abaco para hornos de electrodo de c. alterna

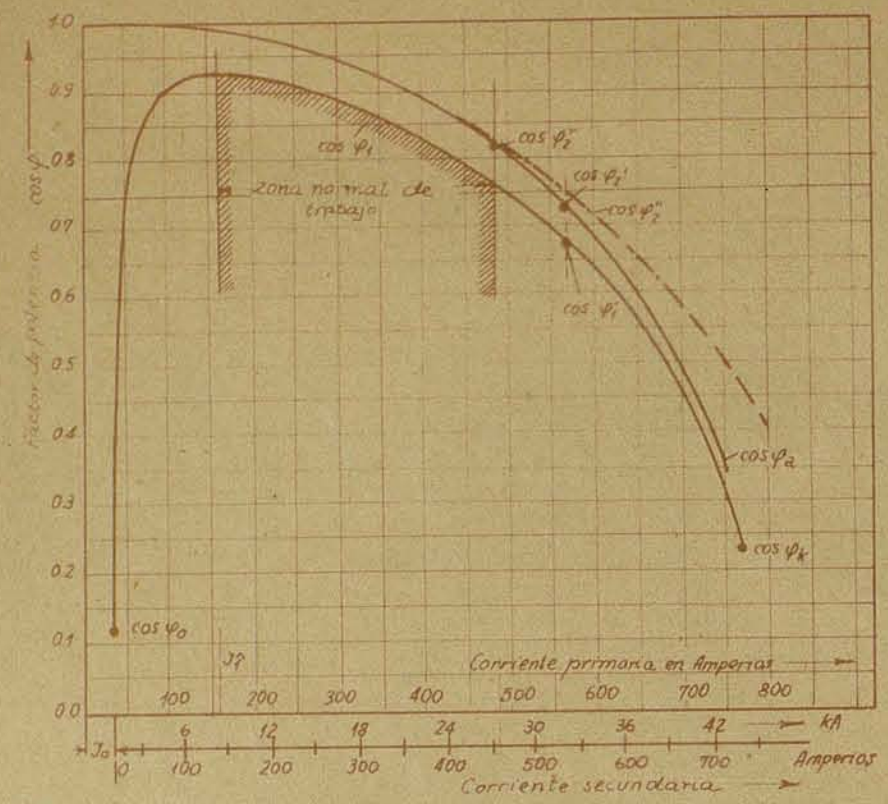


Fig. 21.

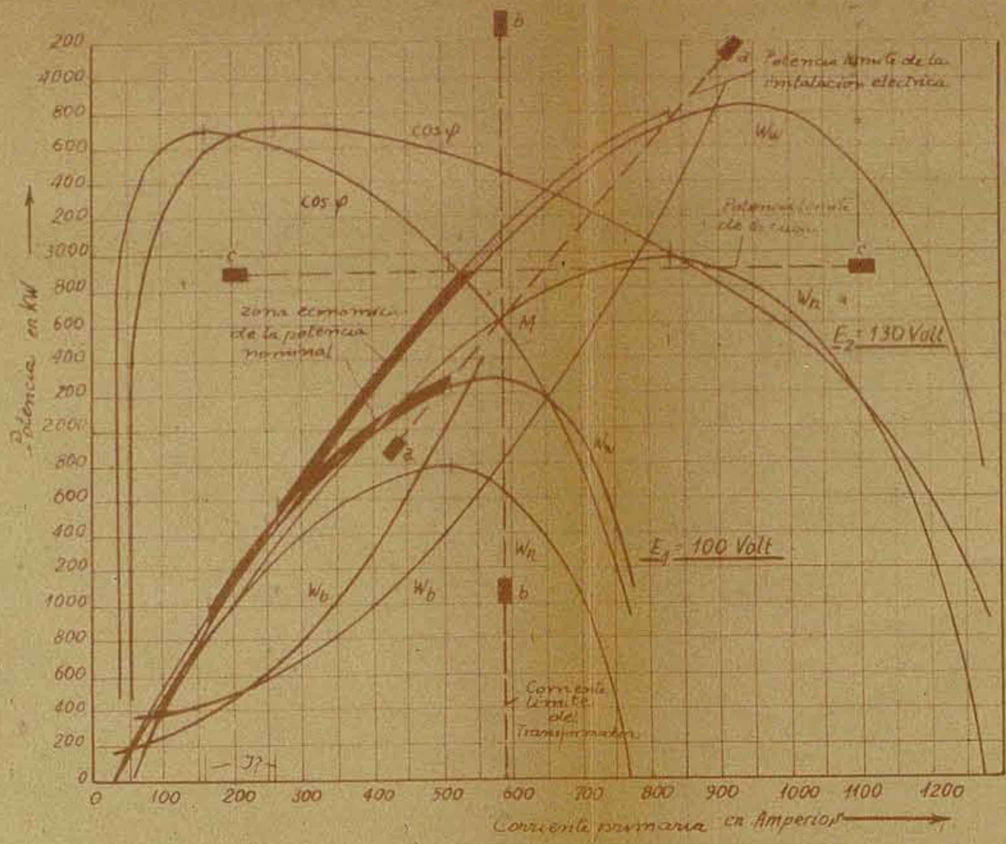


Fig. 25.

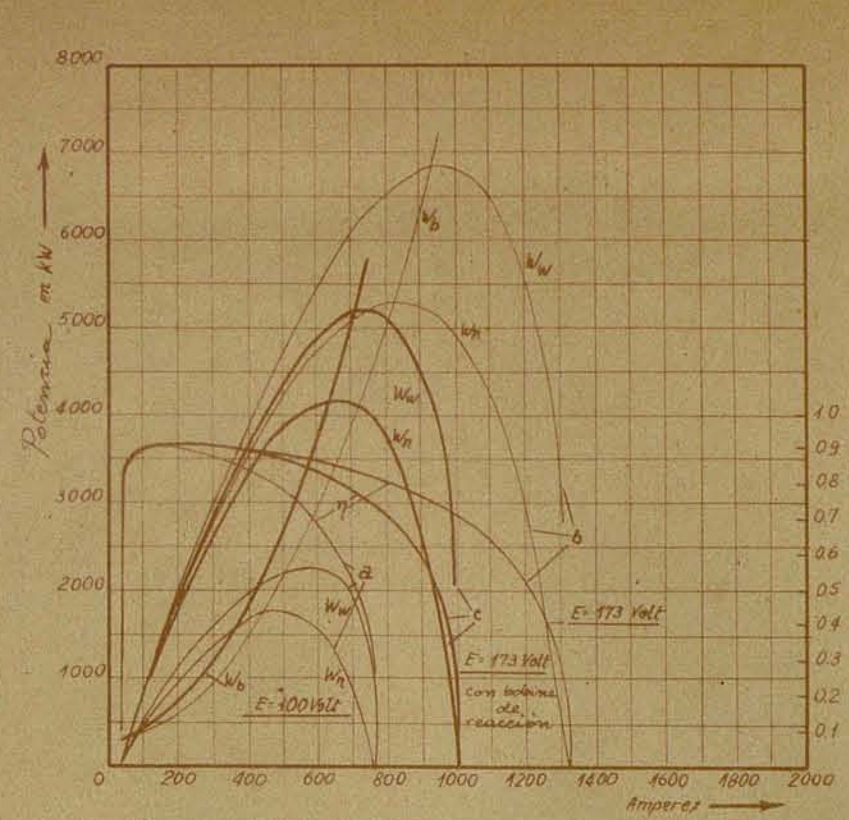
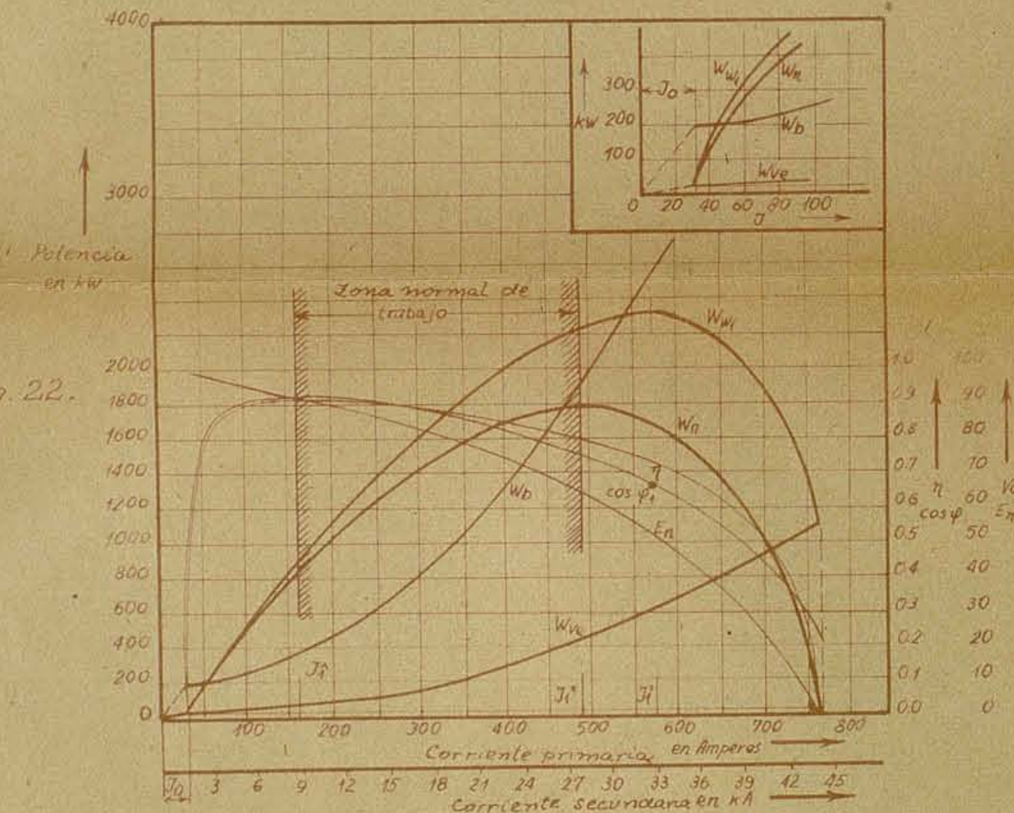


Fig. 26.

Fig. 22.



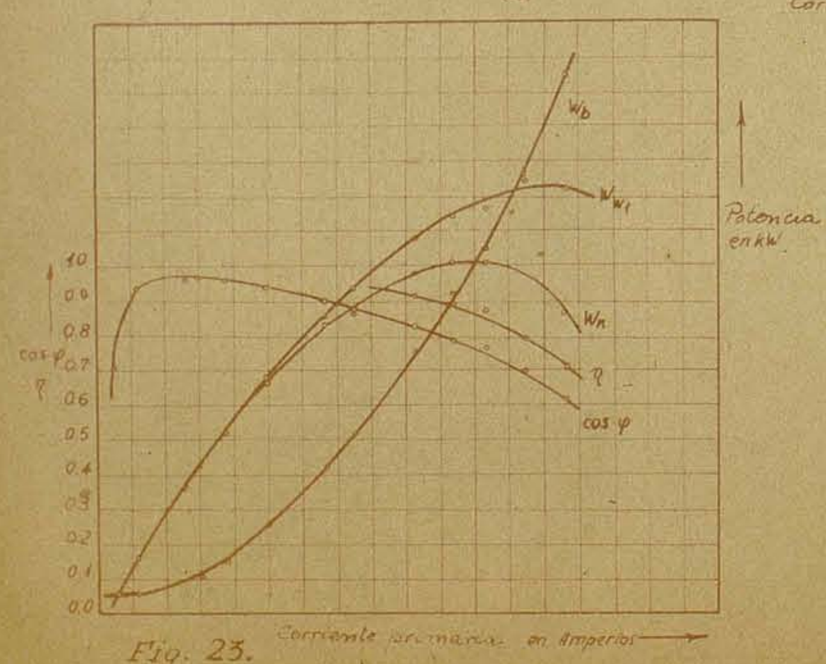


Fig. 23.

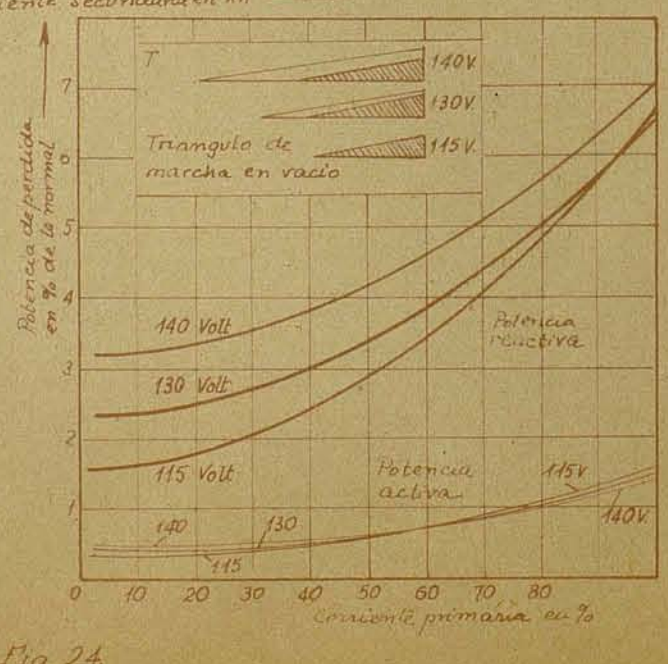


Fig. 24.

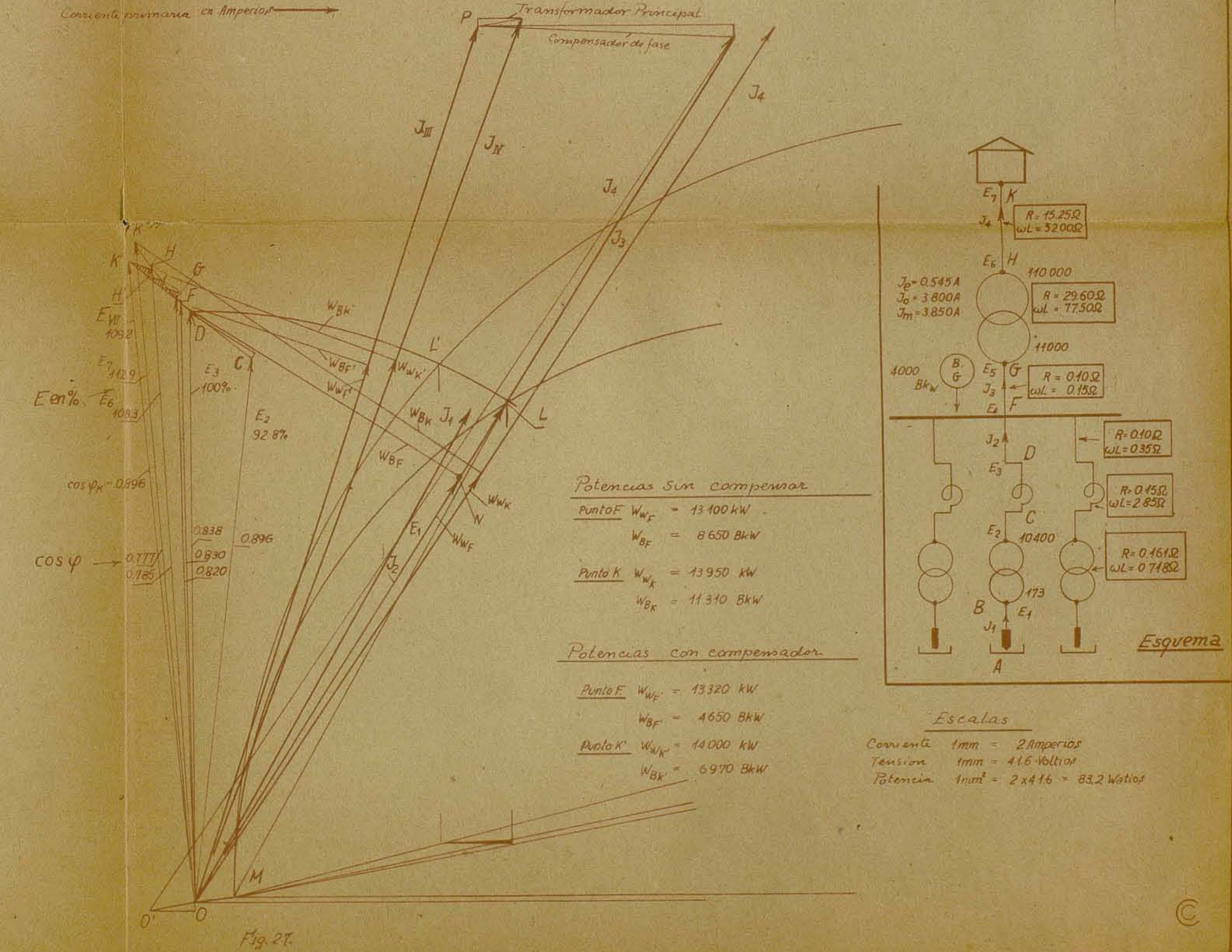


Fig. 27.

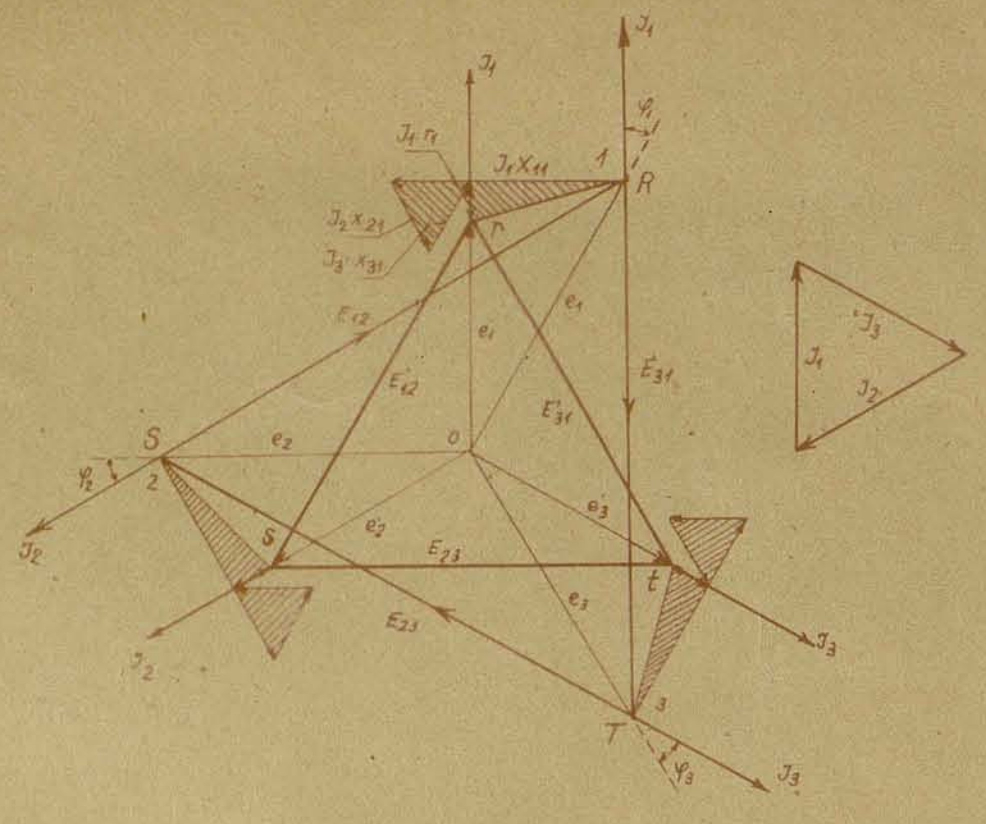
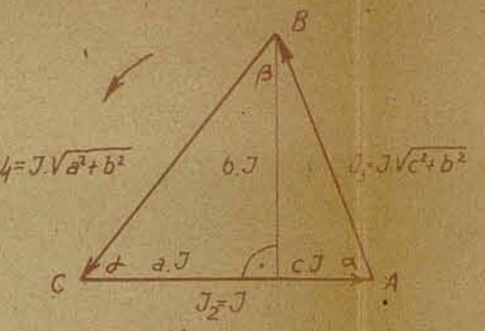


Fig.28.



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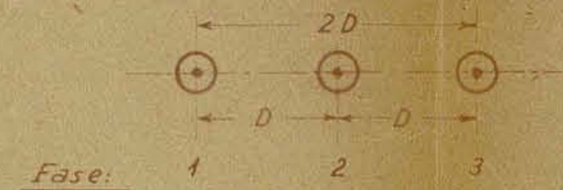


Fig.30

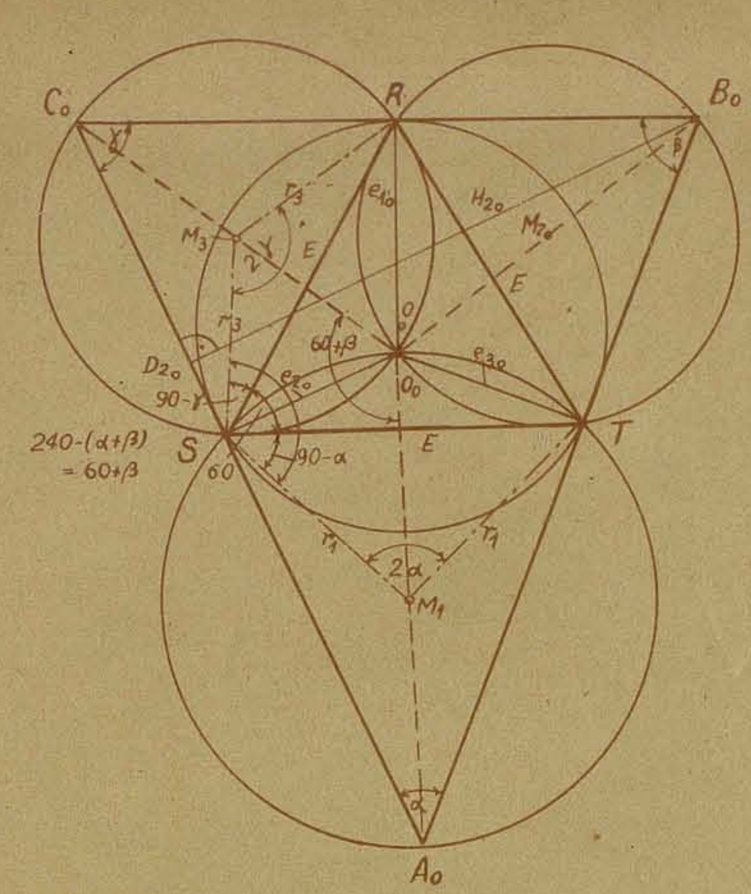


Fig. 33.

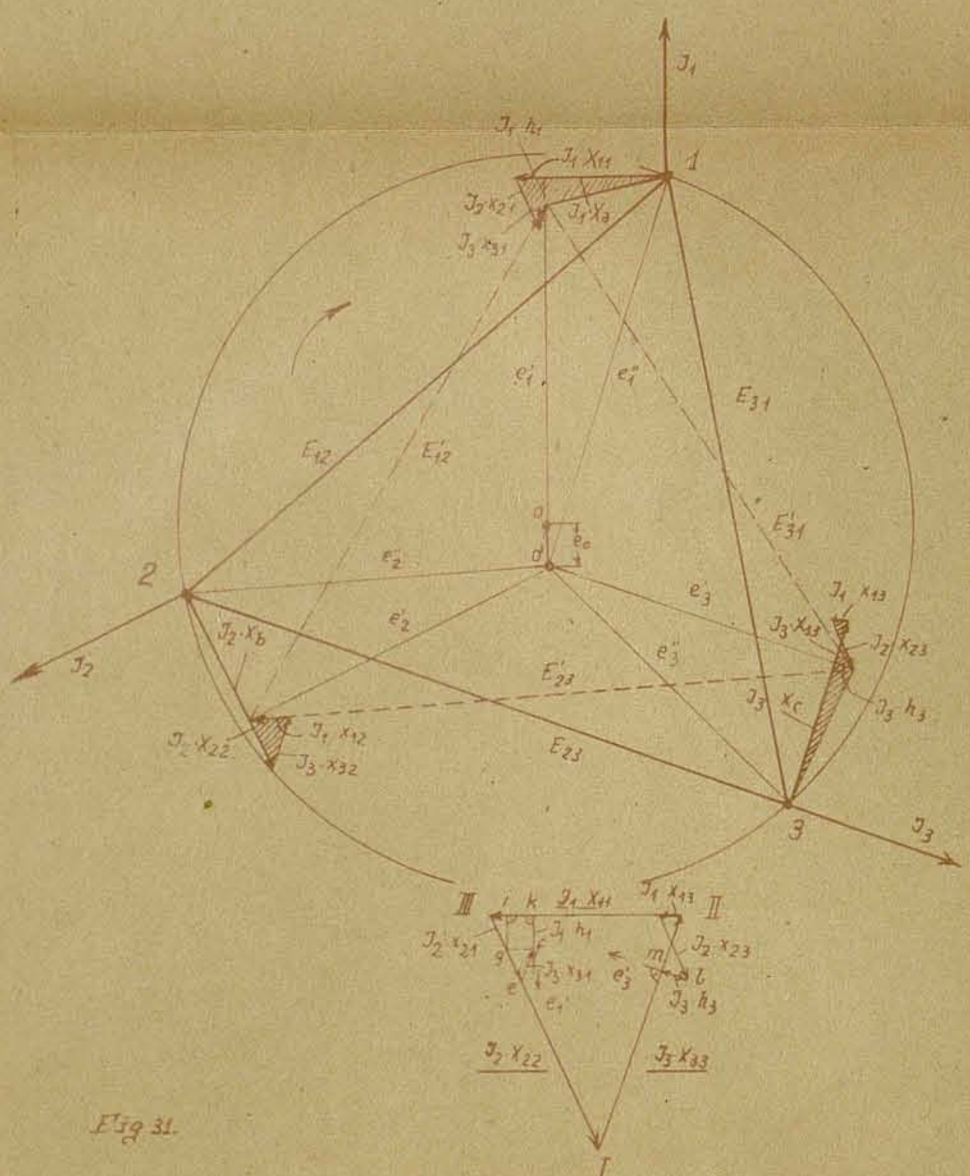
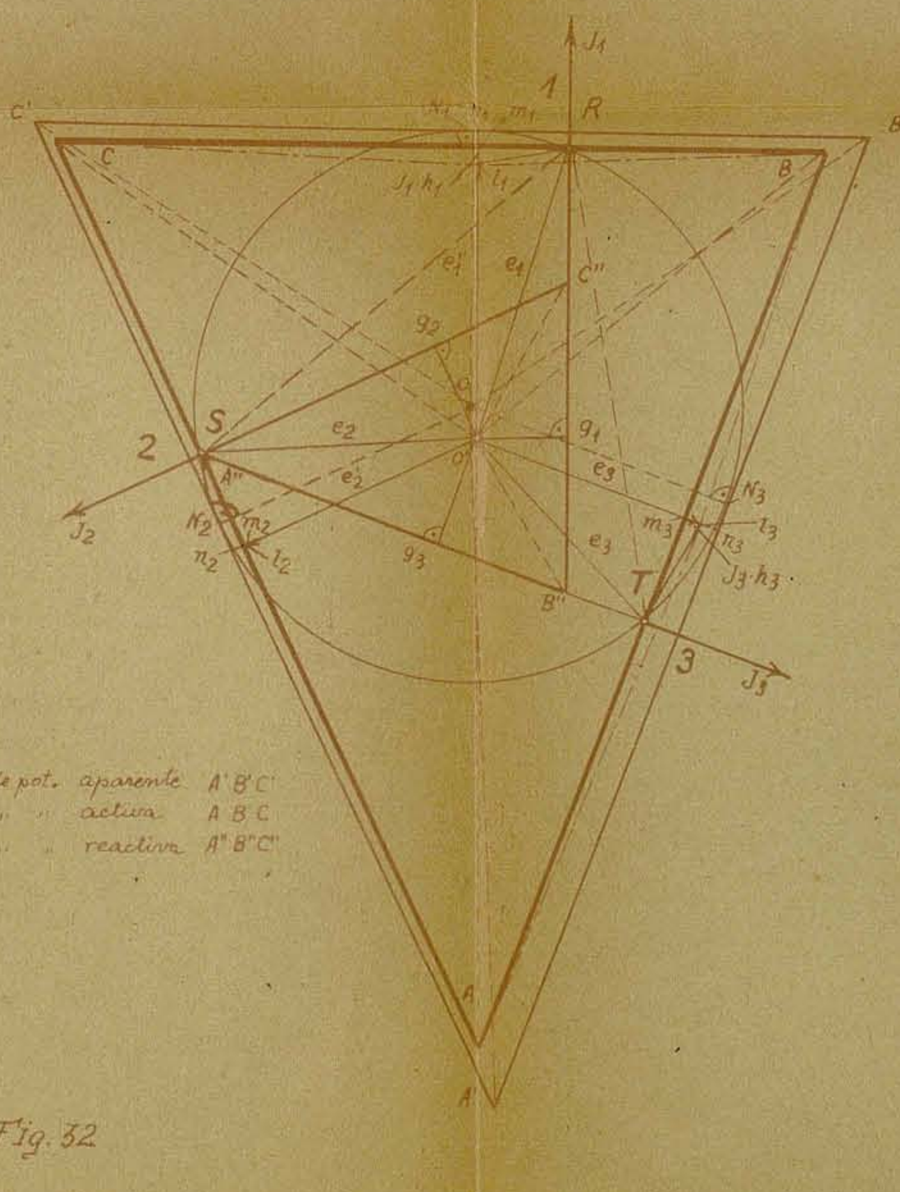


Fig 31.



Triangulo de pot. aparente A' B' C'
" " " activa A B C
" " " reactiva A'' B'' C''

Fig. 32

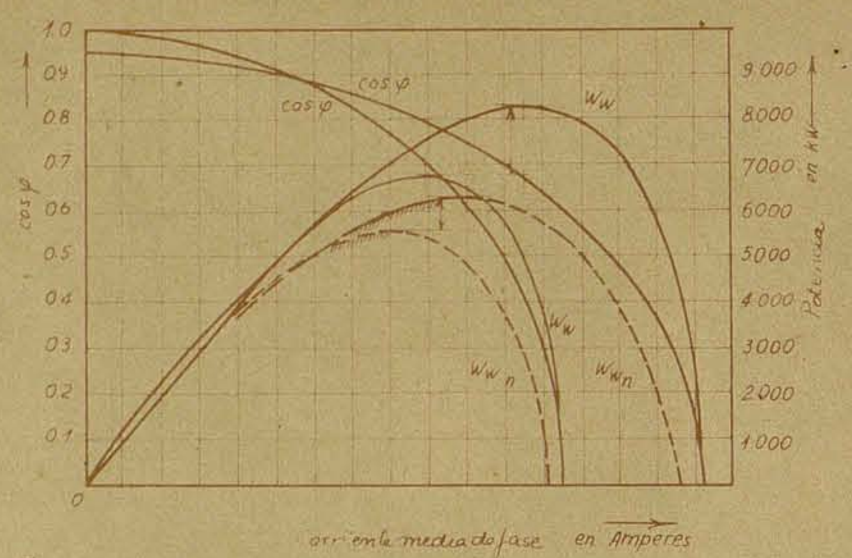
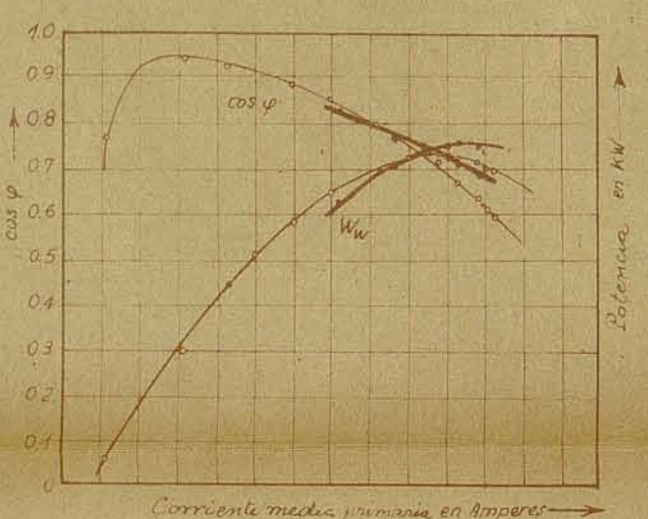


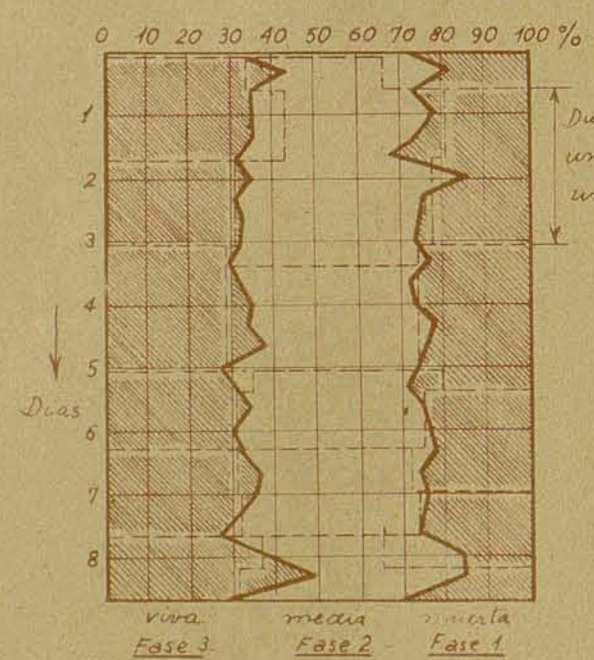
Fig 34.



Carga simétrica

" asimétrica

Fig 35.



Potencia de fusión

Consumo de electrodos/hora

Fig 36.

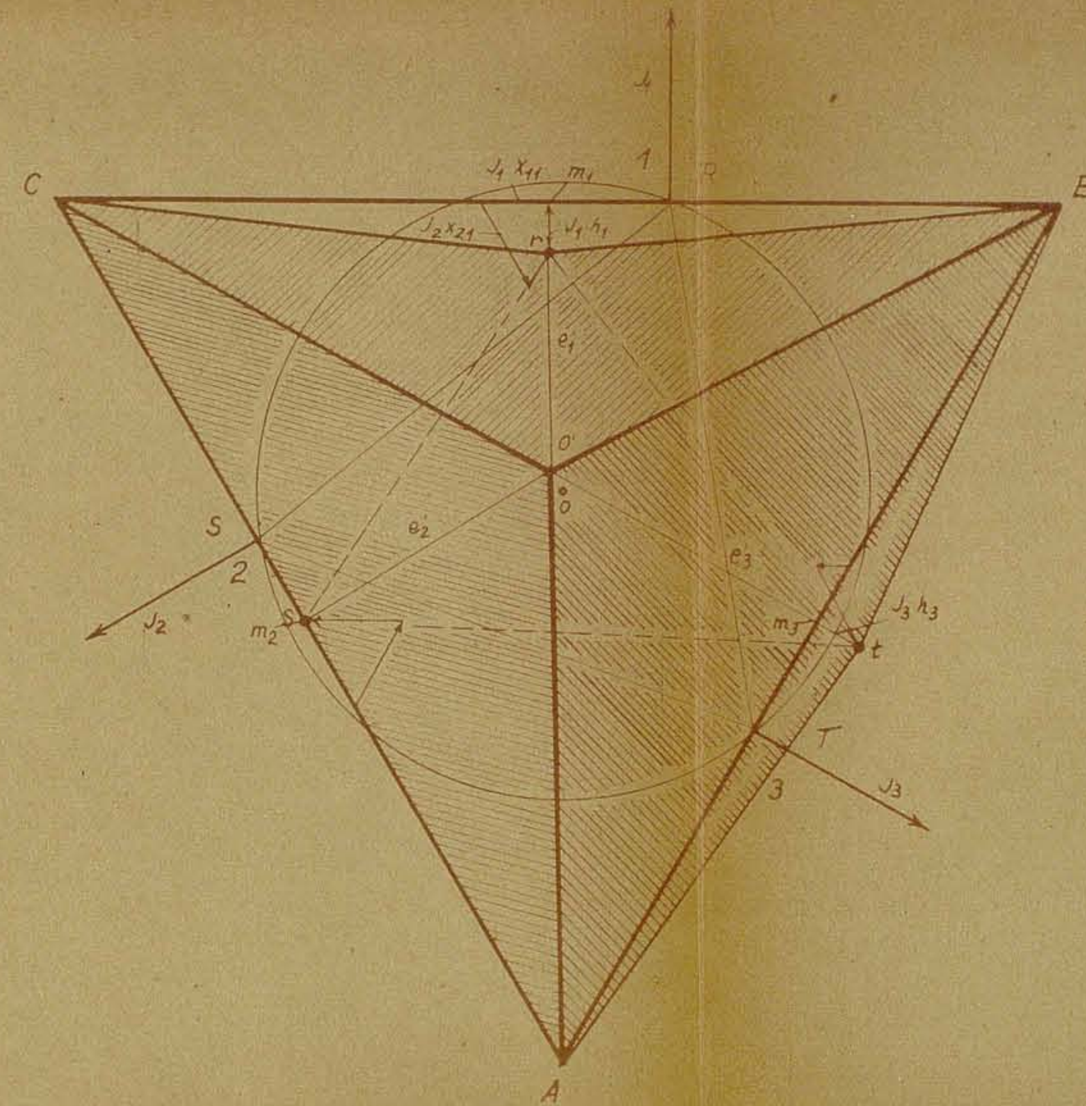


Fig 37.

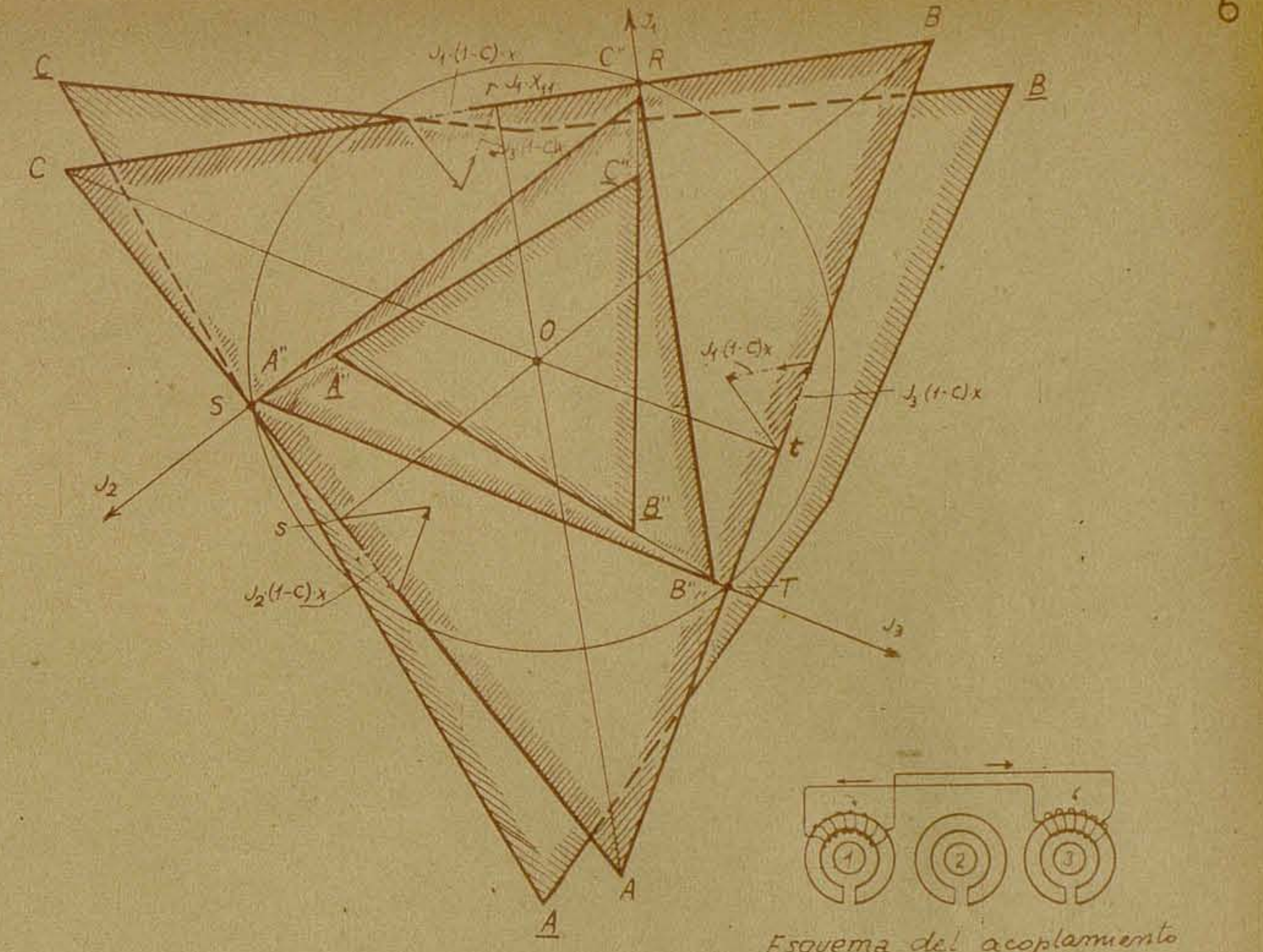


Fig 39.

Esquema del acoplamiento adicional

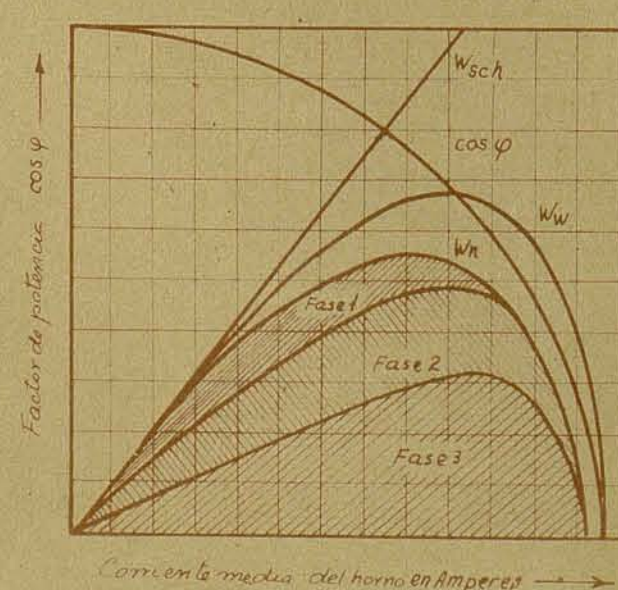


Fig 38.

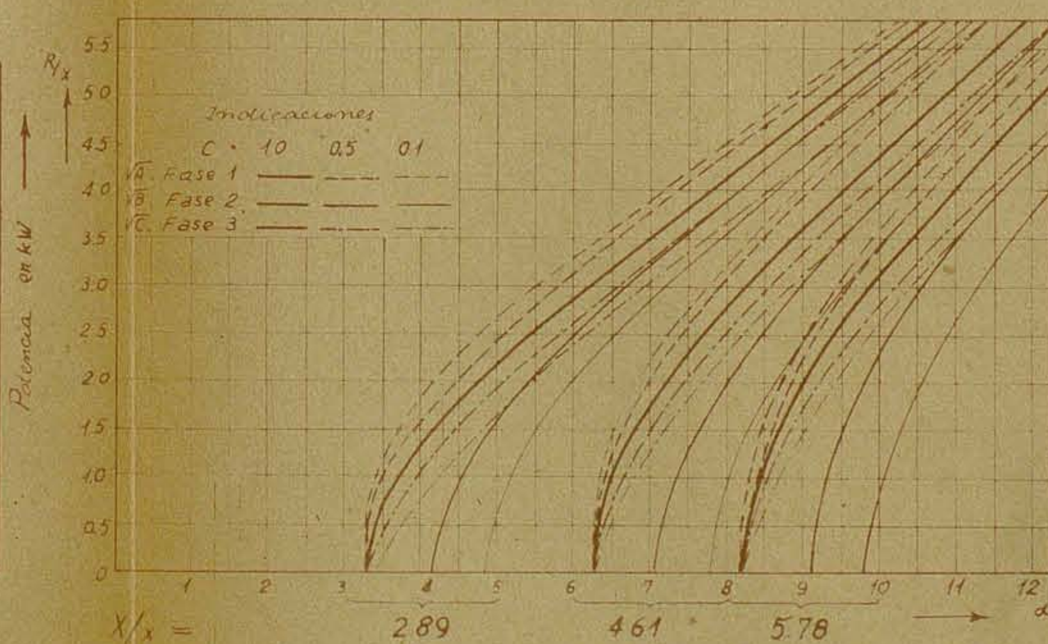


Fig 40.

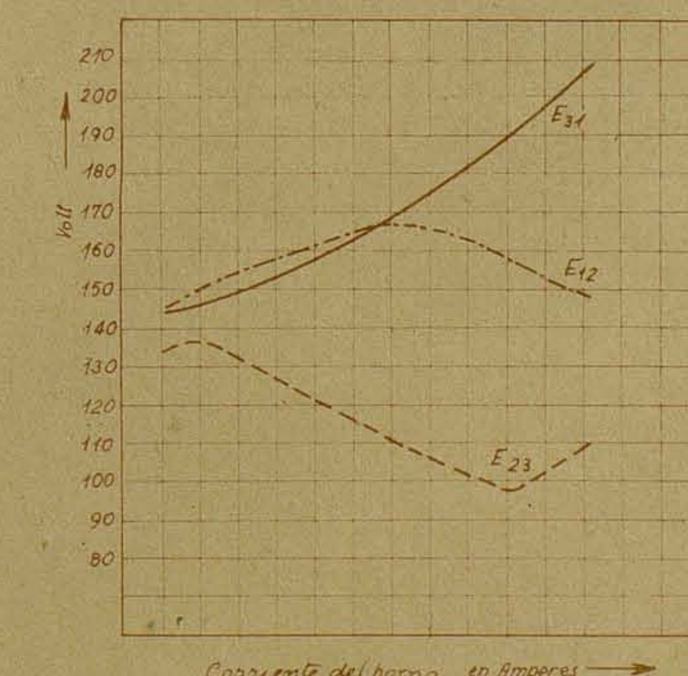


Fig 41.

©

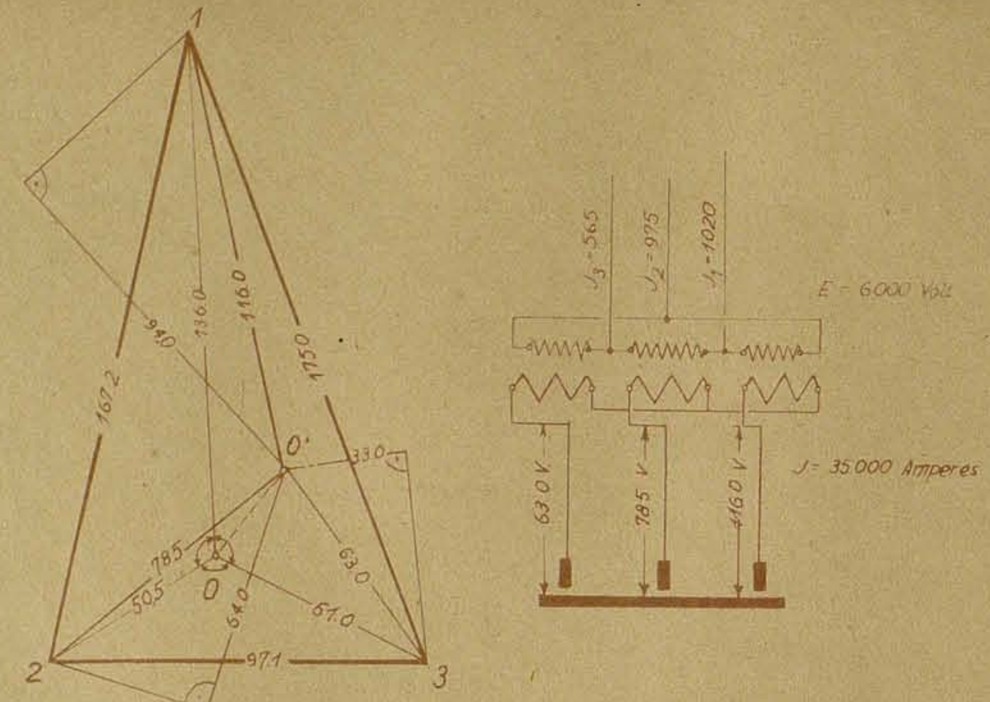


Fig 42.

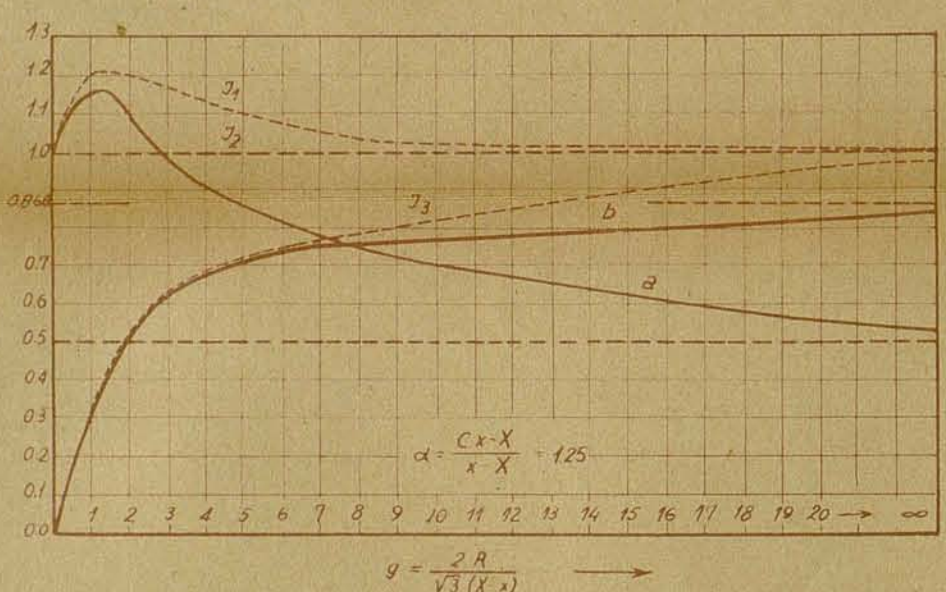


Fig. 43.

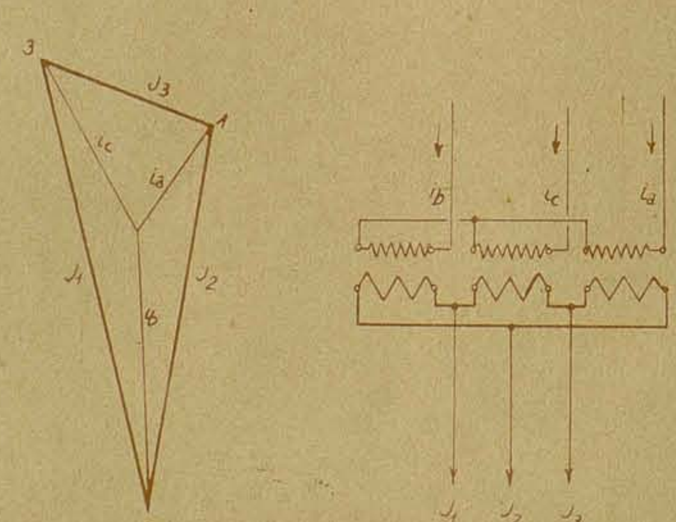
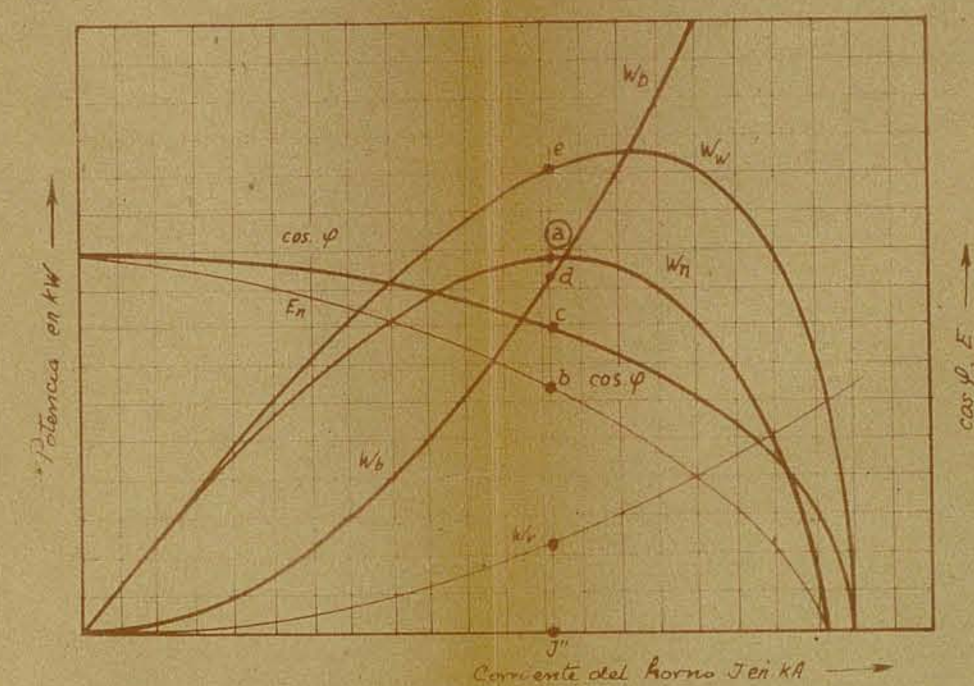


Fig 44.



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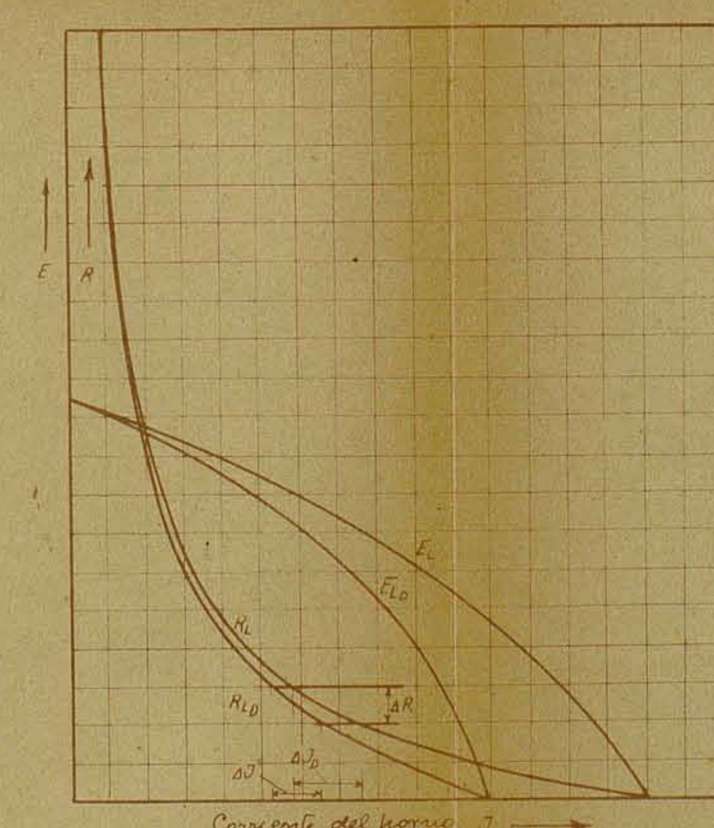


Fig 46a.

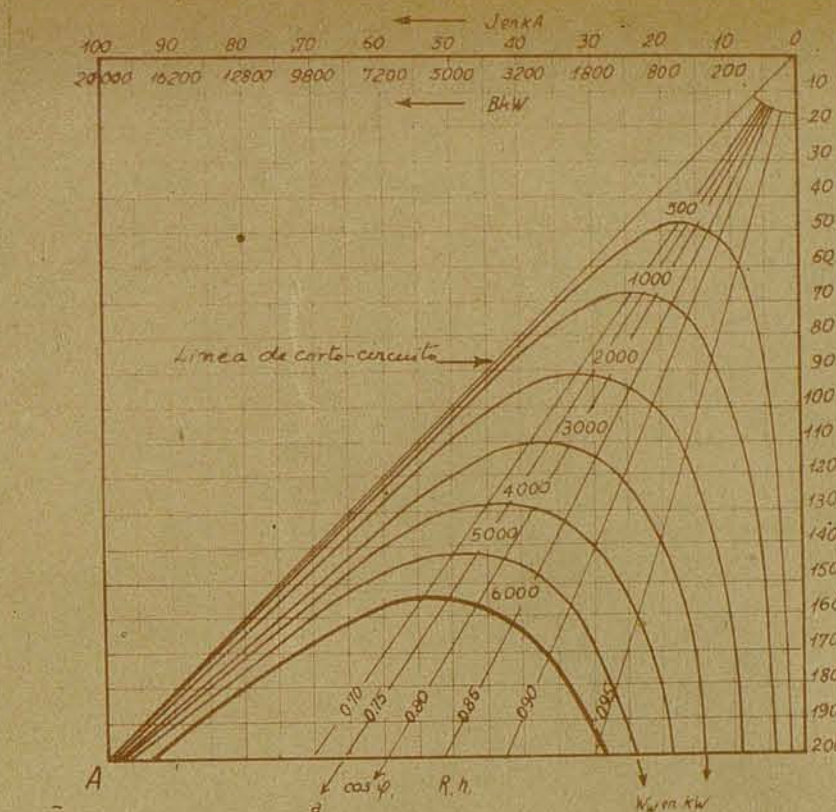


Fig 47.

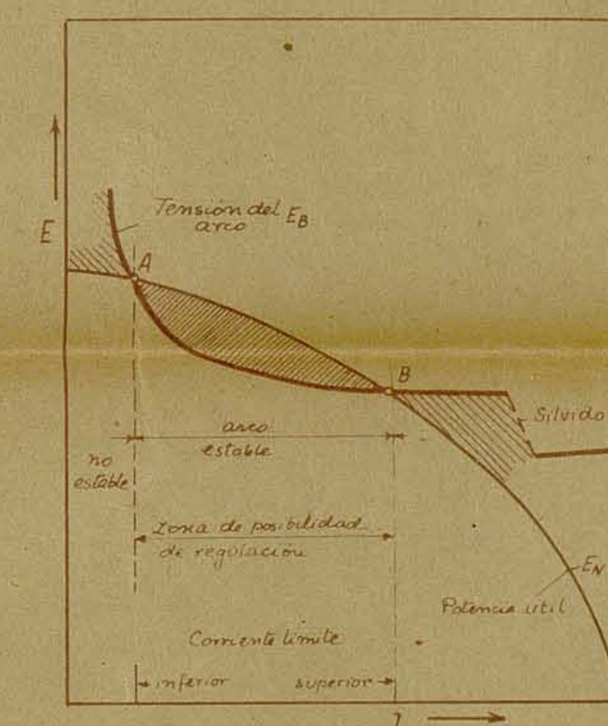


Fig 48.

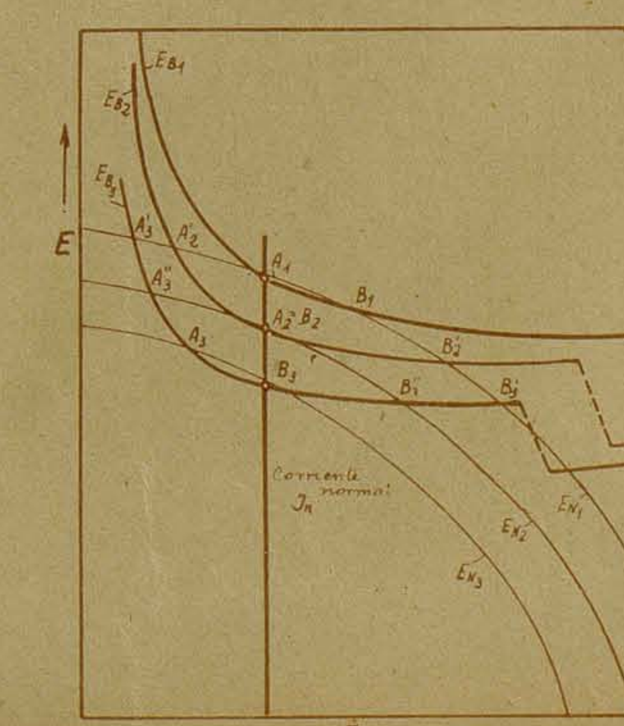


Fig 49

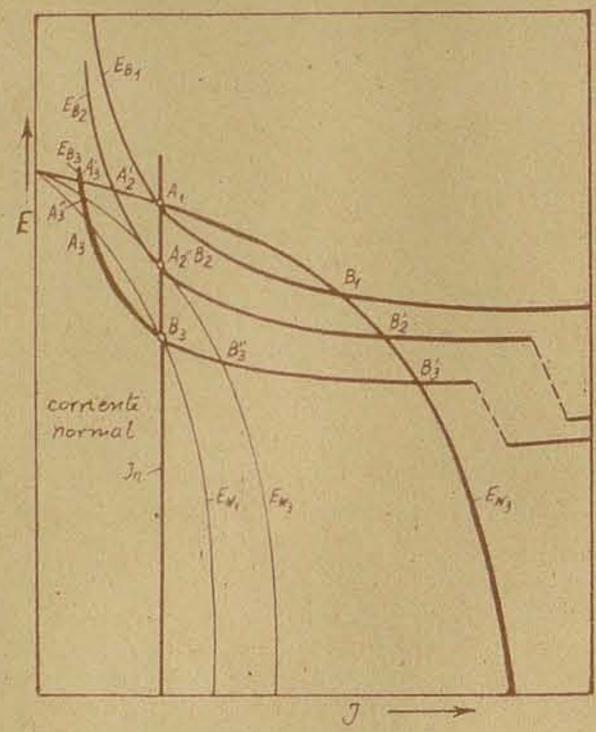


Fig. 50.

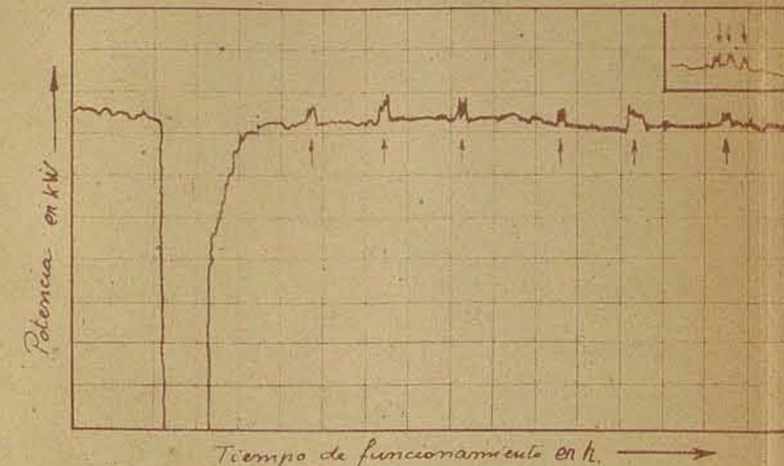
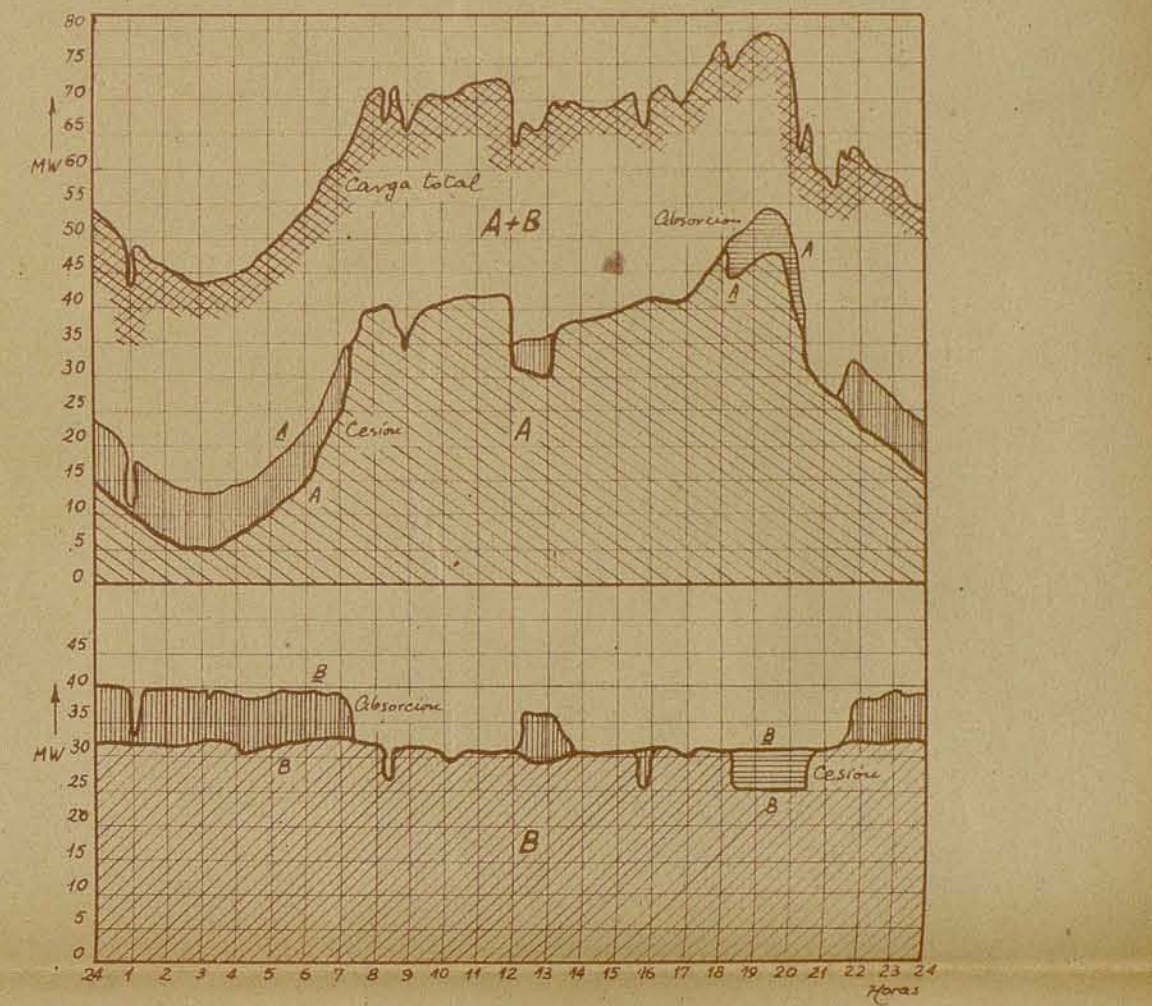


Fig. 55.



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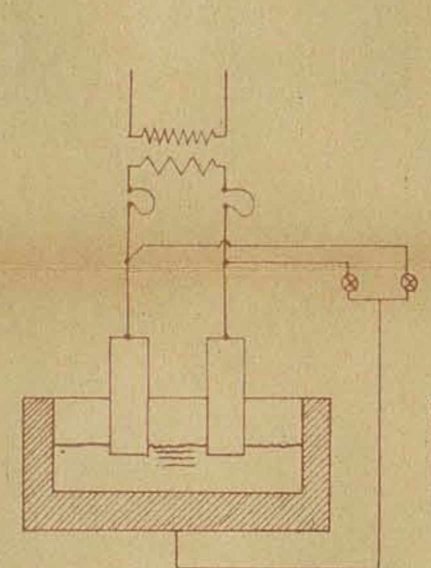


Fig. 51

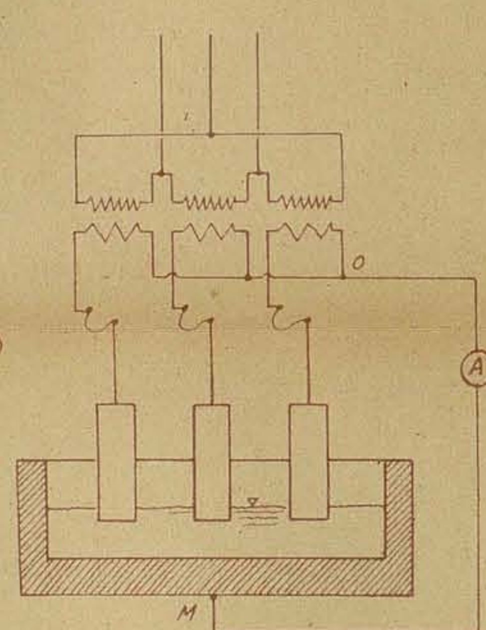


Fig. 52.

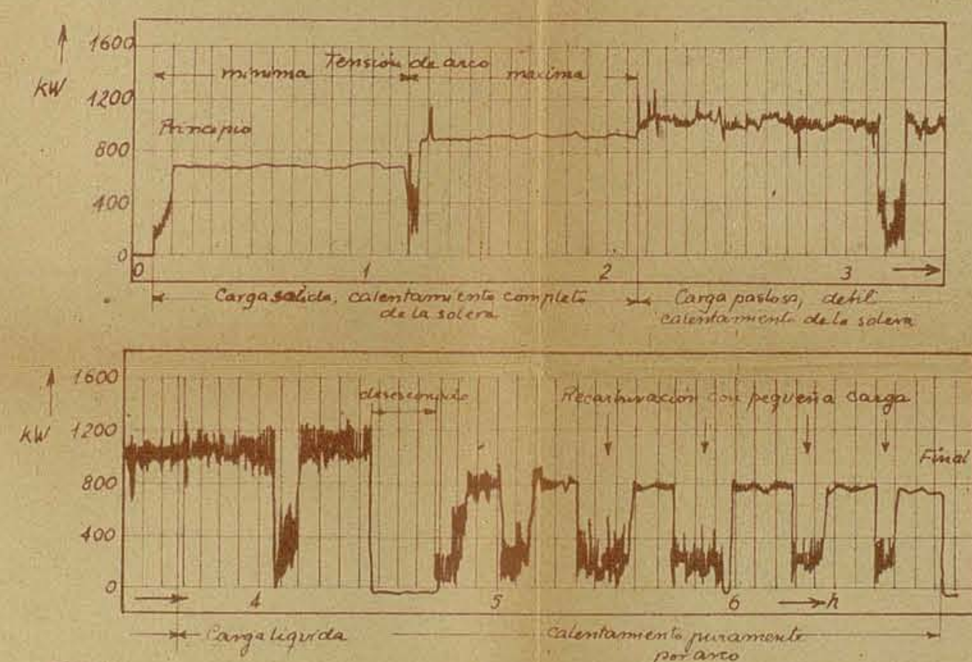


Fig. 56.

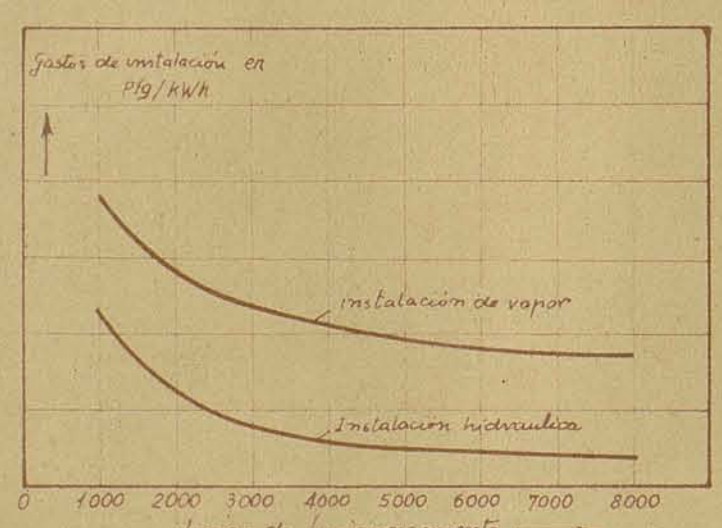
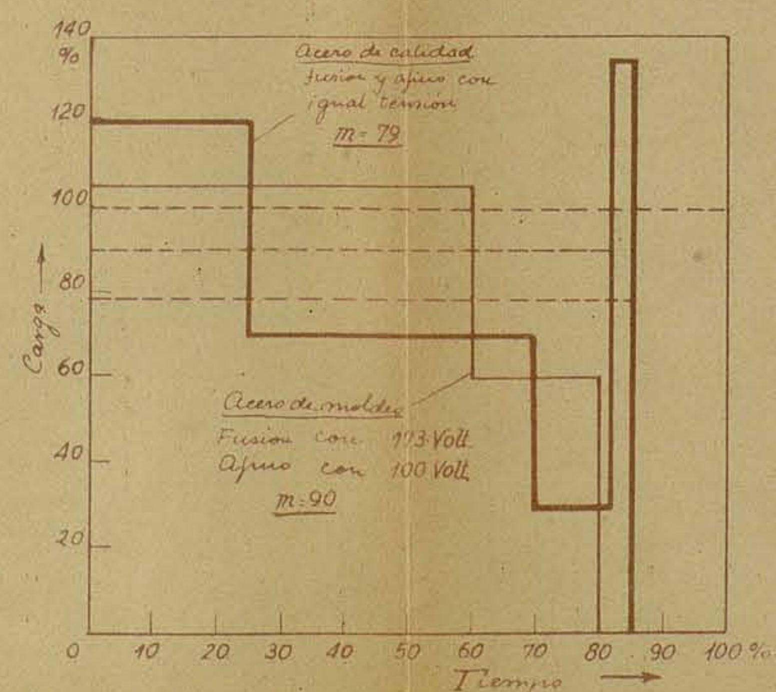


Fig. 53.



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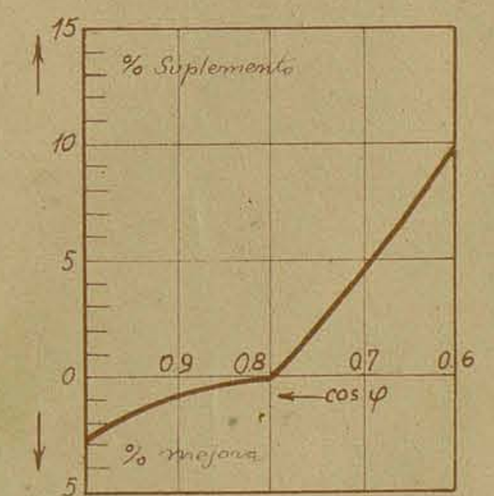


Fig. 59.

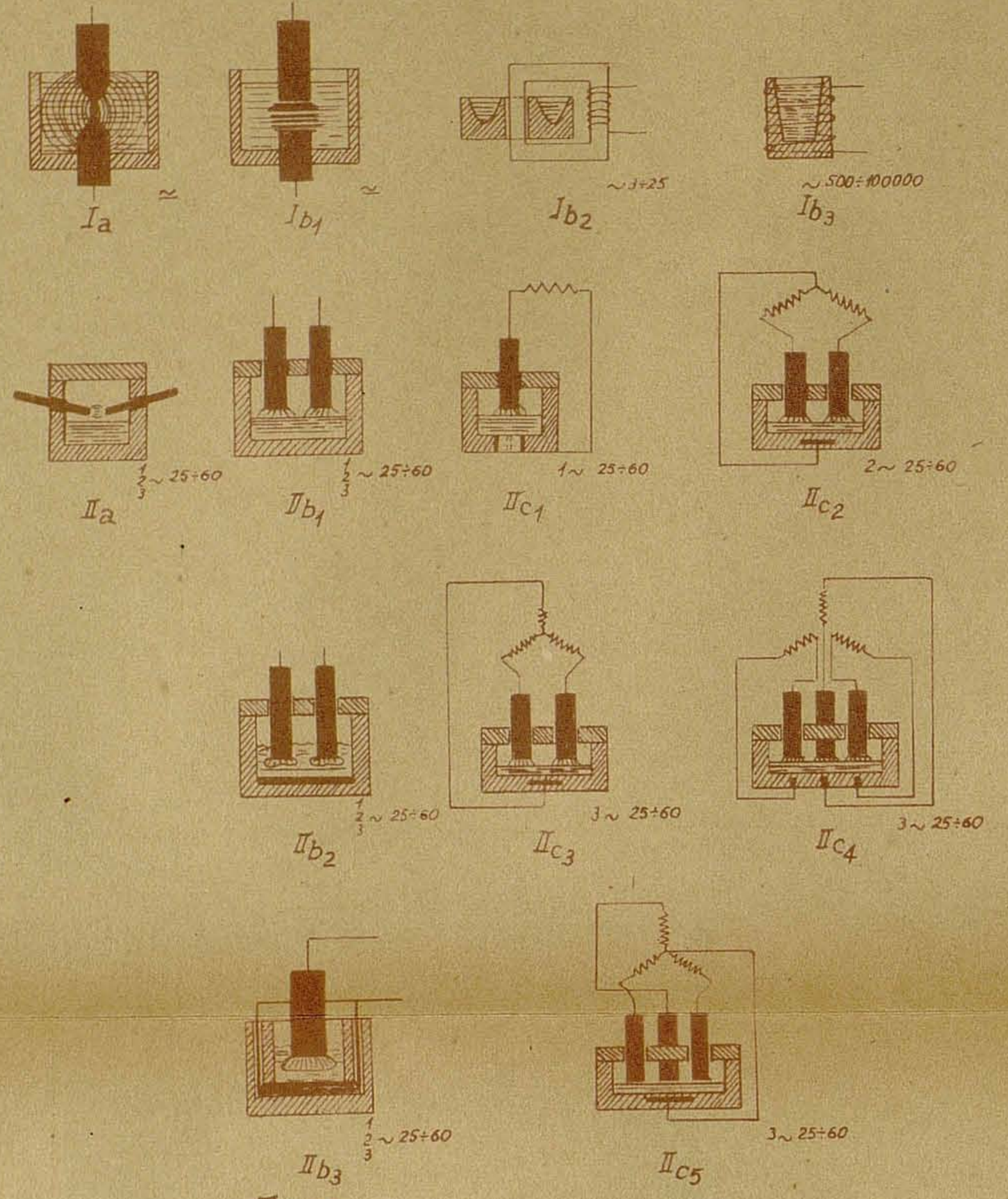


Fig. 60.

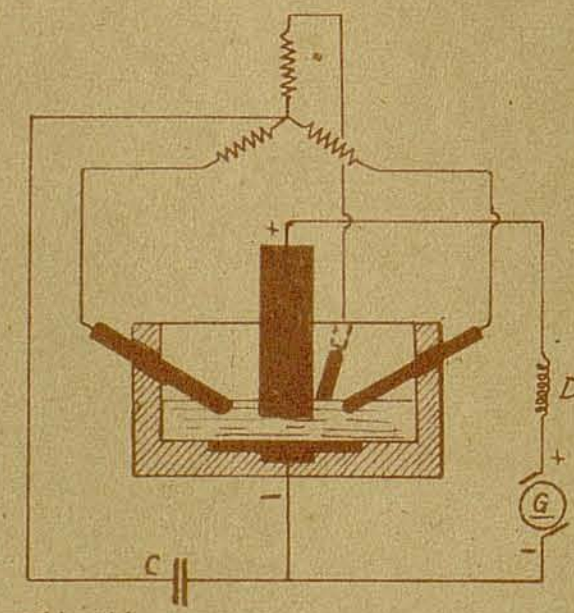


Fig. 61.

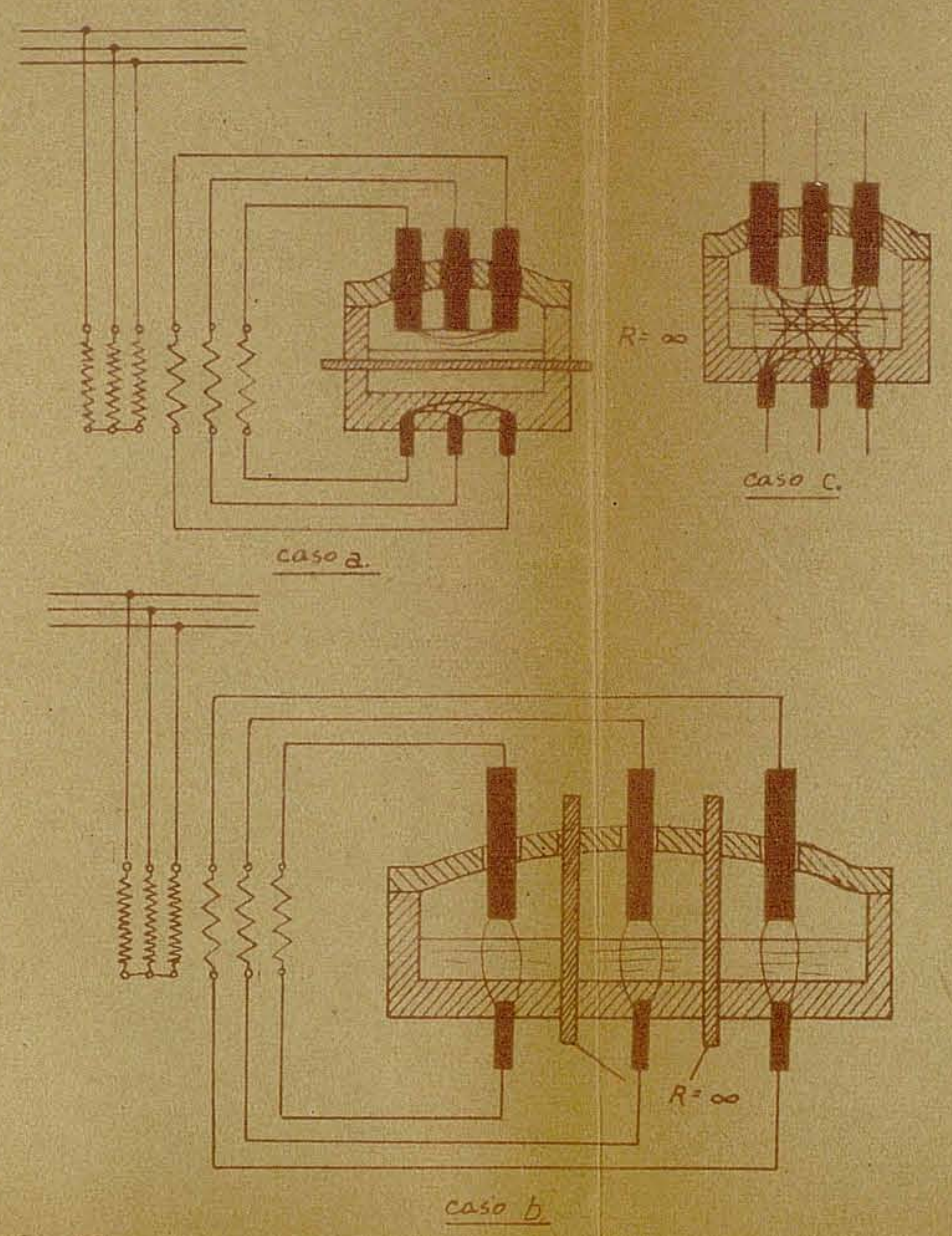


Fig. 62.

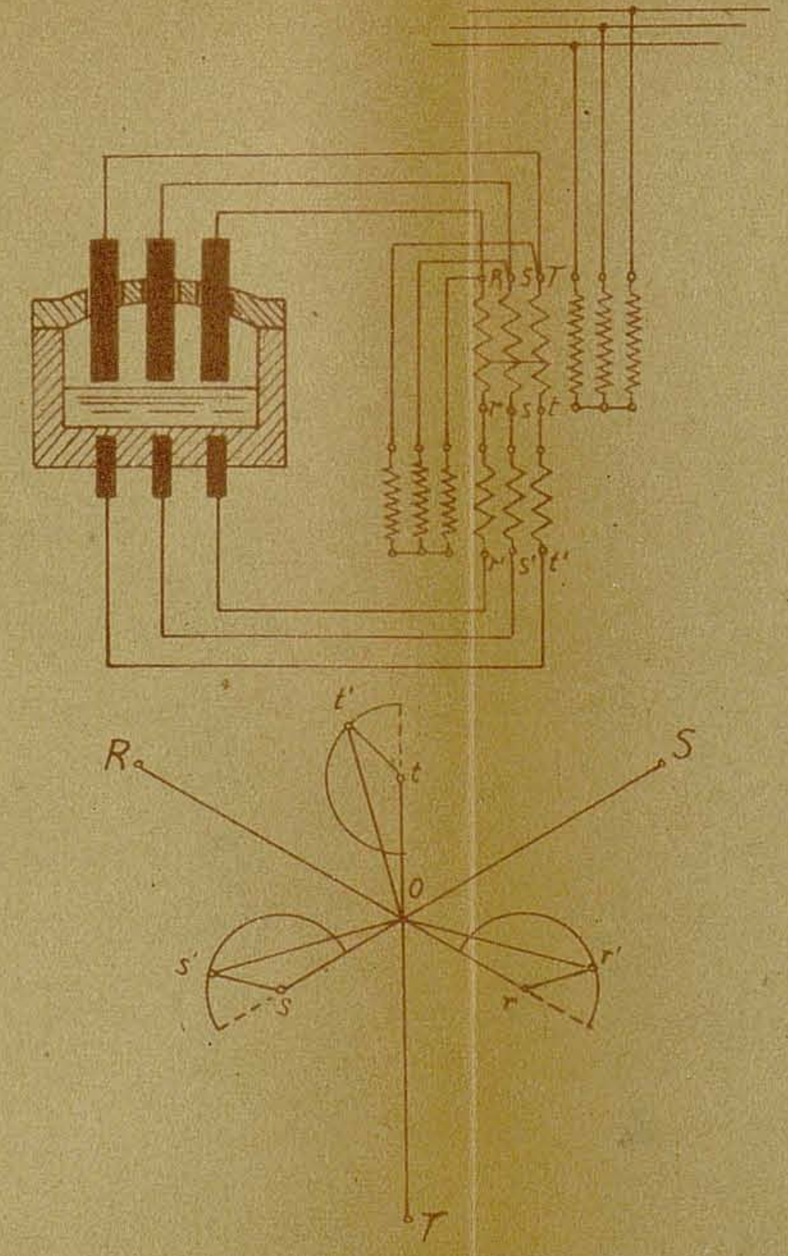


Fig. 63.

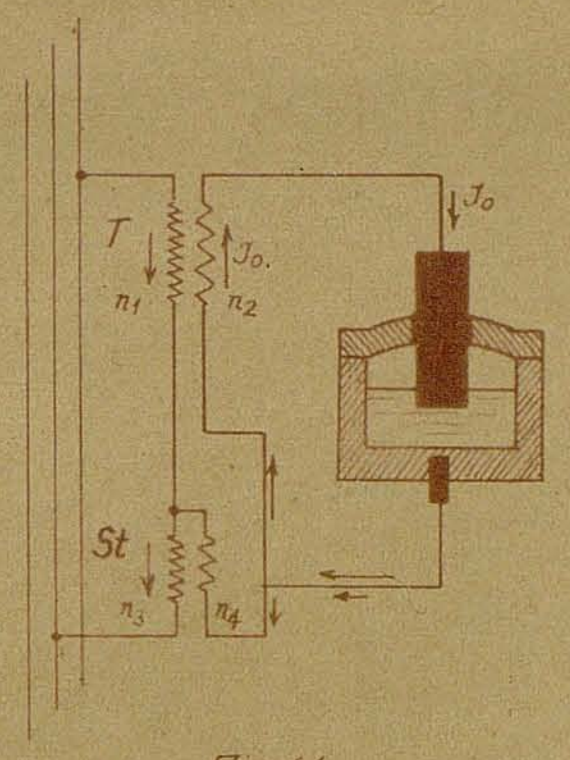


Fig. 64.

Fig. 65.

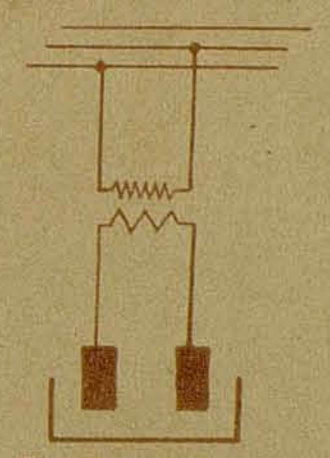


Fig. 66.

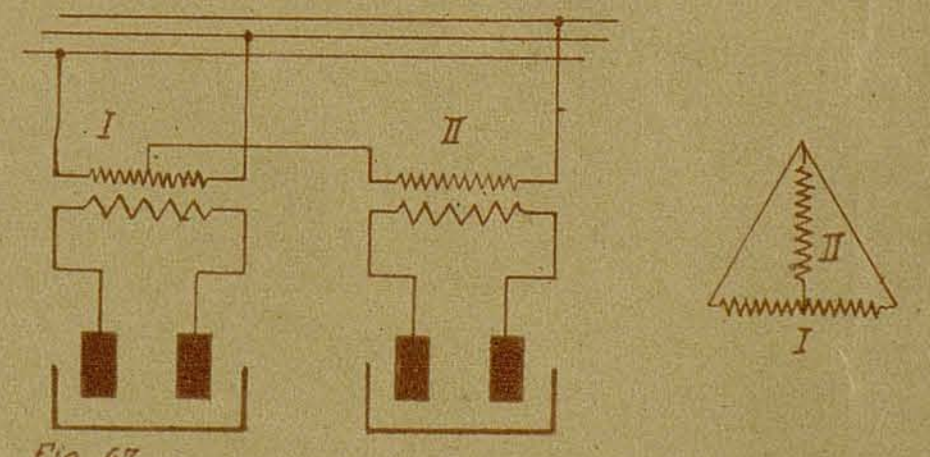


Fig. 67.

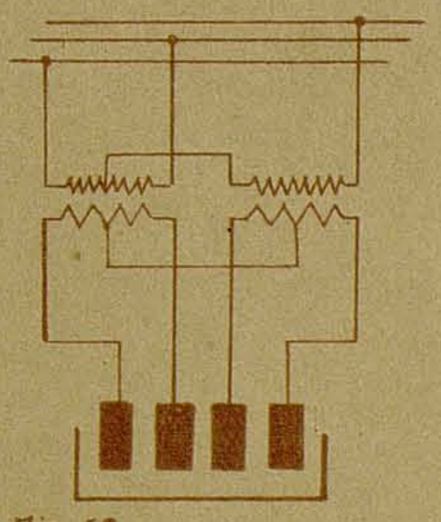


Fig. 68.

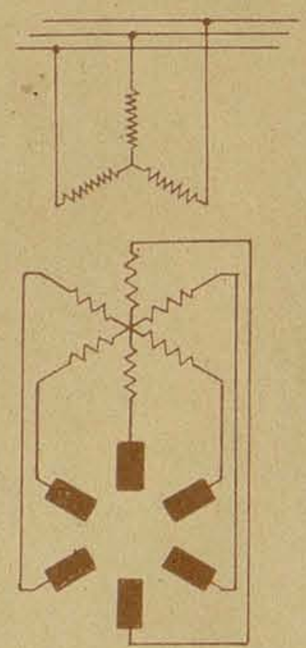


Fig 69.

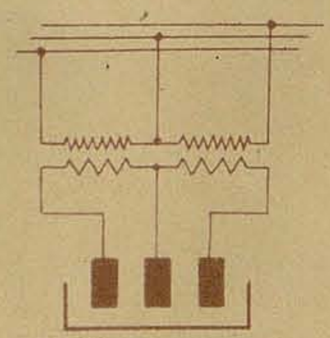


Fig. 70

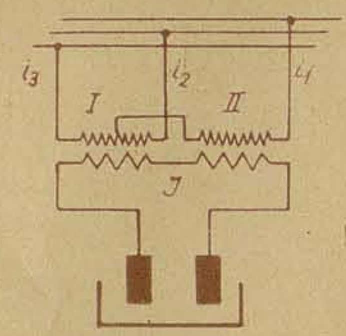


Fig. 71.

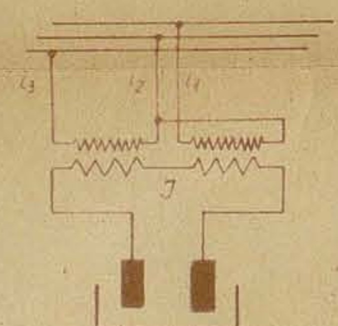


Fig. 72.

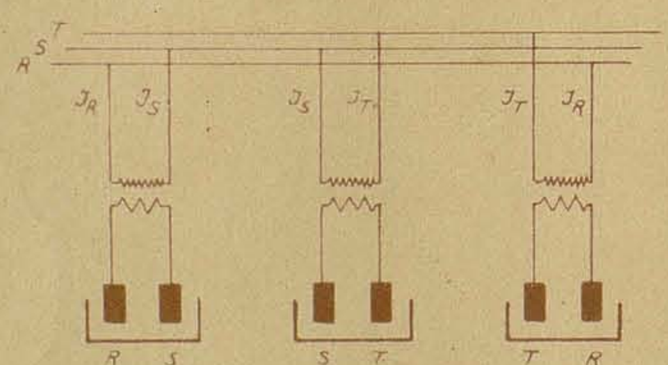
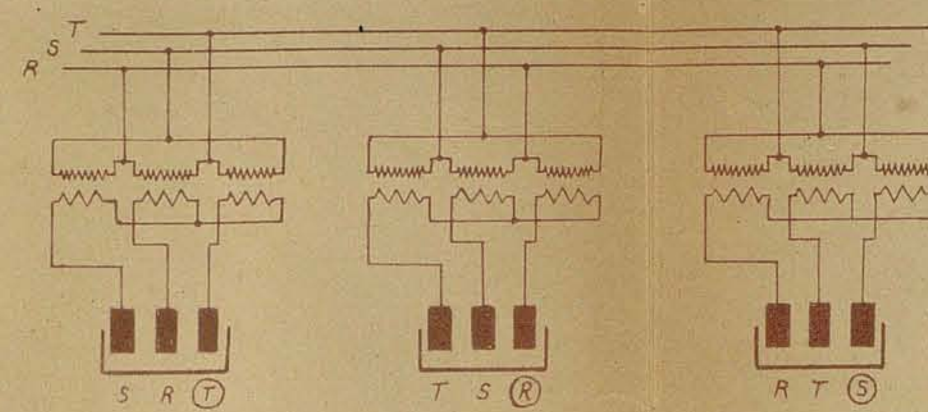


Fig 73.



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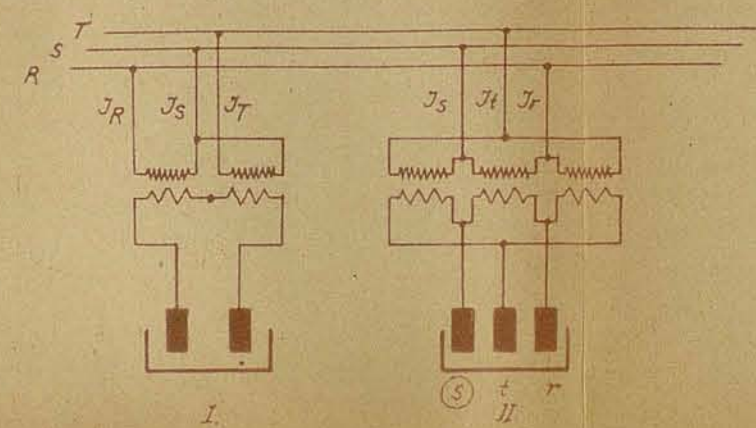


Fig 75.

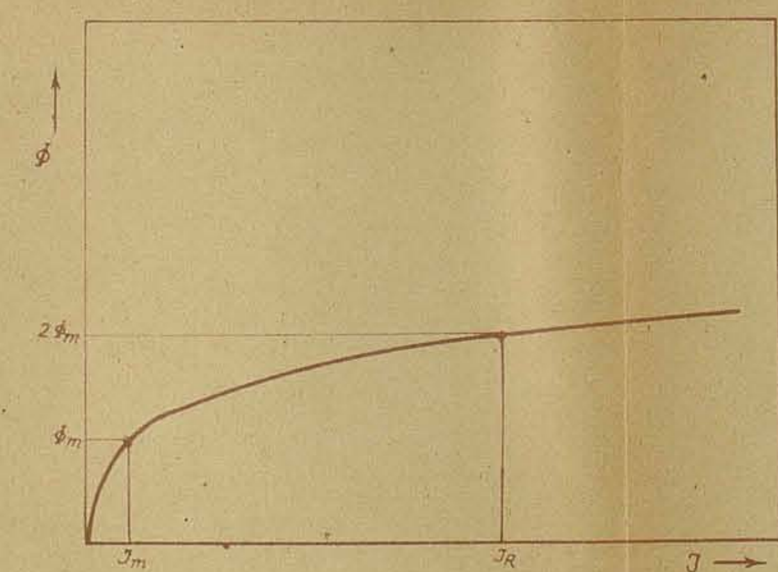


Fig. 76.


Fig. 77.

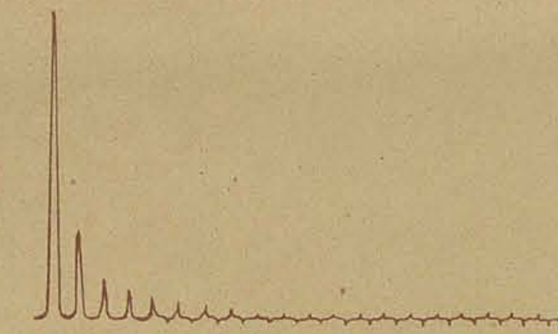


Fig. 78.


Fig 79.

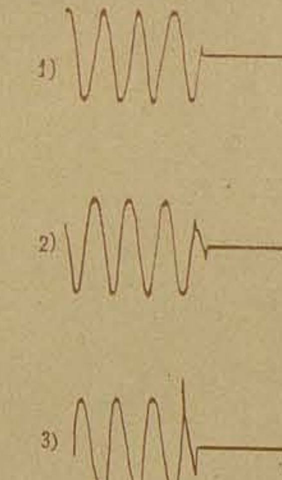


Fig. 80.

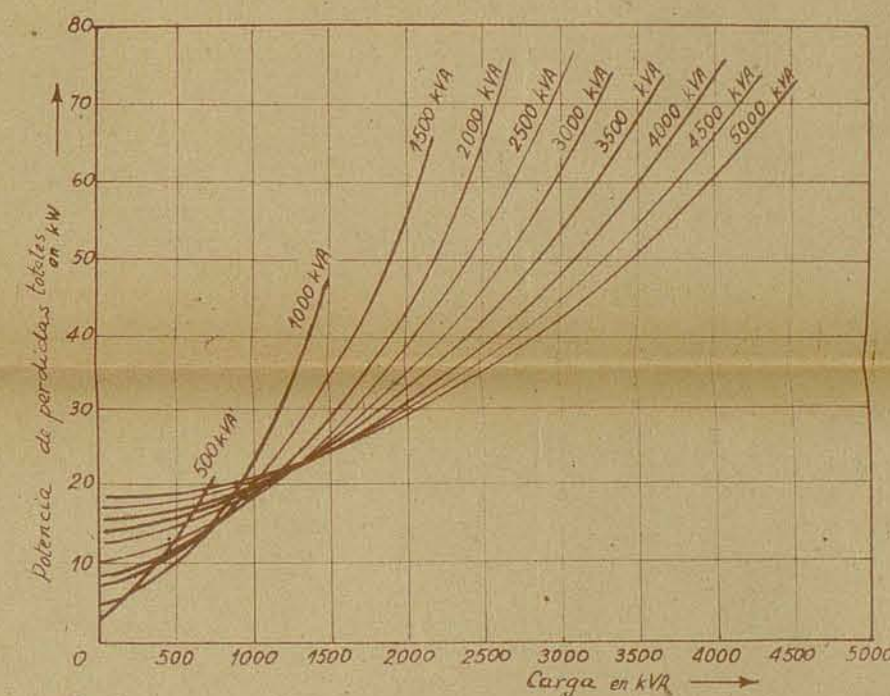


Fig 81.

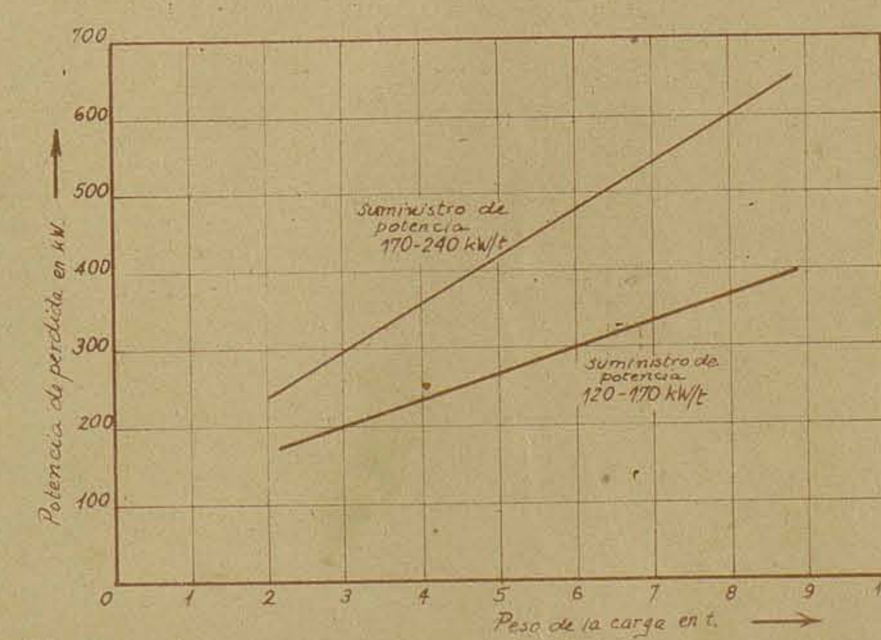


Fig. 82.

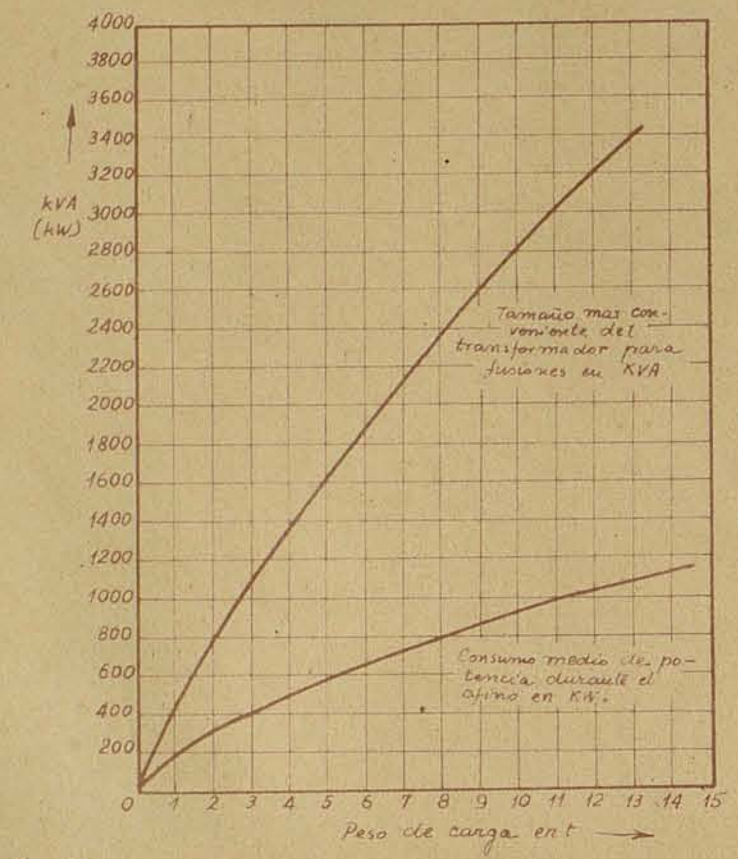


Fig 83.

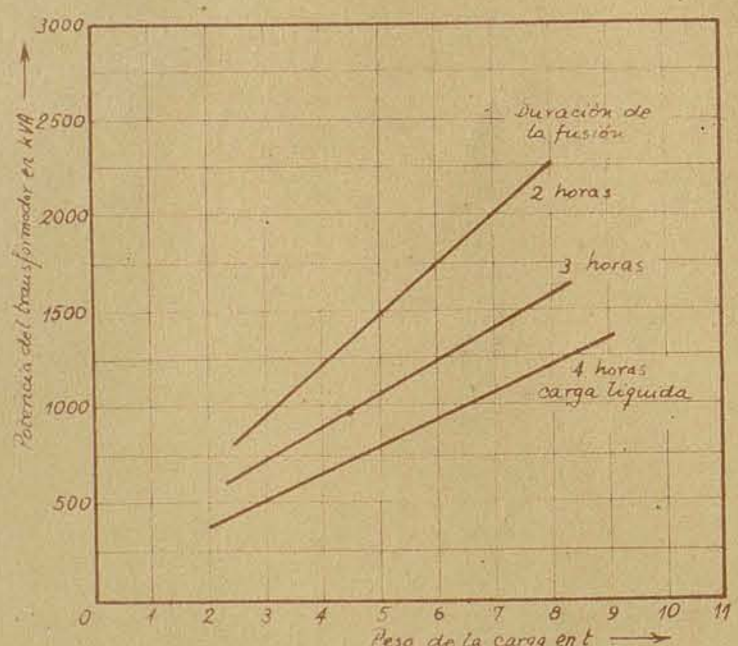


Fig. 84.

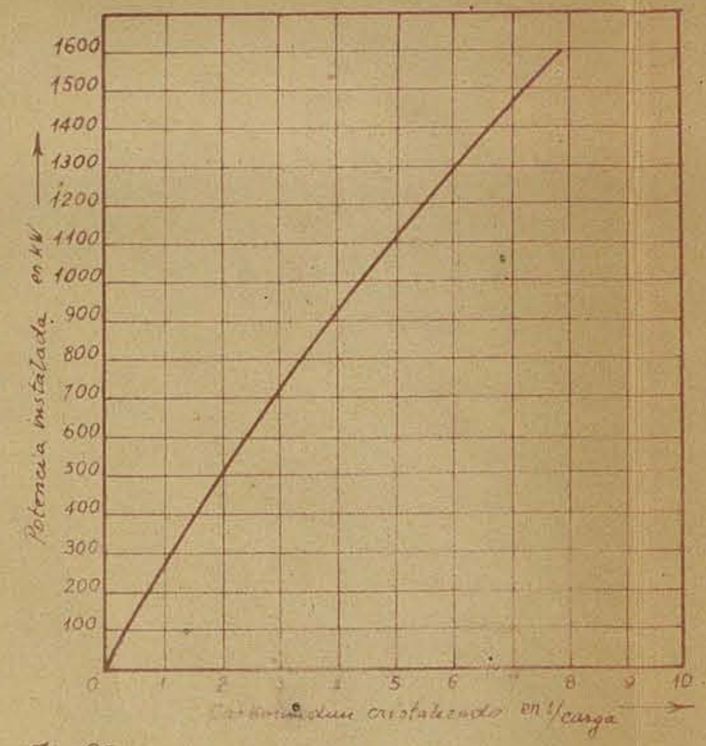


Fig 85.

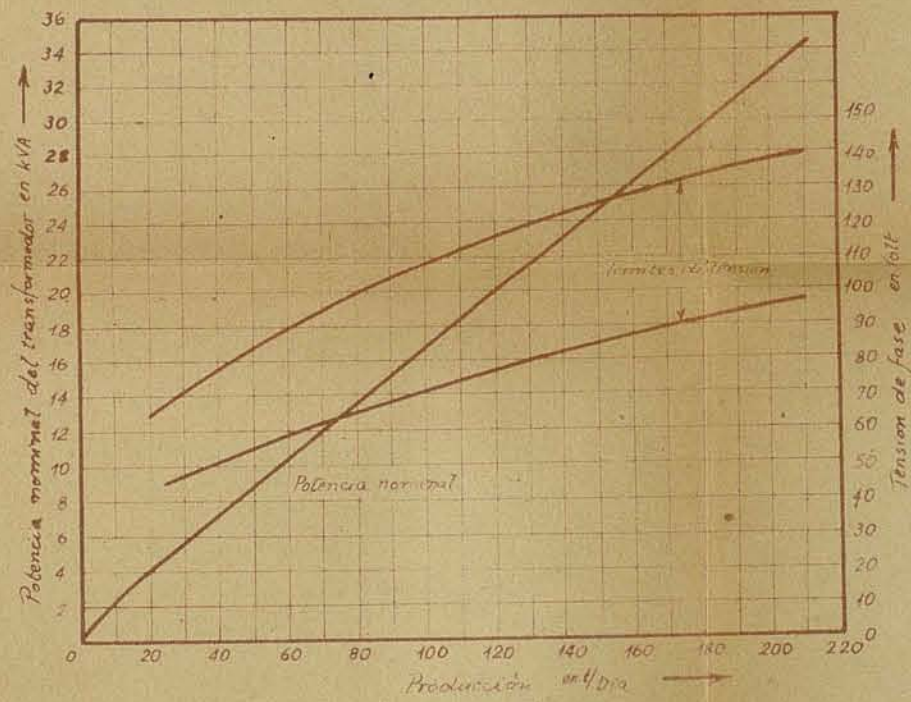


Fig. 86.

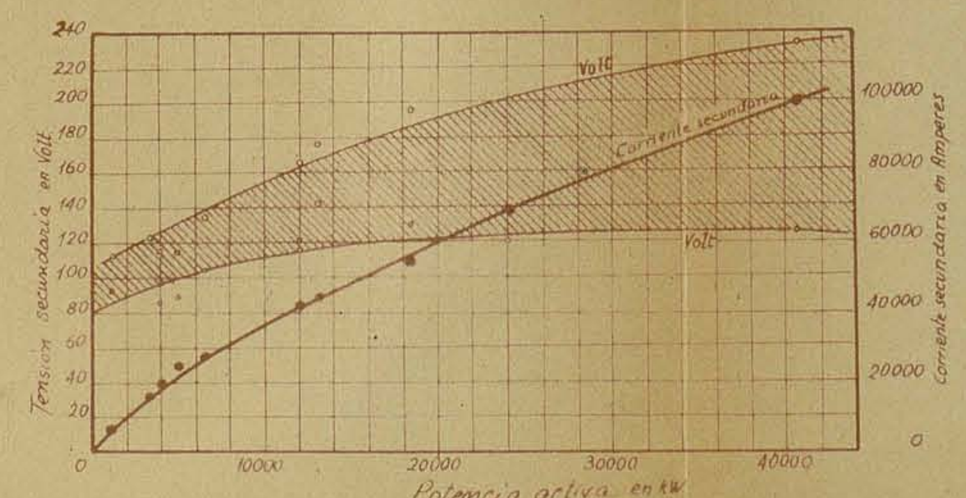


Fig 87.

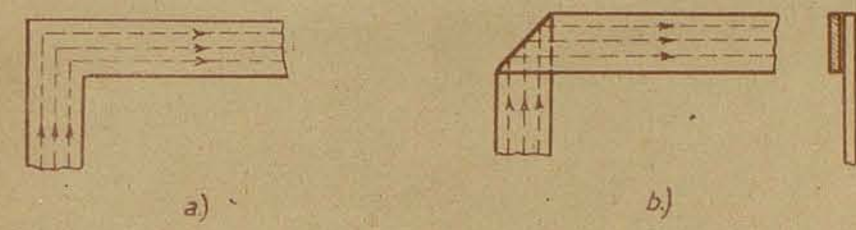


Fig. 89.

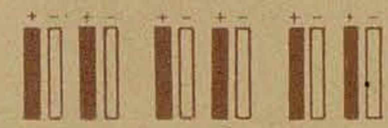


Fig 90.

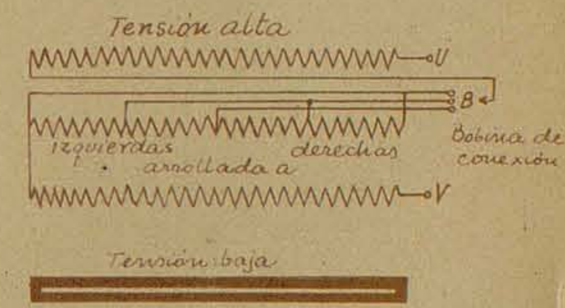


Fig 91.

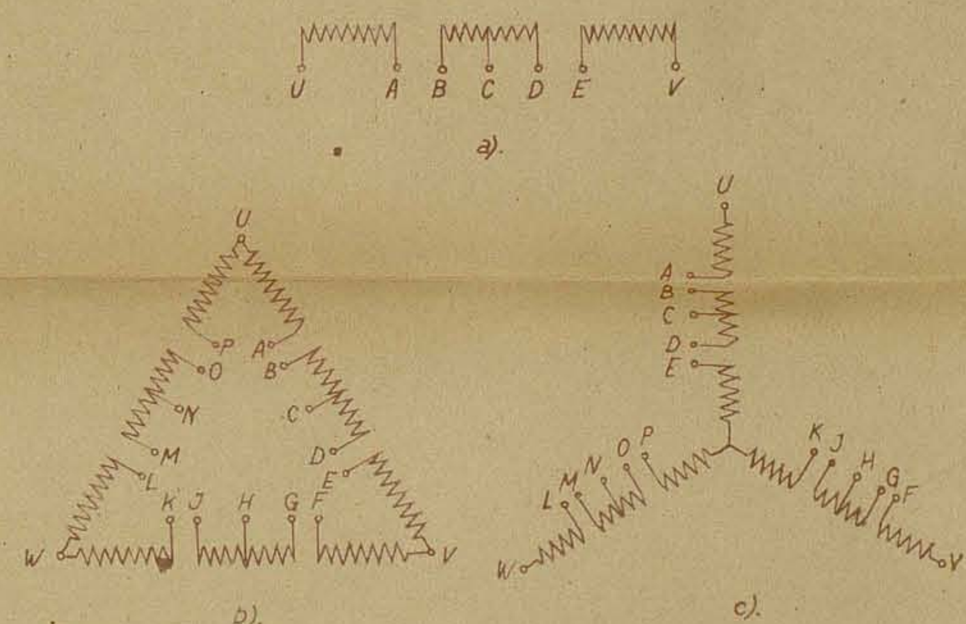


Fig 92.

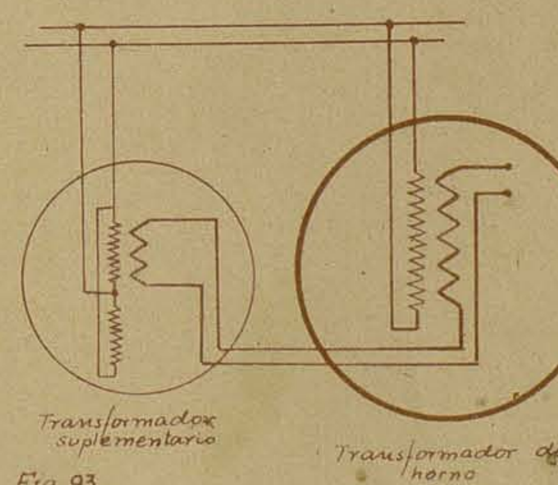


Fig. 93.

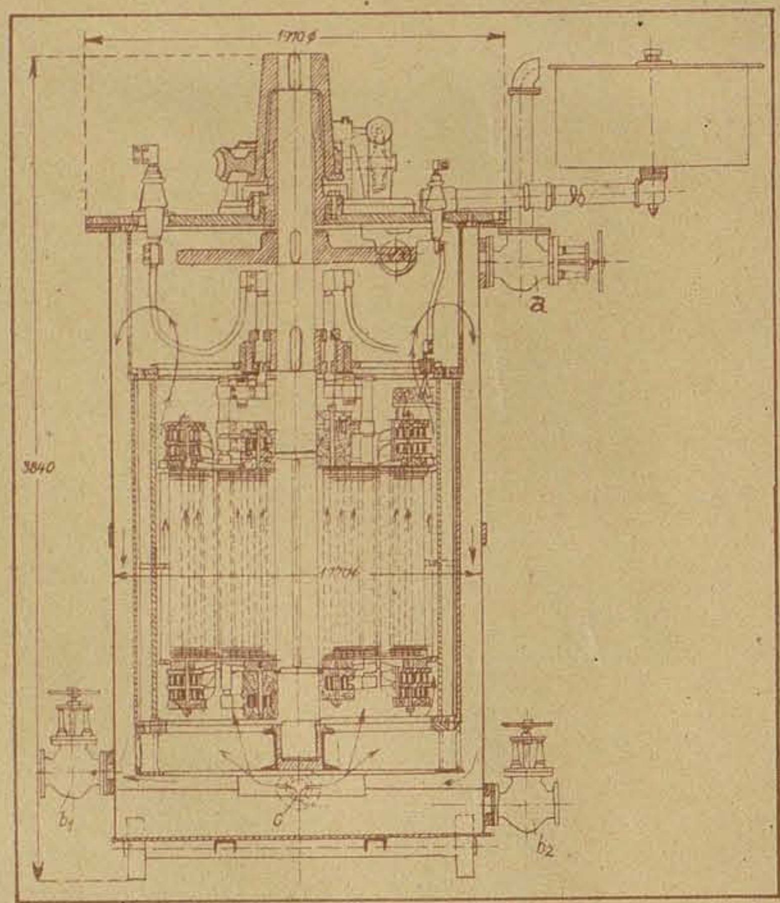


Fig. 94.
Corte de un gran transformador rotatorio

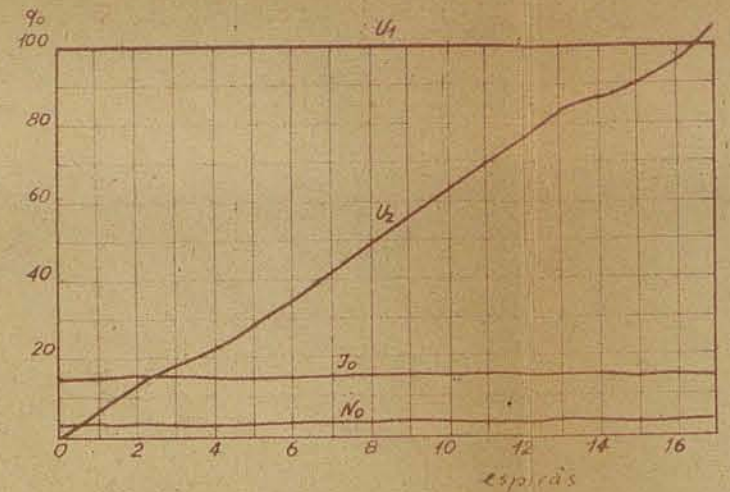


Fig. 96.

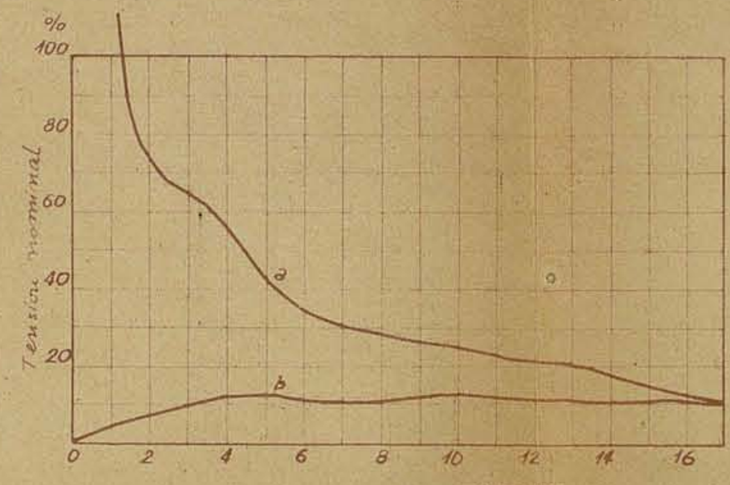


Fig. 97.

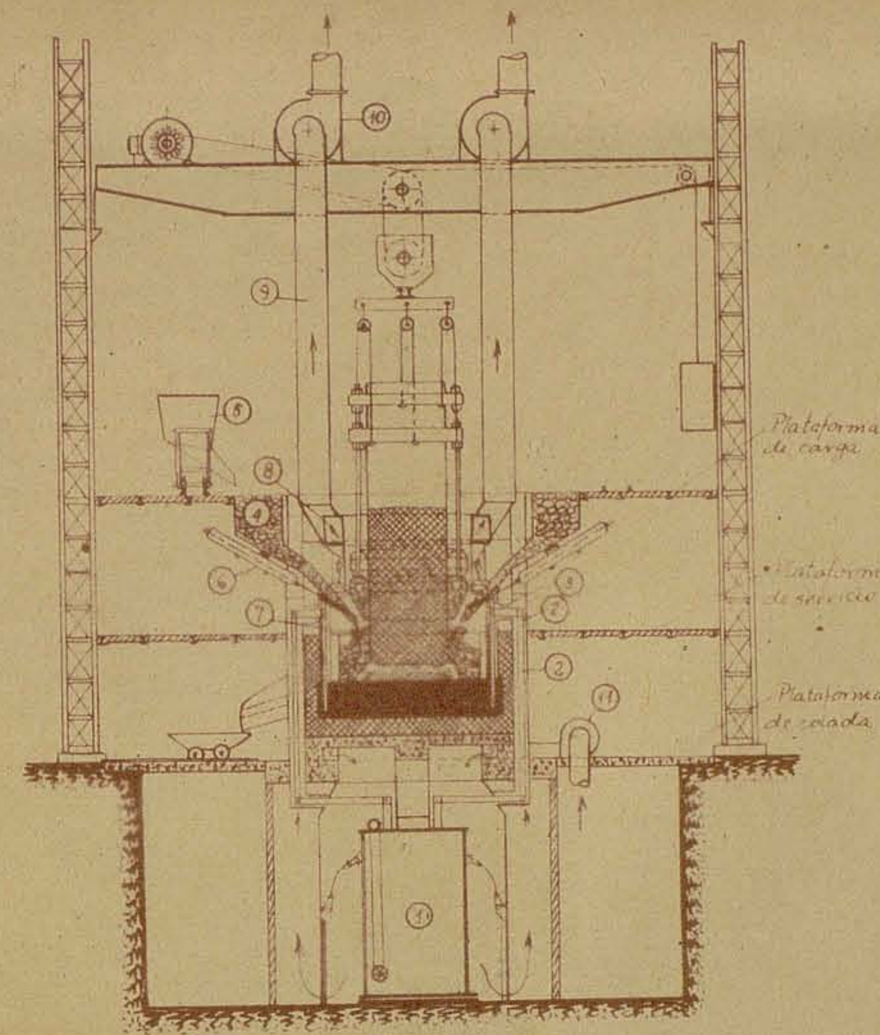


Fig. 106
Corte transversal de un Horno monofasico Miguet
Leyenda 1. Transformador. 2 conductores secundarios 3. Tomas. 4 Tolva de carga. 5 carretilla de carga. 6. Empujador hidraulico 7 Colector de gases refrigerado por agua. 8 Canal anular de gases. 9 Salida de gases 10 Ventilador 11. Aspirador.

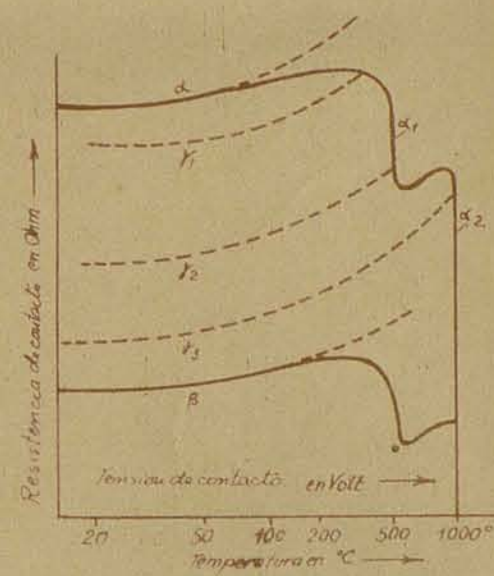


Fig. 107.

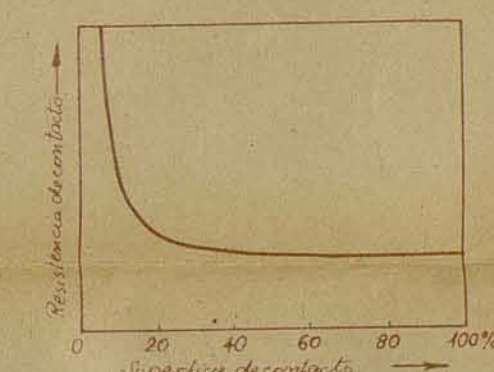


Fig. 108.

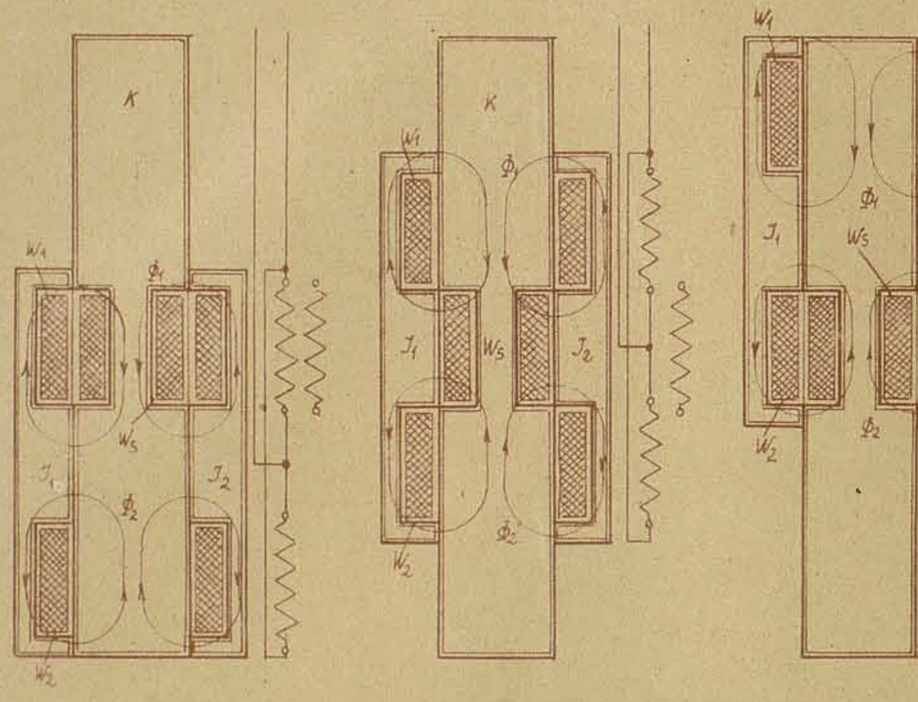


Fig. 95.

Cuadro de conexiones

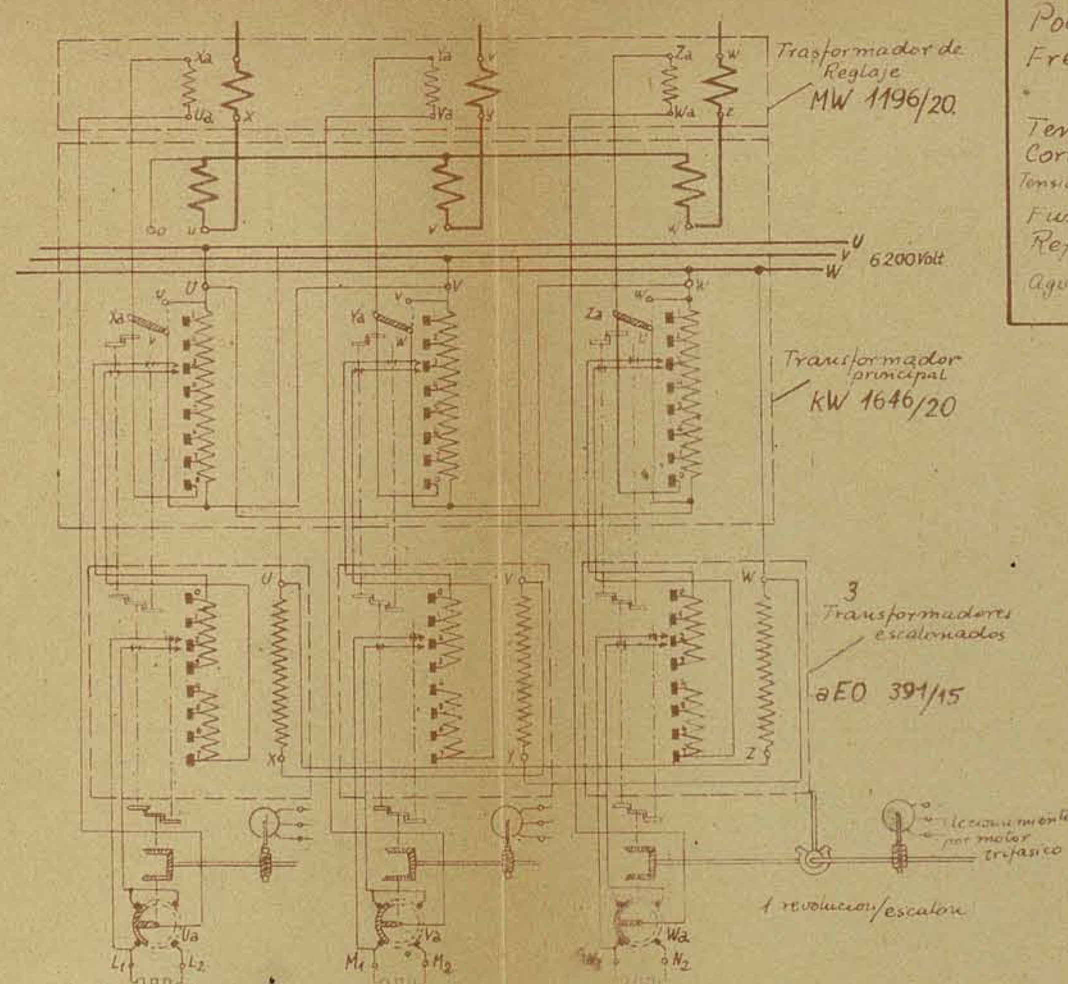


Fig 103
Esquema de conexiones de un gran transformador de Horno para 40.000 kVA

Potencia nominal kVA 40.000
Frecuencia nominal Hz 50

	primario	secundario
Tension nominal V	Δ 6200	234-126 en llo escalon - vacio
Corriente nominal A	3720	100000

Tension nominal de corto circuito 7.5 %.
Funcionamiento tipo DB
Refrigeracion tipo OWA
Agua de refrigeracion 420 l/min. Tempᵃ de entrada 25°C
Engrase 8200 l/min.

Esquema de Regulación

Alta tension			Baja - tension						
Conexión	Volt	Conexión	Conexión	Volt	Conexiones del inversor	Conexión	Pos. del conmutador grueso	Pos. del fino	Tensión
Δ	6200	UVW	λ	2333	XaV YaW ZaU	uvw	1	1	111
			»	2282			1·2	6	106
»	»		»	2231			2·3	3	101
»	»	»	»	2192			3	0	96
»	»	»	»	2140			3·4	5	91
»	»	»	»	2089	»		4	2	86
»	»	»	»	2037	»		5	7	81
»	»	»	»	1999	»	»	5·6	4	76
»	»	»	»	1947	»	»	6	1	71
»	»	»	»	1895	»	»	6·7	6	66
	»		»	1844		»	7·0	3	61
»	»			1805	»	»	0	0	56
		»	»	1753	XaU YaV ZaW		0·1	5	51
»			»	1702			1	2	46
»			»	1650			2	7	41
»	»	»	»	1614	»		2·3	4	36
»	»	»	»	1560	»		3	1	31
»	»	»	»	1508	»		3·4	6	26
»	»	»	»	1457	»		4·5	3	21
»	»	»	»	1418	»	»	5	0	16
»	»	»	»	1366	»		5·6	5	11
»	»	»	»	1315	»		6	2	6
»	»	»	»	1264	»	»	7	7	1

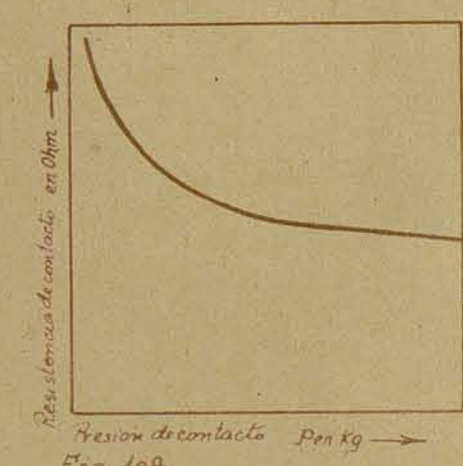


Fig. 109.

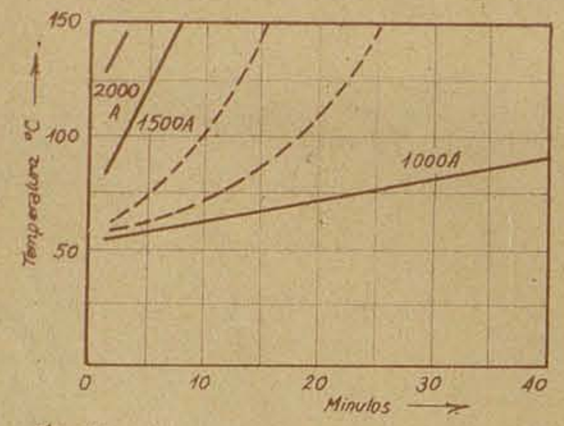


Fig. 110.

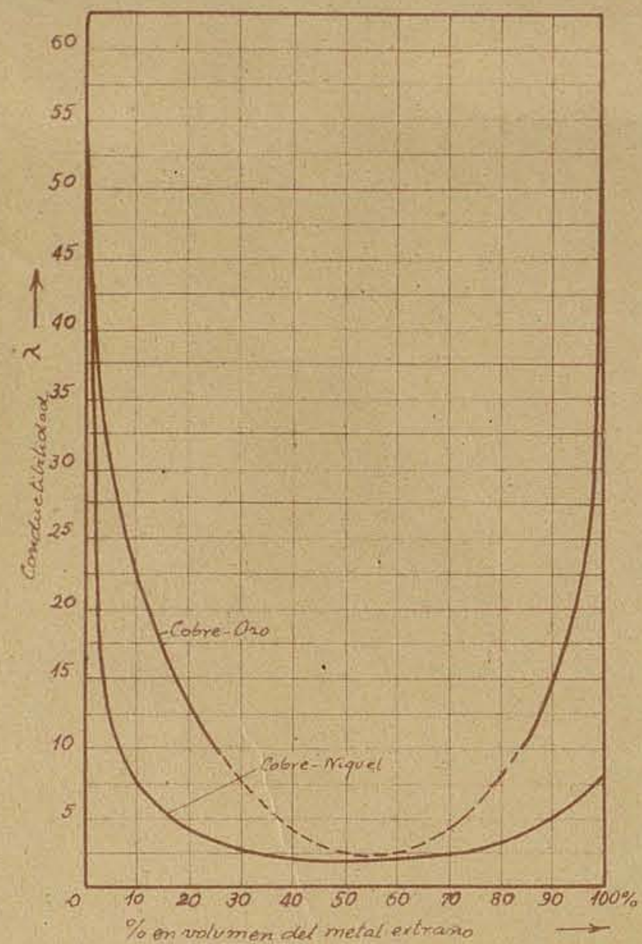


Fig. 113.

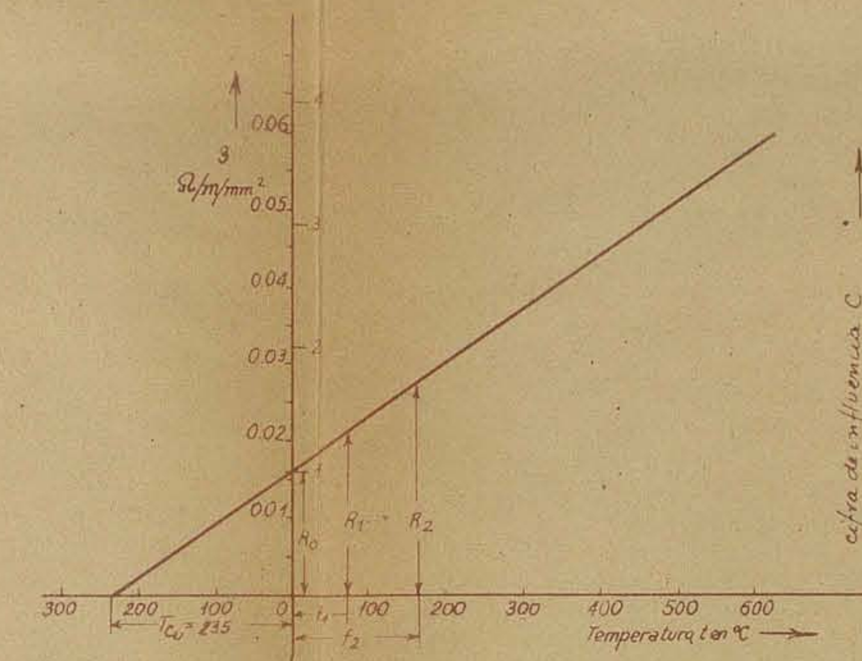


Fig. 114.

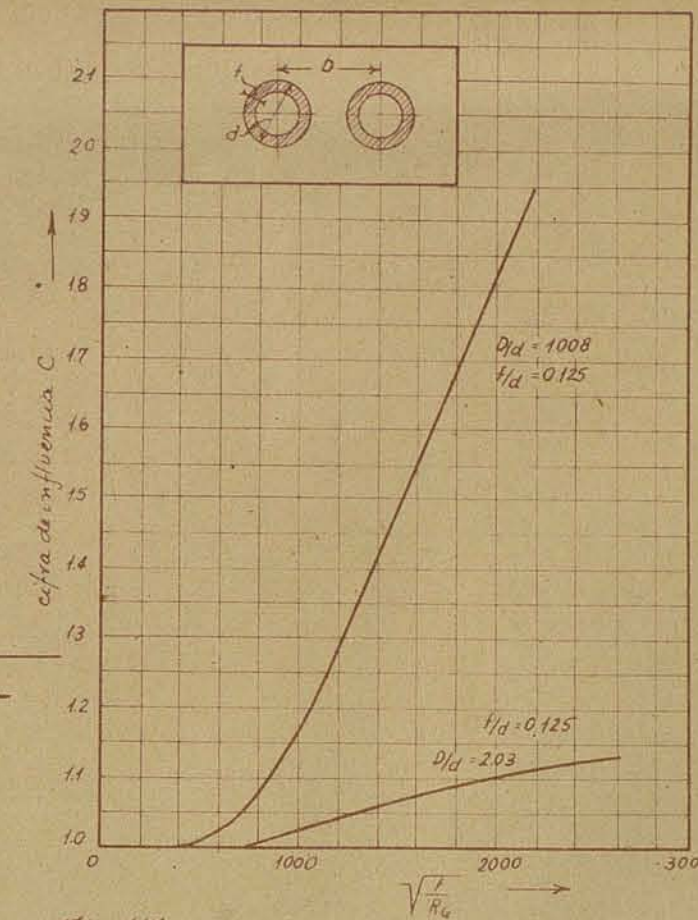


Fig. 117

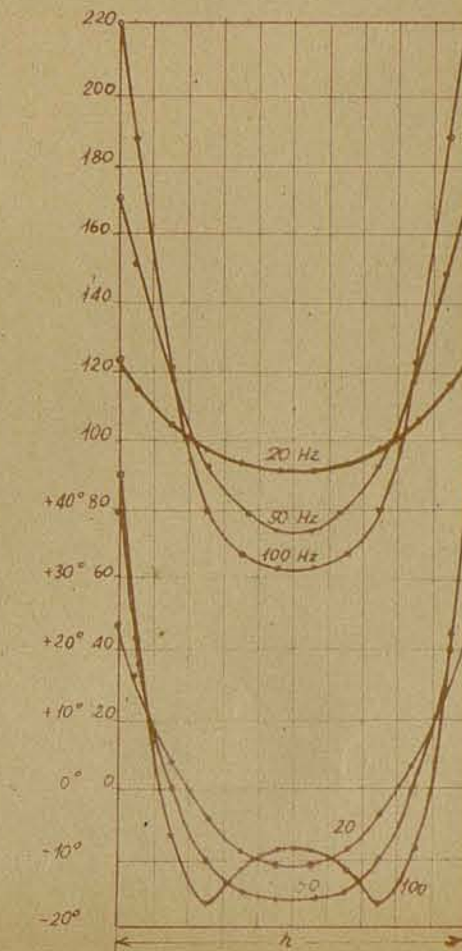


Fig. 118.

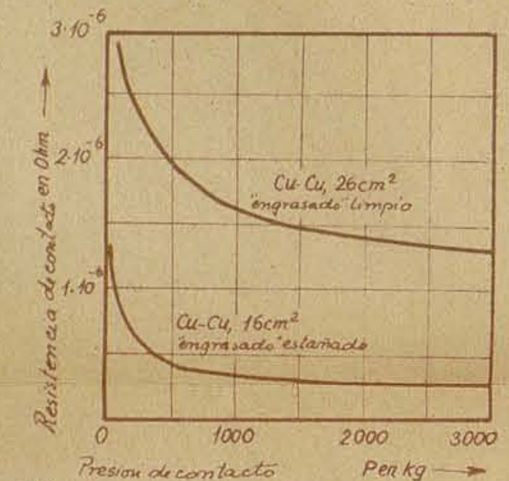


Fig. 111.

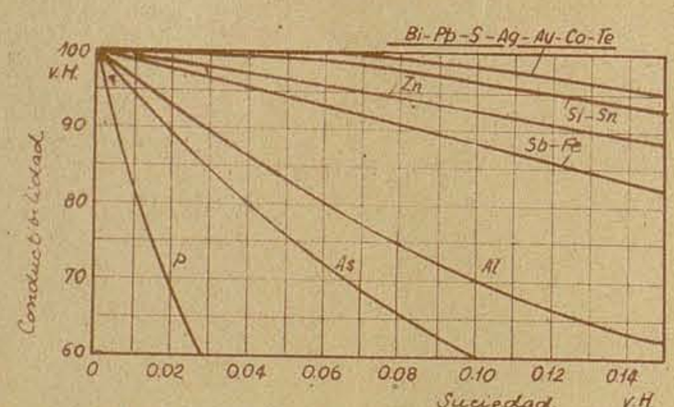


Fig. 112.

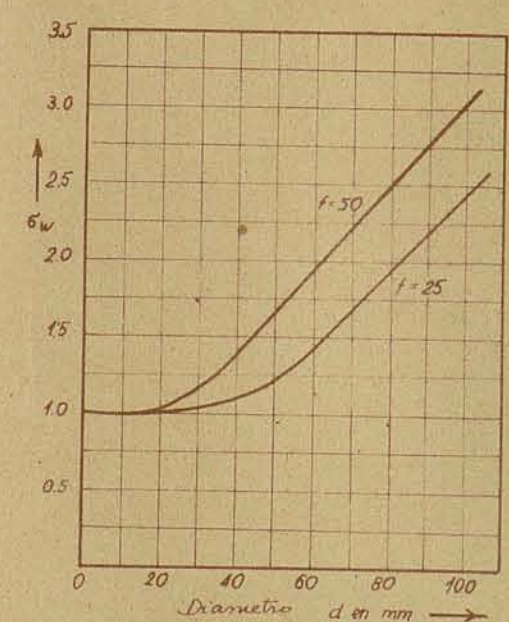


Fig 115

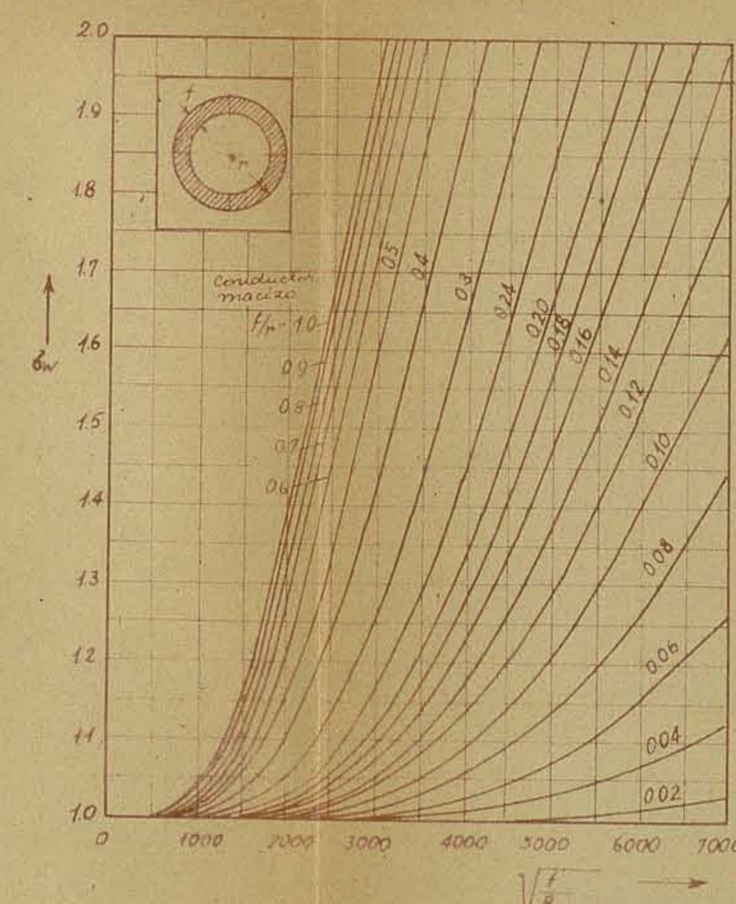


Fig. 116

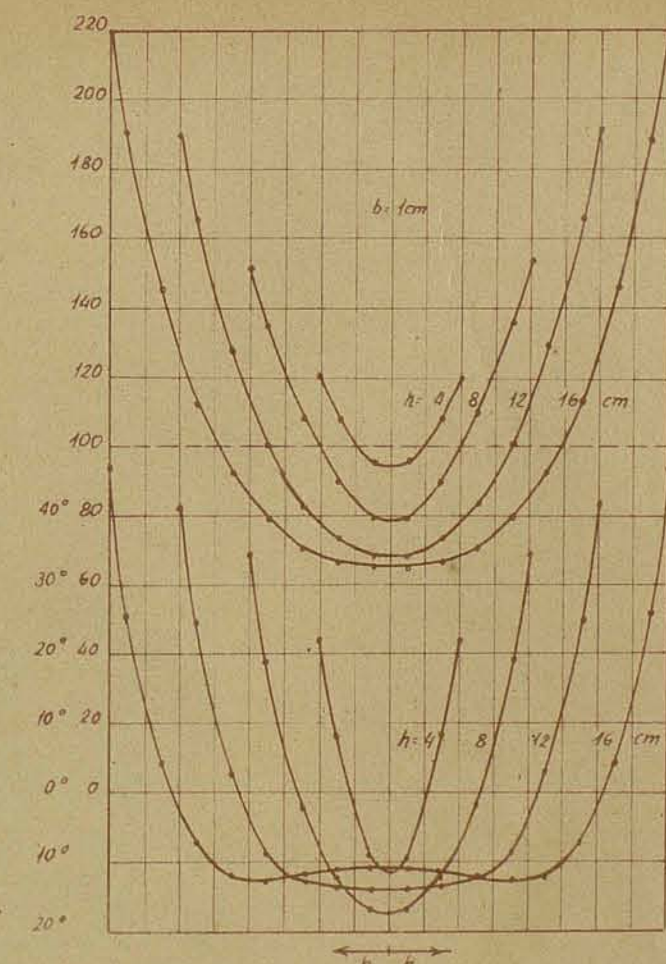


Fig 119.

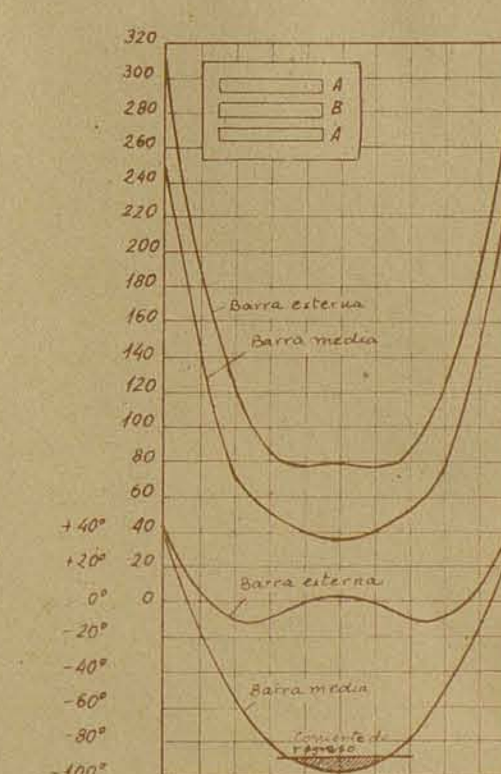


Fig. 120.

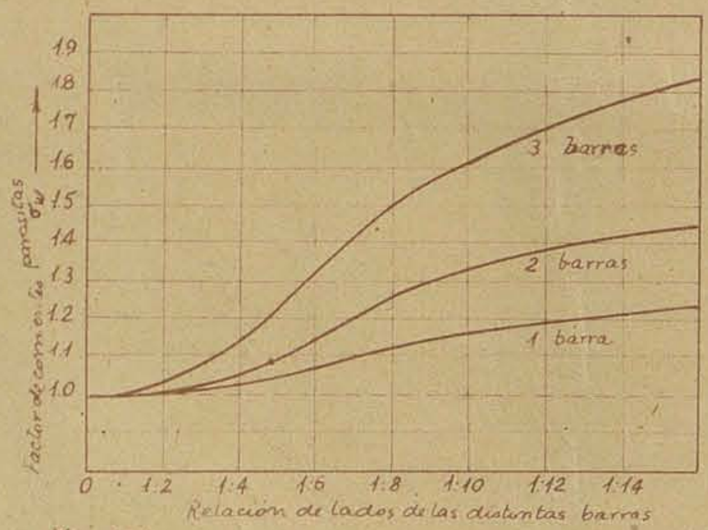


Fig. 121.

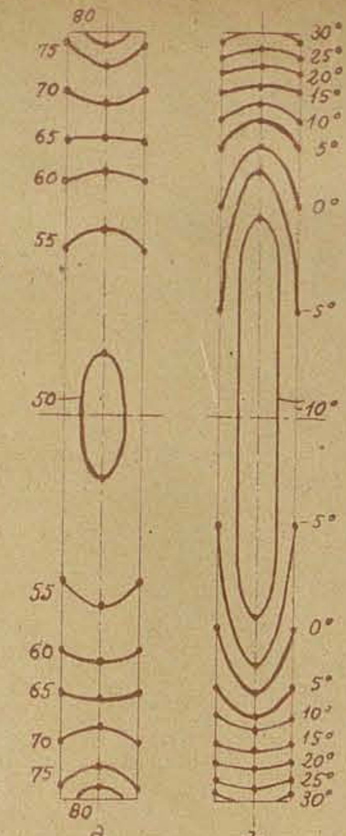


Fig. 122

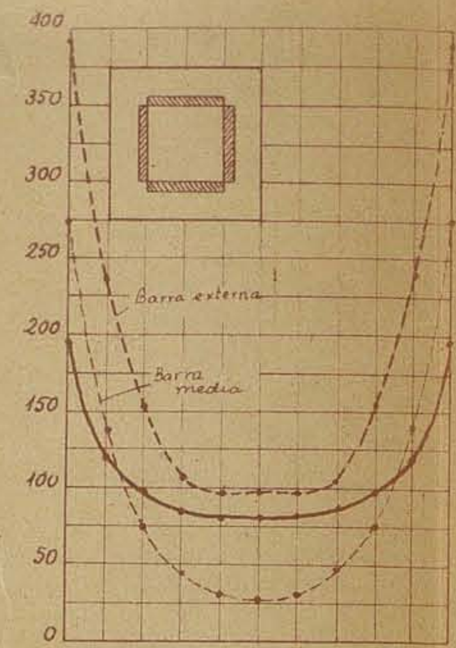


Fig. 123

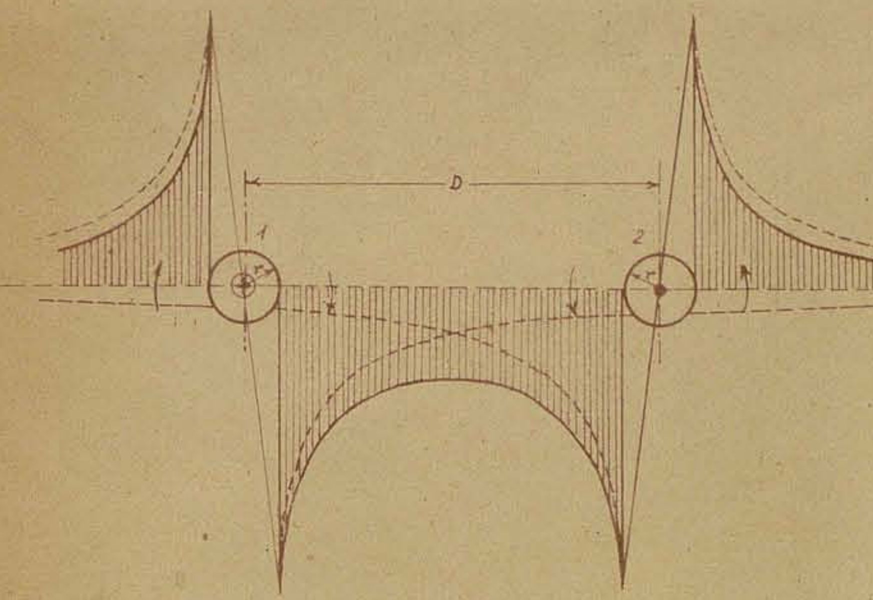


Fig. 135

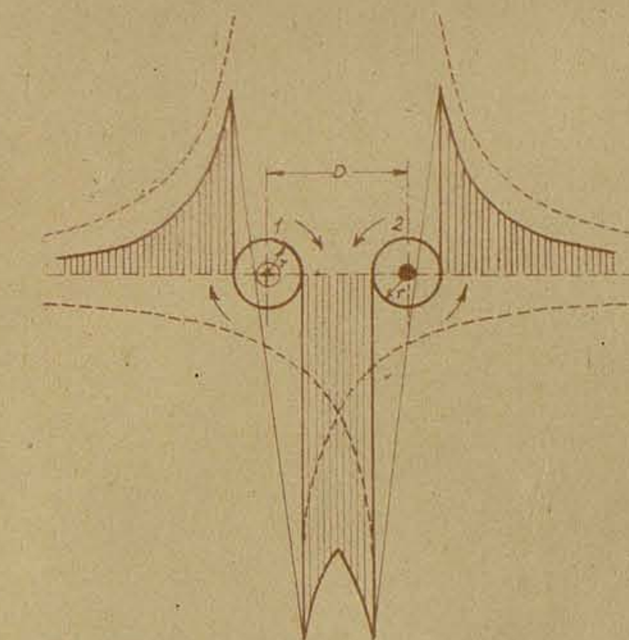


Fig. 136.

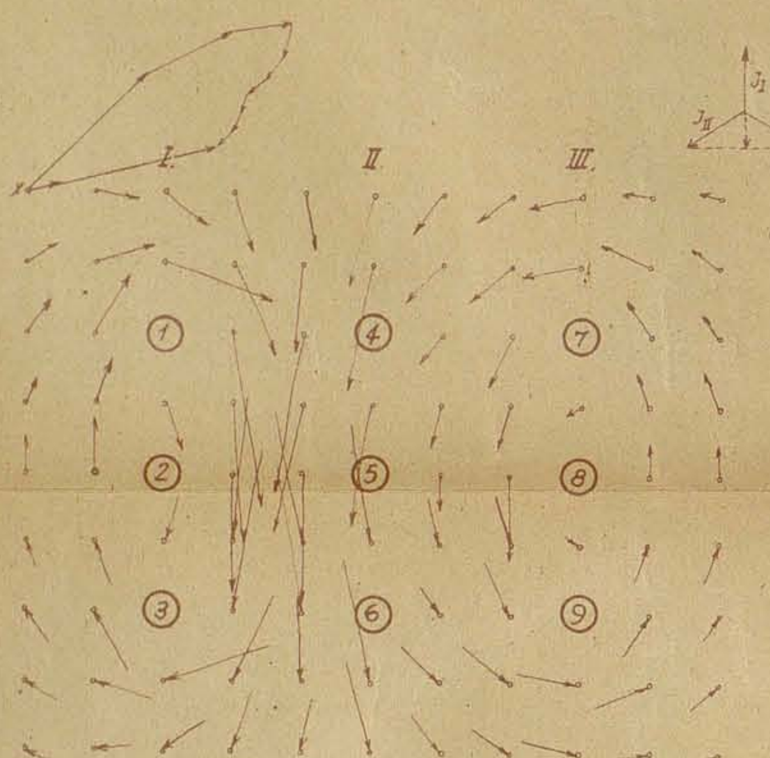


Fig. 124.

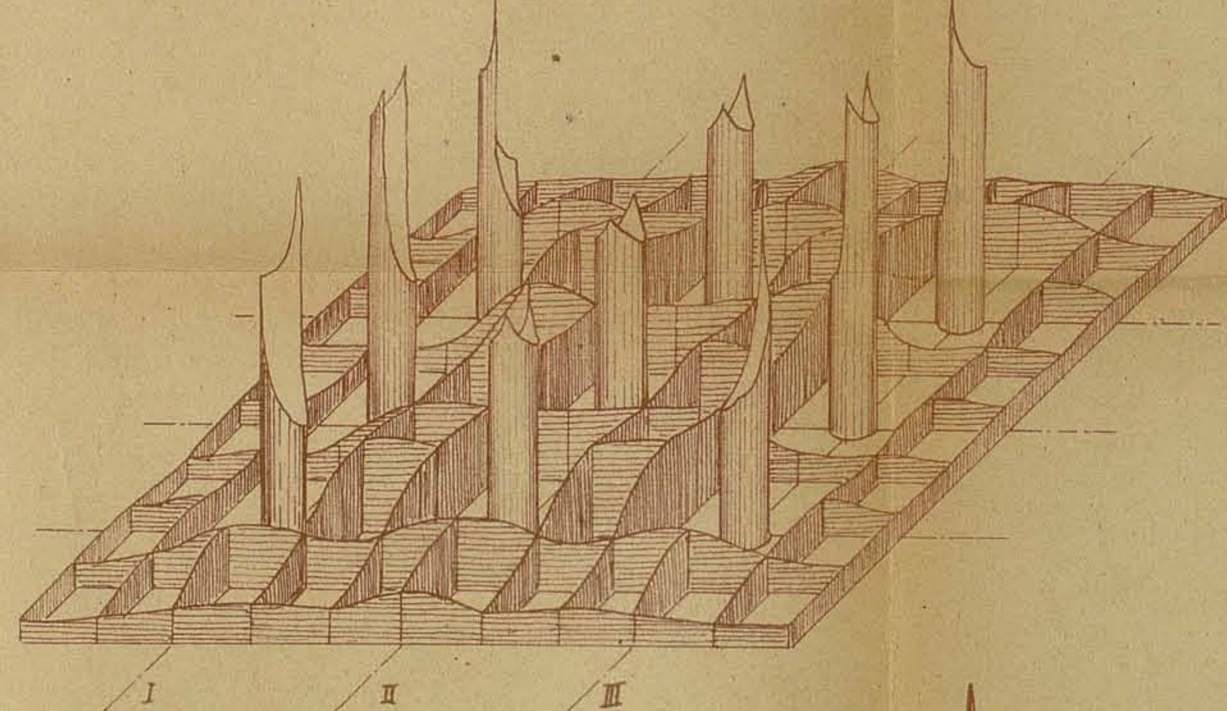


Fig. 126.

	Forma del Conductor		L(Henry)%
1.	Circulo d= 1.02m		100.0
2.	idem partido en dos en angulo recto		99.1
3	Cuadrado. lado 0'80 m		99.2
4.	idem. dividido en dos en angulo recto		93.6
5.	Rectangulo 0'50x1.10m		94.7
6.	idem dividido en dos en angulo recto		89.3
7.	Rectangulo 0'40x1.2m		88.5
8.	idem partido en tres en angulo recto		81.5
9.	Triangulo equilatero lados de 1.07m		94.0
10.	idem partido en dos en angulo recto		90.3

Fig. 137.

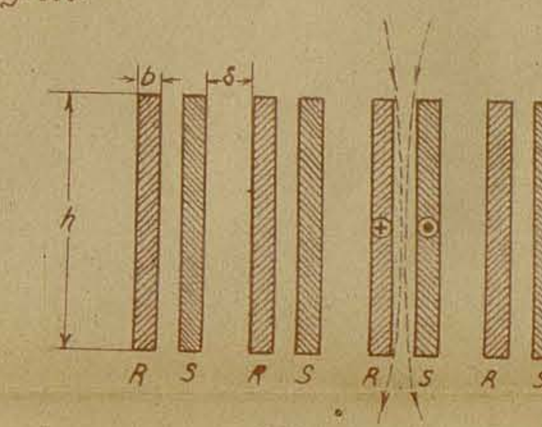


Fig. 138.

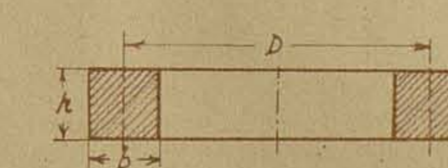


Fig. 139.

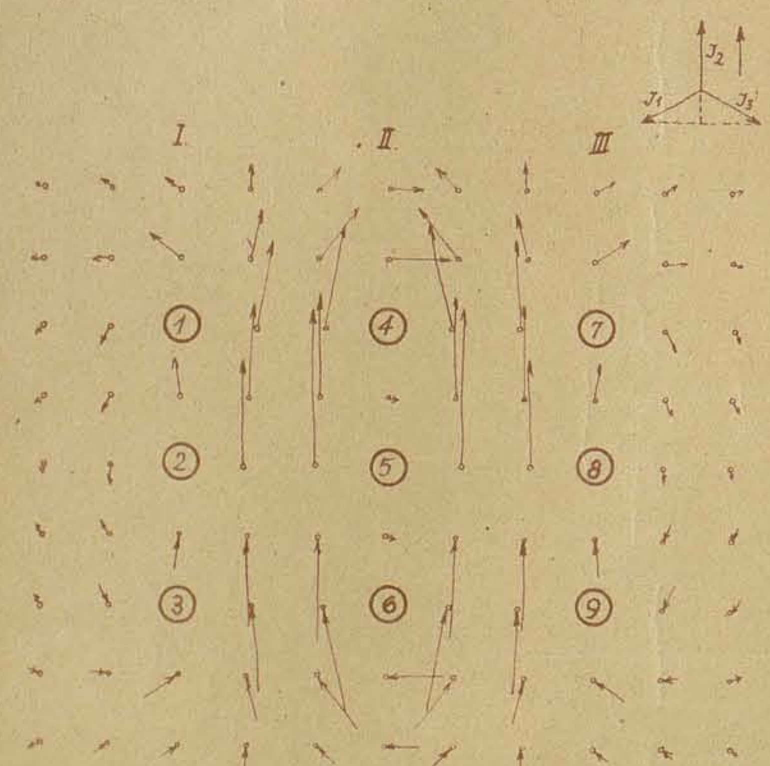


Fig. 125

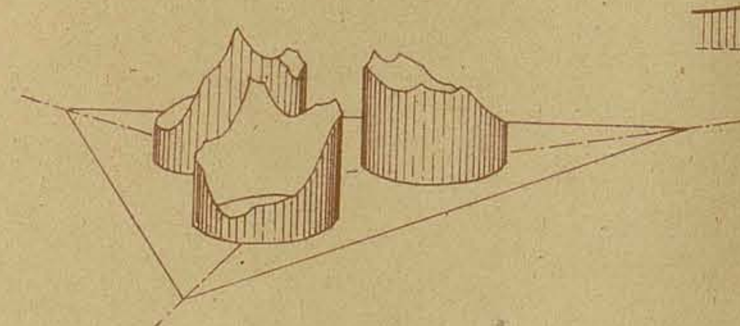


Fig. 127

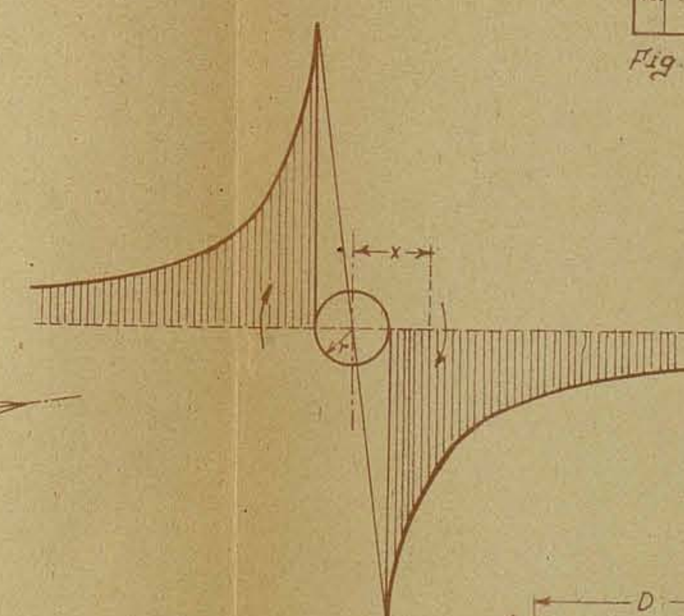


Fig. 134.

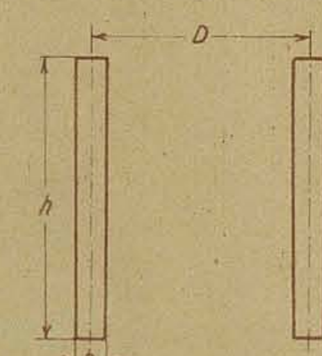


Fig. 140.

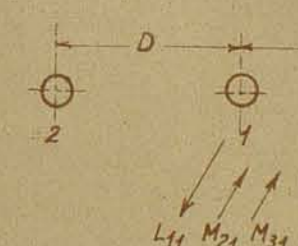


Fig. 143

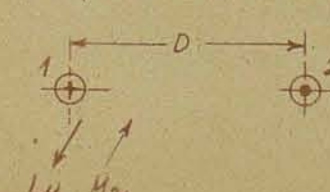


Fig. 141

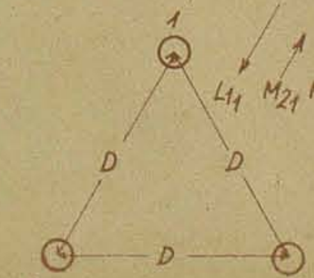


Fig. 142.

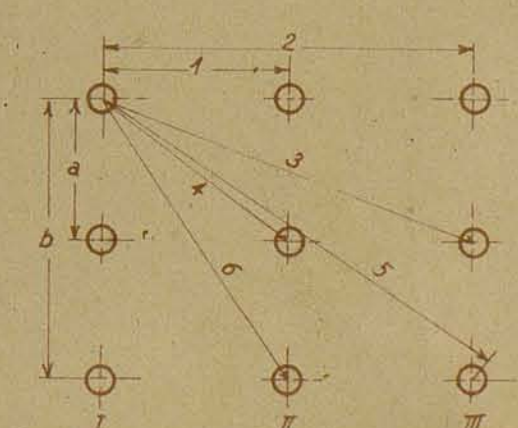
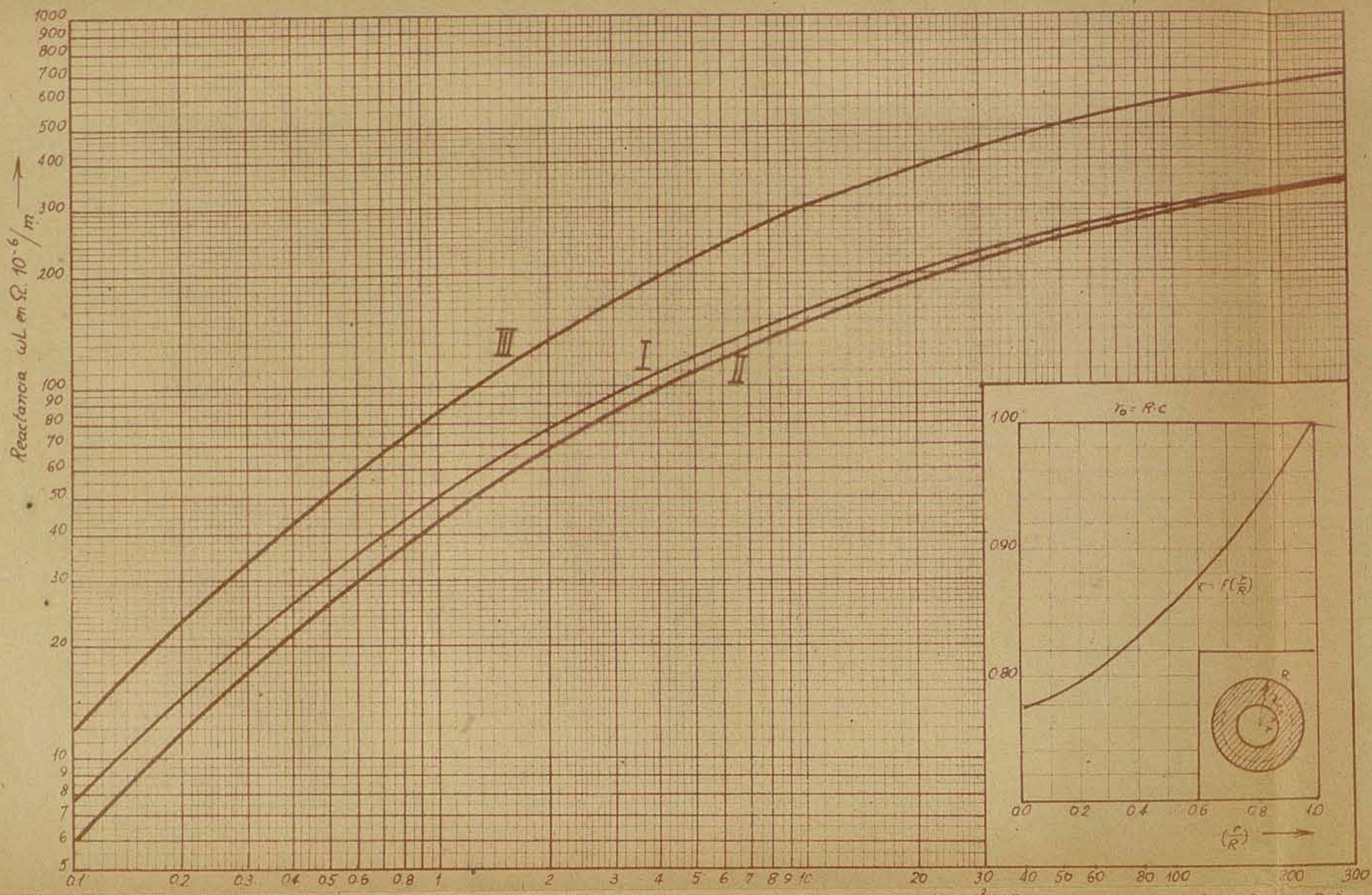
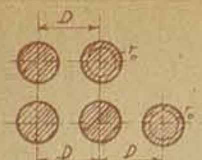


Fig. 144



$\left(\frac{D}{r_0}\right) \longrightarrow$



D = Distancia entre conductores en cm

r_0 = Radio mag. equivalente en cm

l = Longitud del conductor en m.

I. C. trifasica $\omega L = 48 \cdot l \cdot lg \frac{(D+r_0)^2 (2D+r_0)}{r_0^3} 10^{-6} = 48 \cdot l \cdot lg \left[1+4\left(\frac{D}{r_0}\right)+5\left(\frac{D}{r_0}\right)^2+2\left(\frac{D}{r_0}\right)^3\right] 10^{-6}\,\Omega$

II C. monofasica conductor de ida $\omega L = 144 \cdot l \cdot lg \left(1+\frac{D}{r_0}\right) \cdot 10^{-6}\,\Omega$

III C. monofasica Conductor ida y vuelta $\omega L = 288 \cdot l \cdot lg \left(1+\frac{D}{r_0}\right) \cdot 10^{-6}\,\Omega$

Fig. 145. Tabla para el calculo de la inductividad por el metodo de corte

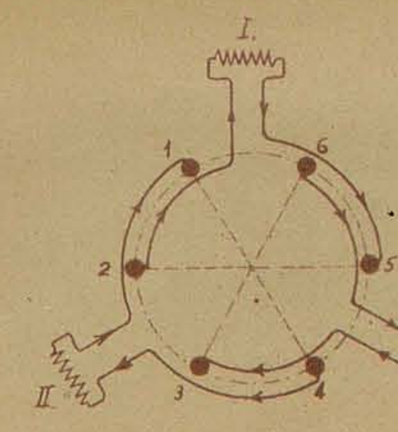


Fig. 146

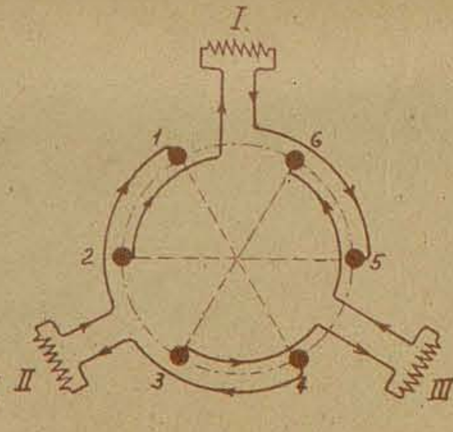


Fig. 147

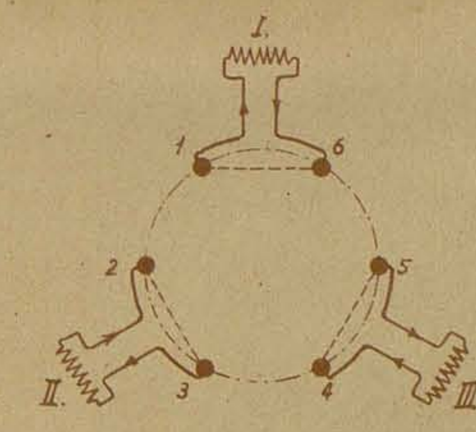


Fig. 148

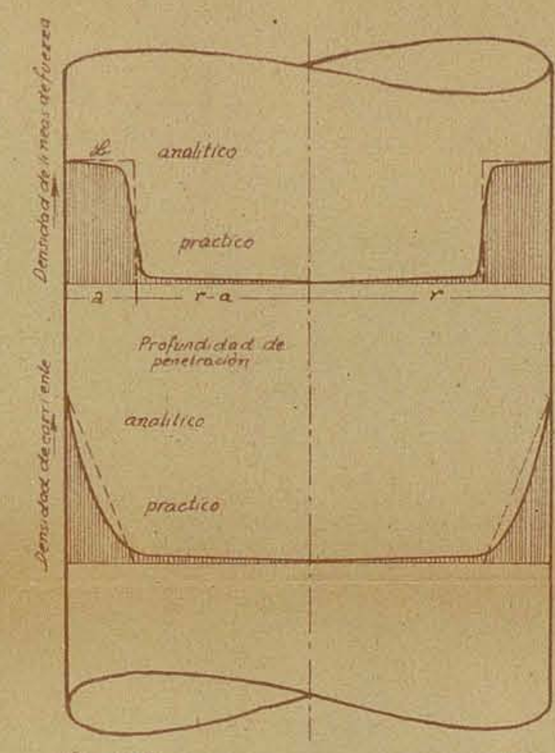


Fig. 151.

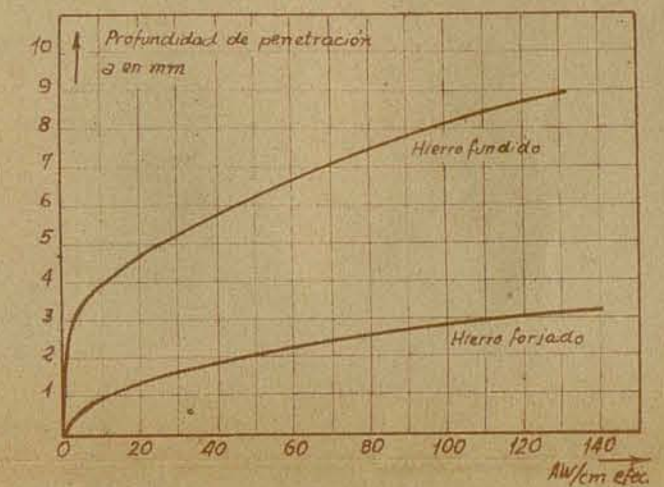


Fig. 152.

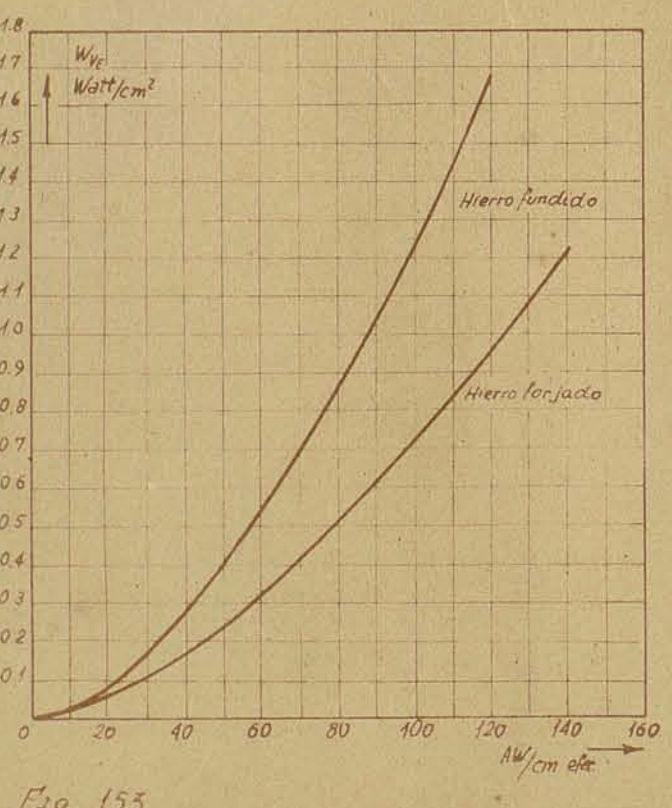


Fig. 153

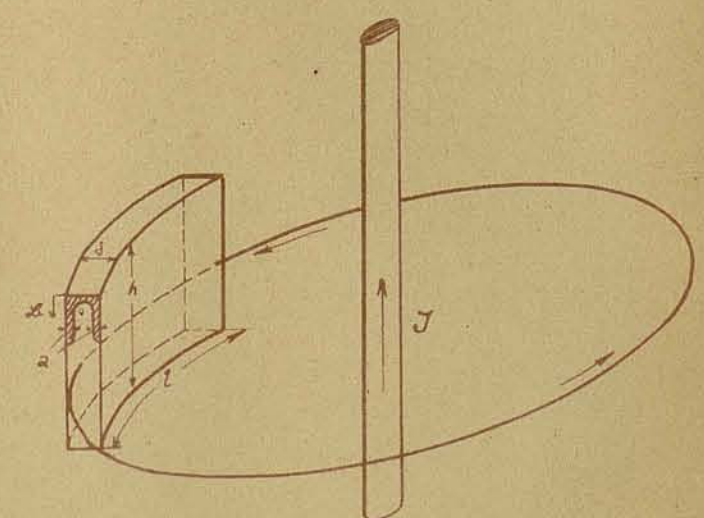


Fig. 154

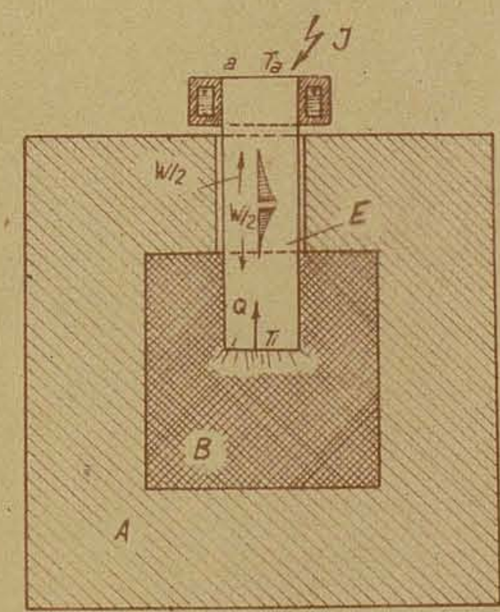


Fig. 159.

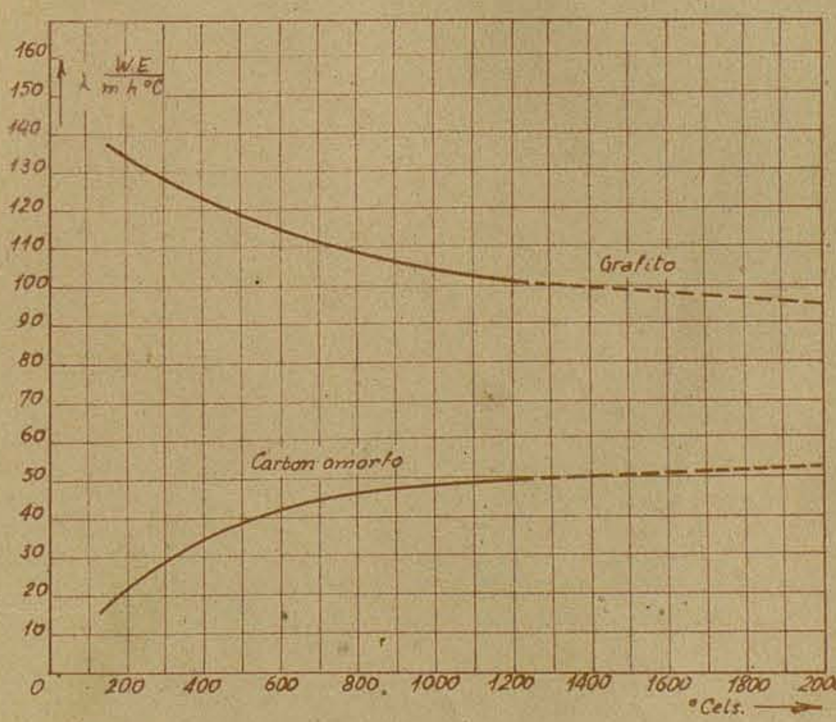


Fig. 160

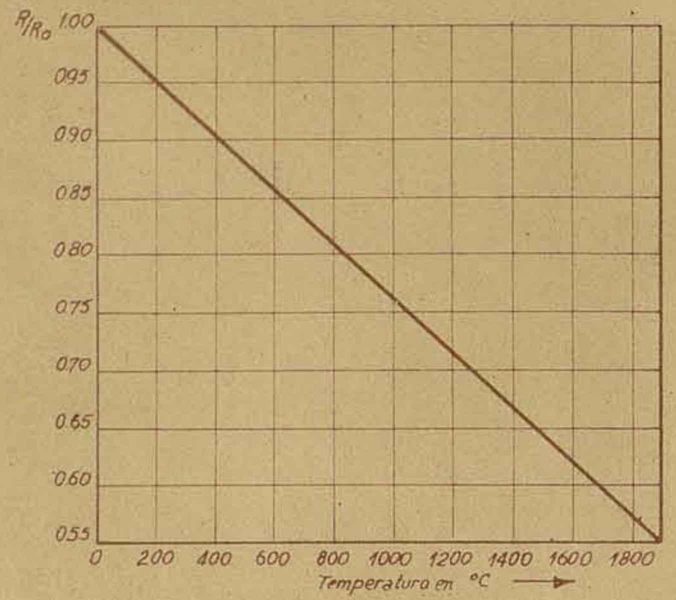
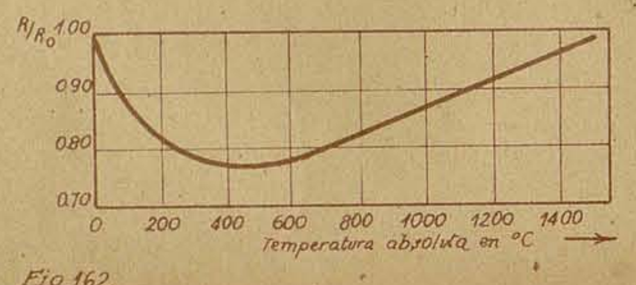


Fig. 161



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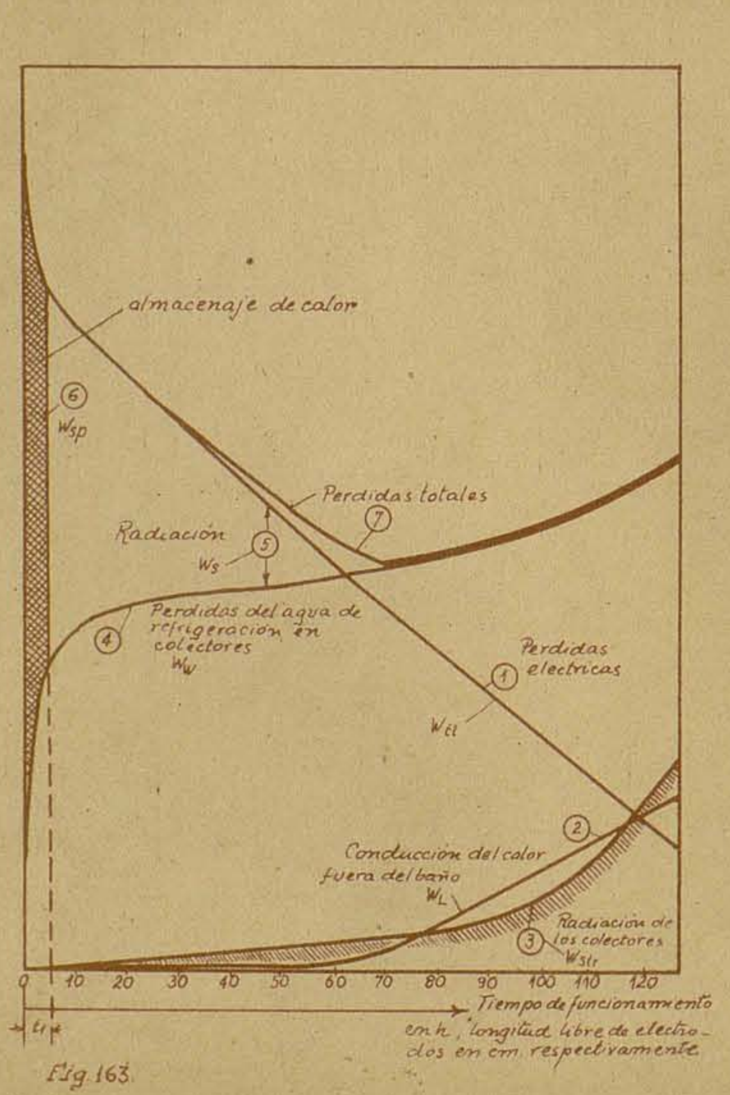

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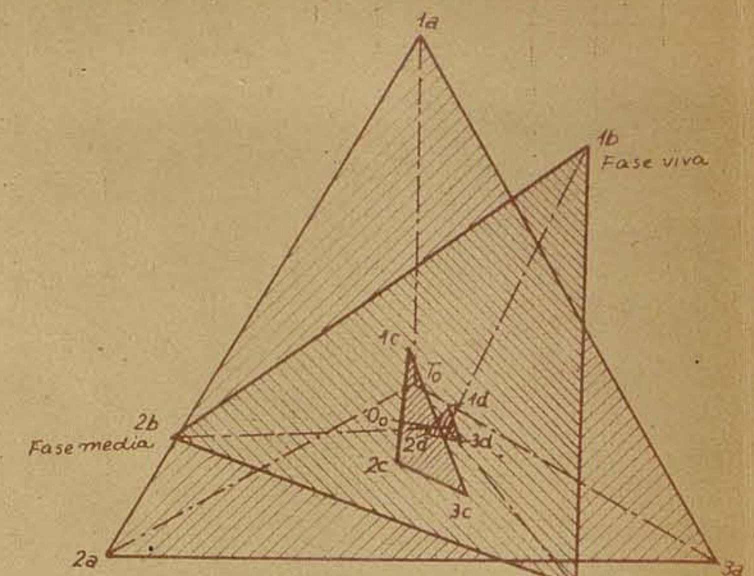


Triangulo de tensiones medido en un Horno trifasico

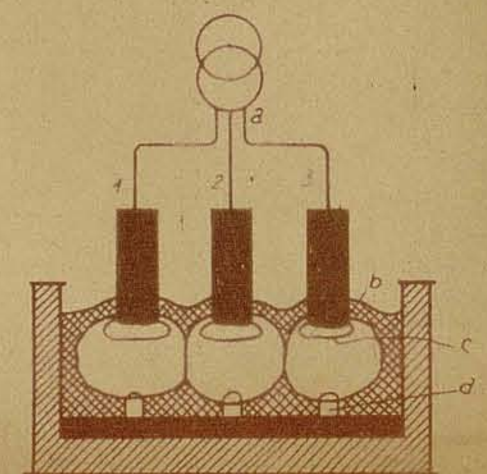


Fig. 164.

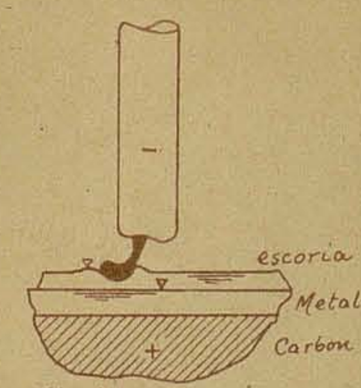


Fig. 165.
Arco normal en un Horno de metal para corriente continua (segun Kelleher)

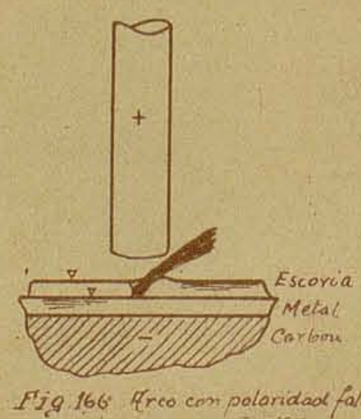


Fig. 166. Arco con polaridad falsa en un Horno como Fig. 165

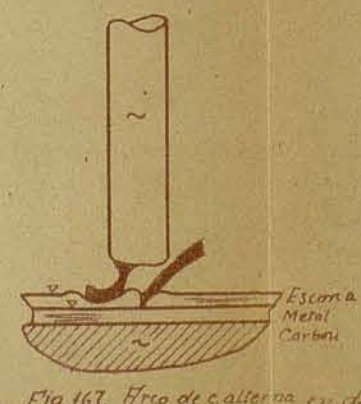


Fig. 167. Arco de c. alterna en debidas condiciones en un Horno de metal (segun Kelleher)

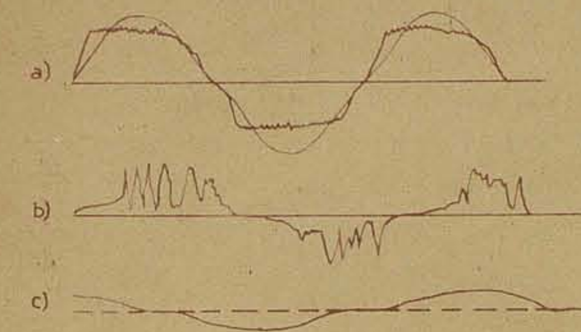


Fig. 168.

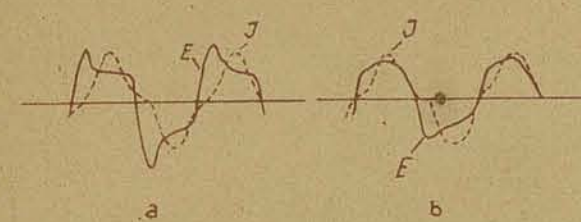


Fig. 169.

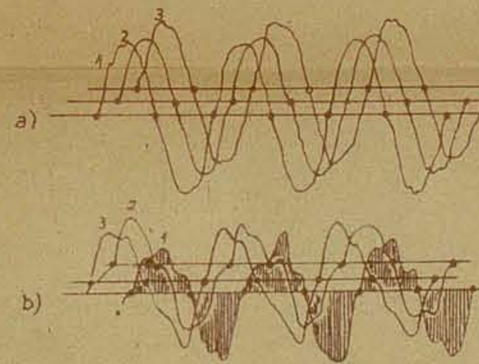


Fig. 170.

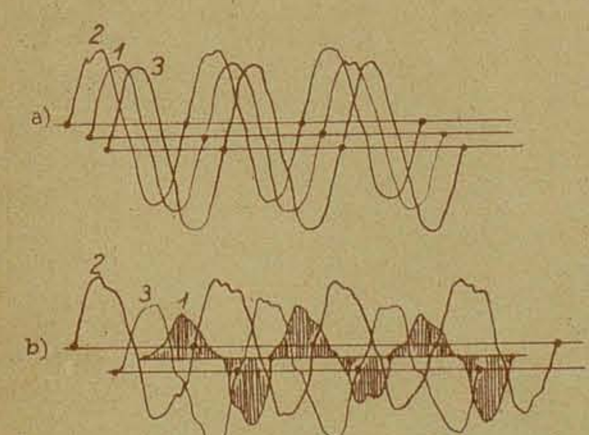


Fig. 171

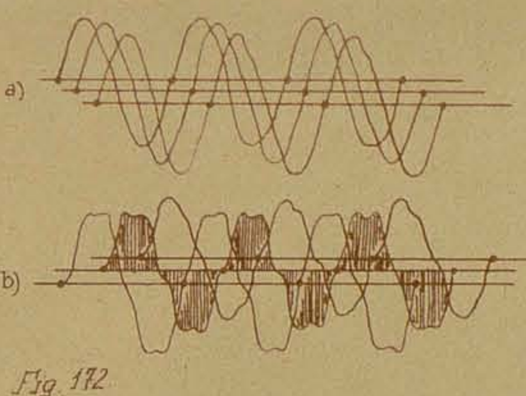


Fig. 172

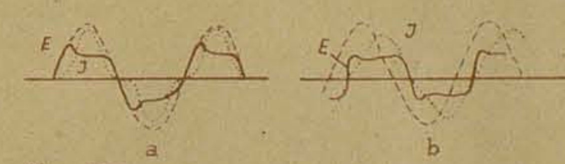


Fig. 173.

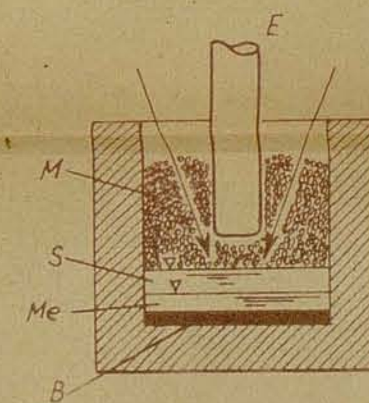


Fig. 174

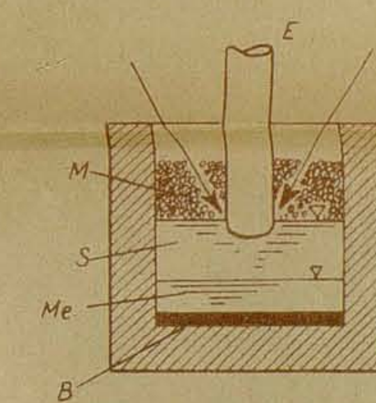


Fig. 175.

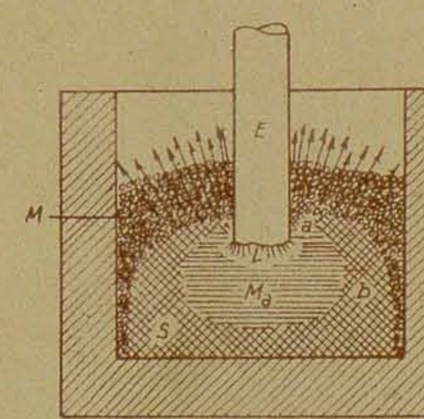


Fig. 176

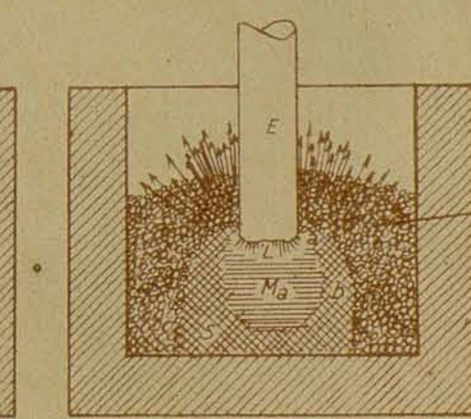


Fig. 177

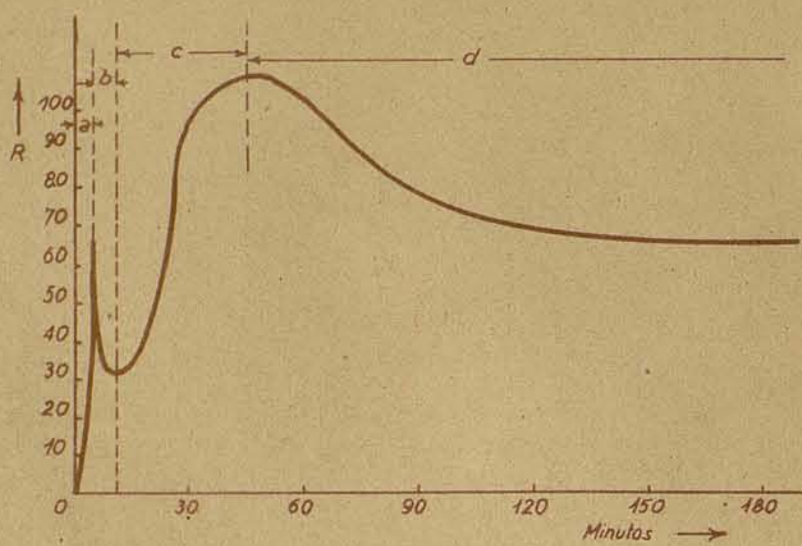


Fig. 178

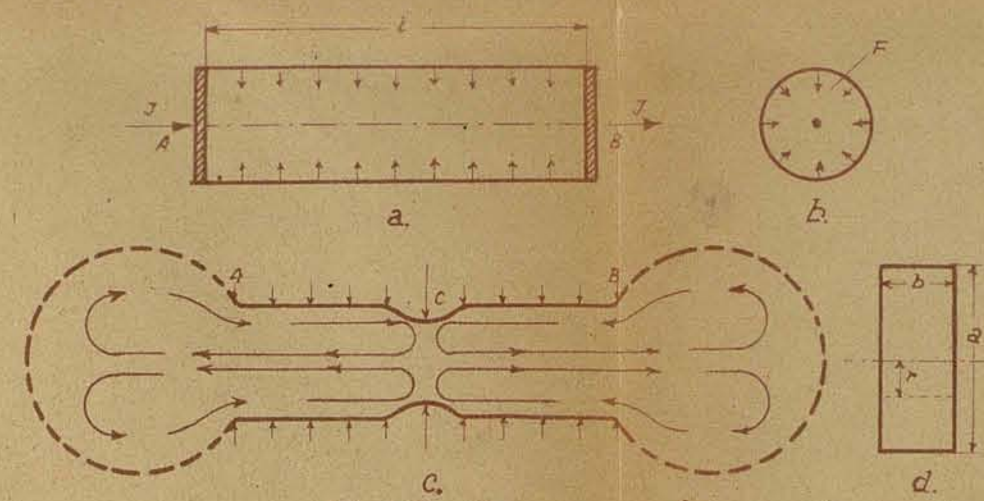


Fig. 181. Fenomenos de fuerzas de la corriente

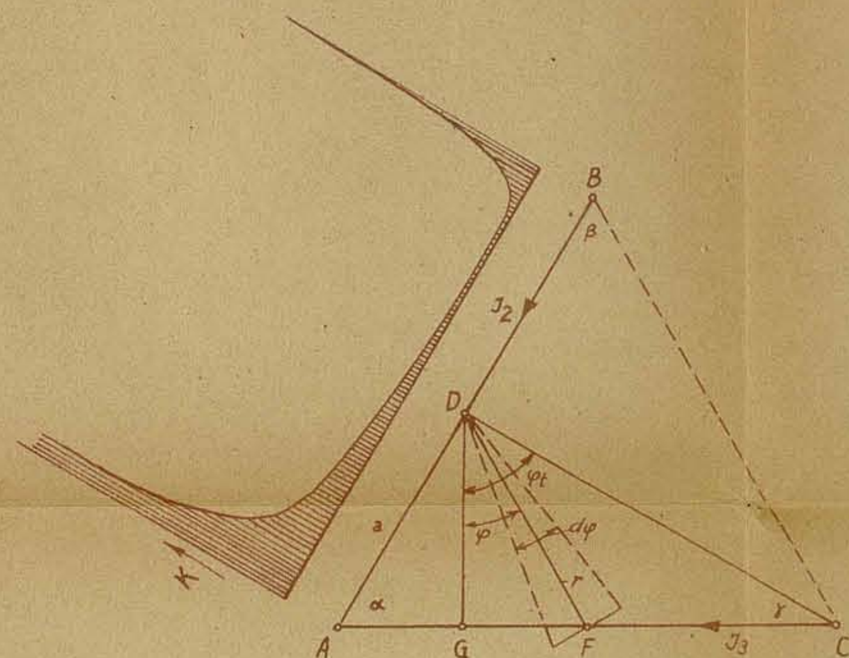


Fig. 182

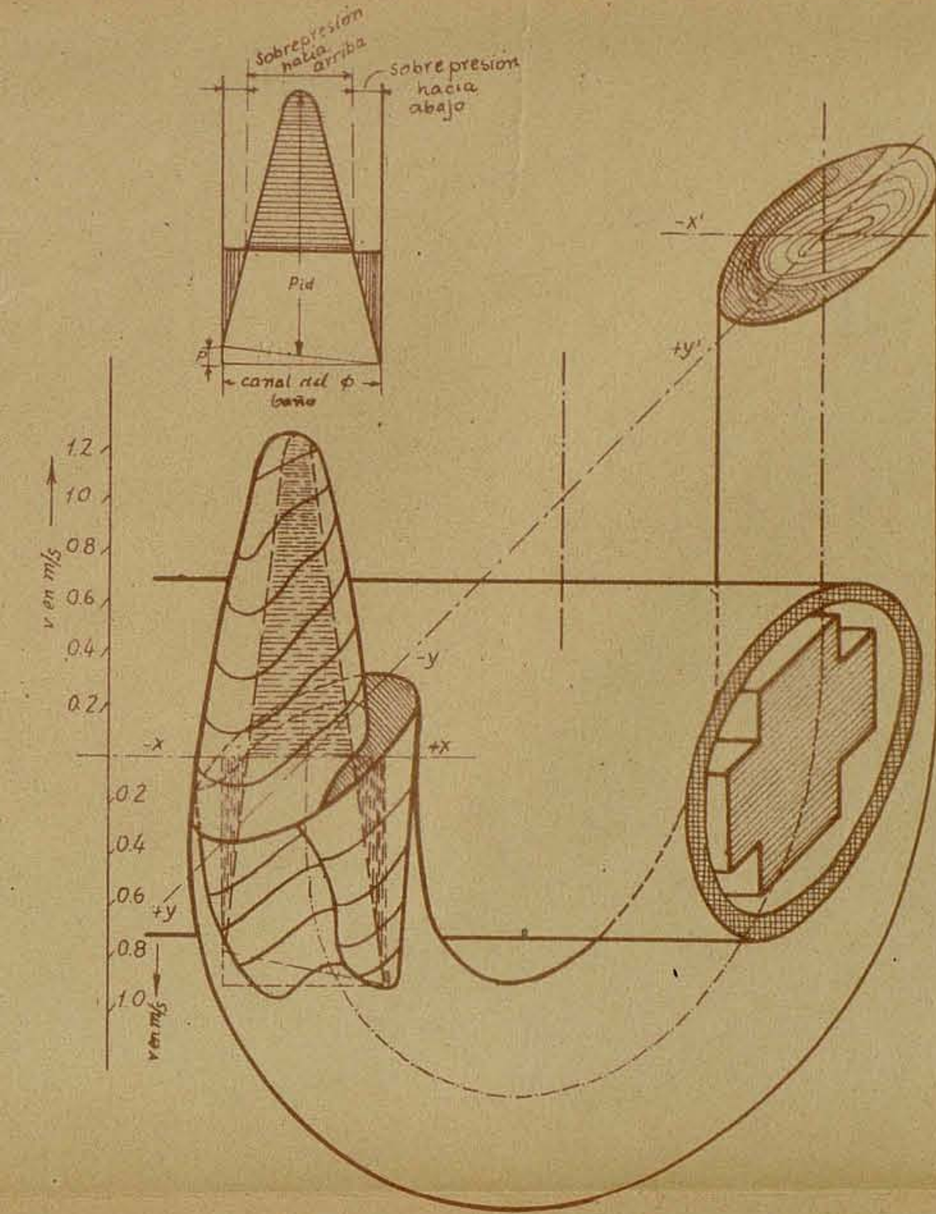


Fig. 184. Grafico de corrientes en un Horno de inducción

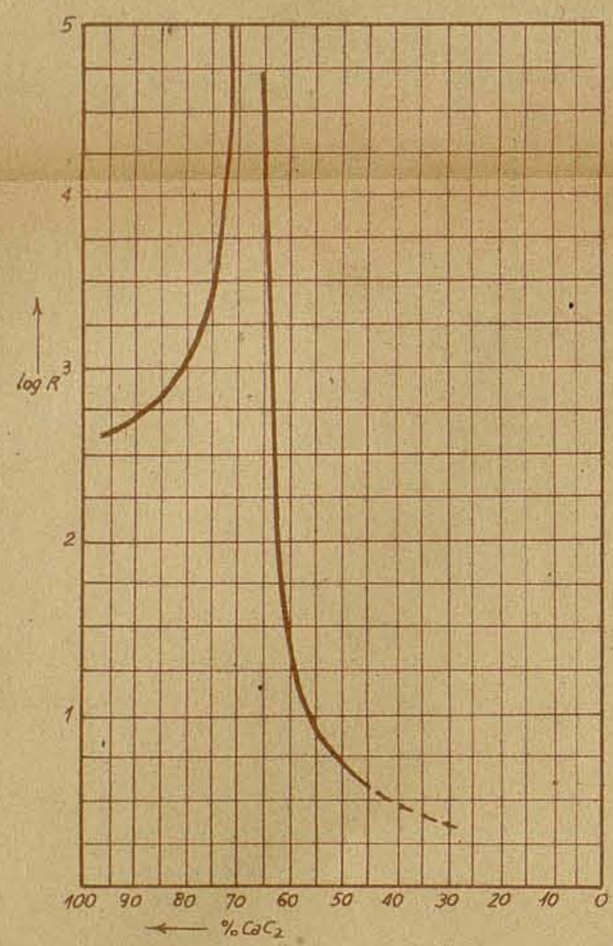


Fig. 180.

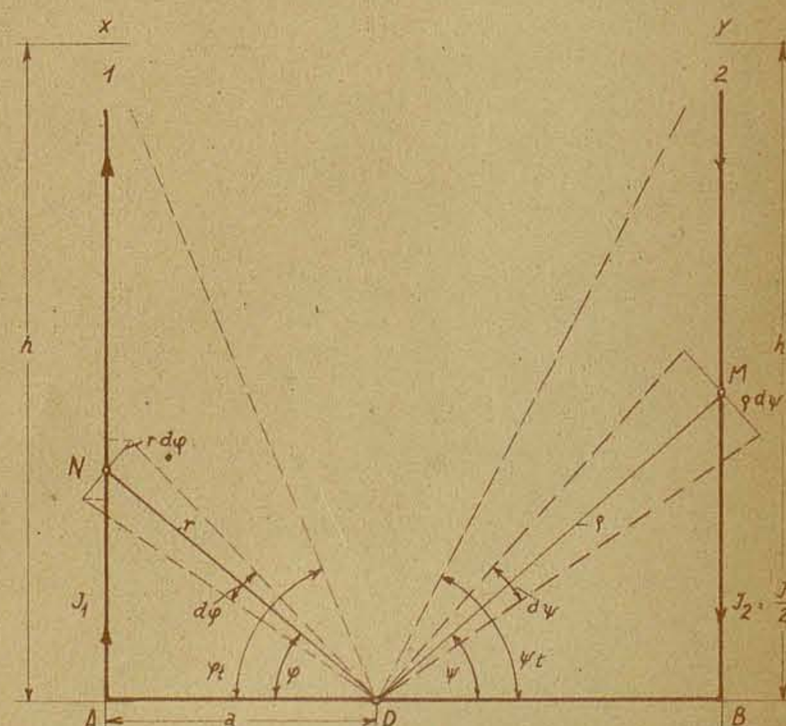


Fig. 183.

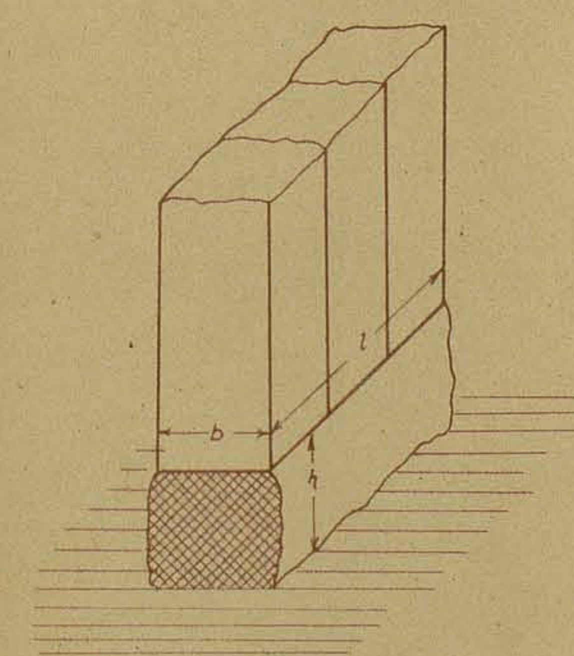


Fig. 185. Volumen de baño de un electrodo rectangular.

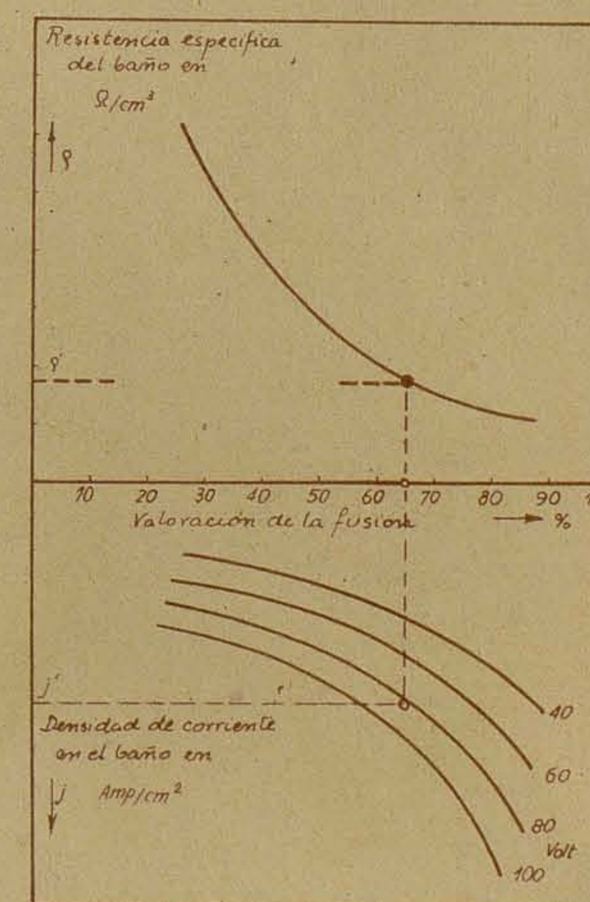
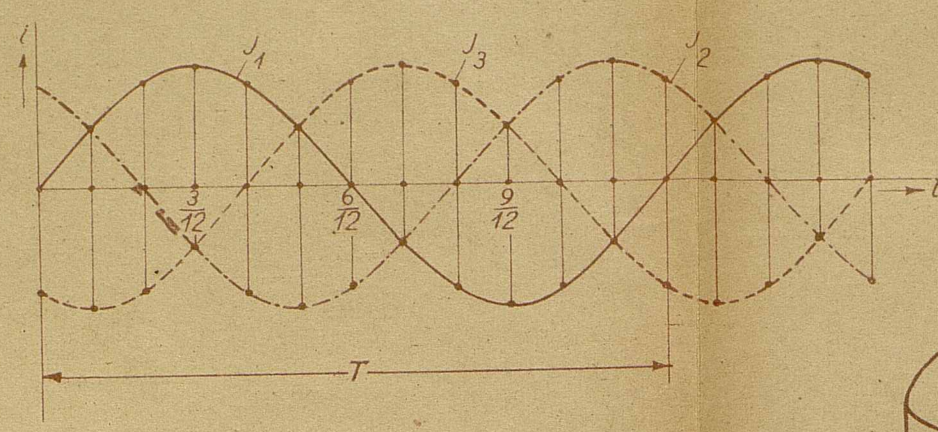
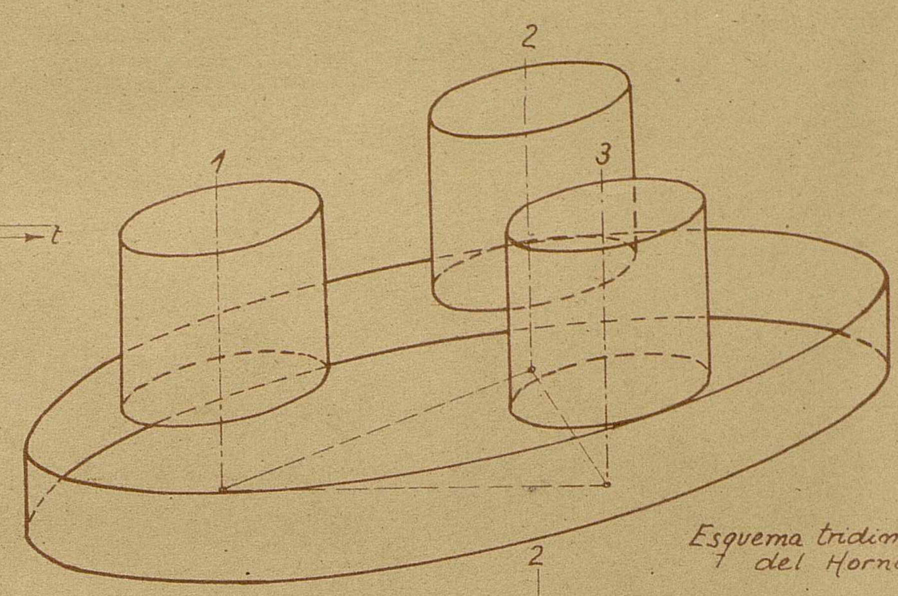


Fig. 186. Curvas de una electro fusión





Esquema tridimensional del Horno

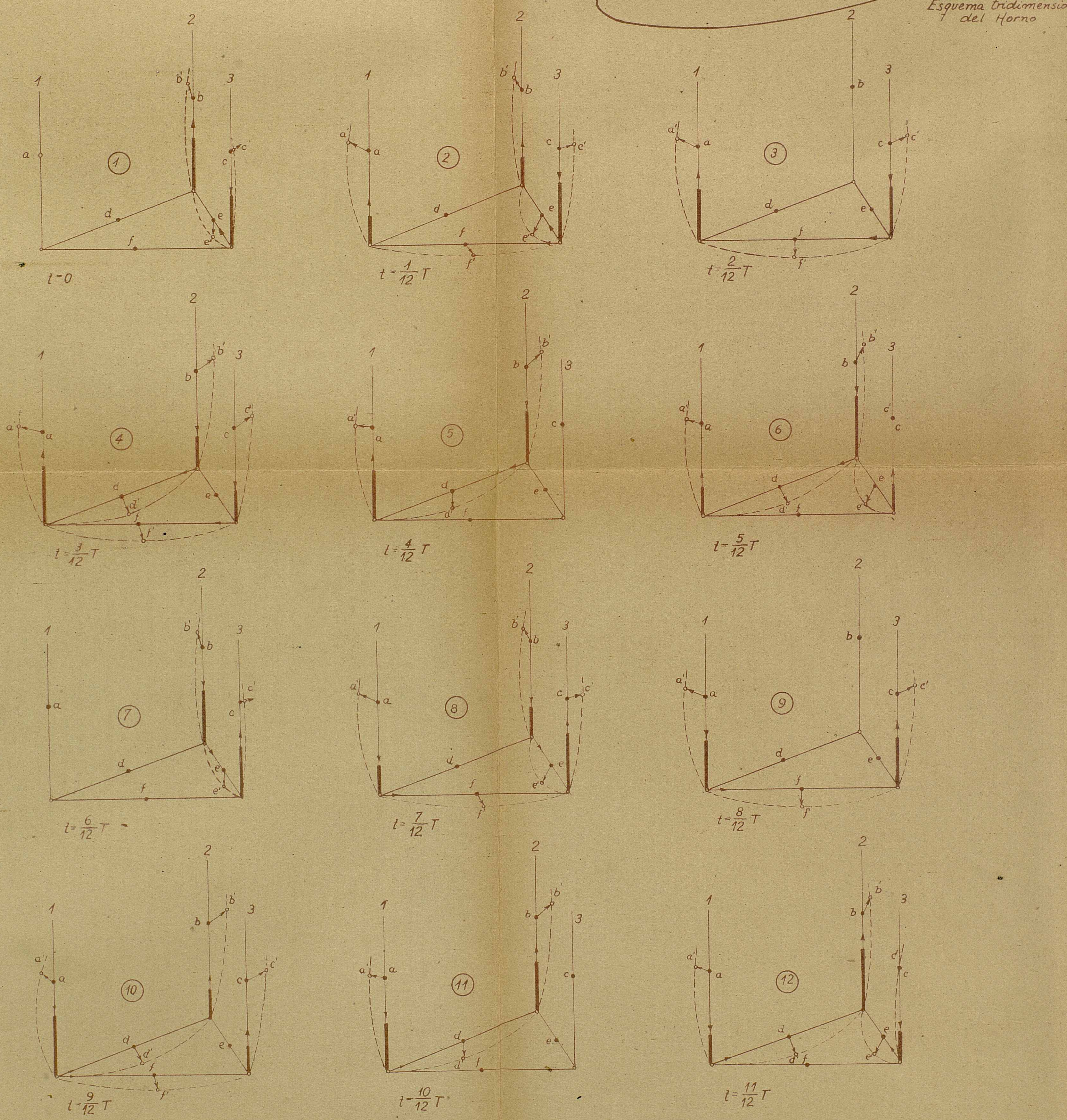


Tabla I. Marcha de corriente en Horno trifasico en las diferentes fases de un periodo.

©

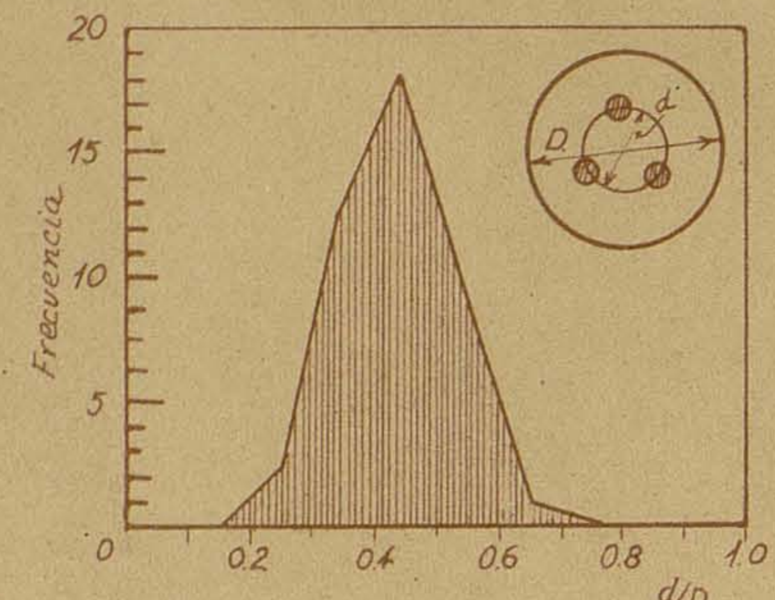


Fig. 187. Relación d/D en los Hornos eléctricos alemanes

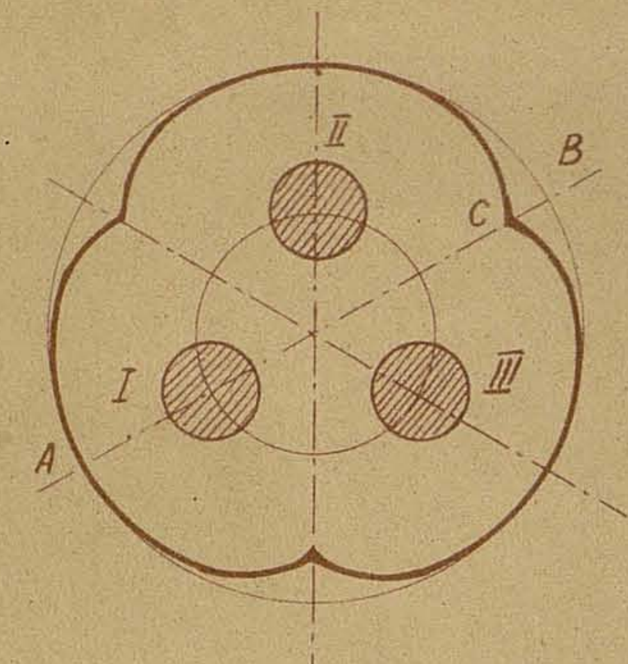


Fig. 190.

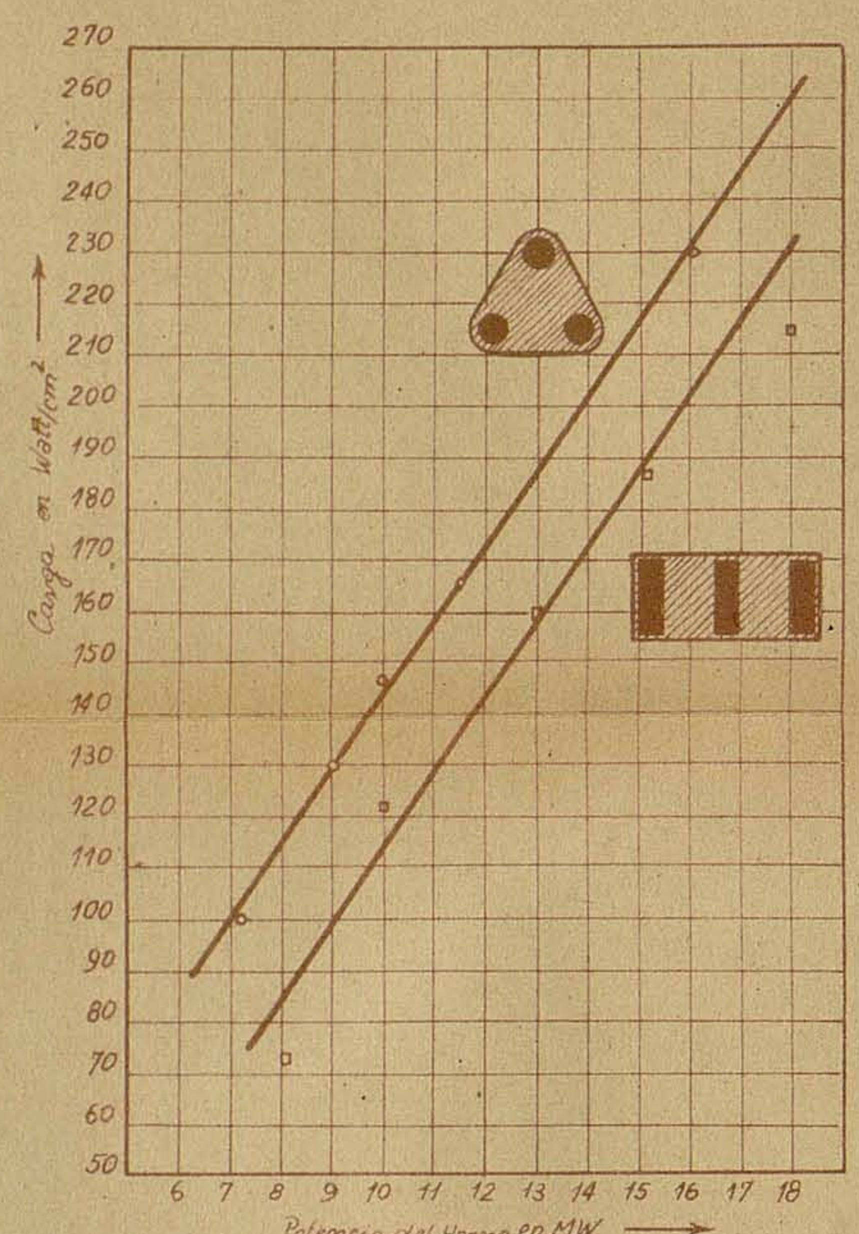


Fig. 188. Carga eléctrica en los Hornos de Carburo de distintas disposiciones de electrodos.

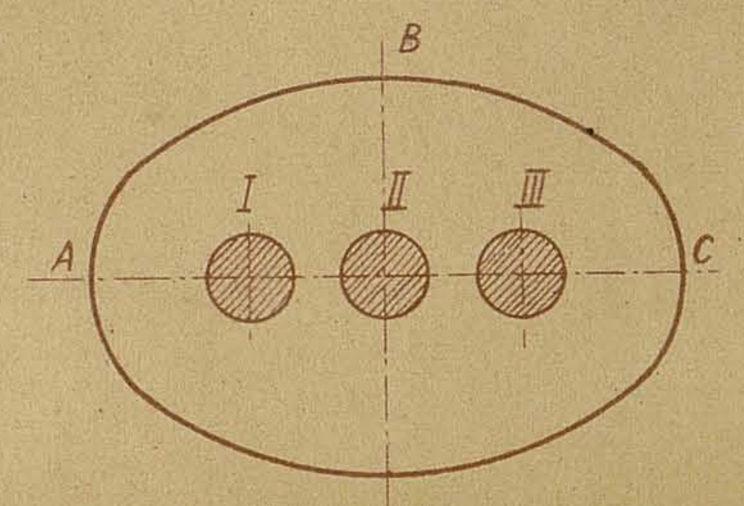


Fig. 191.

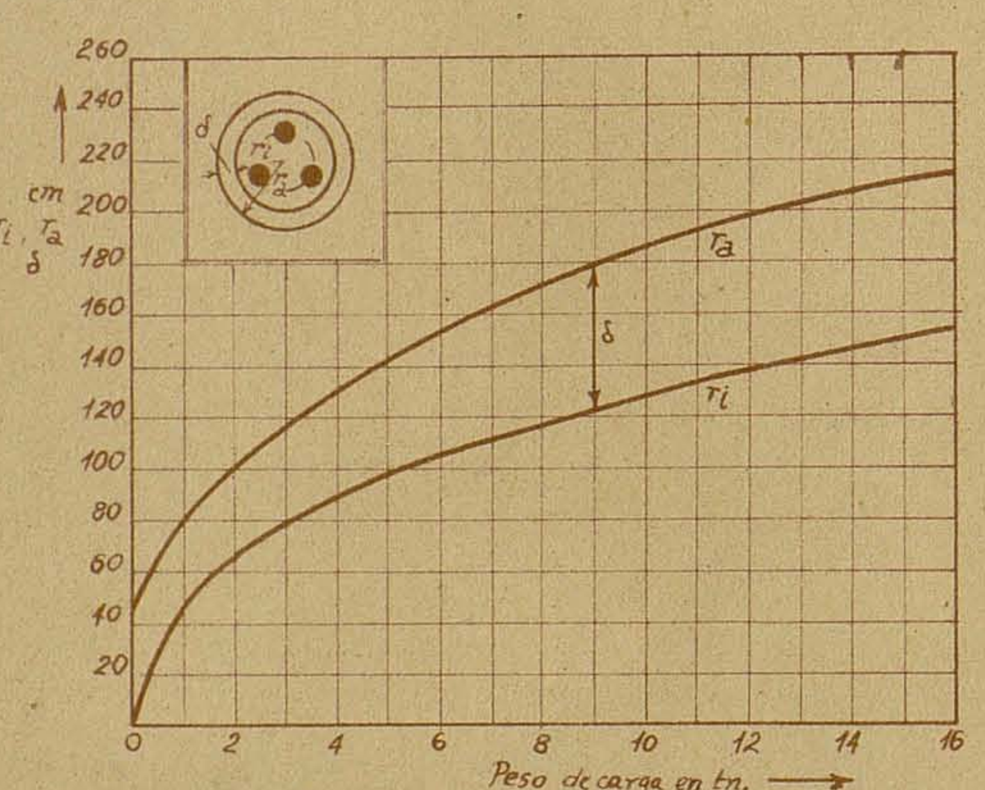


Fig. 189. Radios interno, externo y espesor de paredes

Cuerpo	Volumen	Superficie
	1.00	4.83
d h	1.00	5.50
b · h · l	1.00	6.00
a b b·h 2/3a	1.00	6.16
a 2a 3a	1.00	6.68

Fig. 192. Relación Superficie a Volumen en crisoles de distintas formas.

Fig. 195. "Conductibilidad geométrica" ó factor de forma para esferas huecas y cubos

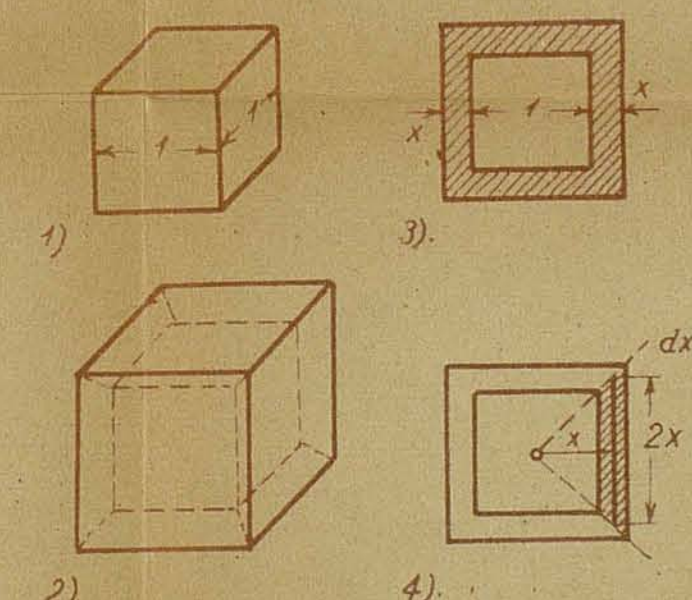


Fig. 196. Determinación de la resistencia geométrica

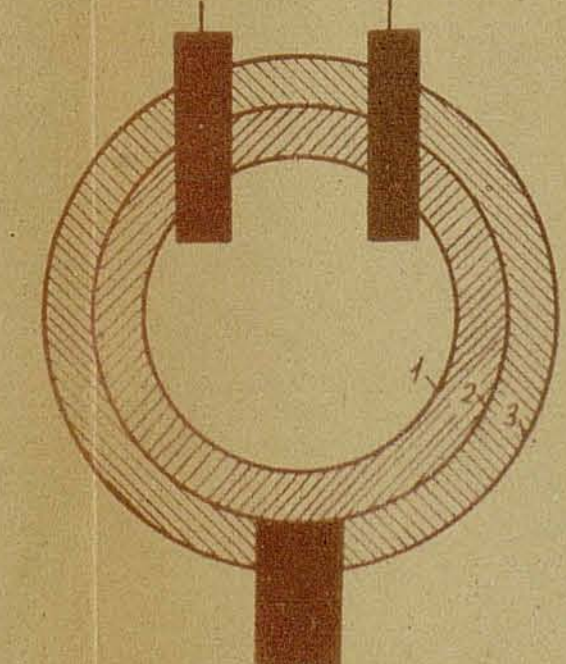


Fig. 198. Crisol con paso parcial de corriente a través del aislante térmico, al electrodo de solera.

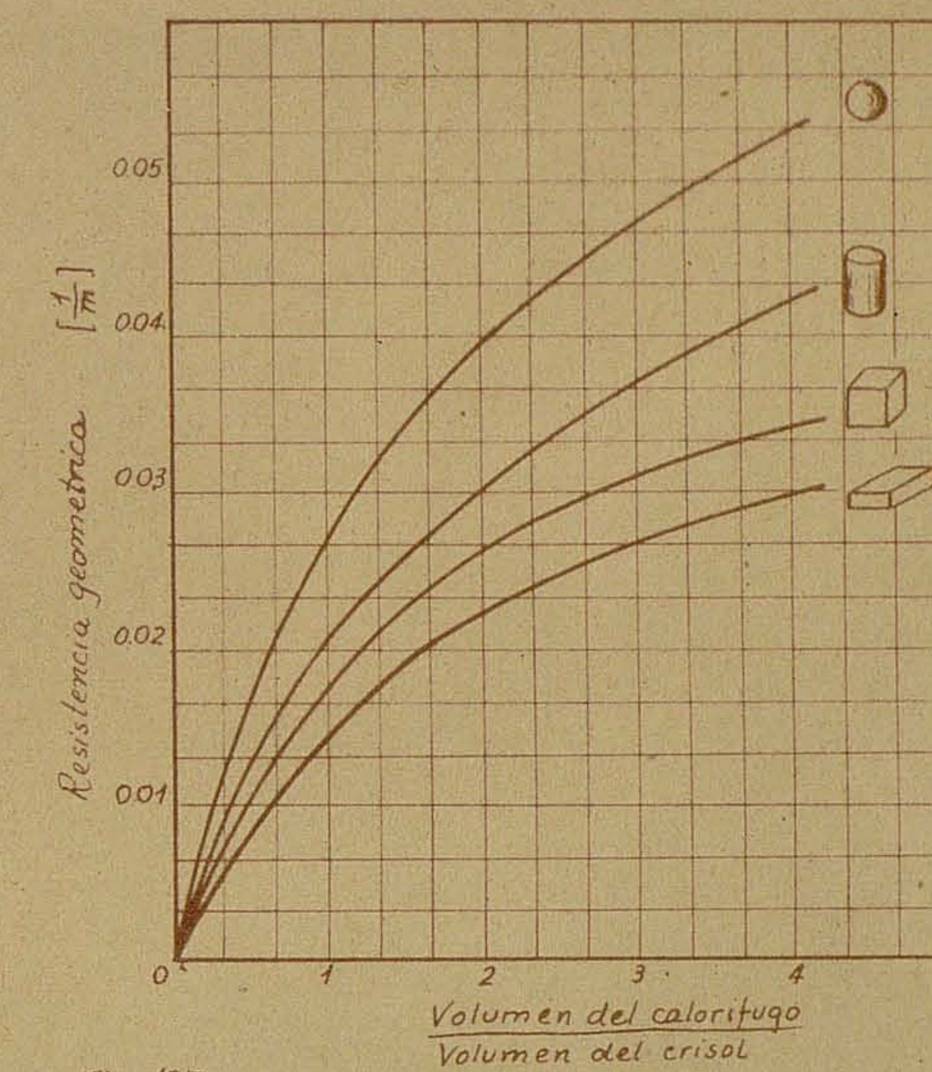


Fig. 197.

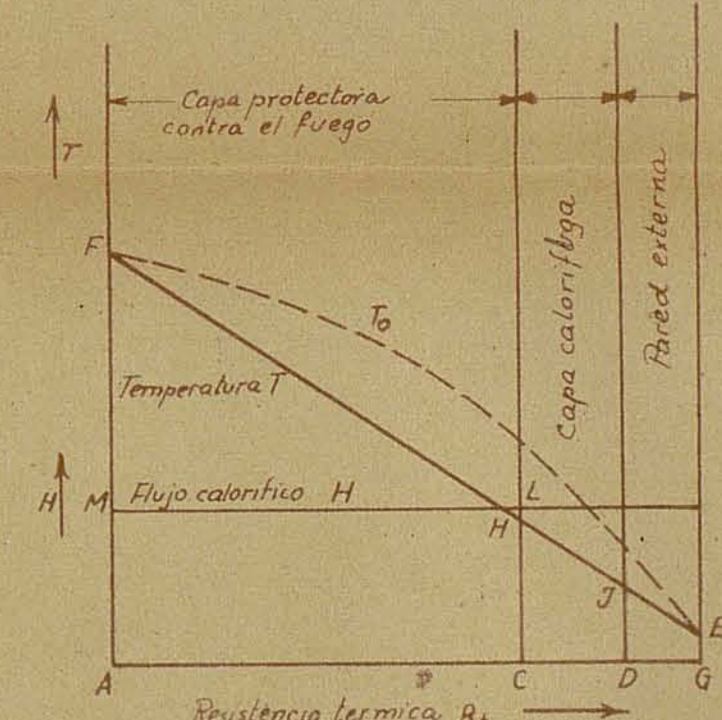


Fig. 199. Esquema de la potencia térmica de un Horno eléctrico (Kawasakiya)

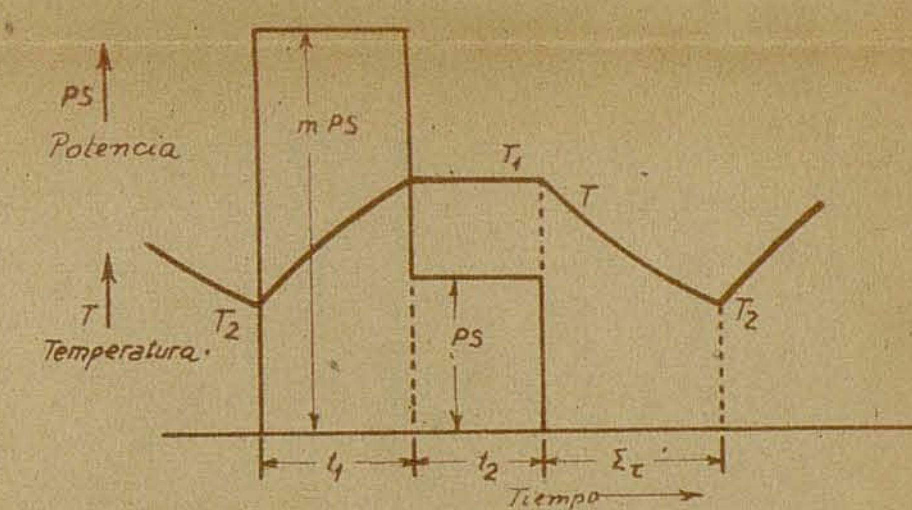


Fig. 200. Esquema térmico

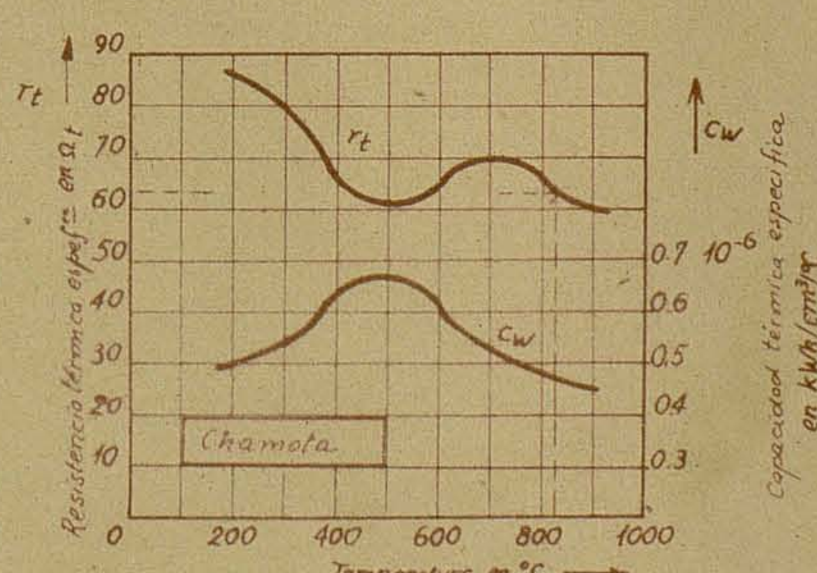


Fig. 204. Característica para la chamota (Ejemplo de Kawasakiya)

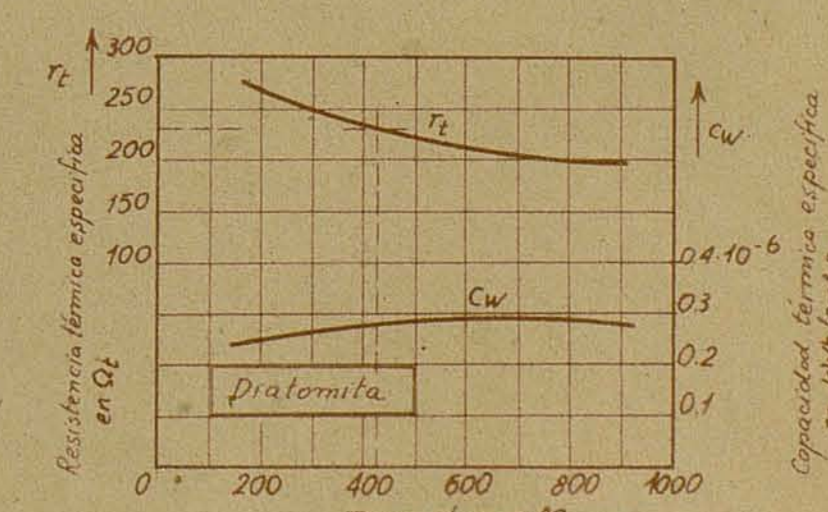


Fig. 205. Característica para la diatomita (Referente al ejemplo de Kawasakiya)

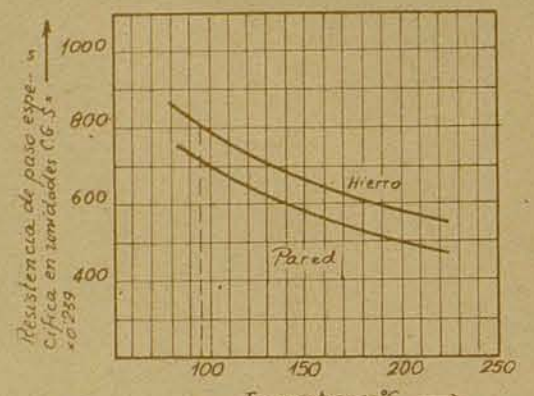


Fig. 206. Resistencia de paso de calor en superficies, según Kawasakiya

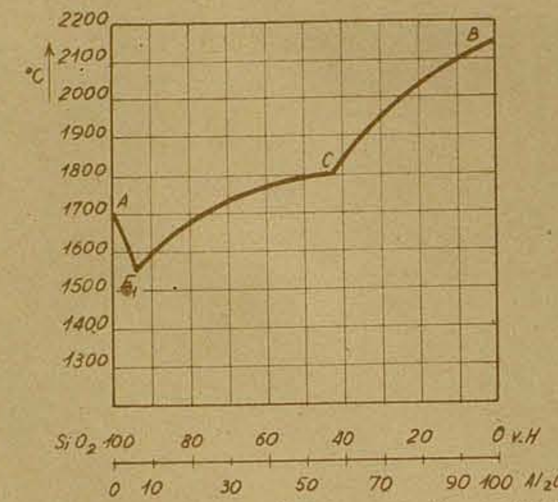


Fig. 209. Línea de fusión del sistema $Al_2O_3 - SiO_2$

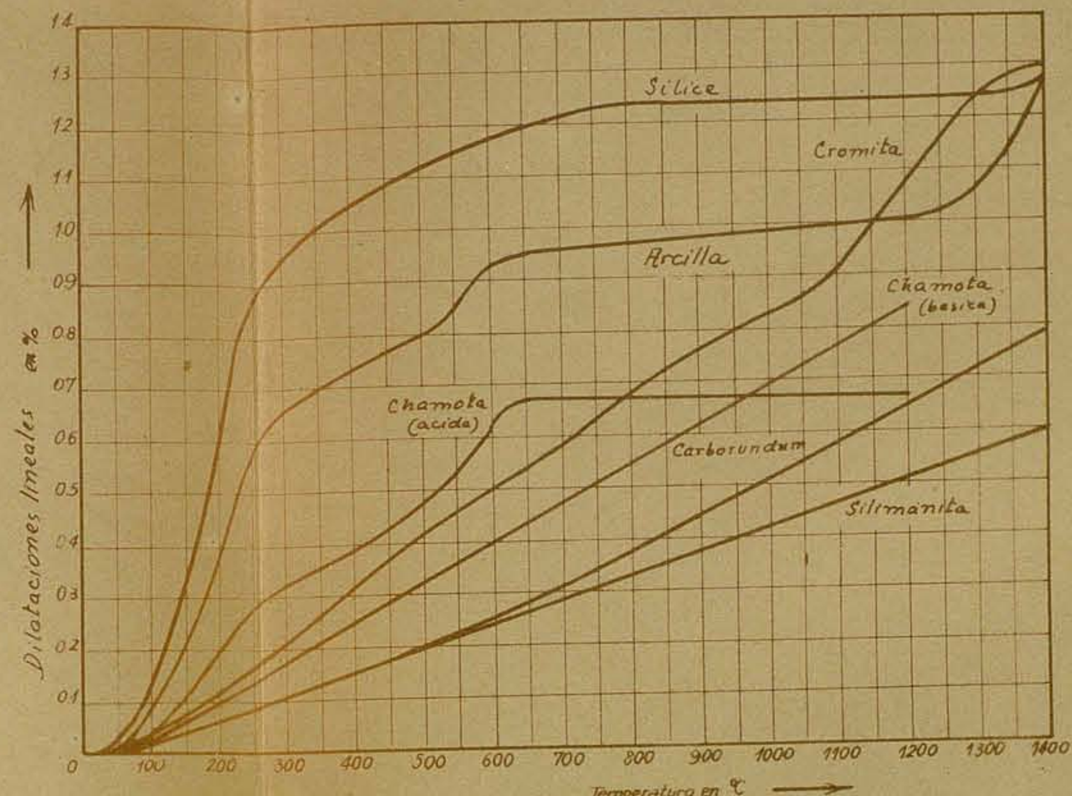


Fig. 210. Dilatación térmica de los refractarios

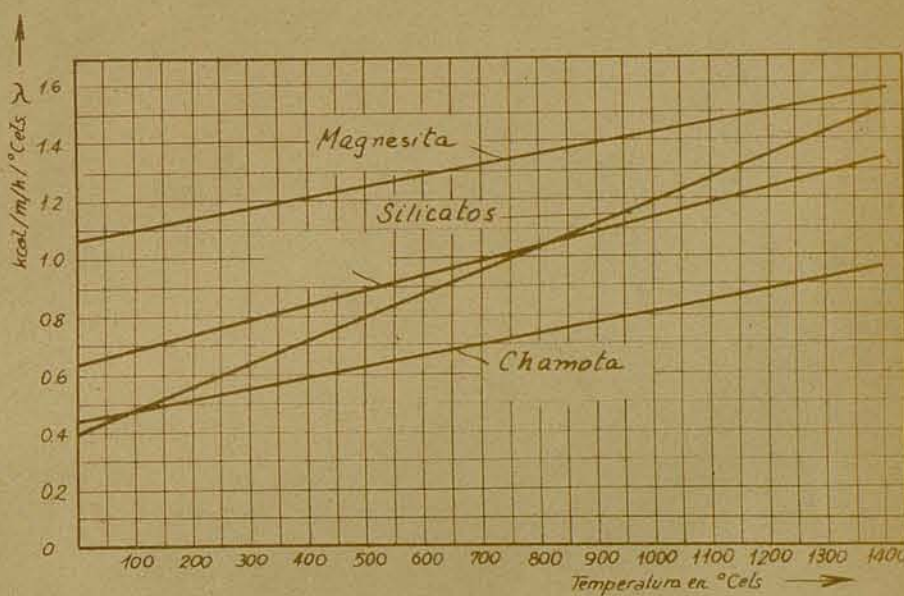


Fig. 212.

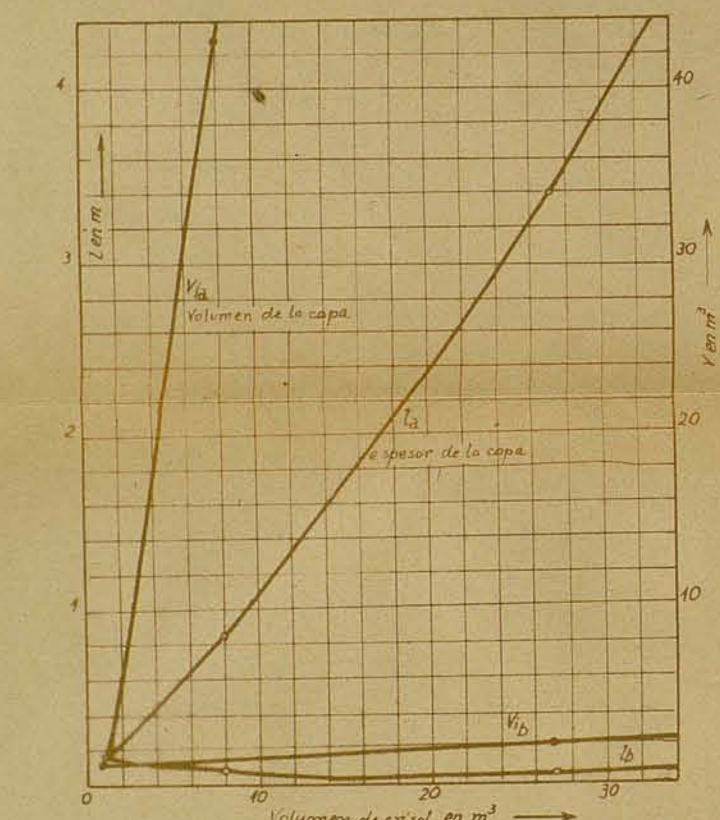


Fig. 207. Volumen V_l y espesor l de la capa aislante al variar el volumen de crisol cúbico
a) Perdidas constante absolutas de calor
b) » » por m^3 de volumen de crisol

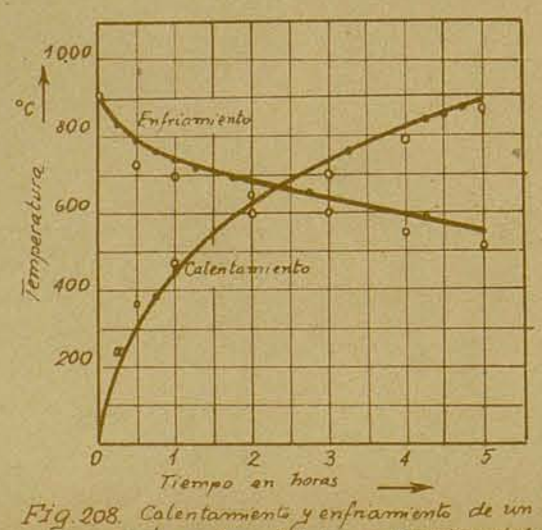


Fig. 208. Calentamiento y enfriamiento de un horno según valores teóricos y experimentales.

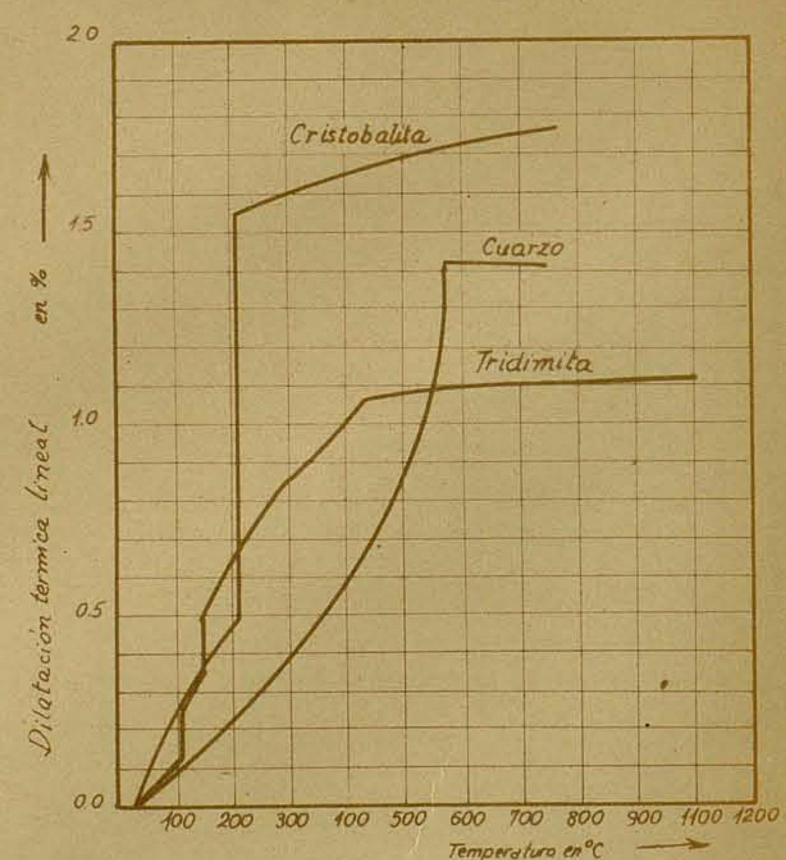


Fig. 211.

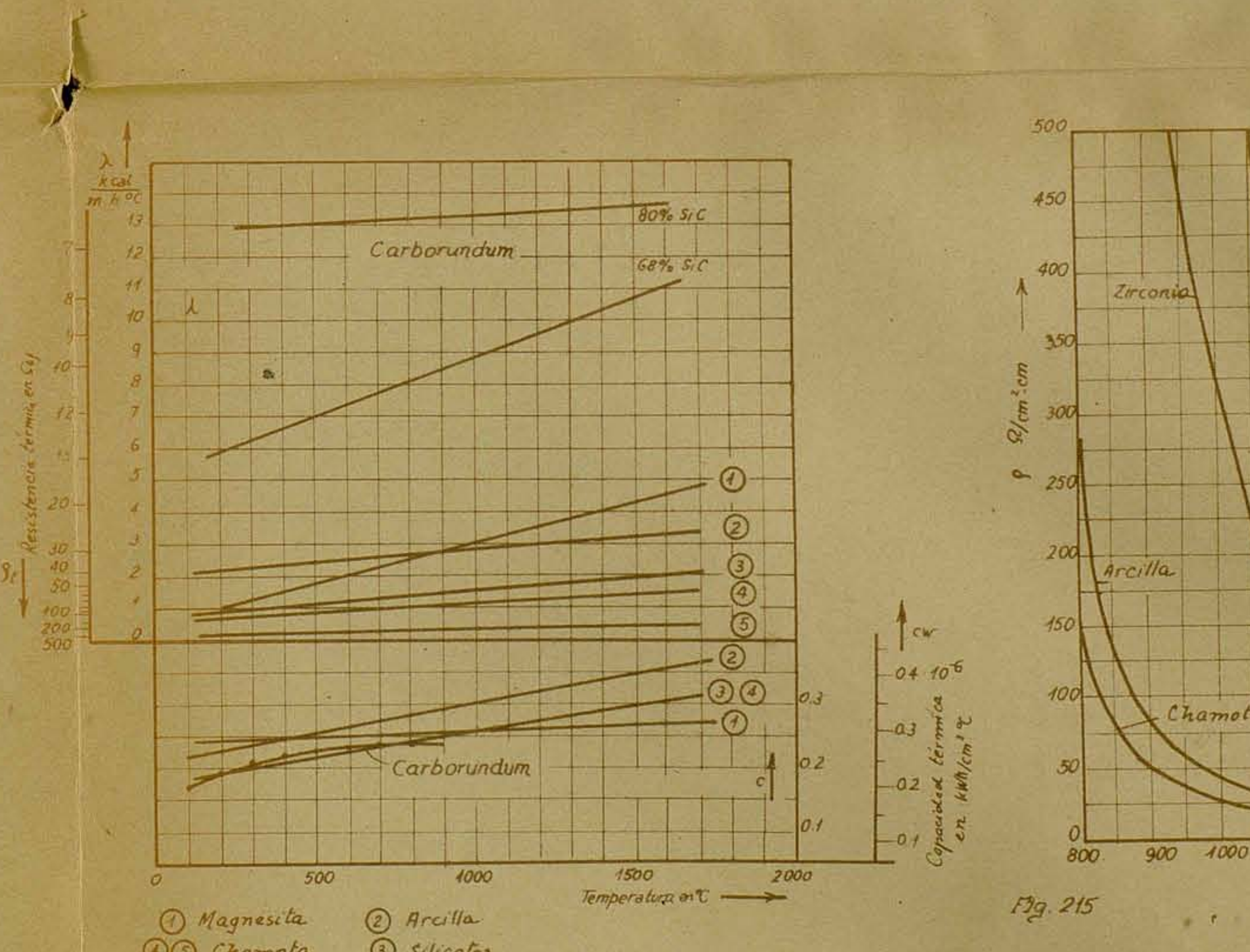


Fig. 213. Cifras características de refractarios.

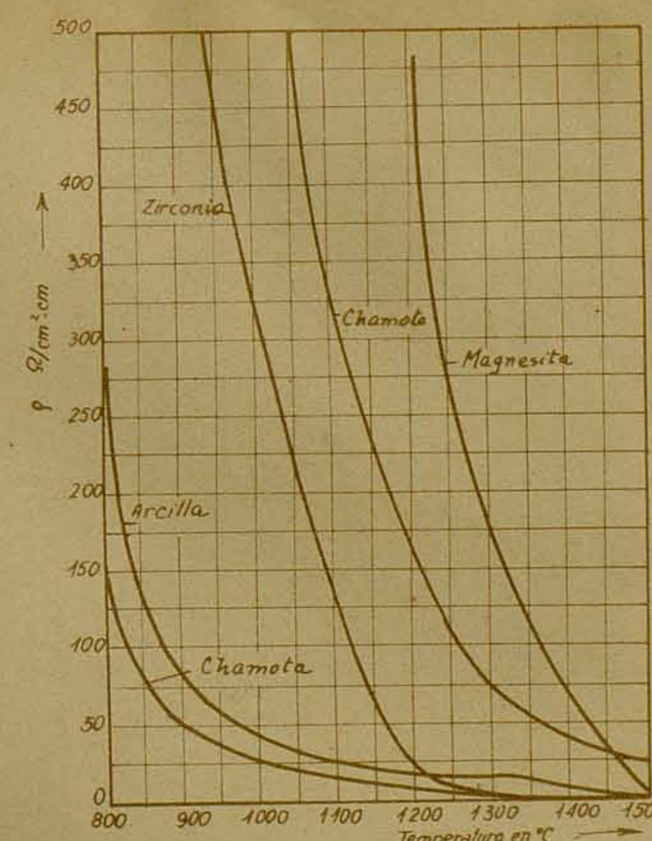


Fig. 215

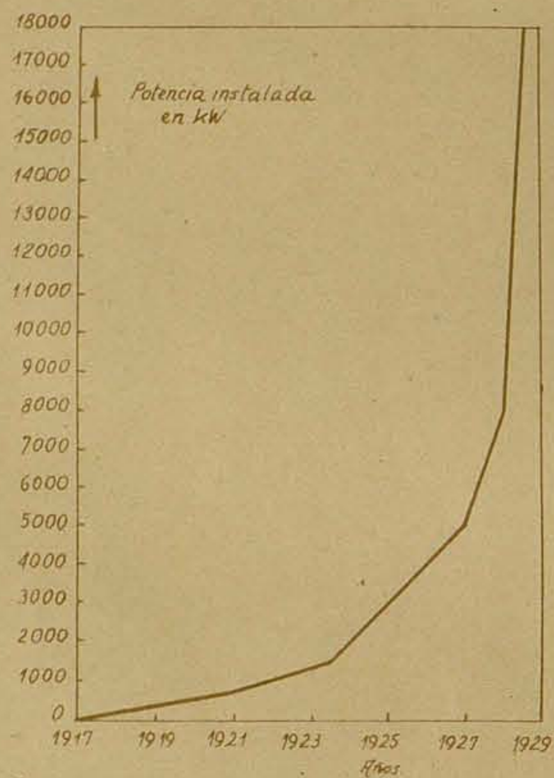


Fig. 216.

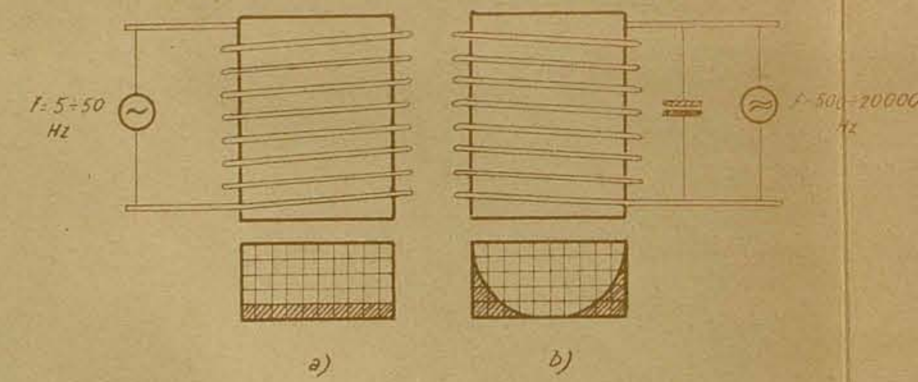


Fig. 220.

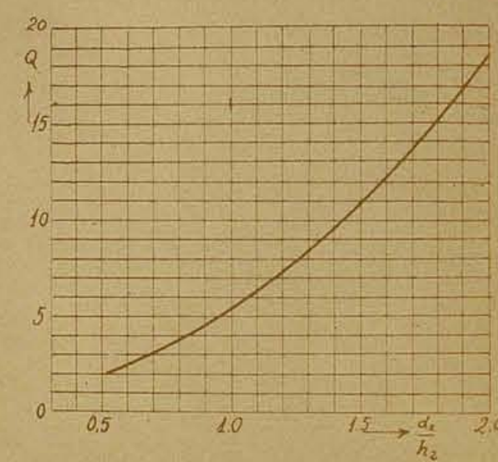


Fig. 222.

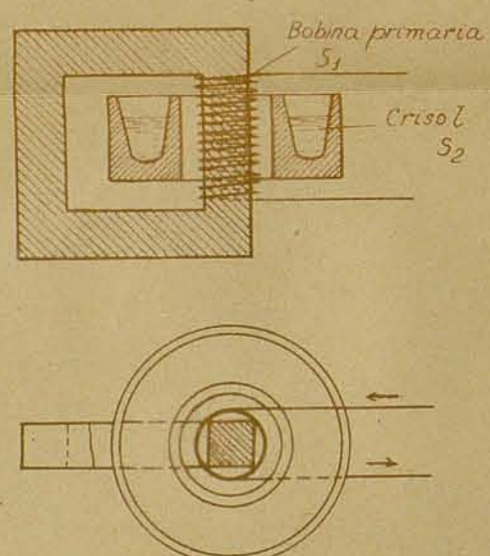


Fig. 217.

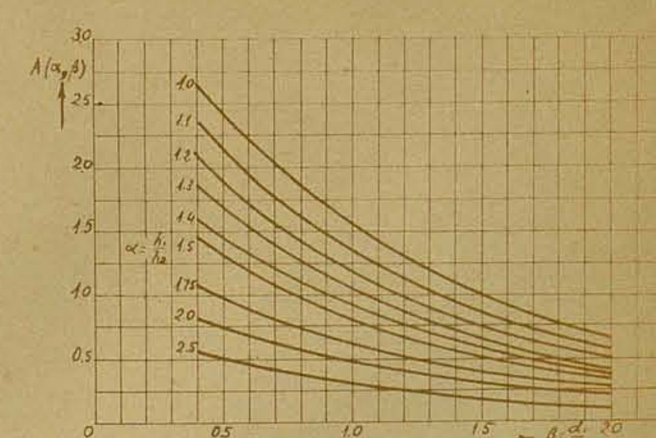


Fig. 223.

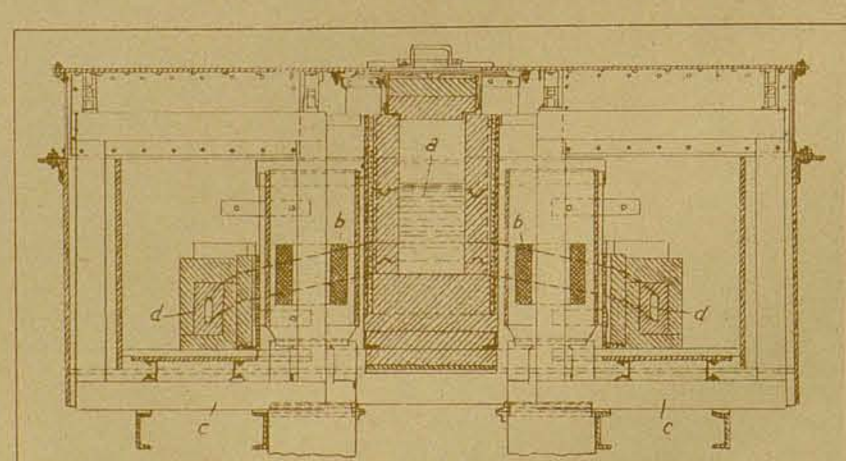


Fig. 218. Horno de inducción de baja frecuencia para refusión de aleaciones
a = crisol central, b = bobina primaria C = nucleo de hierro d = anillo secundario

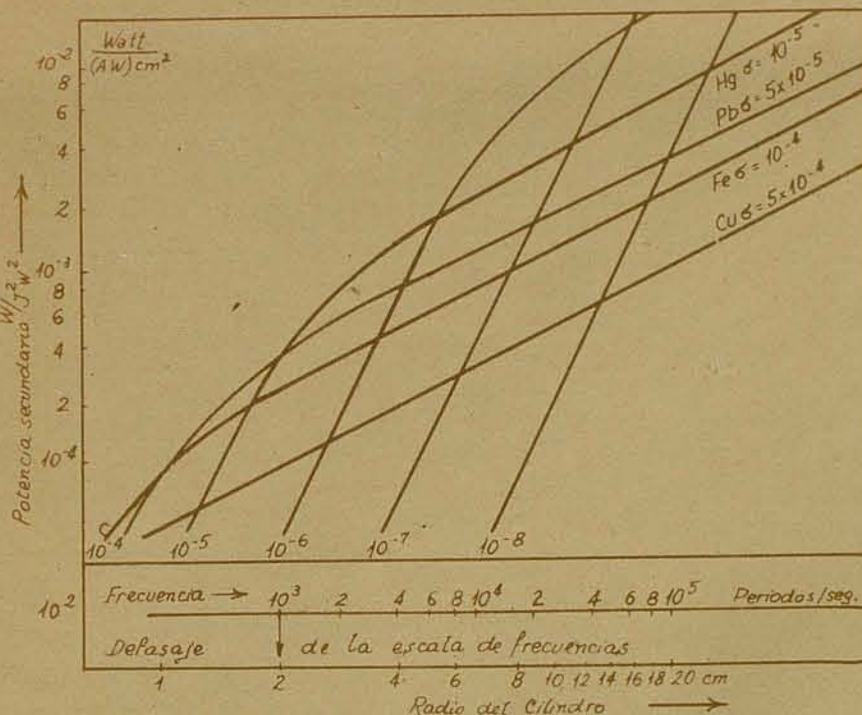


Fig. 224.

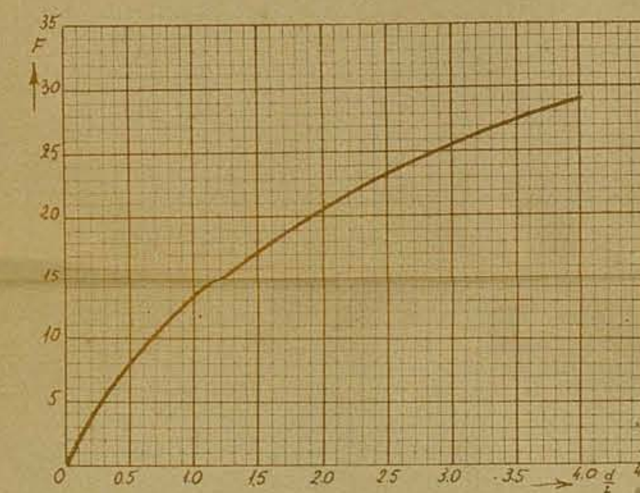


Fig. 225. función $F = f\left(\frac{d}{h}\right)$. (según Esmarch.)

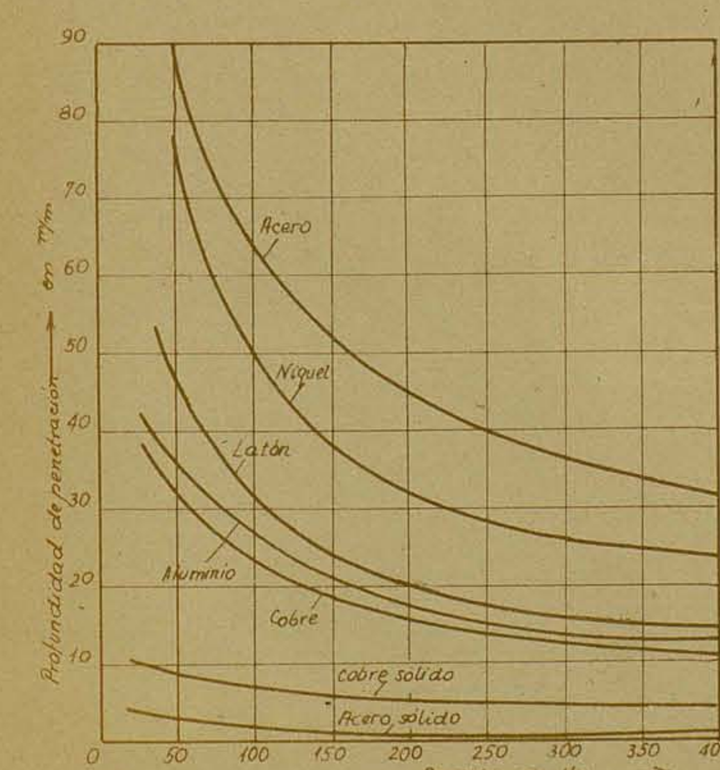


Fig. 226

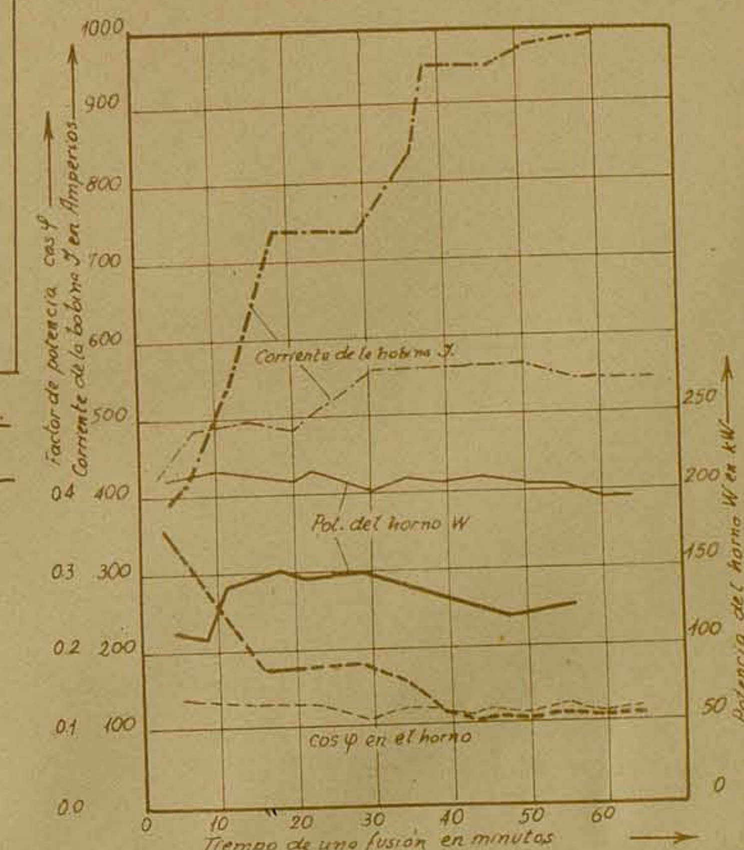


Fig. 227.

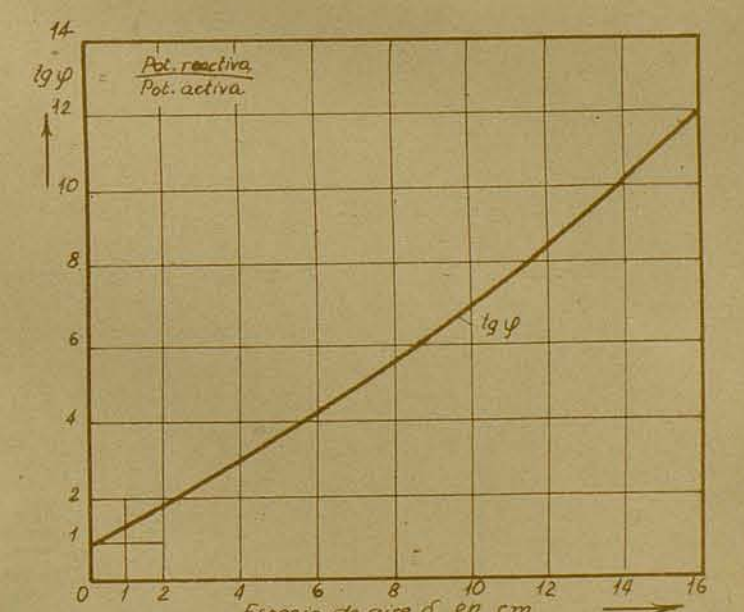
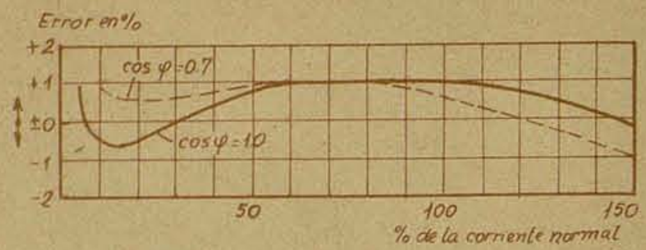


Fig. 228.



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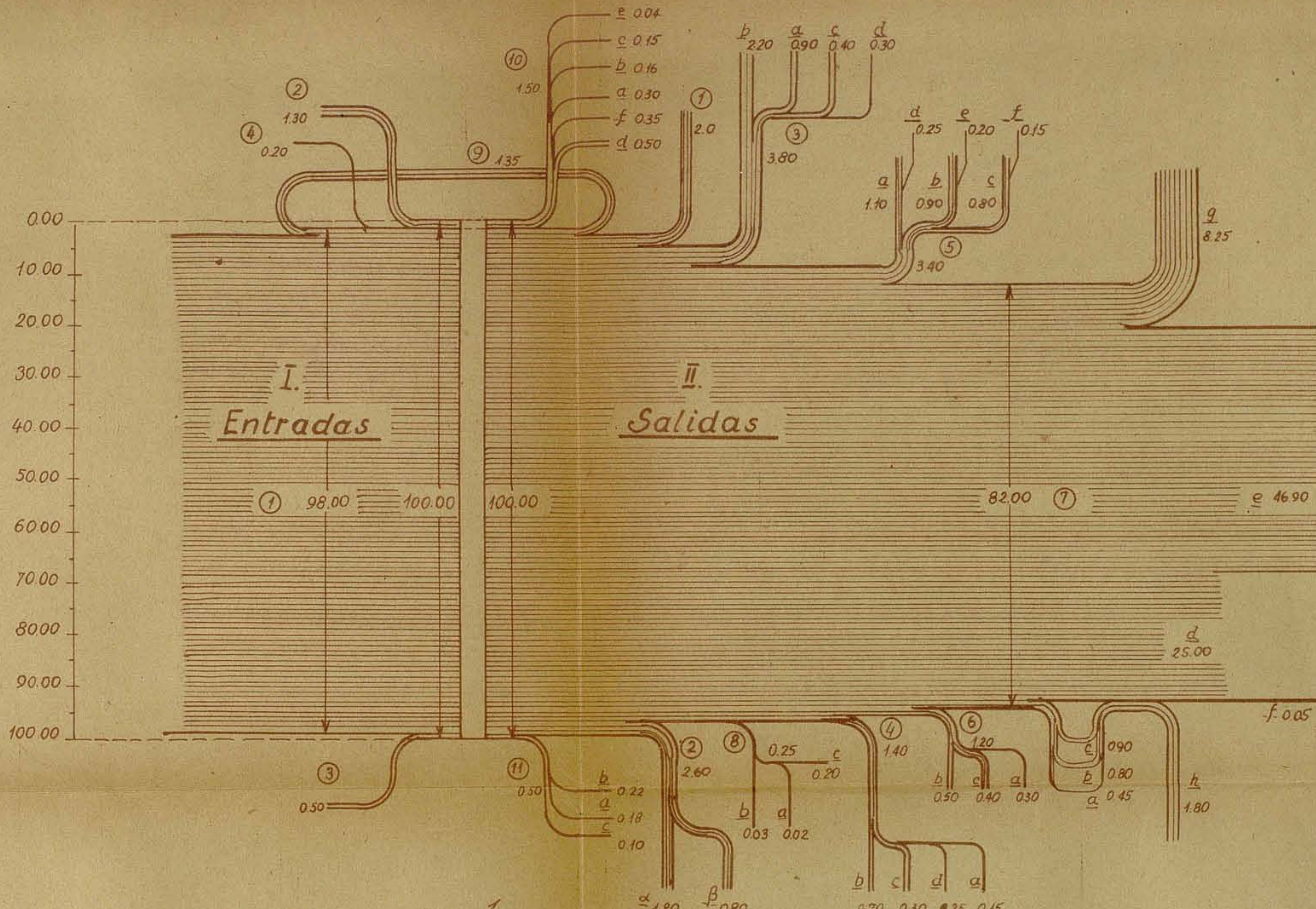

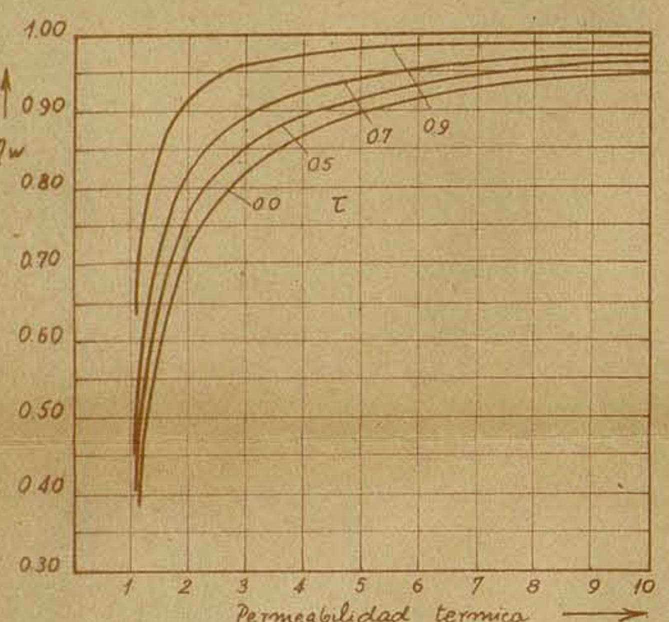

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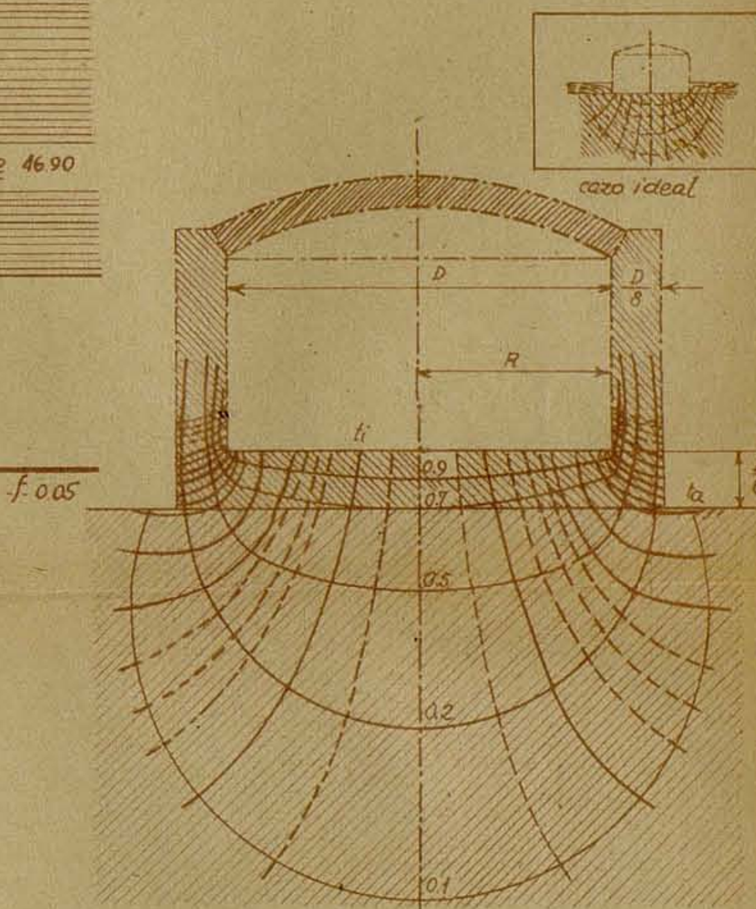

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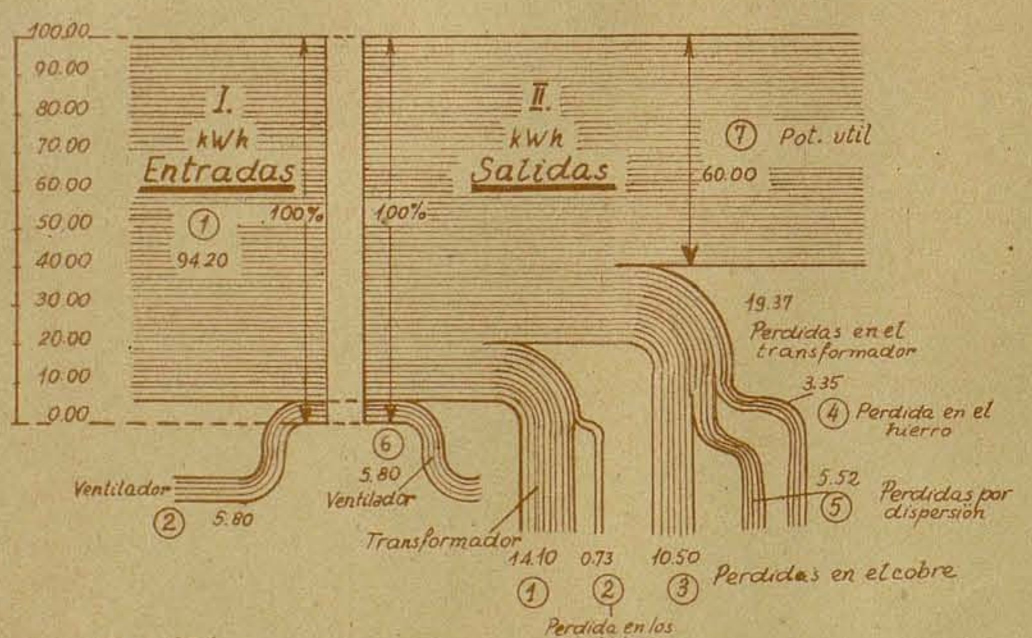

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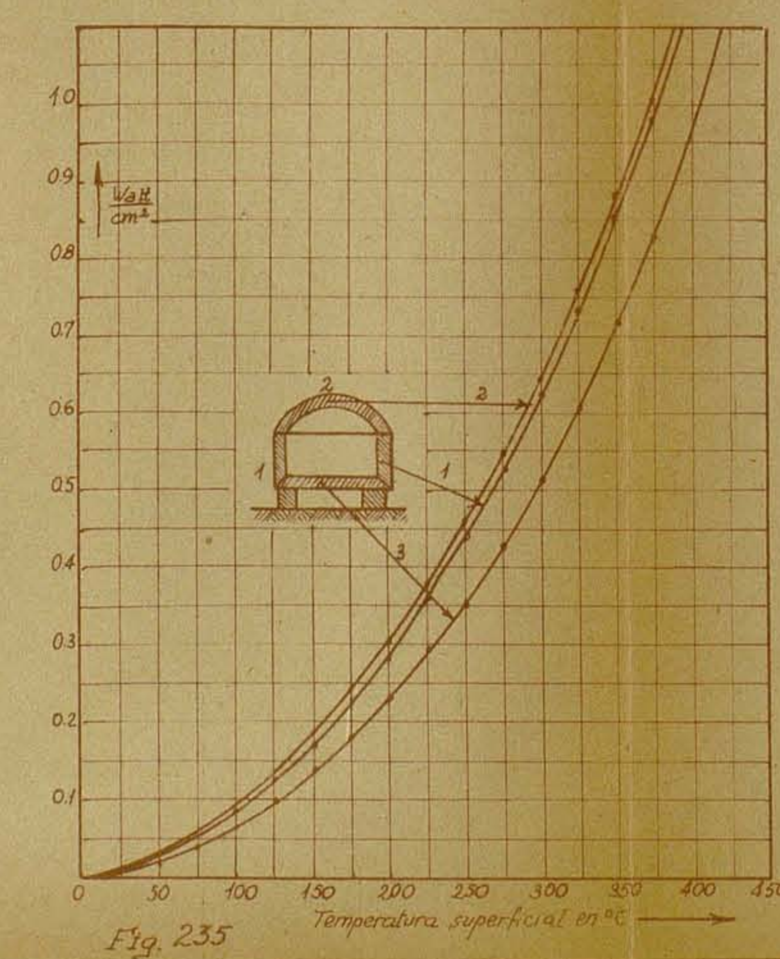


Fig. 235

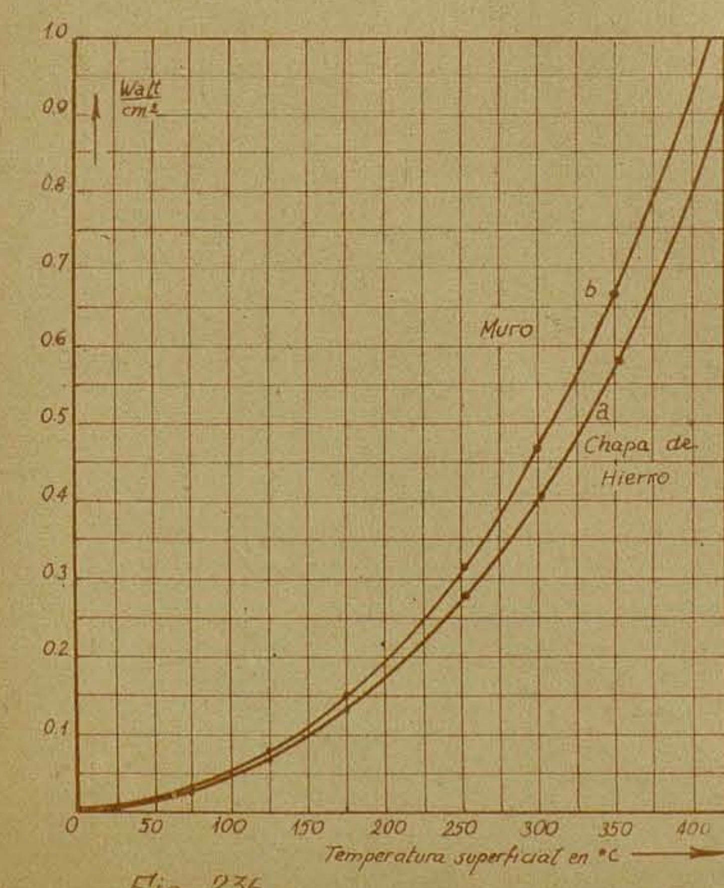
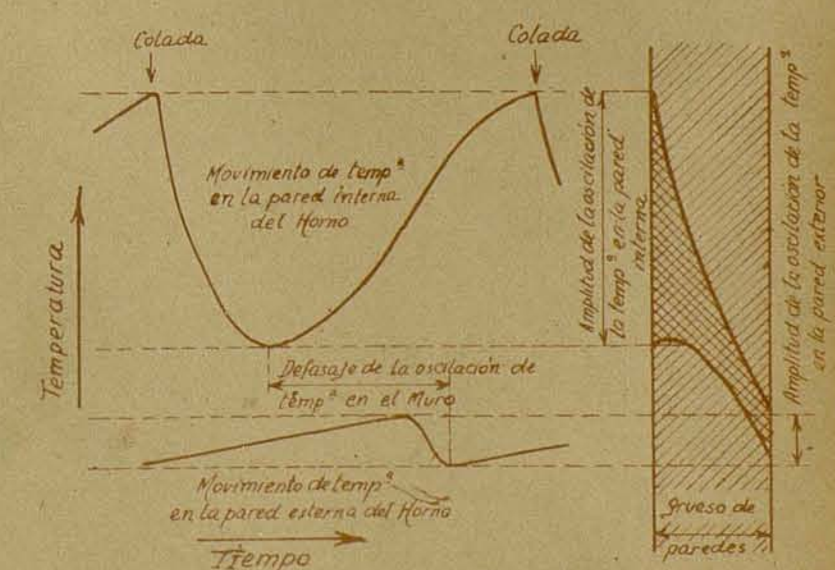


Fig. 236



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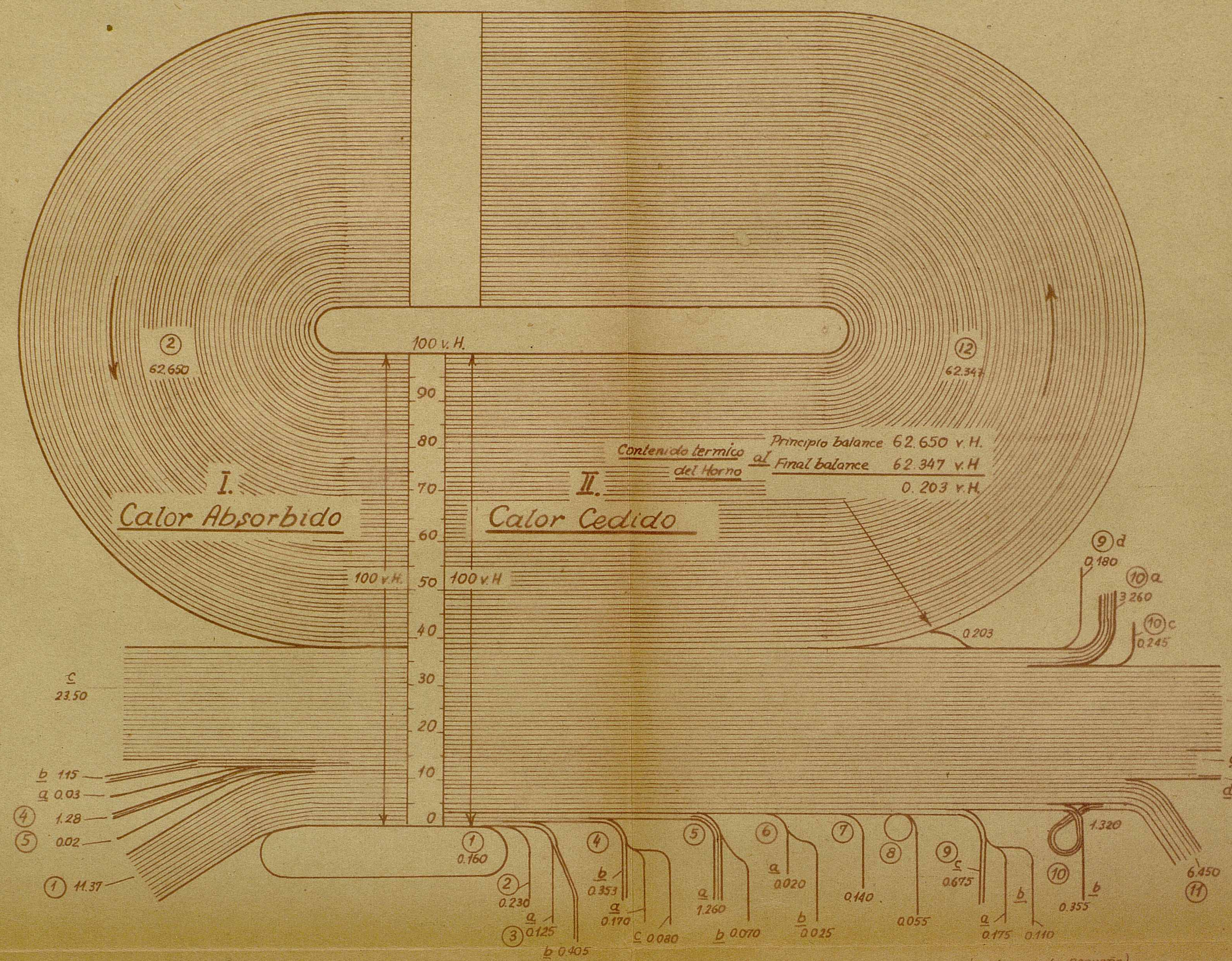


Fig. 242. Ejemplo del balance termico de un gran horno de fusion (con tiempo de comparacion demasiado pequeño)

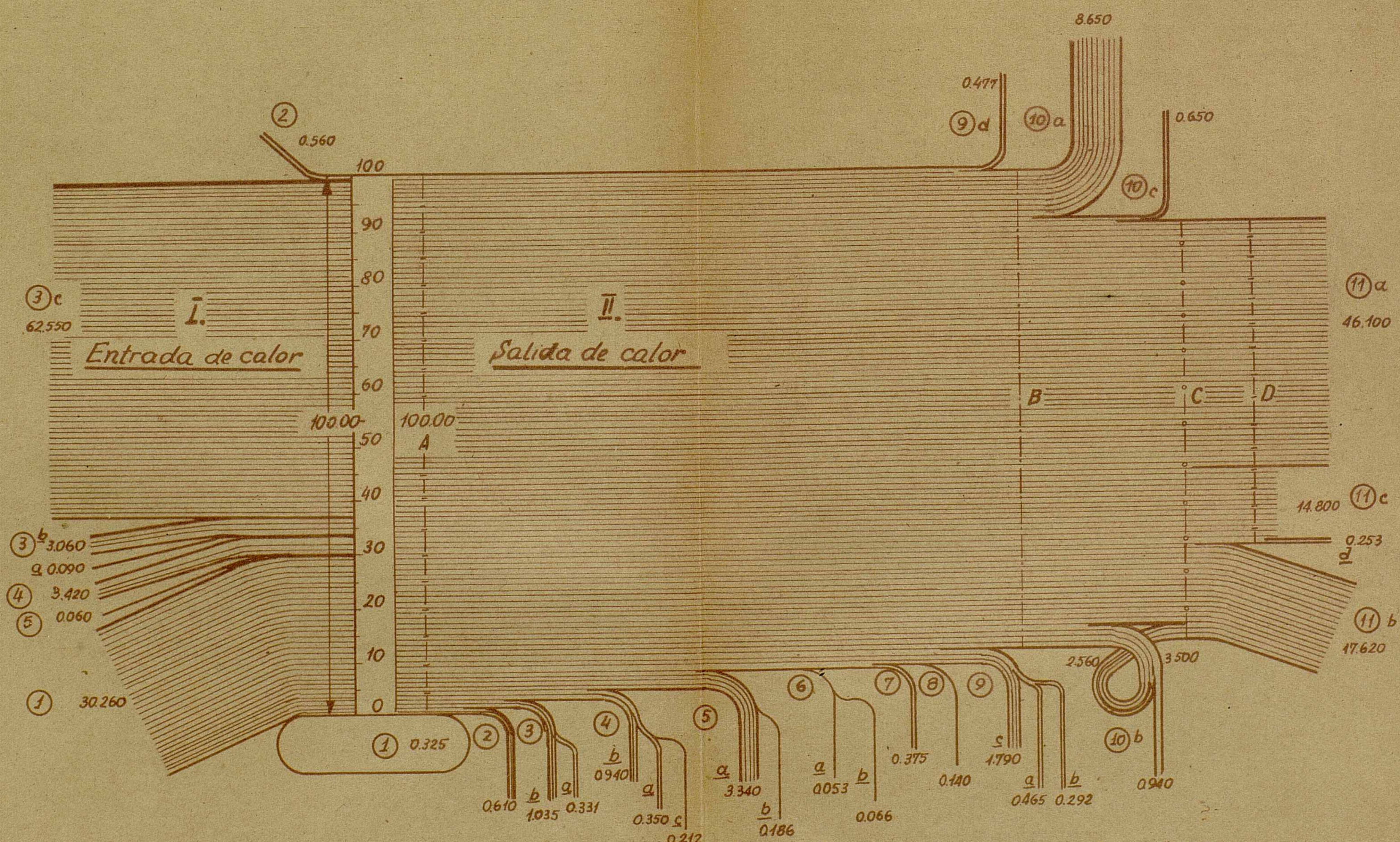


Fig. 243. Calculo de ganancia y perdida de energia calorifica en el proceso de fusion de un horno electrico

©

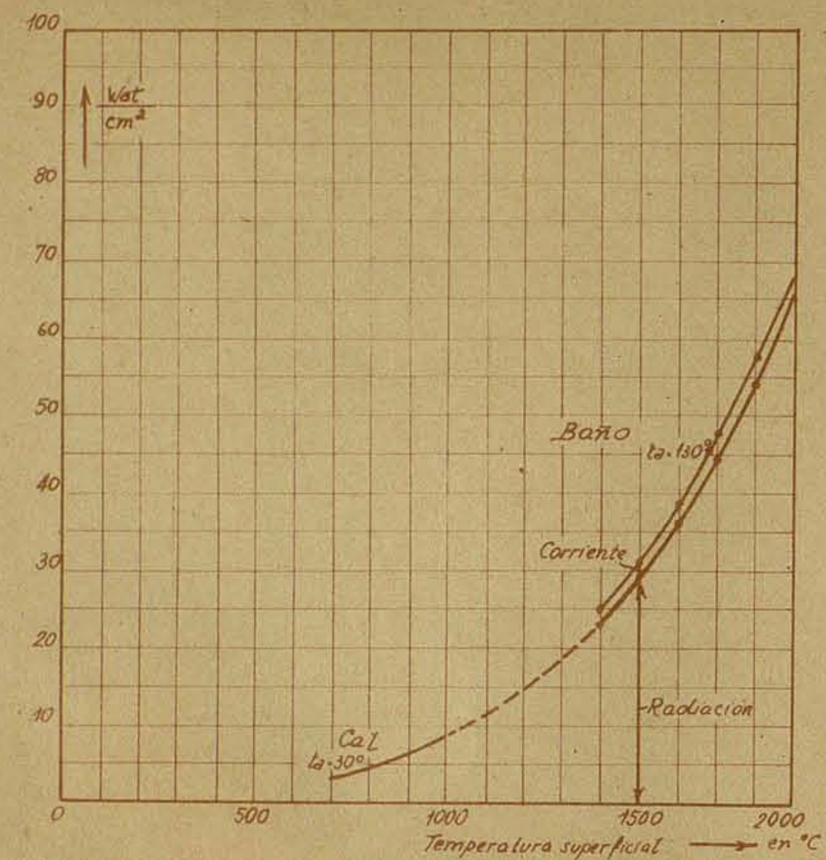


Fig. 237.

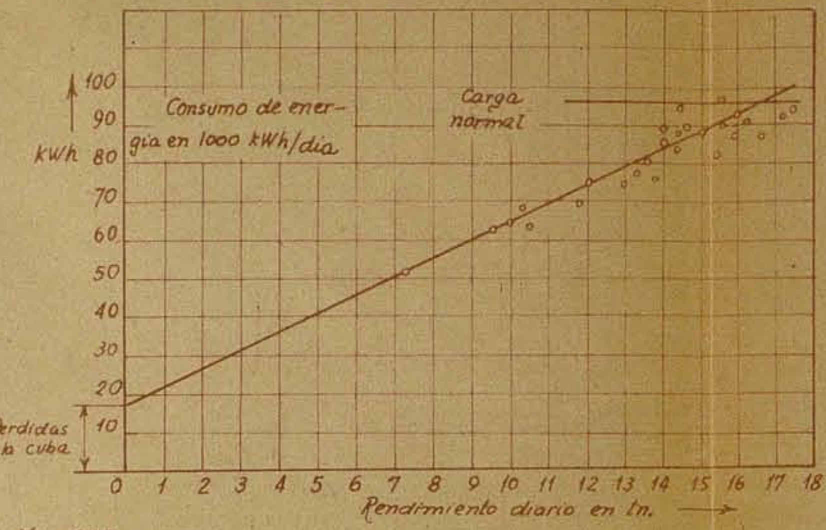


Fig. 239.

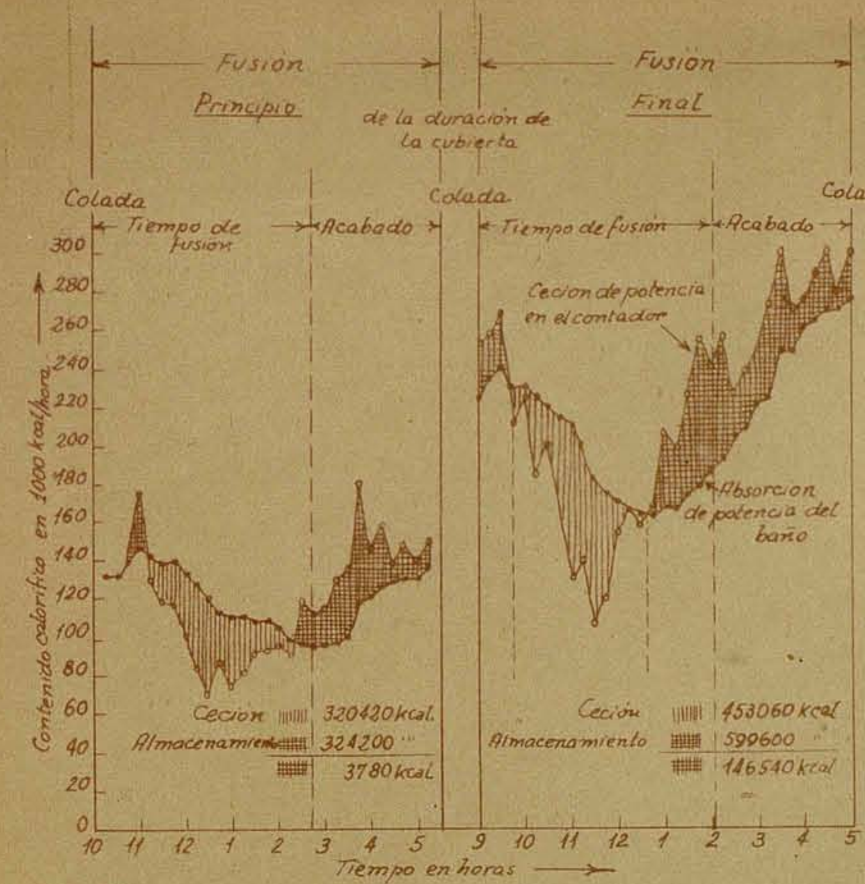
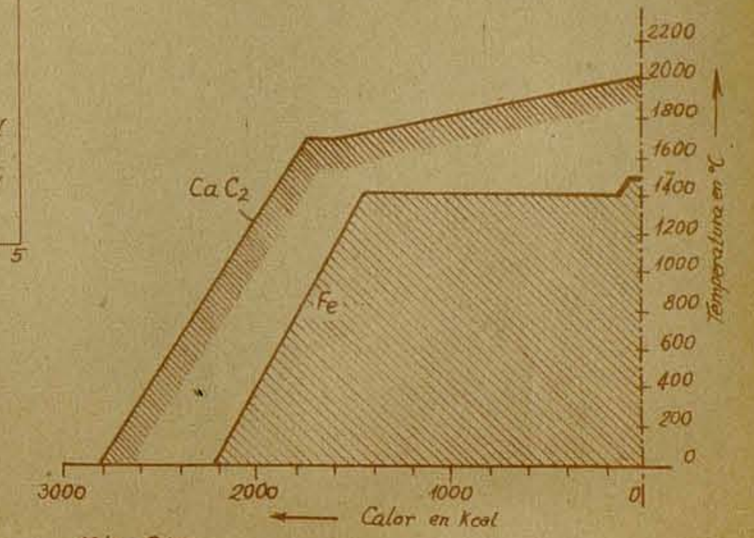


Fig. 241.



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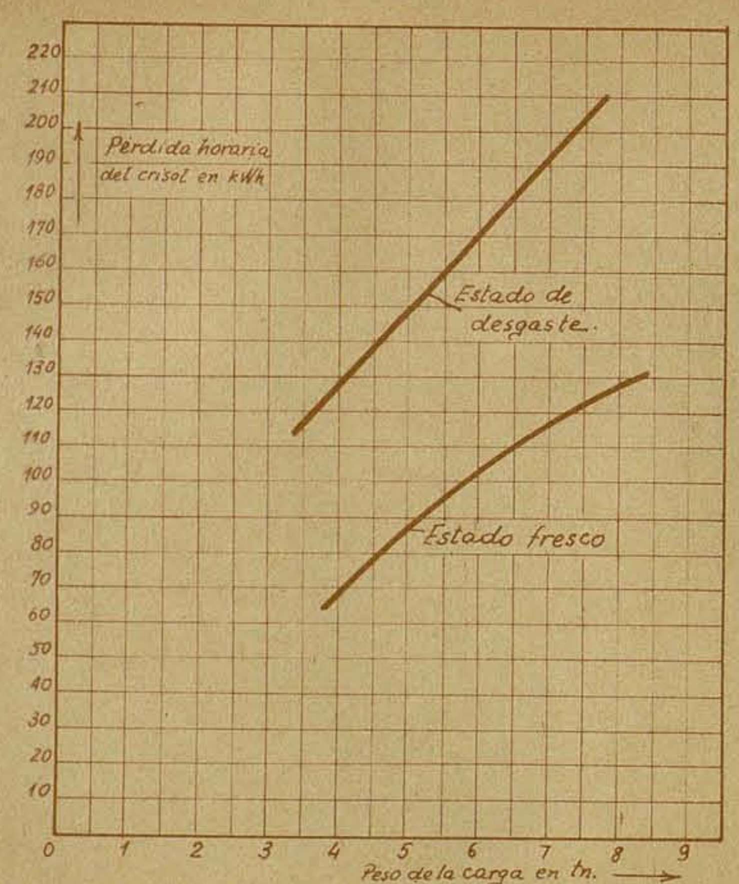

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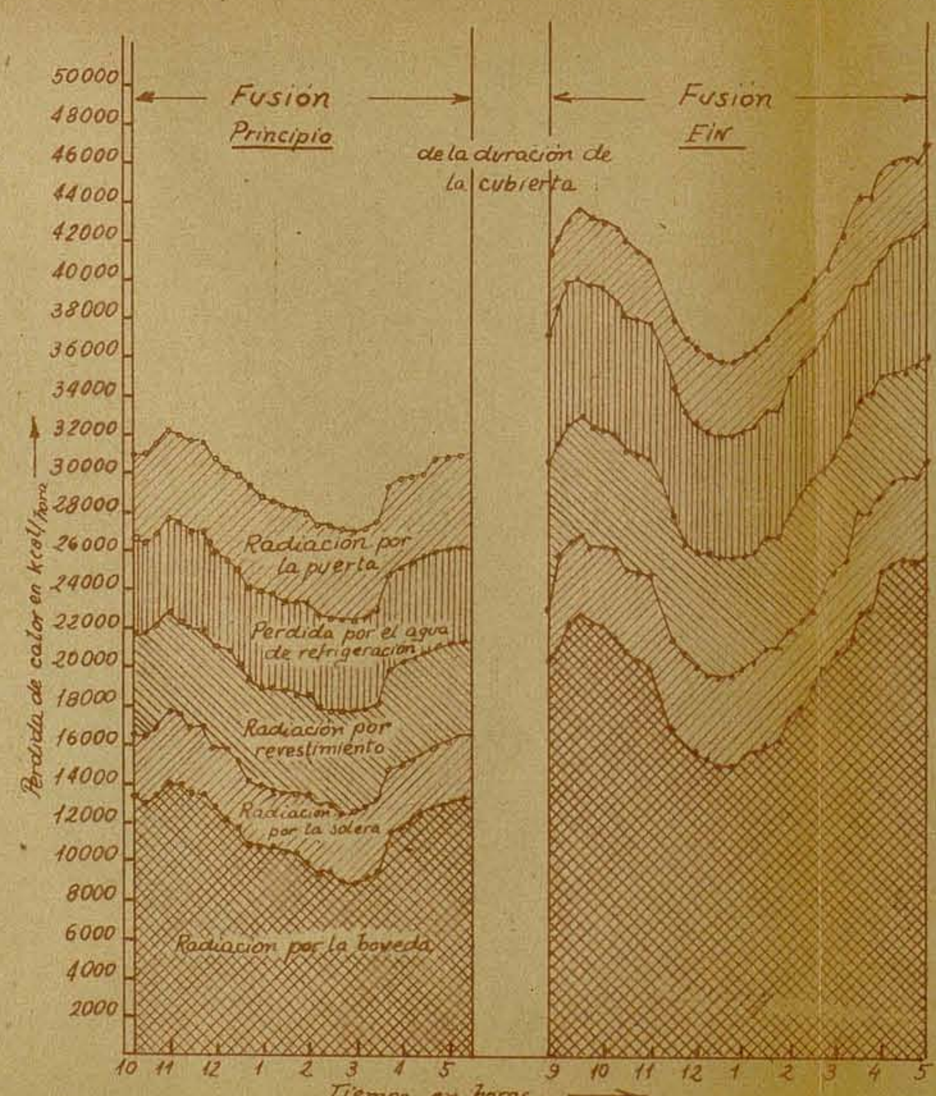

Fig. 240

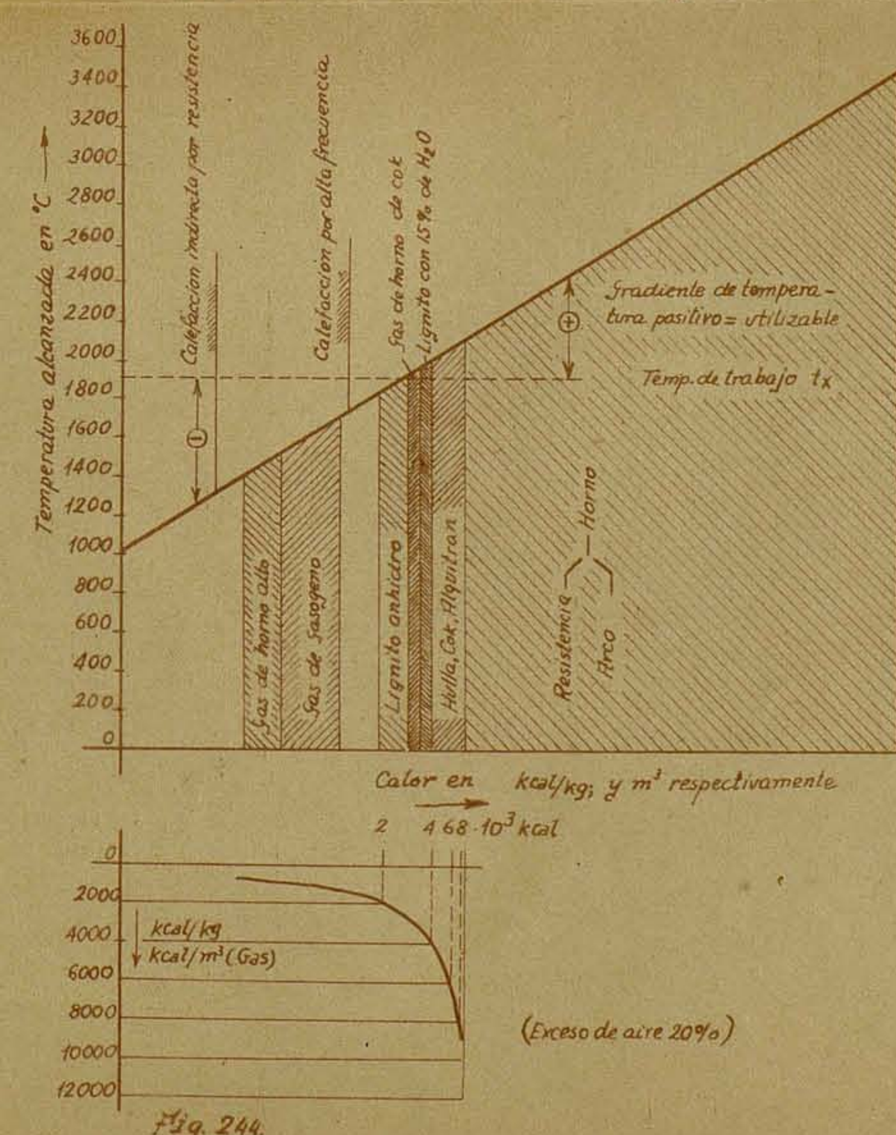

Fig. 244.

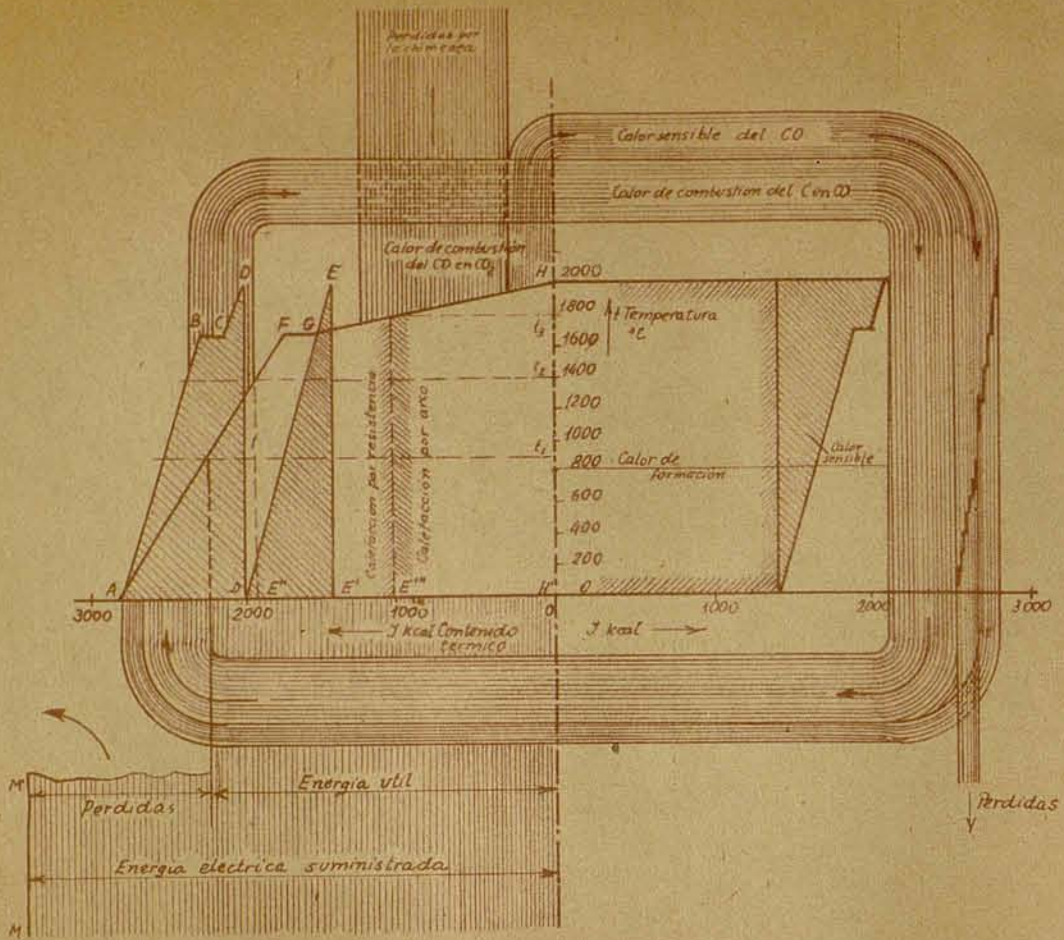

Fig. 246.

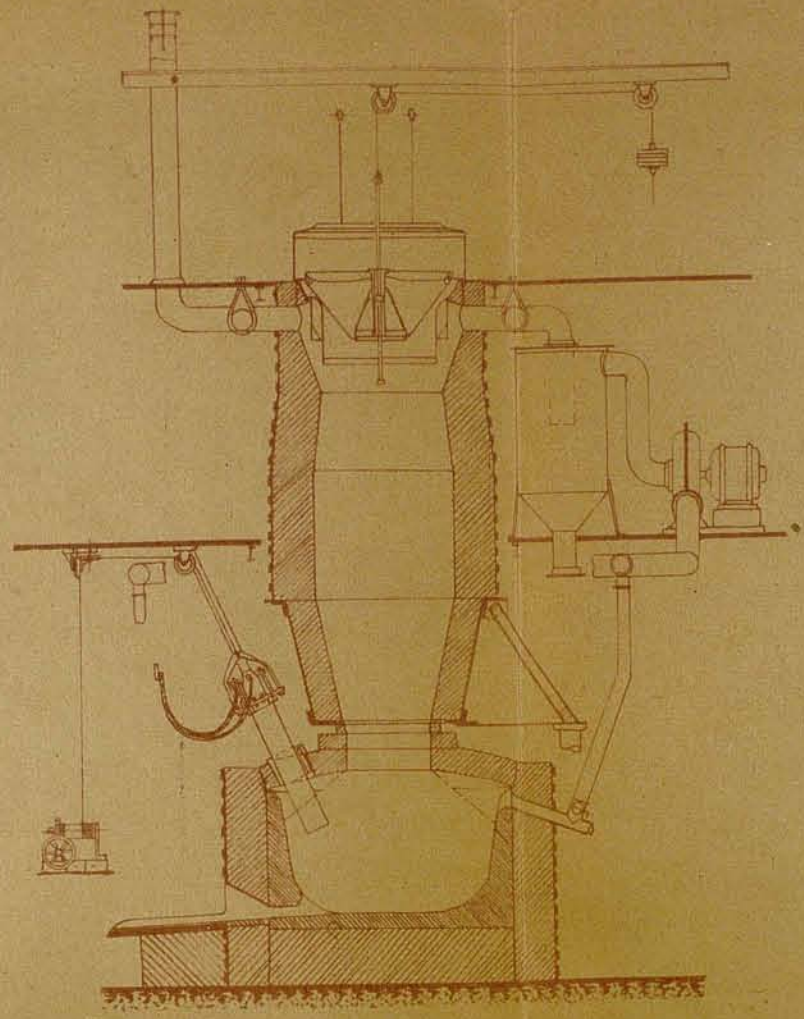

Fig. 247. Horno alto eléctrico (corte longitudinal).

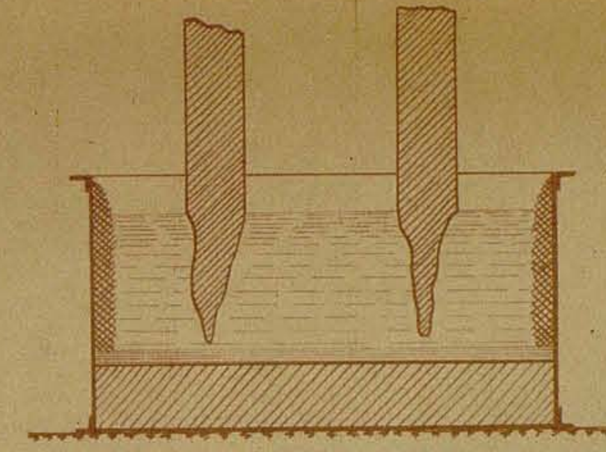

Fig. 251. Exesiva penetración en el baño

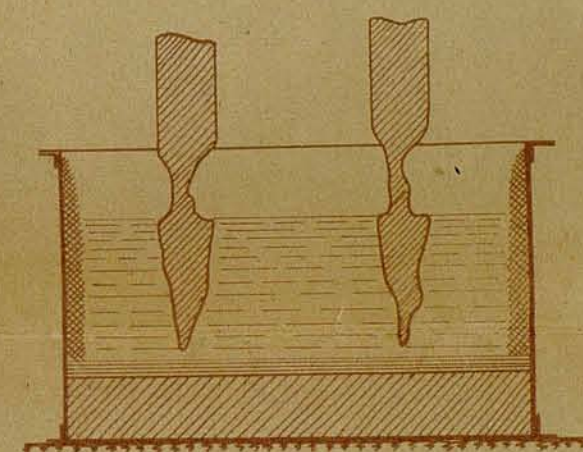

Fig. 252. Desgaste con cuba demasiado alta y exesiva inmersión.

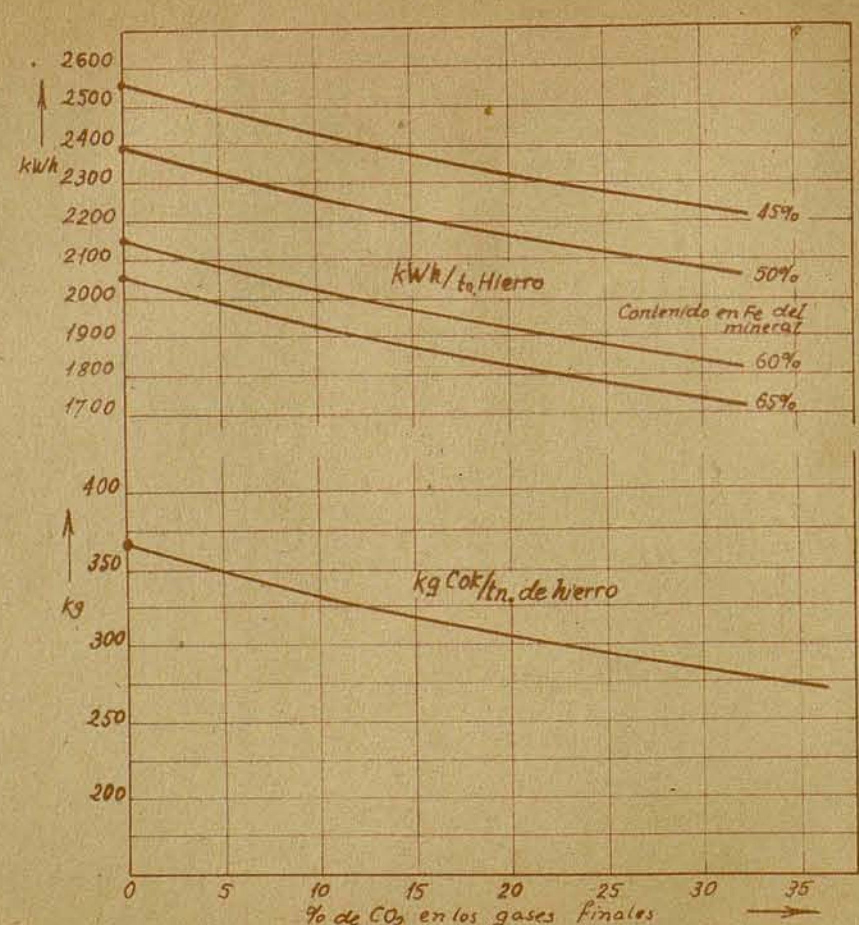

Fig. 248.

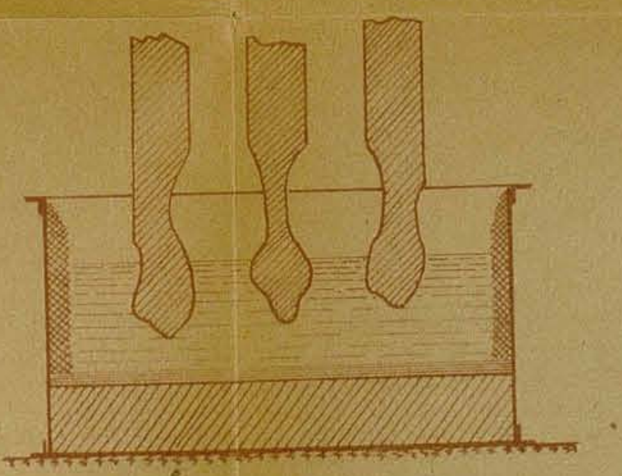

Fig. 249. Quemado de electrodos con distancia demasiado pequeña

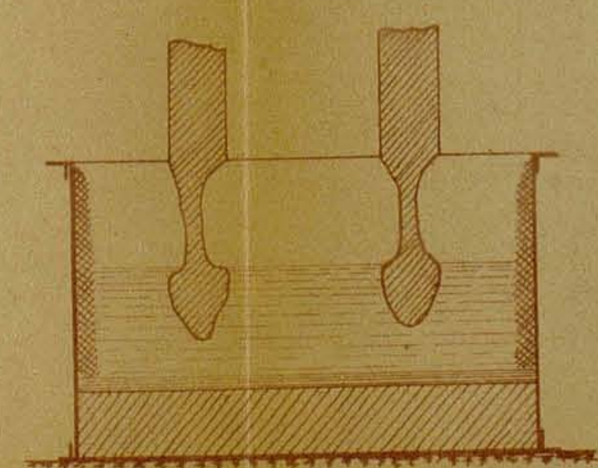

Fig. 250. Cuba demasiado alta

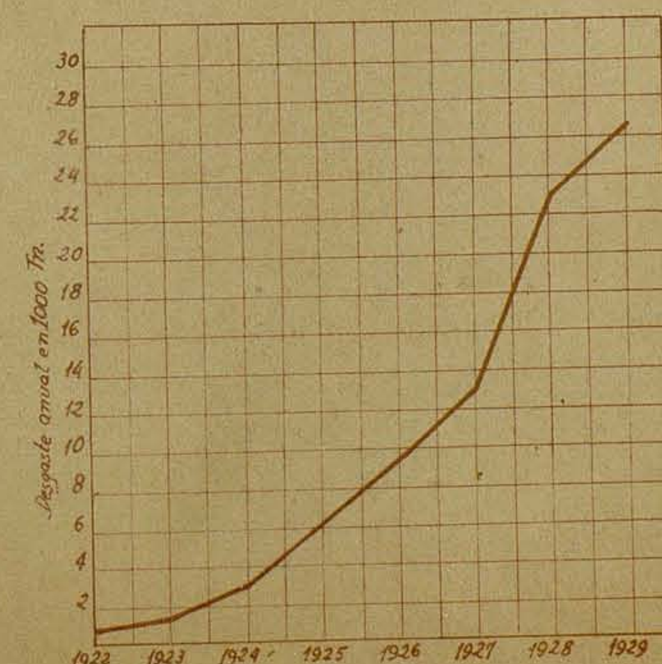

Fig. 253.