

INSTITUTUL POLITEHNIC "TRAIAN VUIA" TIMISOARA
FACULTATEA DE MECANICA

ing. TIBERIU NAGY

CONTRIBUTII PRIVIND STUDIUL CAUZELOR UZURII ROTILOR
LA VEHICULELE CFR CIRCULIND
CU VITEZE MARI SI FOARTE MARI

Teză de doctorat
(Volumul II)

BIBLIOTECA CENTRALĂ
UNIVERSITATEA "POLITEHNICA"
TIMIȘOARA

CONDUCATOR STIINTIFIC

prof.emerit ing. IOAN ZAGANESCU

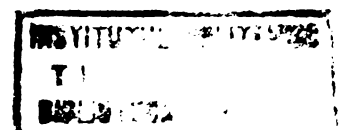
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Dulap	345 Lit. G

CUPRINS

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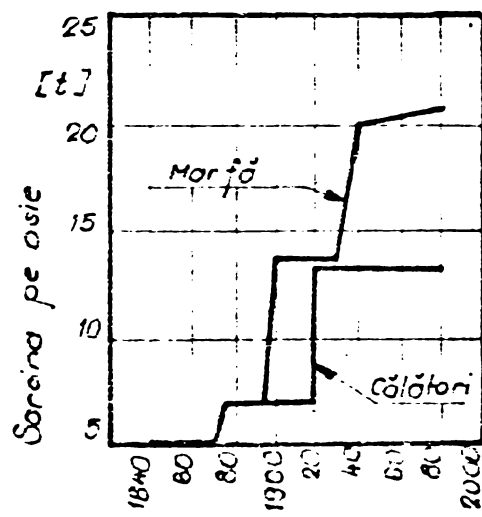
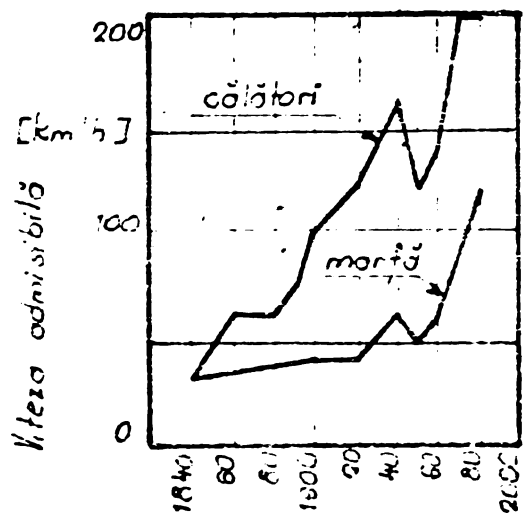


FIG. 1a / 12 /

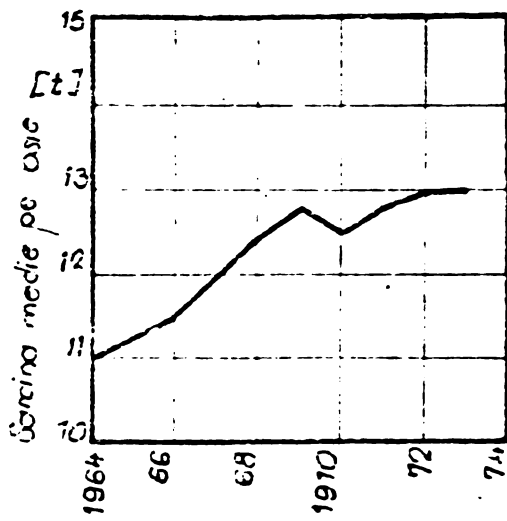
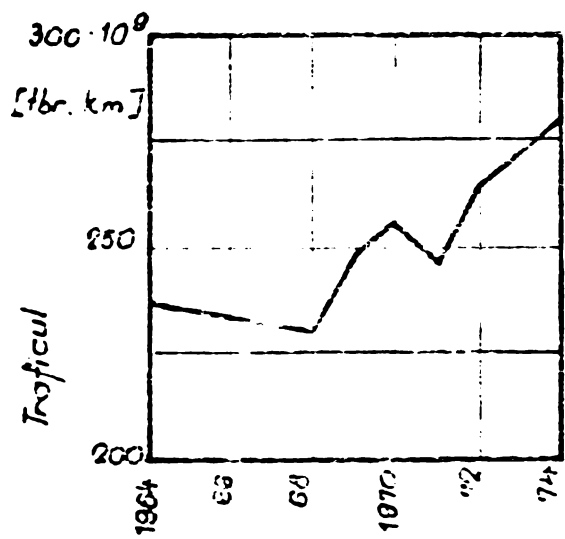
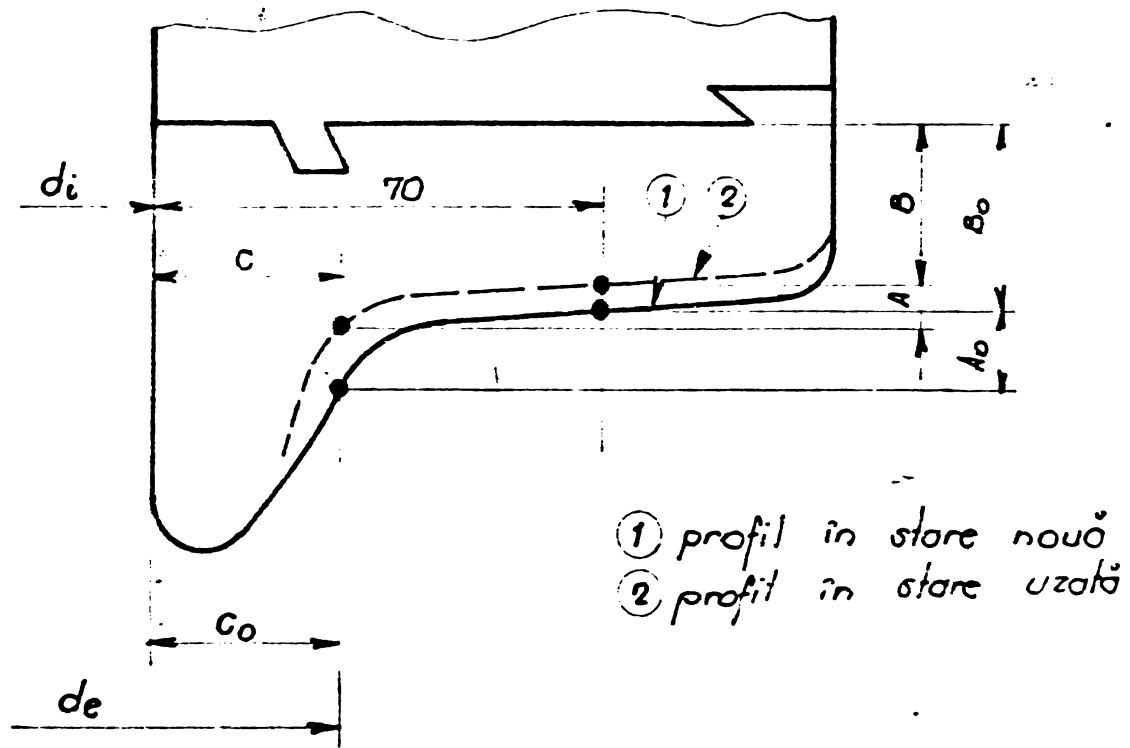
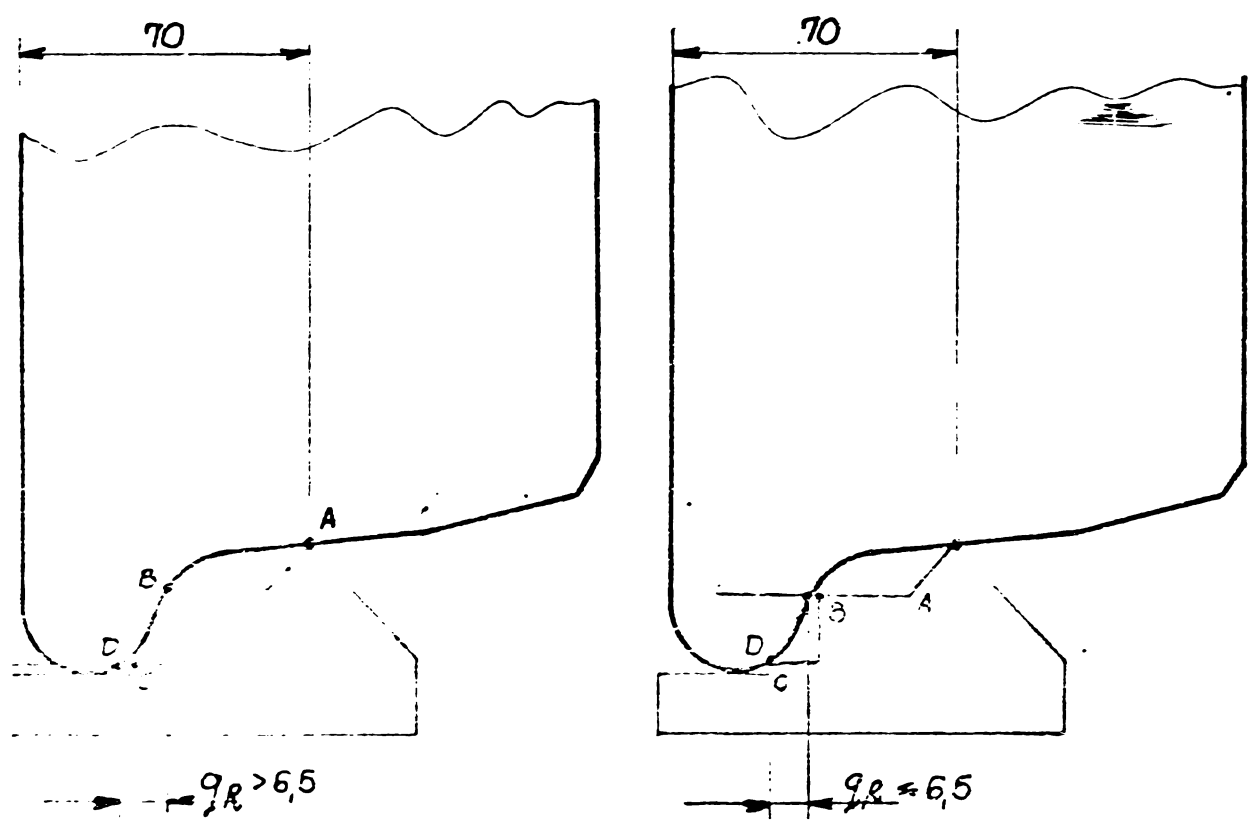


FIG. 1b / 12 /



Gota	VALOAREA pentru vitezele de: (km/h)		
	< 80	80... 100	100... 140
A_{max}	8	7	5
B_{max}	33	35	45
C_{min}	22	22	25
d_e min.	1410		
d_e max.	1426		

FIG. 3 . / 89/



profil admis in circulatie

profil neadmis in circulatie

a)

b)

FIG. 4

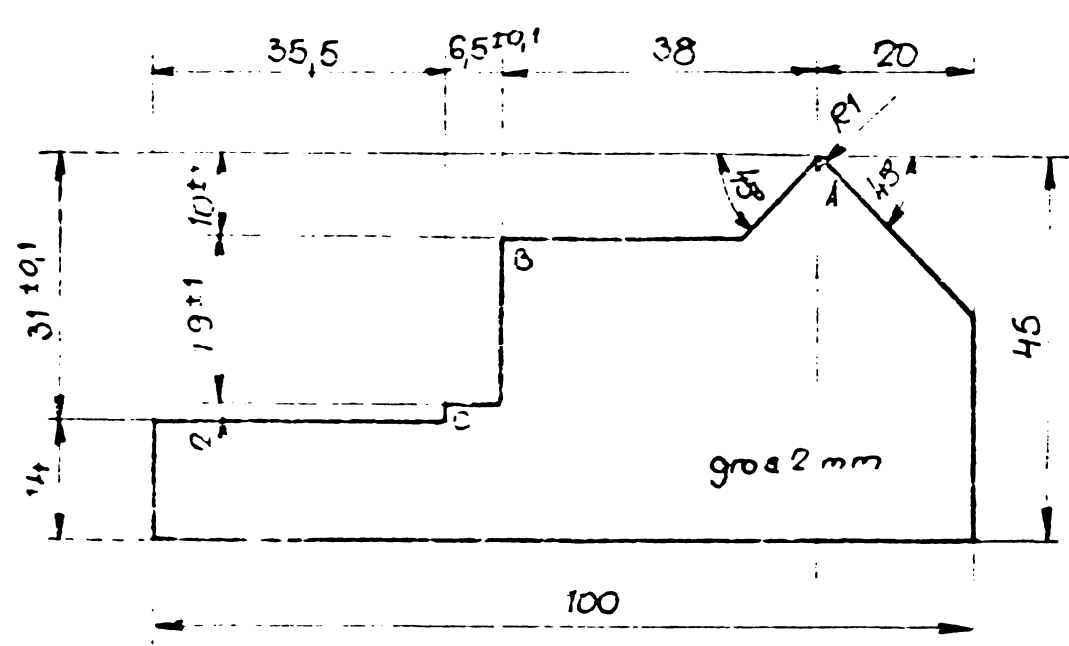


FIG. 5

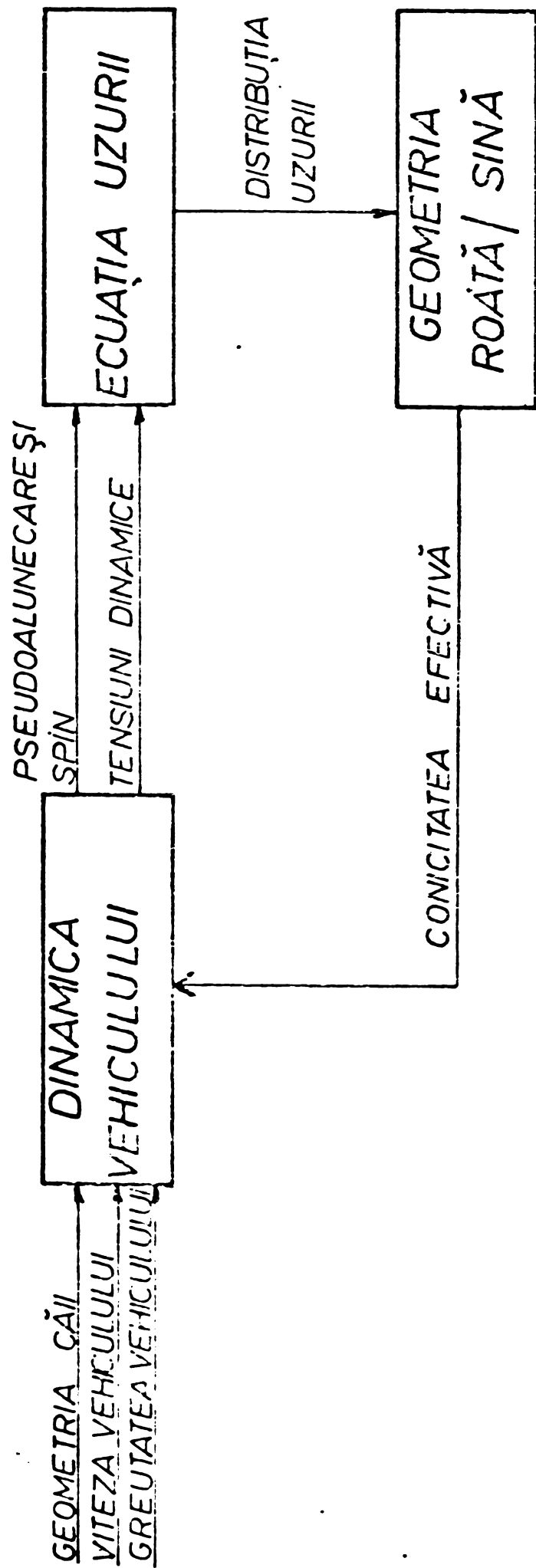


FIG. 6 . 143, 51 /

BUCLA DE REACȚIE DINAMICĂ - UZURĂ - PROFIL

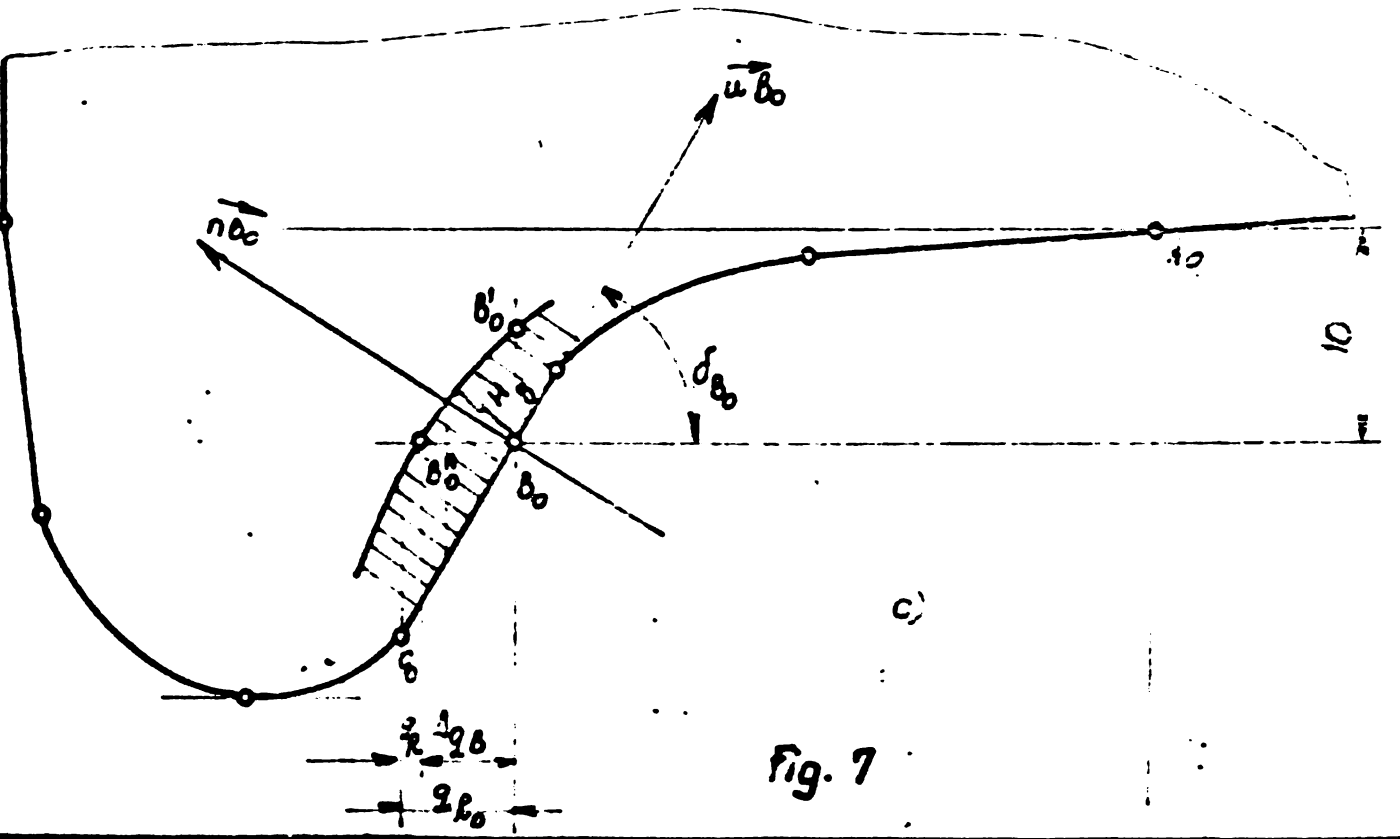
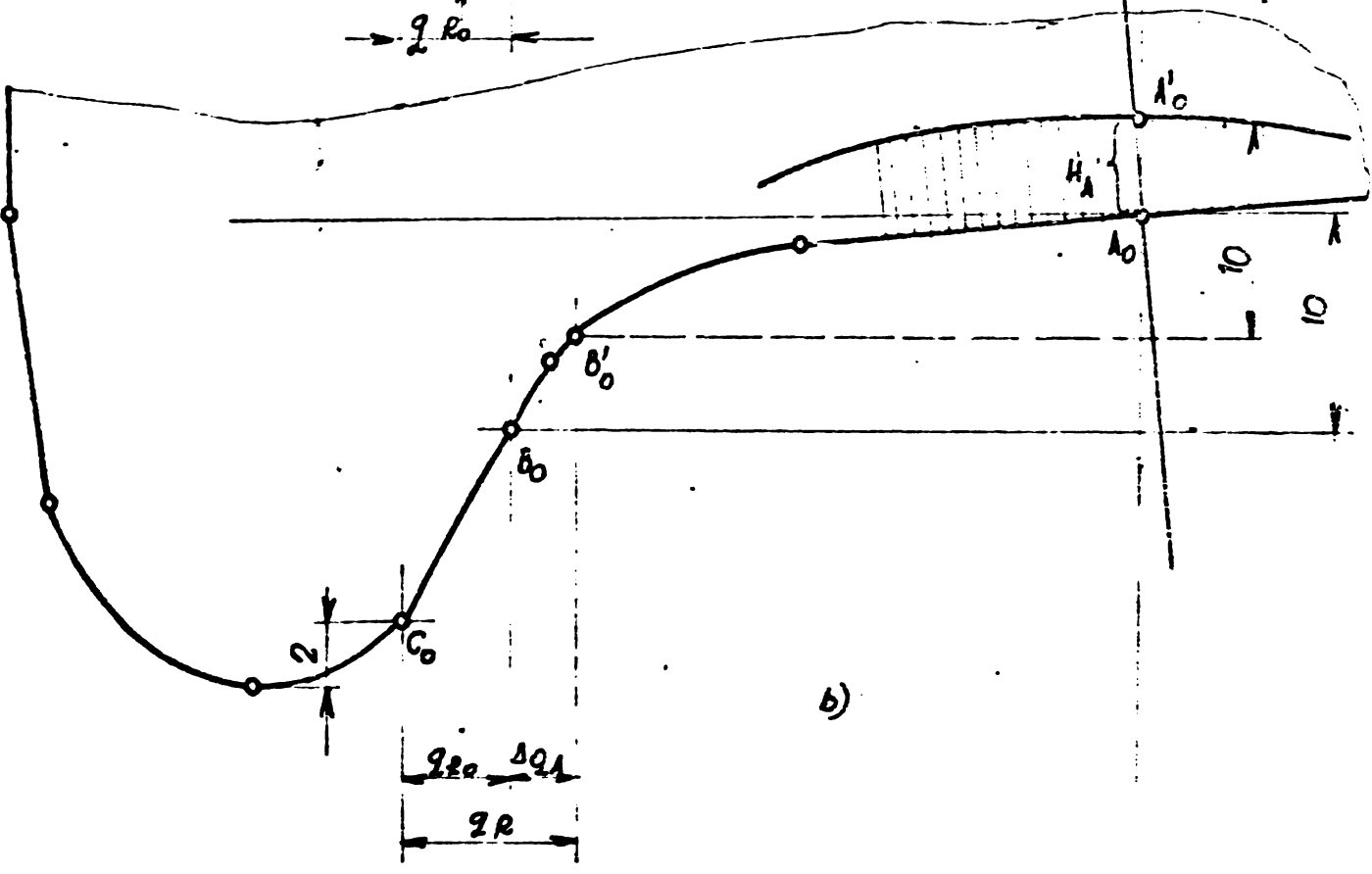
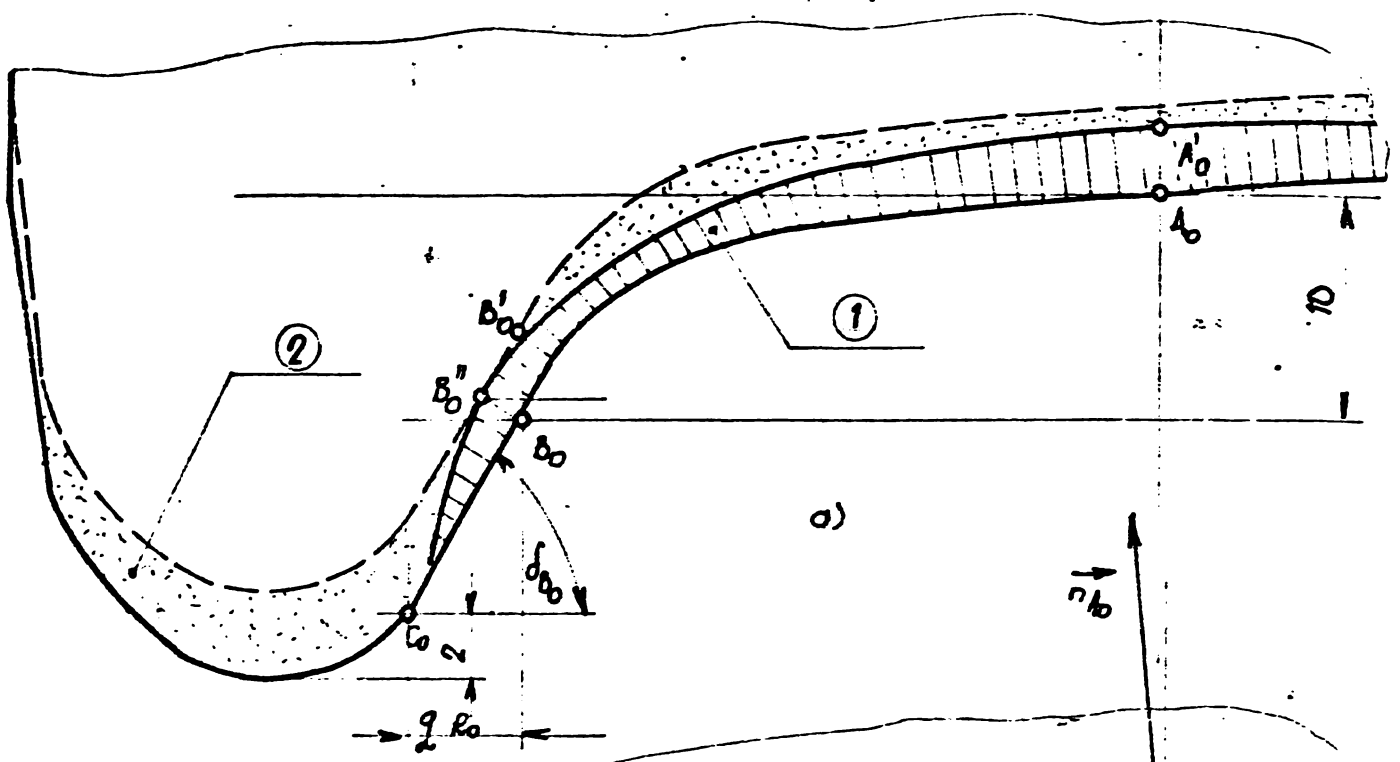


Fig. 7

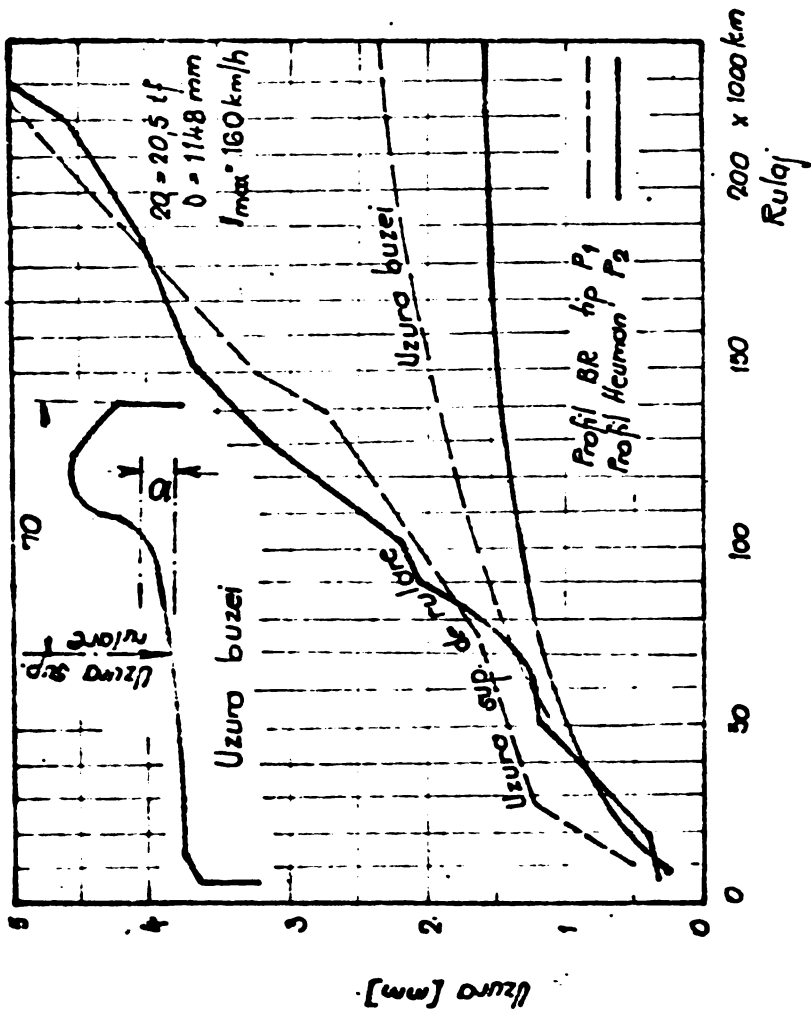


FIG. 9 / 26 /

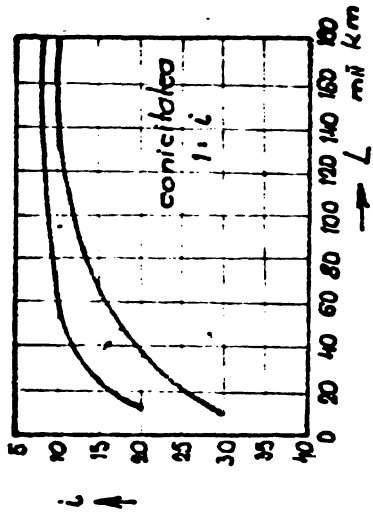


FIG. 8 / 25 /

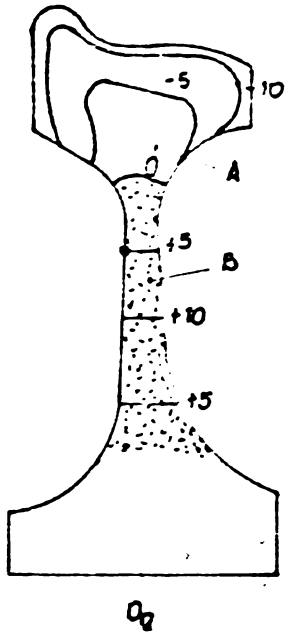


FIG. 10. | 59 |

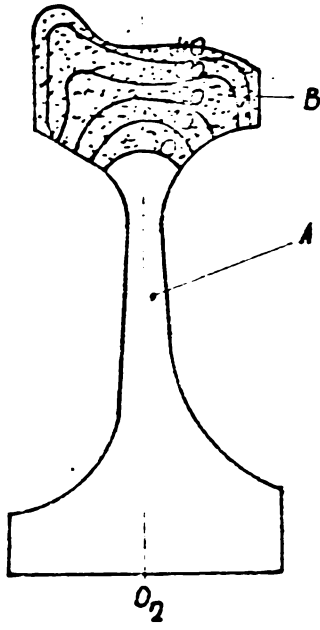


FIG. 11. | 59 |

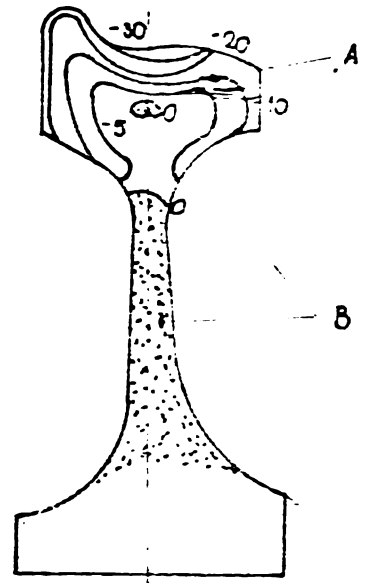


FIG. 12. | 59 |

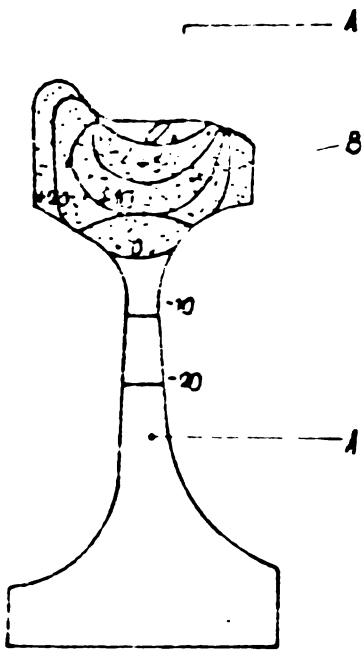


FIG. 13. | 59 |

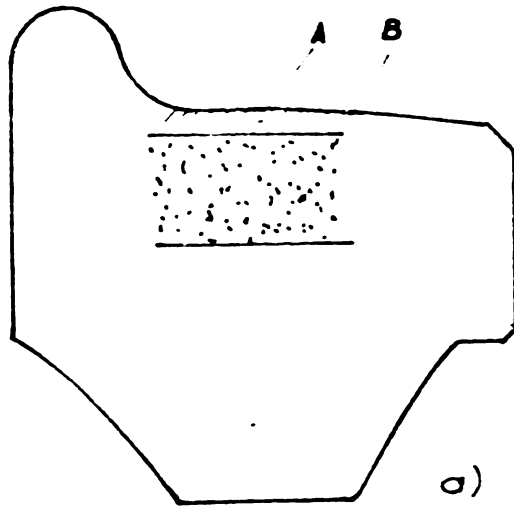
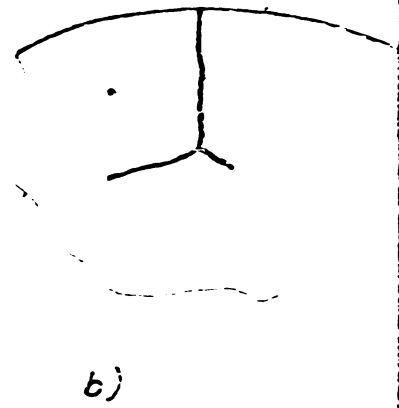


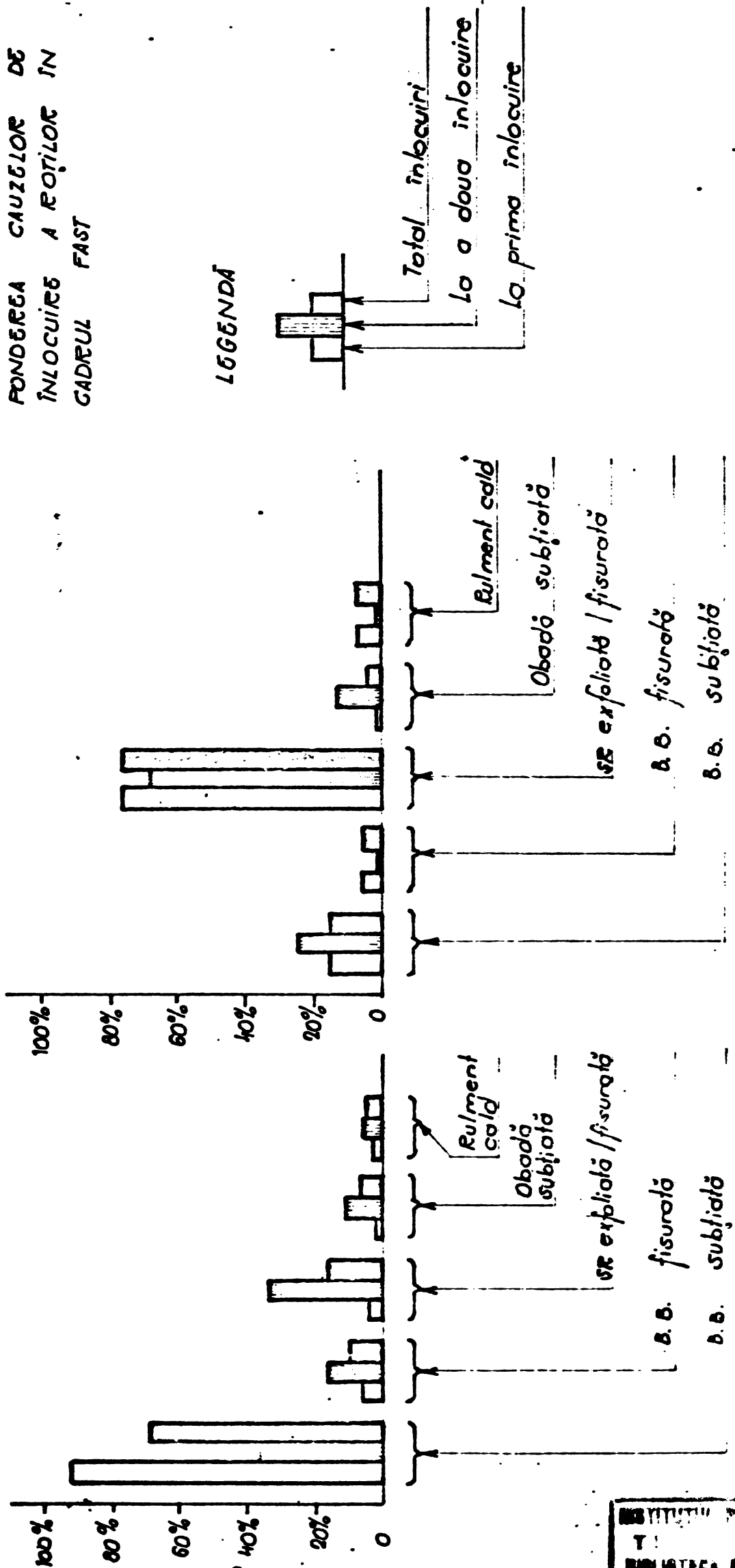
FIG. 14. | 59 |



ROȚI DIN MATERIAL
DE CLASA U (netratat)

ROȚI DIN MATERIAL DE
CLASA C (tratate termic)

FIG. 15 / 23 /



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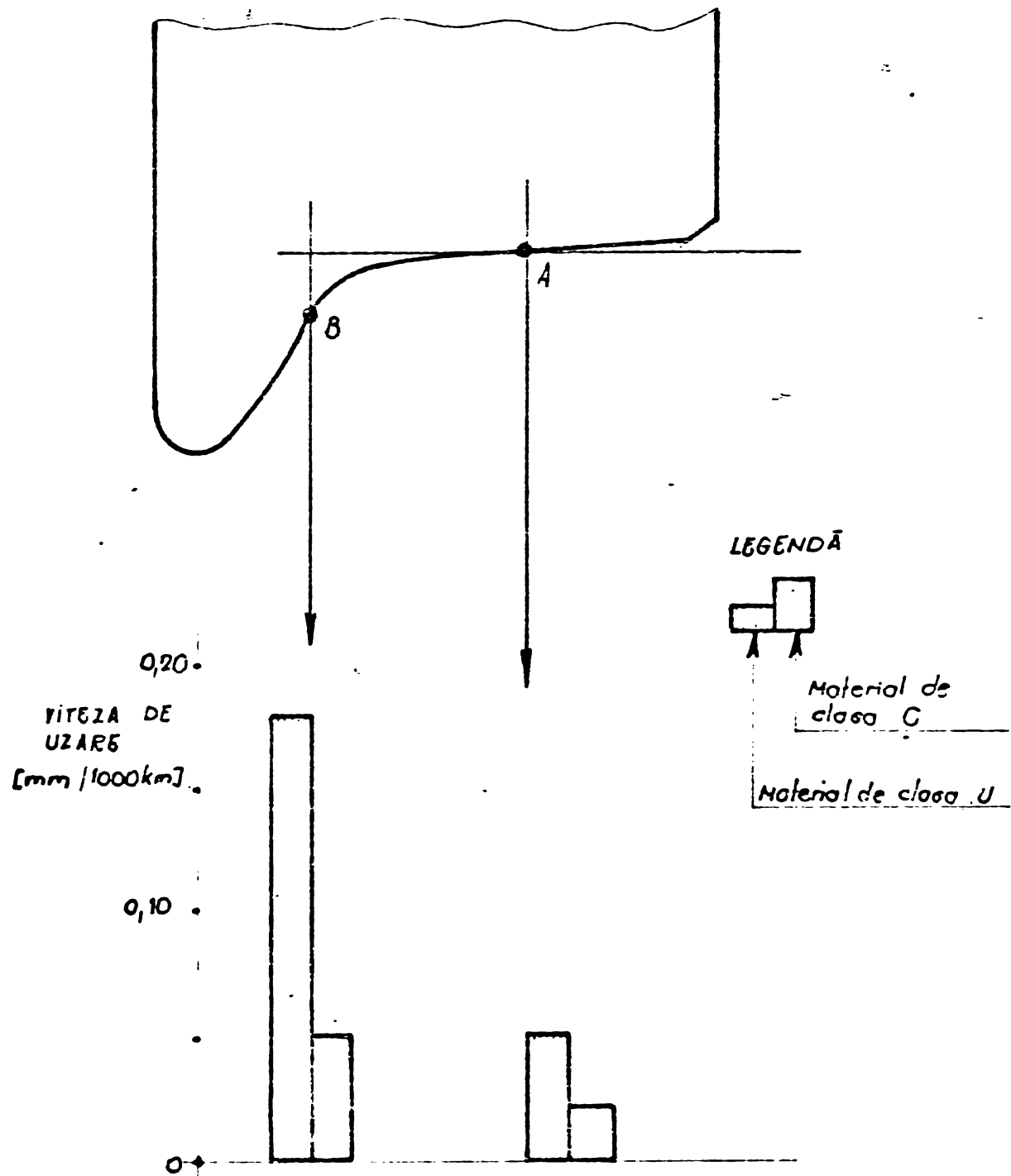


FIG. 16. / 23 /

VITEZA DE UZARE A ROTILOR ÎN CADRUL FAST, DUPĂ
PRIMI 32000 KM DE PARCURS

Sd
Grosimea
buzei
[mm]

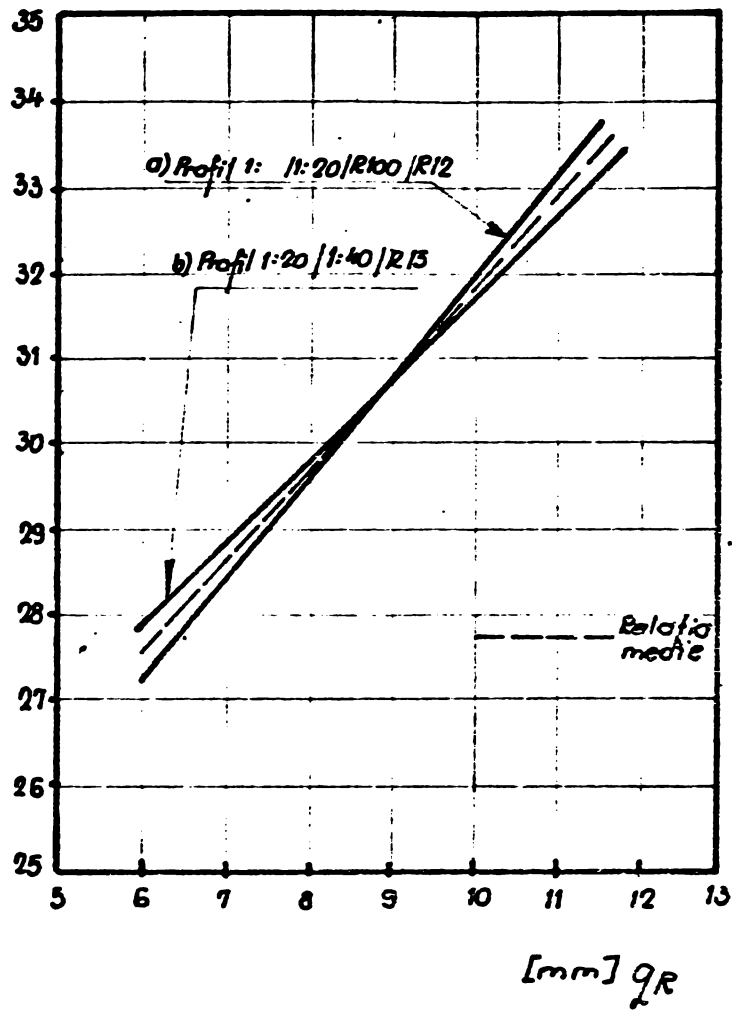
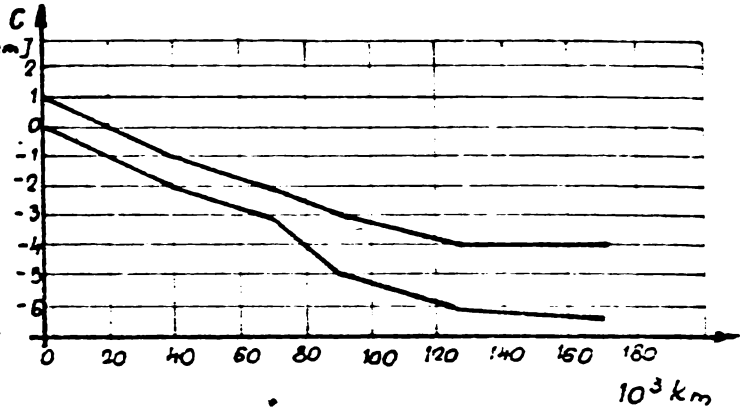
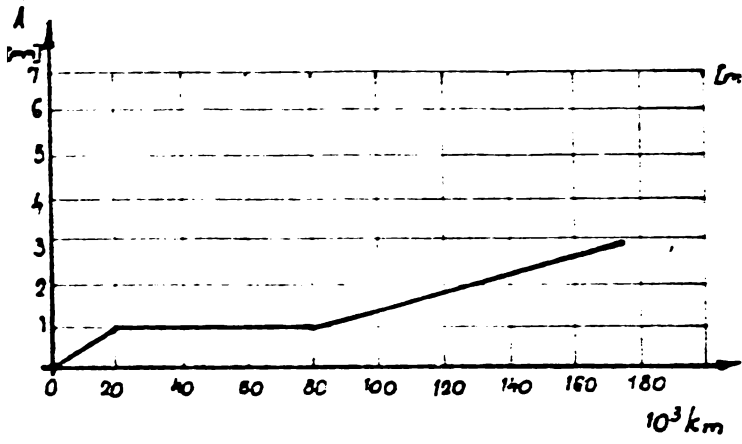
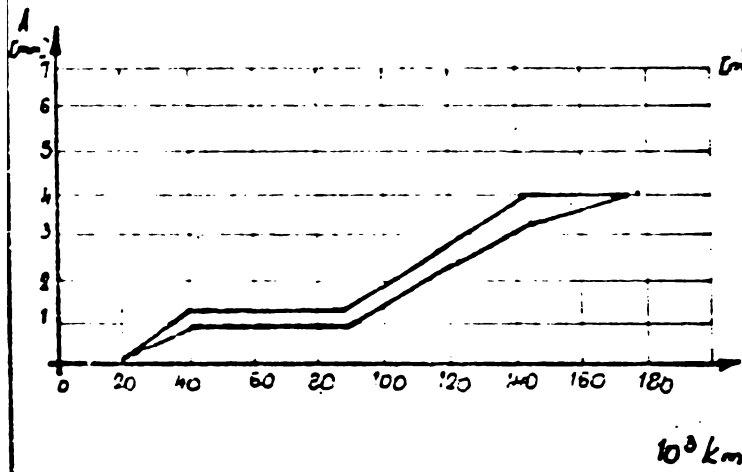


Fig 17 . | 65 |



d.)



b.)

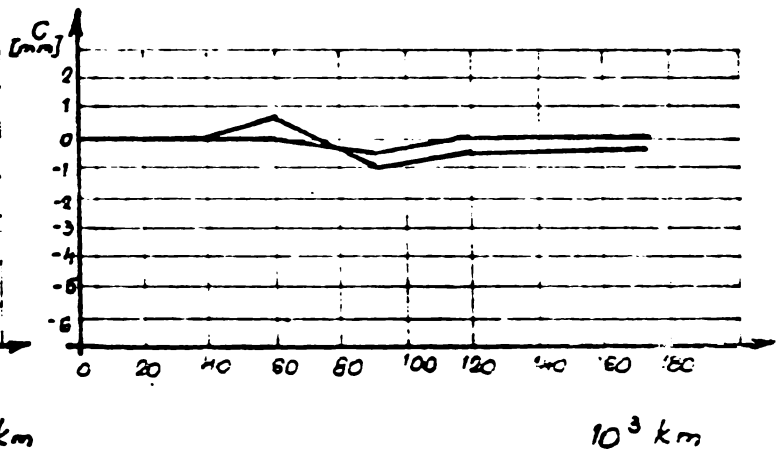
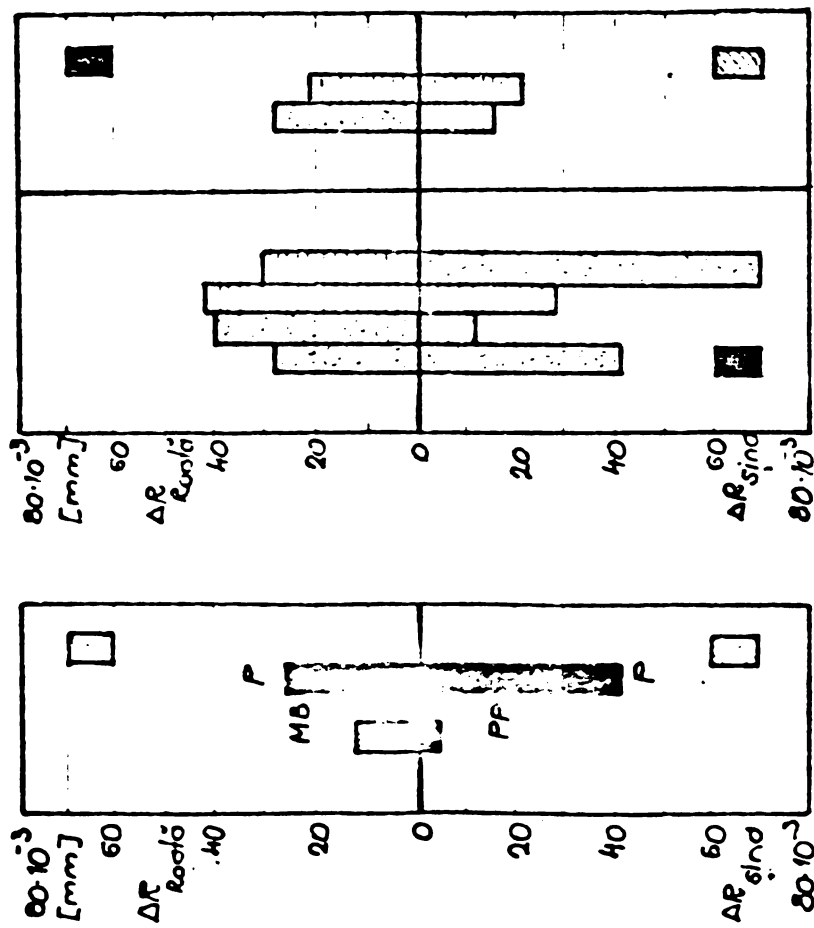





Fig. 18 . | 91 |



Legendă:

-  structură martensitică (M)
-  structură bainitică (B)
-  structură perlitică (P)

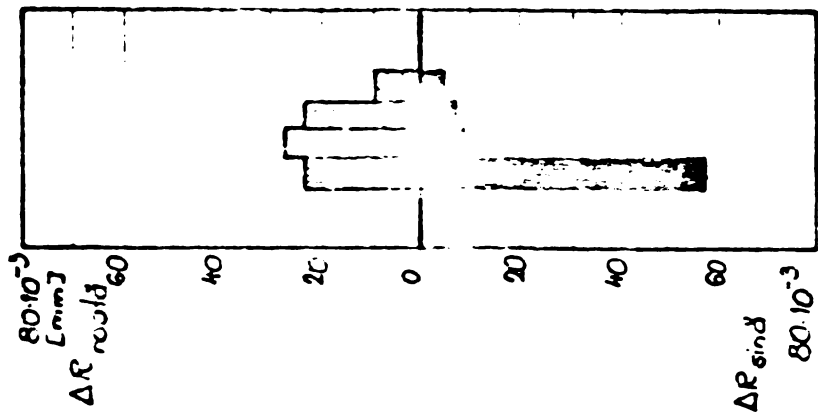
rezistență la rupere : 900 $\frac{MN}{m^2}$

rezistență la rupere : 1100 $\frac{MN}{m^2}$

- a) influența structurii metalografice
- b) influența rezistenței de rupere

FIG. 19 . / 96 /

472.314/3456



Legendă:

- Oțel de șine VA rezistent la uzură, calificata A după UIC, $\sigma_{Rmin} = 900 \text{ MN/m}^2$
- Aliaj Ti AL5 Sn 25
 $\sigma_{Rmin} = 900 \text{ MN/m}^2$
- Aliaj Ti AL 6 V4
 $\sigma_{Rmin} = 800 \text{ MN/m}^2$
- Oțel de roți mofoare M80
 $\sigma_{Rmin} = 800 \text{ MN/m}^2$
- Oțel îmbunătățit (călit + revenit)
 $\sigma_{Rmin} = 900 \text{ MN/m}^2$

FIG. 20 / 971

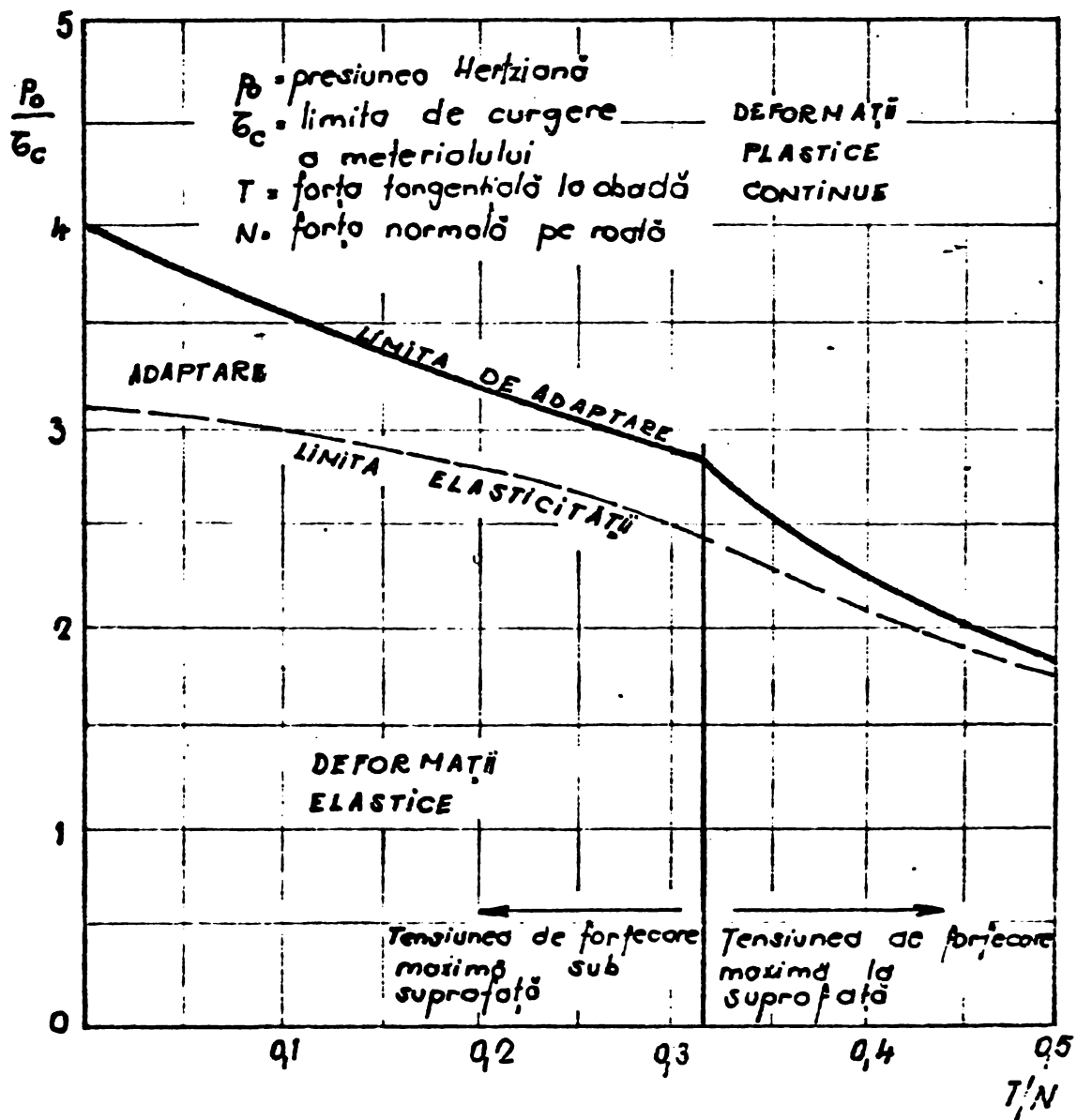


Fig. 21. / 94, 99/

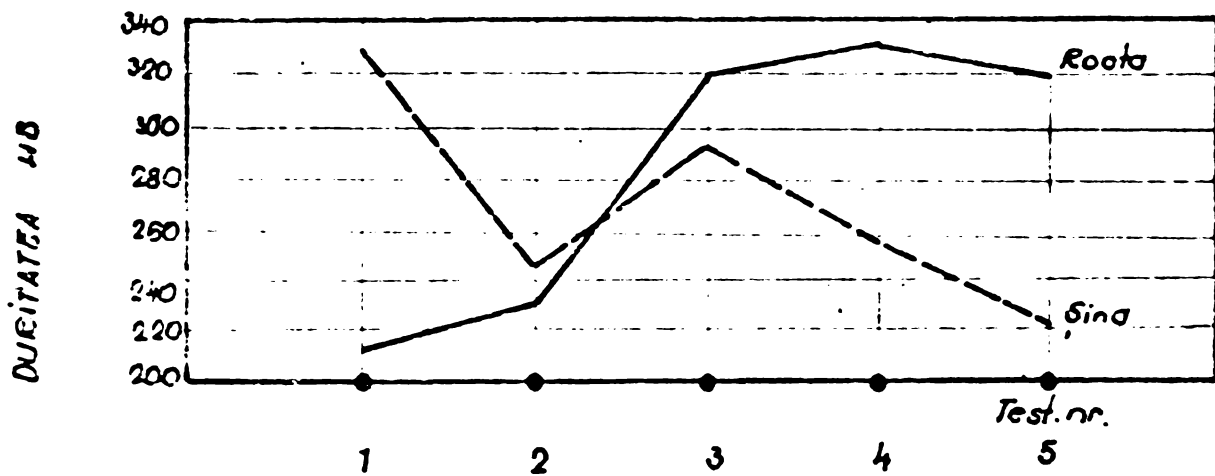
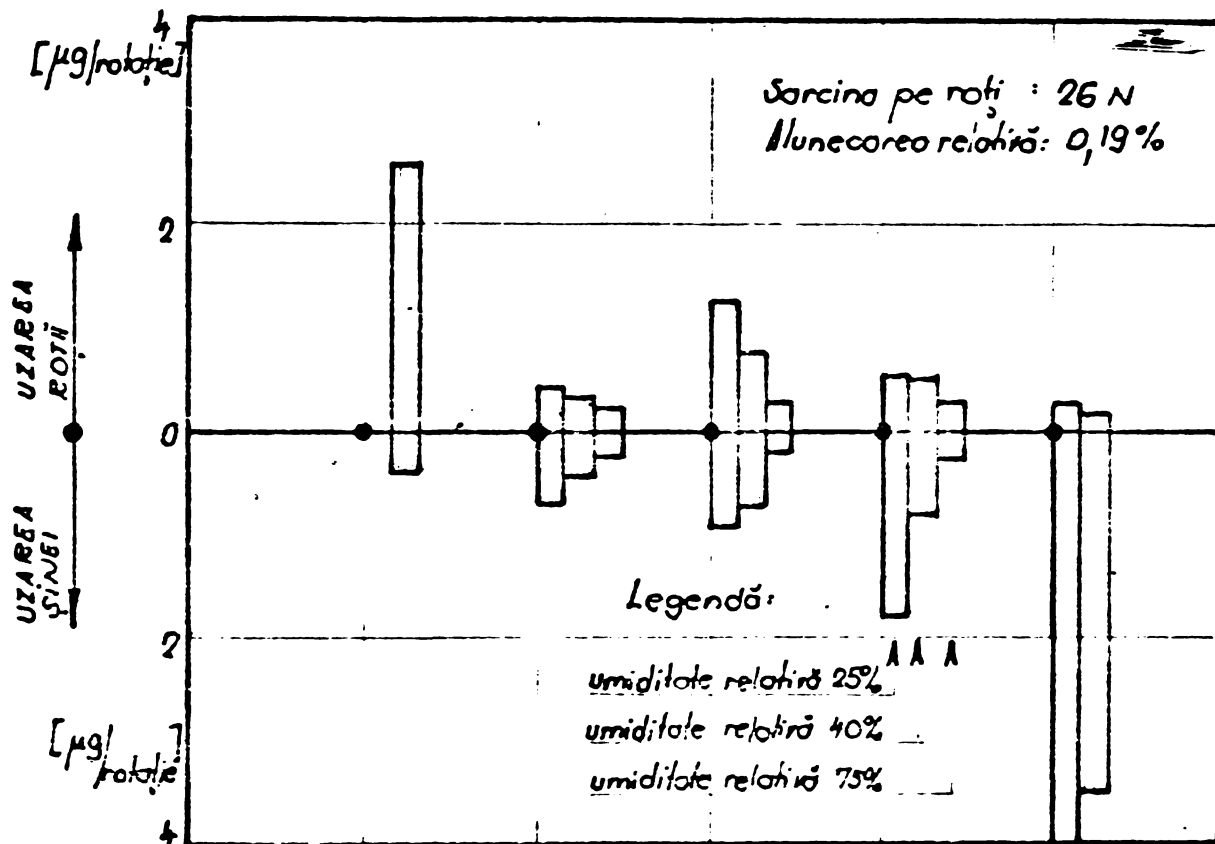


FIG. 22. | 76 |

Uzarea diferitelor perechi de roți roată - șină

-V

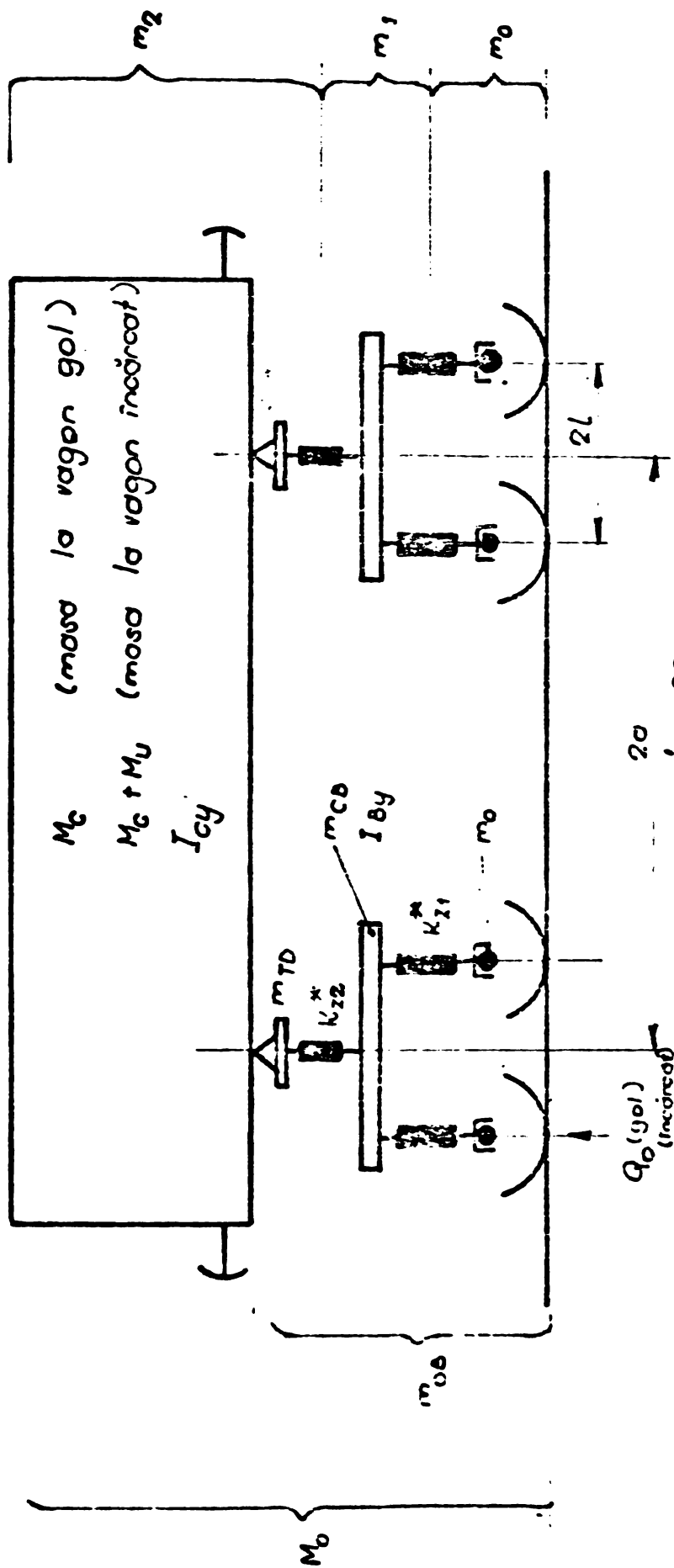


FIG. 23

(Tara)

$$M_0 = M_0 + 2m_{0b}$$

$$m_{0b} = 2m_0 + m_{cb} + m + D$$

$$Q_{0gd} = \frac{1}{4} M_0 \cdot g$$

$$Q_{0, incareat} = \frac{1}{4} (M_0 + M_u) \cdot g$$

$$m_2 \begin{cases} = M_0 + 2m_{0b} & (\text{vagon gol}) \\ = M_0 + 2m_{TD} & (\text{vagon incareat}) \end{cases}$$

$$m_1 = m_{cb}$$

$$m_0 = m_p$$

$$Q_0 = \frac{1}{4} (4m_0 + 2m_1 + m_2) g$$

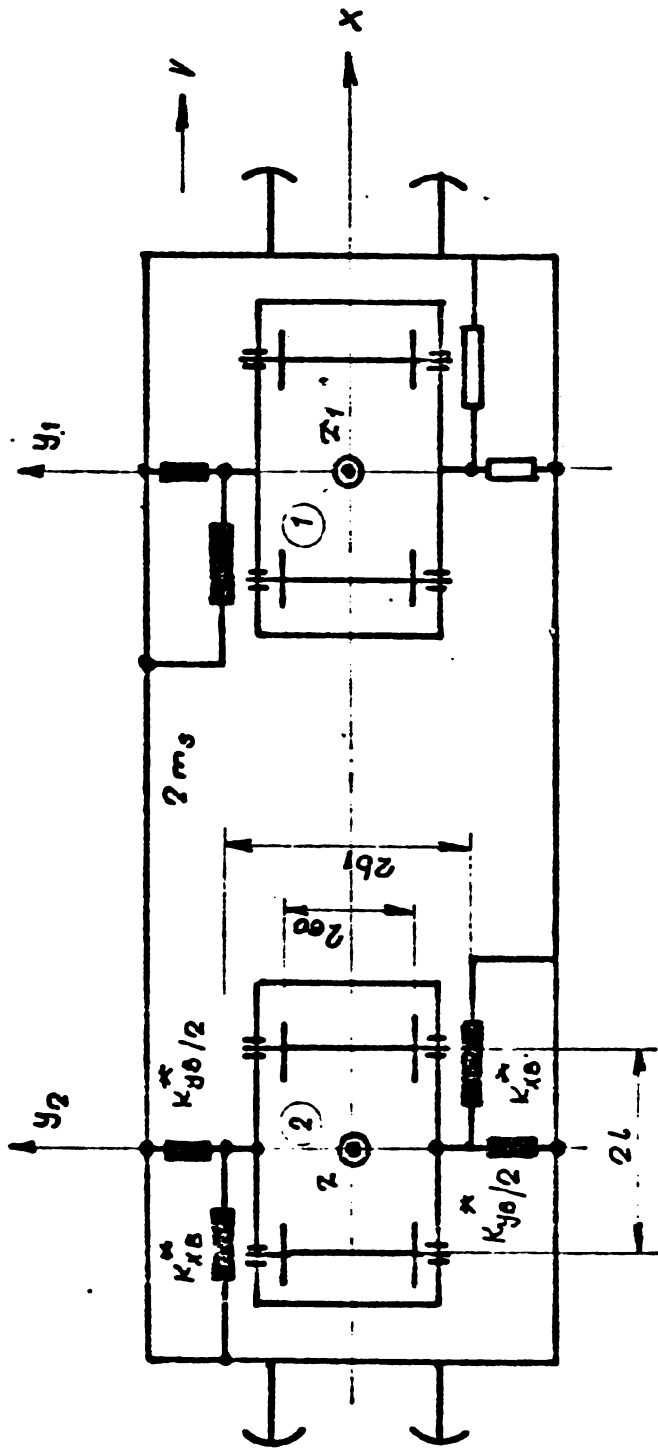
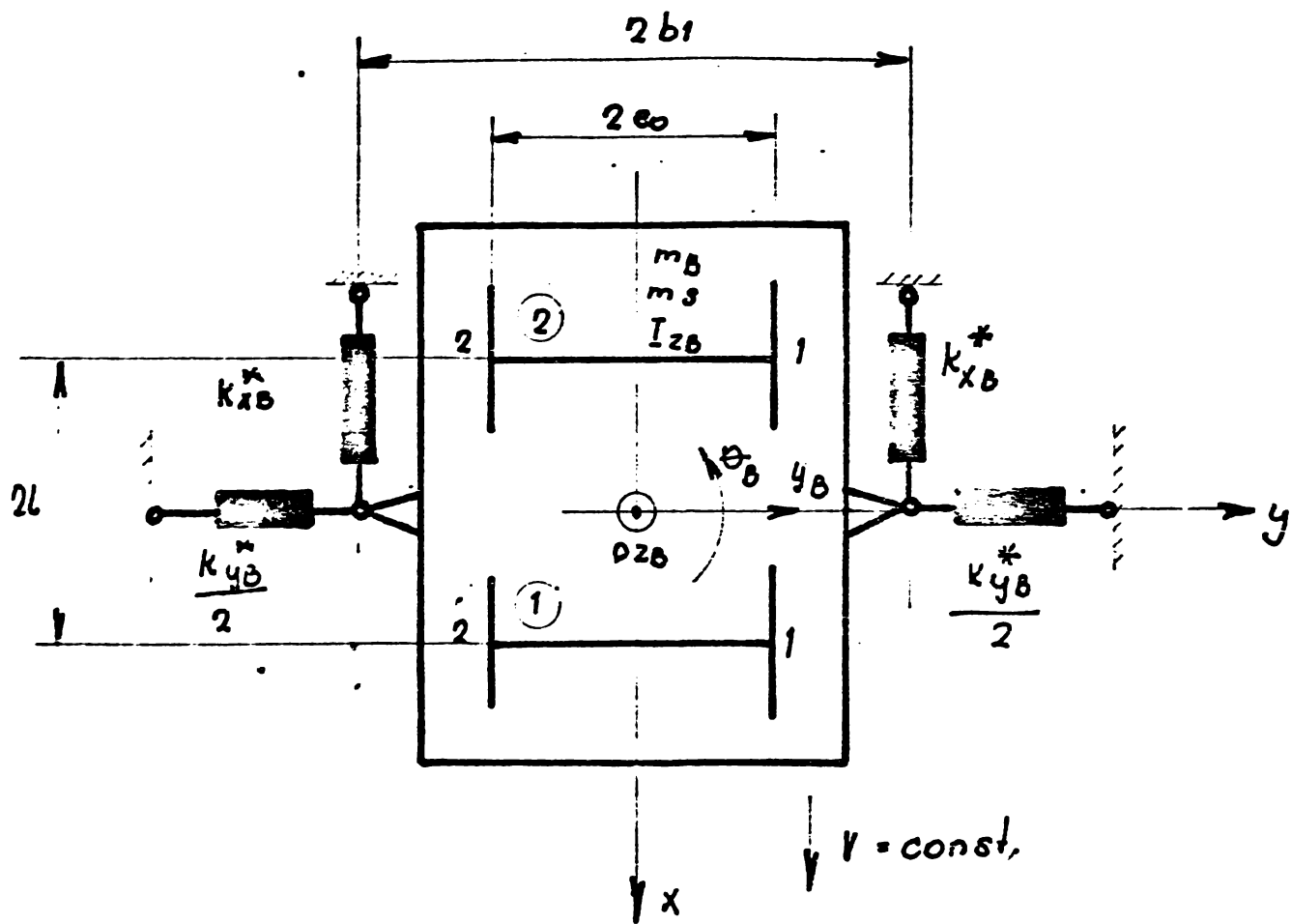


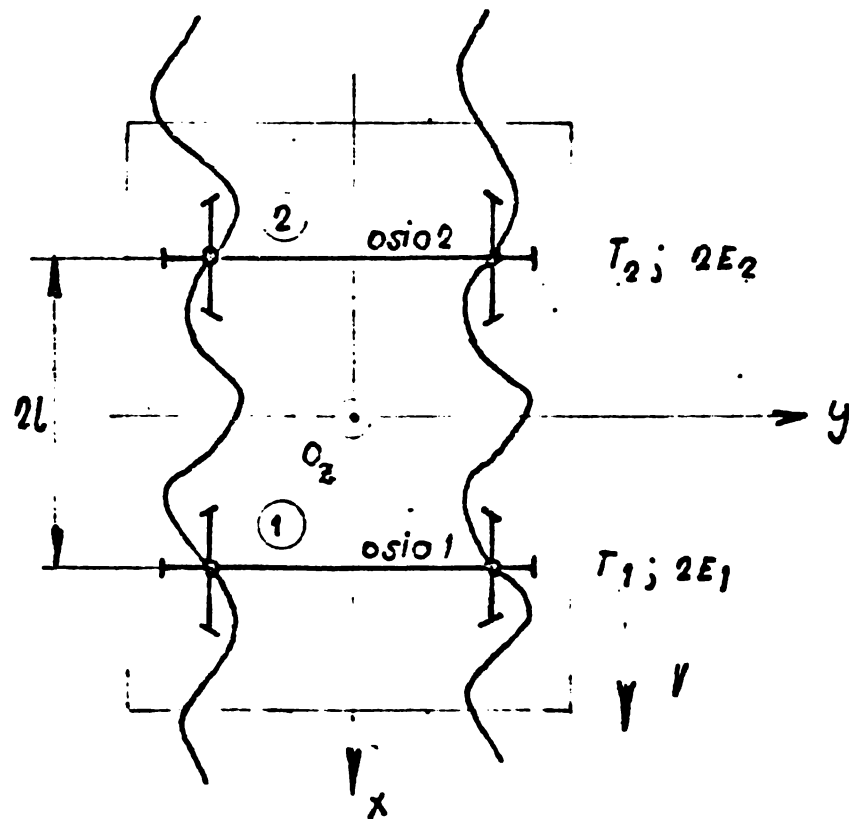
FIG. 24

$$m_0 = m_{c0} + 2m_0$$

$$m_3 = \left\{ \begin{array}{l} \frac{1}{2} (M_c + M_{TD}) \quad \text{la vagon gol} \\ \frac{1}{2} (M_c + M_u + 2m_{TD}) \quad \text{la vagon încărcat} \end{array} \right.$$



a.)

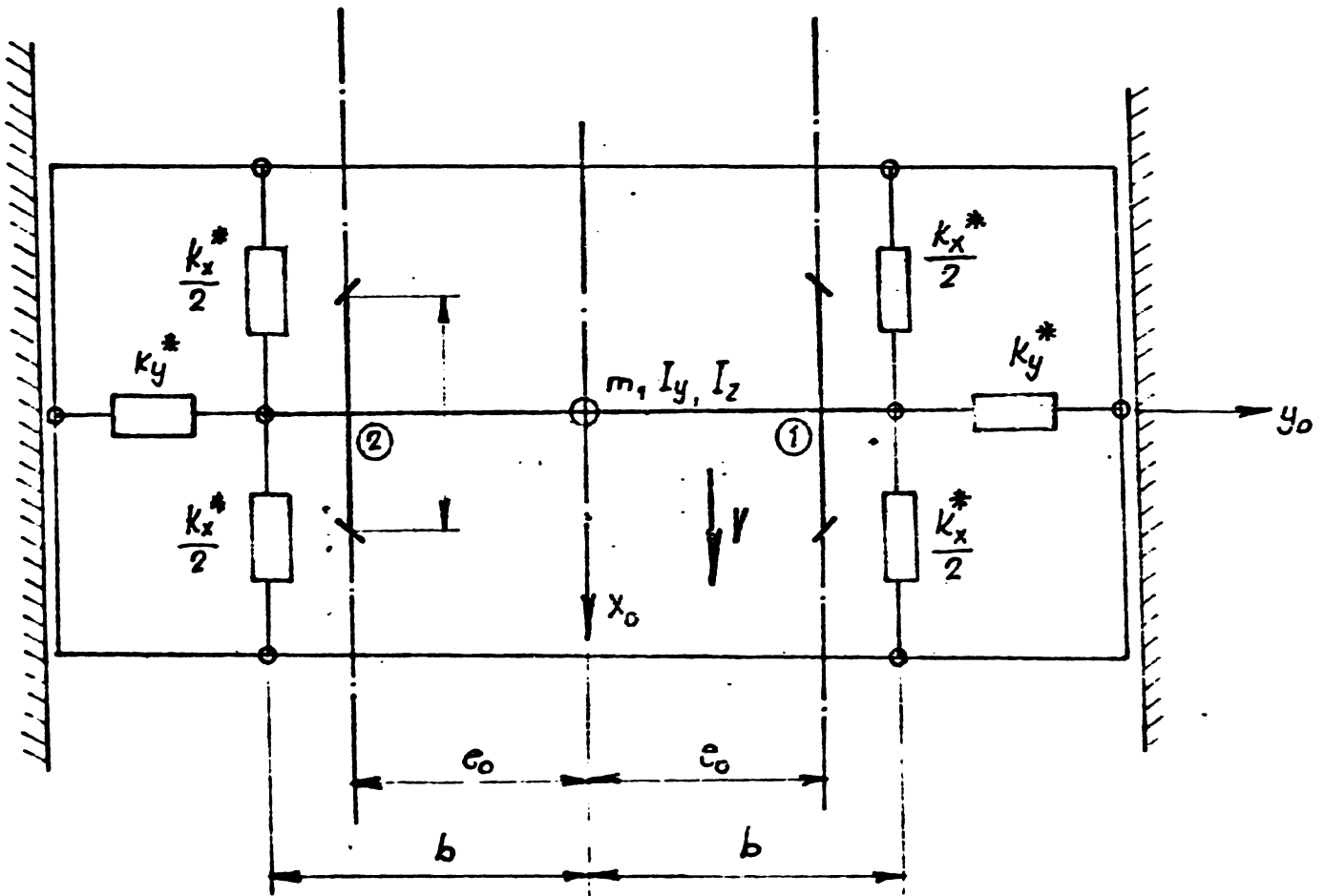


Firul dr.

Firul stg.

b.)

FIG. 25.



$$k_x^* = k_x^* (k_{x1}, c_1)$$

$$k_y^* = k_y^* (k_y, c_y)$$

$$k_z^* = k_z^* (k_z, c_z)$$

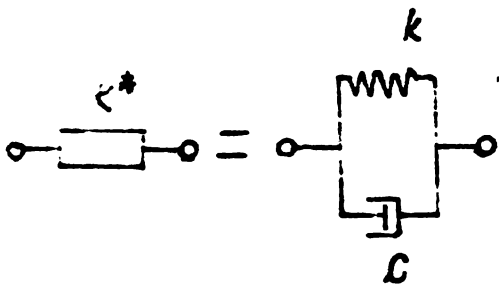
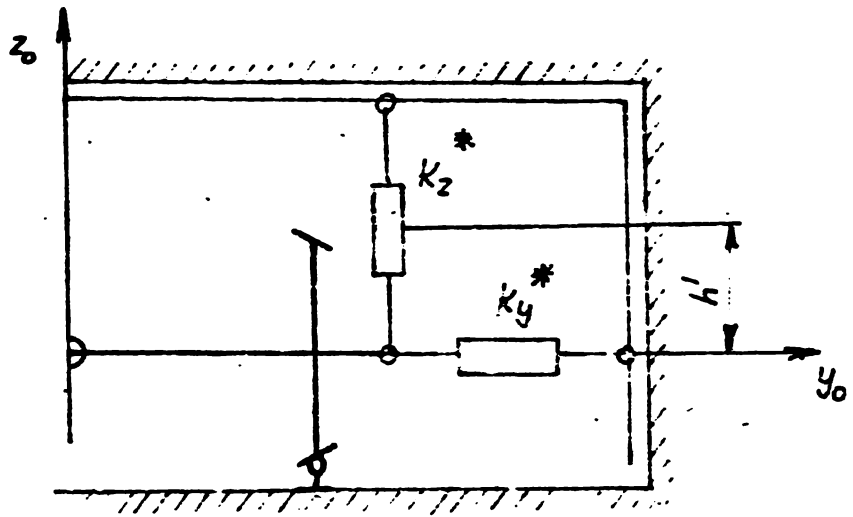


FIG. 26: |78|

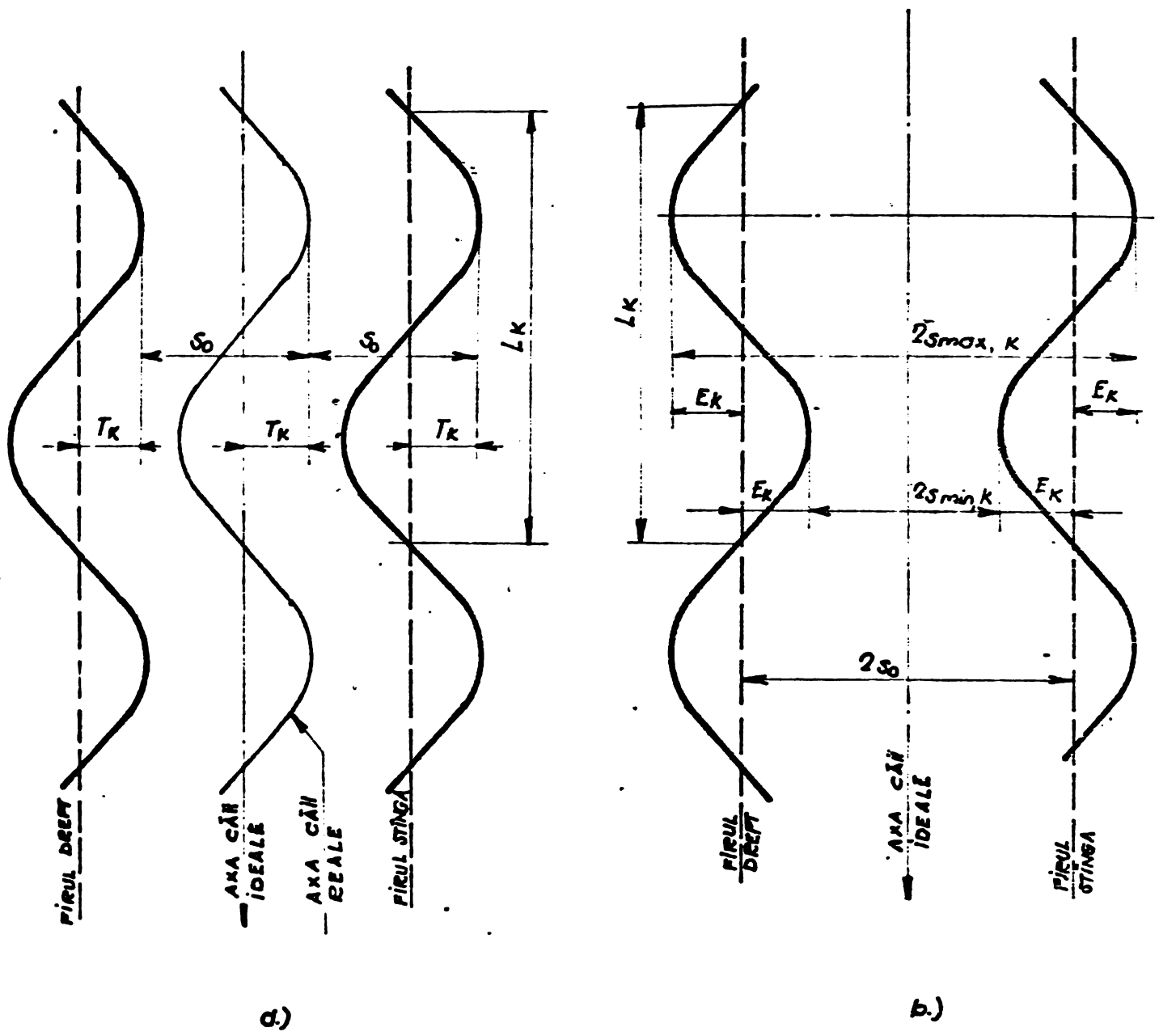
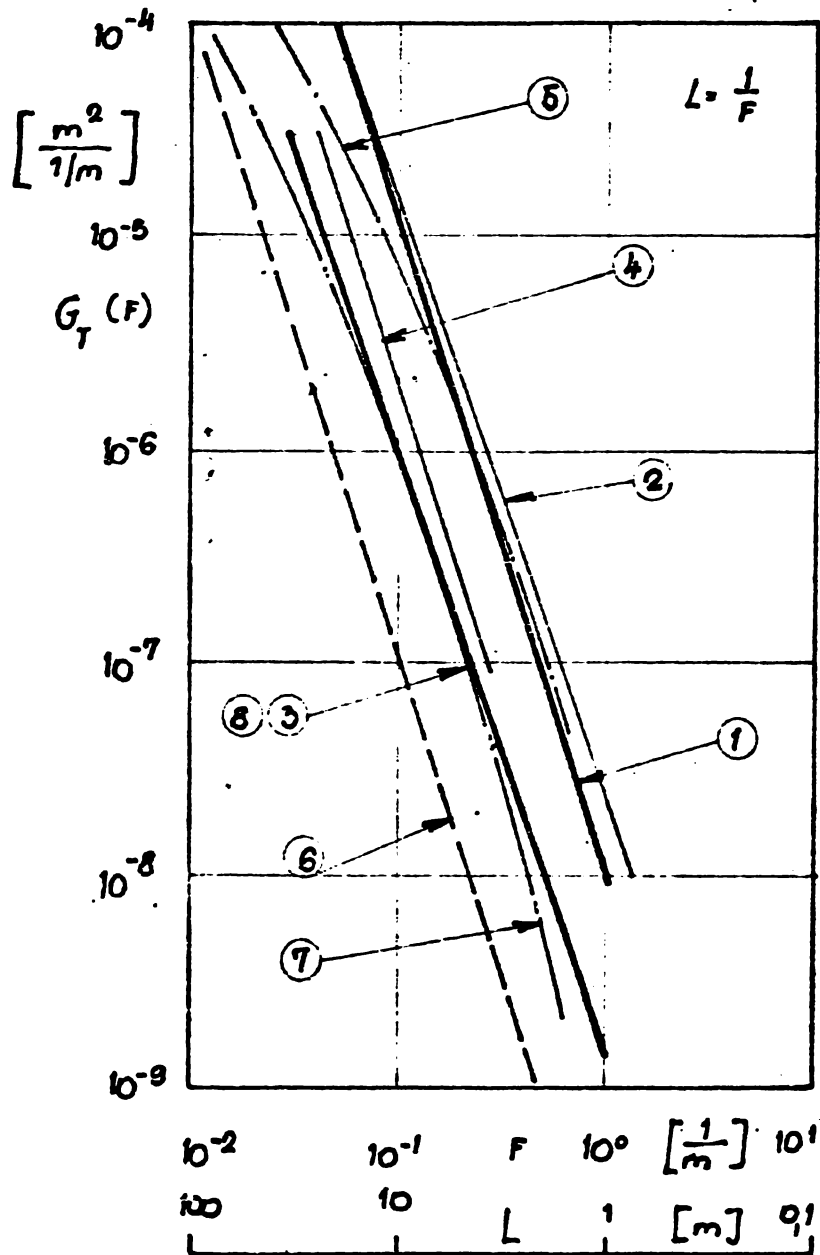


FIG. 27



- LEGENDA:
- ① FORMULA G_T , capitolul 2.2., $k_{IT} = 1,0$
 - ② ÎNFĂȘURĂTOAREA MAXIMELOR [119] ORE C 116
 - ③ ÎNFĂȘURĂTOAREA MINIMELOR [119] ORE C 116
 - ④ ÎNFĂȘURĂTOAREA MINIMELOR [117] KRETTER
 - ⑤ FORMULA SNCF, CALE FREGASTĂ [120] FREDERICH
 - ⑥ TMM-1; BRITISH RAILWAYS [120] FREDERICH
 - ⑦ MEDIA MAI MULTE CURBE [120] FREDERICH
 - ⑧ FORMULA G_T , capitolul 2.2., $k_{IT} = 0,1$

Fig. 28

$$G_{uu}^{(f)} = \begin{array}{c} \begin{array}{cccc} T_1 & T_2 & 2E_1 & 2E_2 \\ \hline G_{T_1 T_1}^{(f)} & G_{T_1 T_2}^{(f)} & 0 & 0 \\ G_{T_2 T_1}^{(f)} & G_{T_2 T_2}^{(f)} & 0 & 0 \\ 0 & 0 & G_{2E_1 2E_2}^{(f)} & G_{2E_1 2E_2}^{(f)} \\ 0 & 0 & G_{2E_2 2E_1}^{(f)} & G_{2E_2 2E_2}^{(f)} \end{array} \\ \begin{array}{l} T_1 \\ T_2 \\ 2E_1 \\ 2E_2 \end{array} \end{array}$$

$$= \begin{array}{cc} \begin{array}{c} G_{-T_{12}}^{(f)} \\ 0 \end{array} & \begin{array}{c} 0 \\ G_{-2E_{12}}^{(f)} \end{array} \\ \hline \begin{array}{c} 0 \\ G_{-2E_{12}}^{(f)} \end{array} & \begin{array}{c} 0 \\ G_{-2E_{12}}^{(f)} \end{array} \end{array} ;$$

unde

$$G_{-T_{12}}^{(f)} = \begin{array}{cc} \begin{array}{c} 1 \\ e^{i \frac{2\pi f l}{v}} \end{array} & \begin{array}{c} e^{-i \frac{2\pi f l}{v}} \\ 1 \end{array} \\ \hline \begin{array}{c} e^{i \frac{2\pi f l}{v}} \\ 1 \end{array} & \begin{array}{c} e^{-i \frac{2\pi f l}{v}} \\ 1 \end{array} \end{array} \cdot \frac{1}{v} \cdot G_T^{(f)}$$

$$G_{-2E_{12}}^{(f)} = \begin{array}{cc} \begin{array}{c} 1 \\ e^{i \frac{2\pi f l}{v}} \end{array} & \begin{array}{c} e^{-i \frac{2\pi f l}{v}} \\ 1 \end{array} \\ \hline \begin{array}{c} e^{i \frac{2\pi f l}{v}} \\ 1 \end{array} & \begin{array}{c} e^{-i \frac{2\pi f l}{v}} \\ 1 \end{array} \end{array} \cdot \frac{1}{v} \cdot G_{2E}^{(f)}$$

$$F = f / v$$

FIG. 29

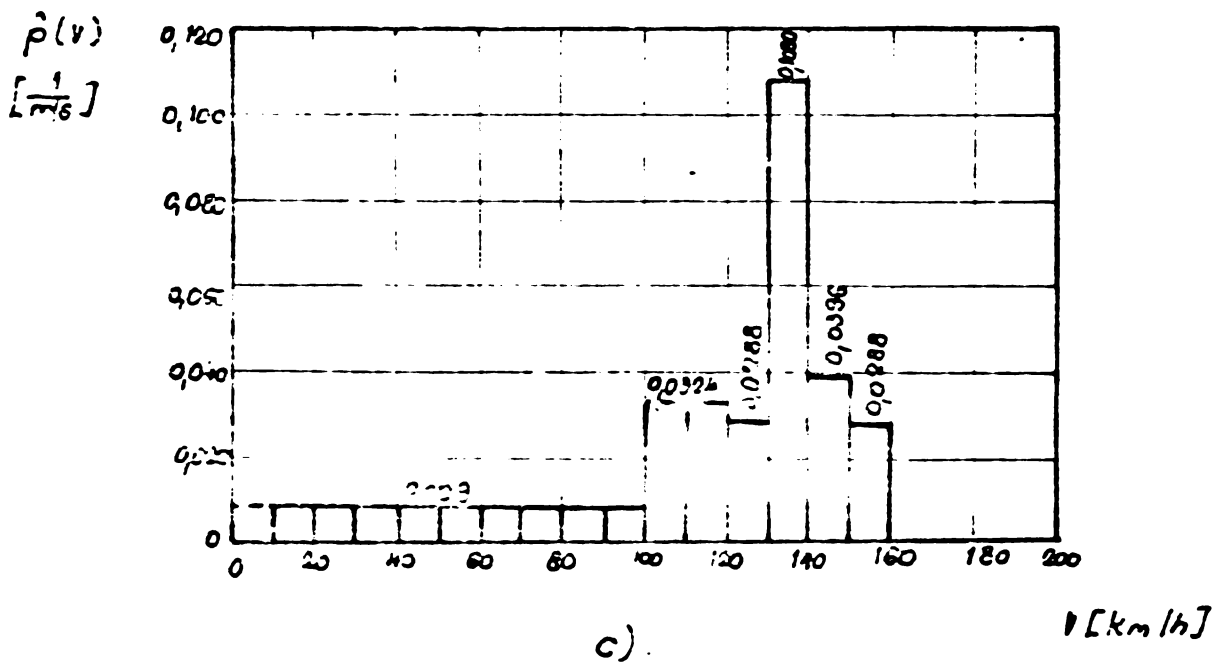
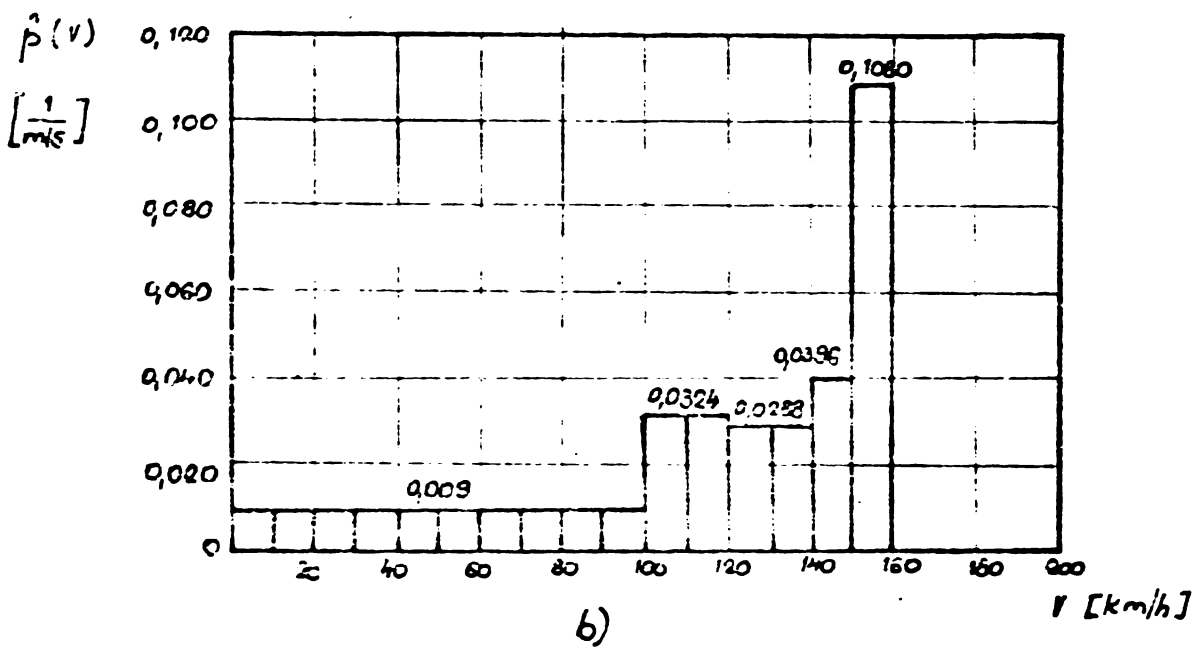
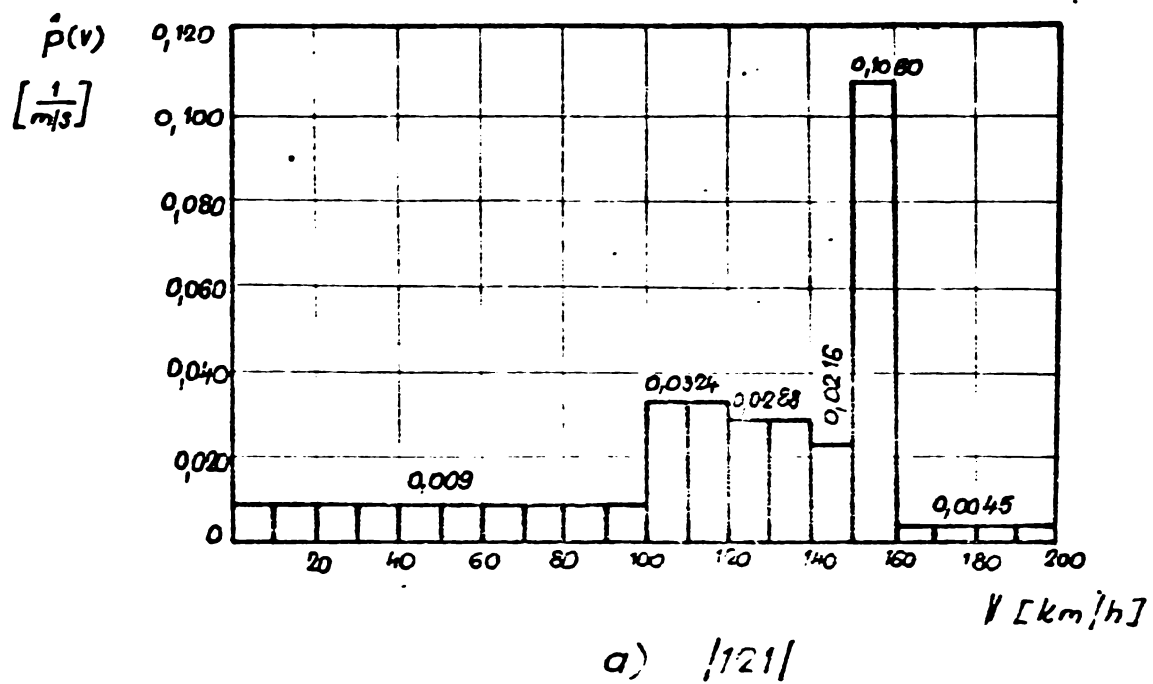


FIG. 30

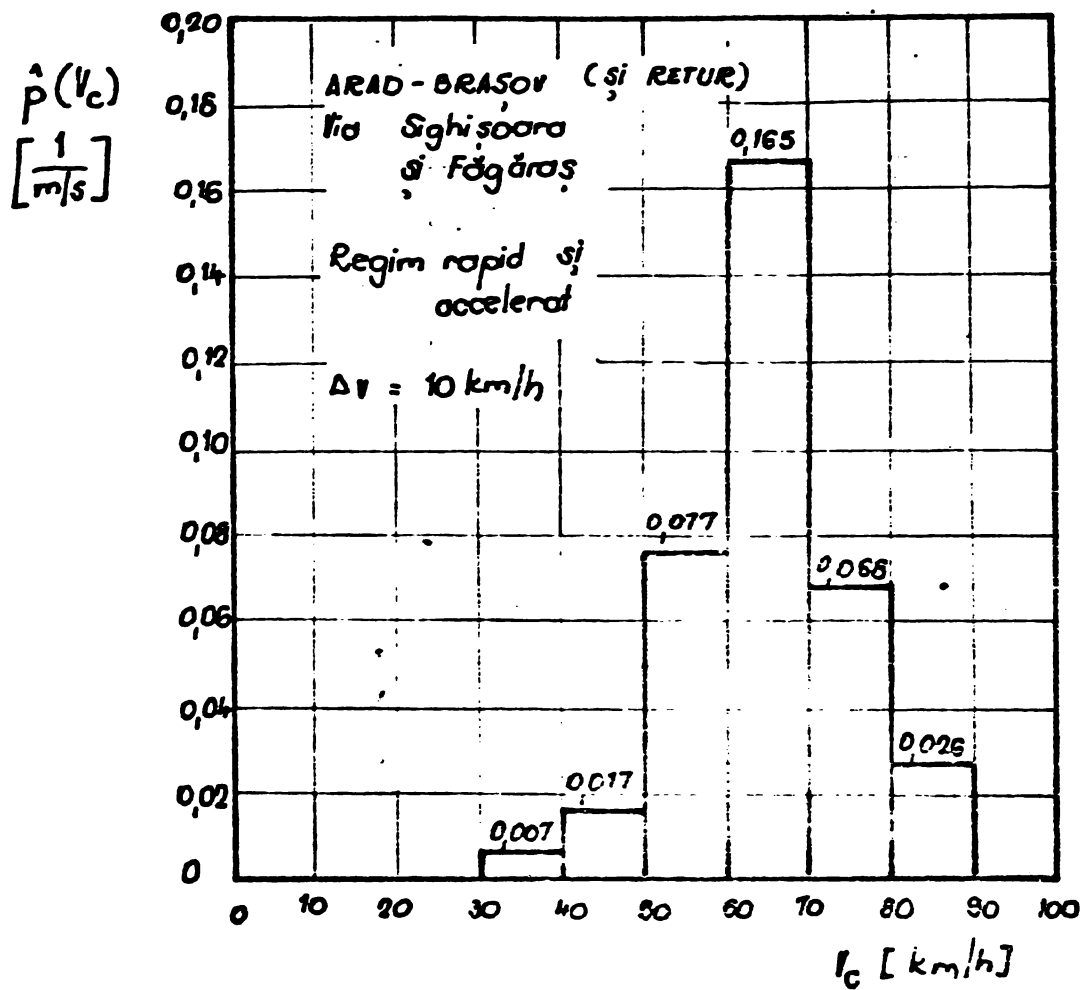


FIG. 31

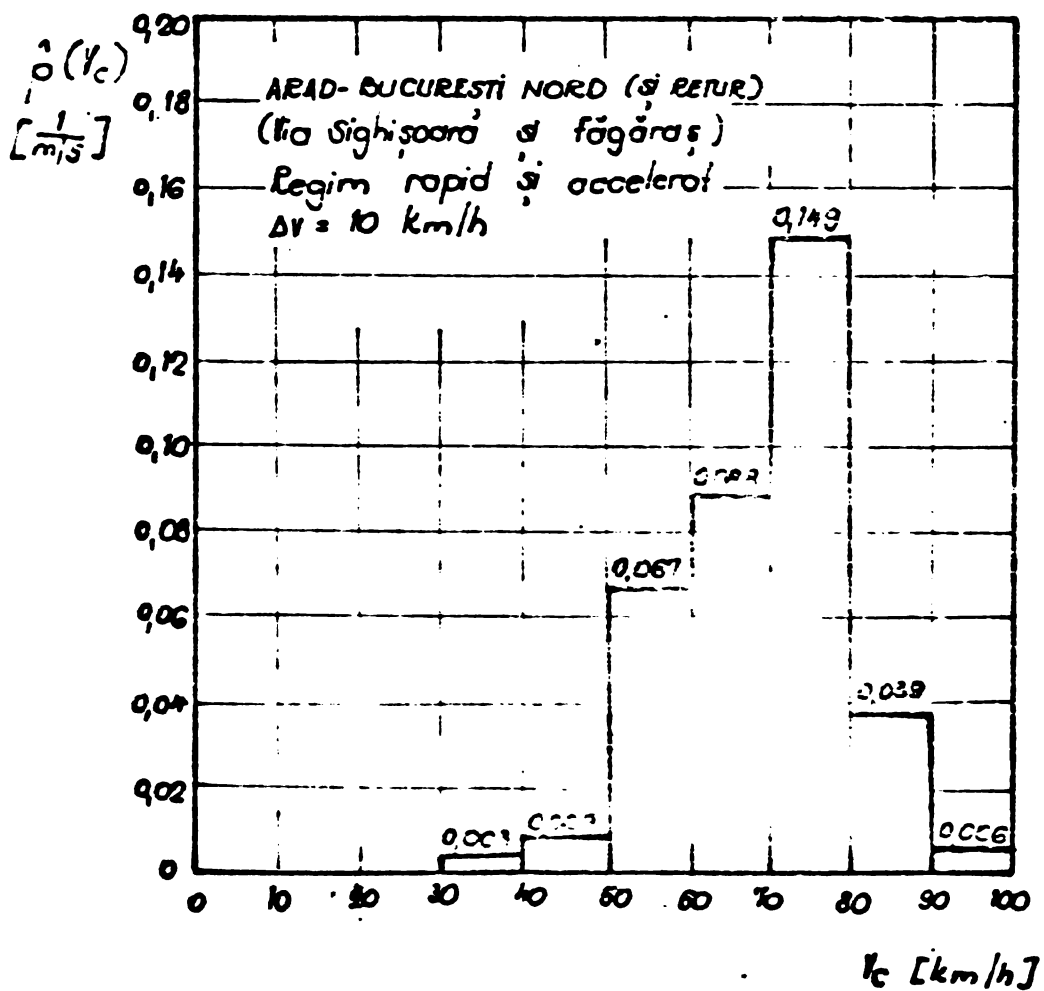


FIG. 32

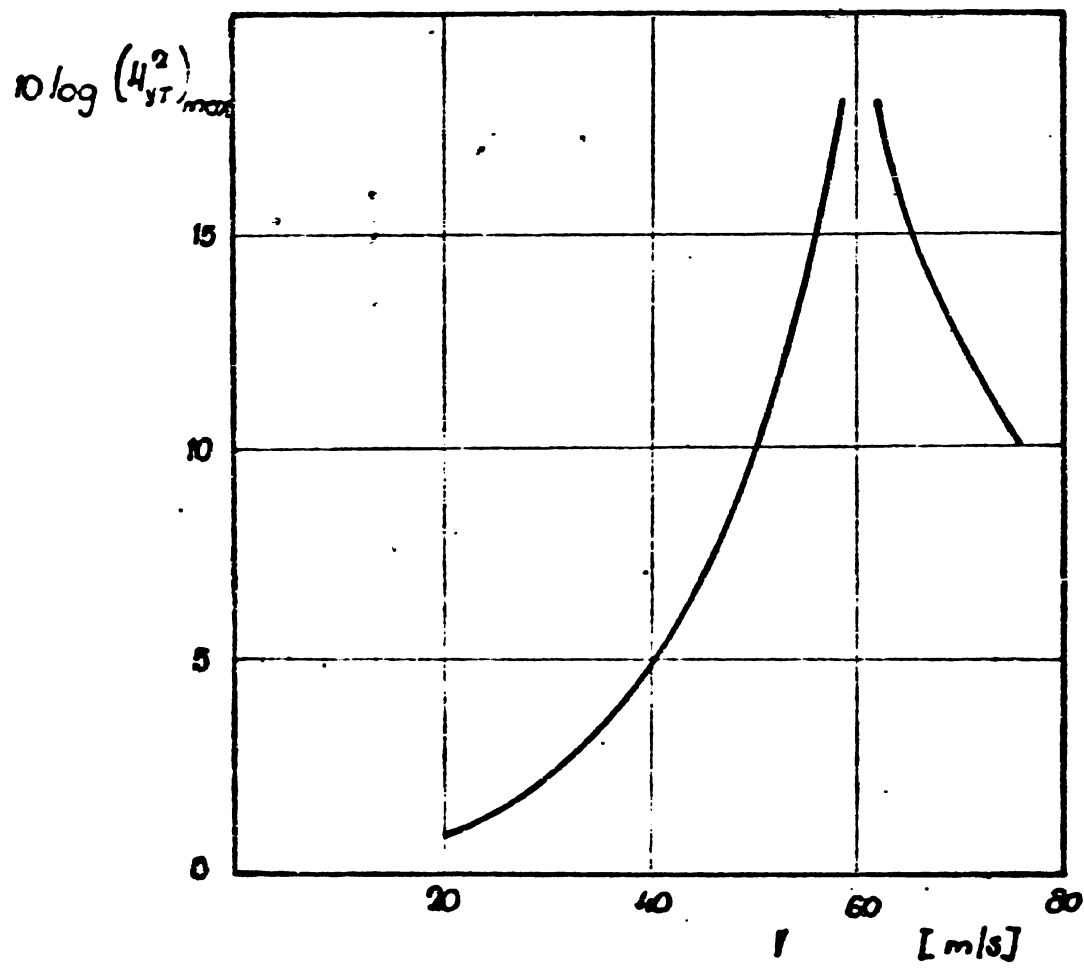


FIG . 33 . | 7 |

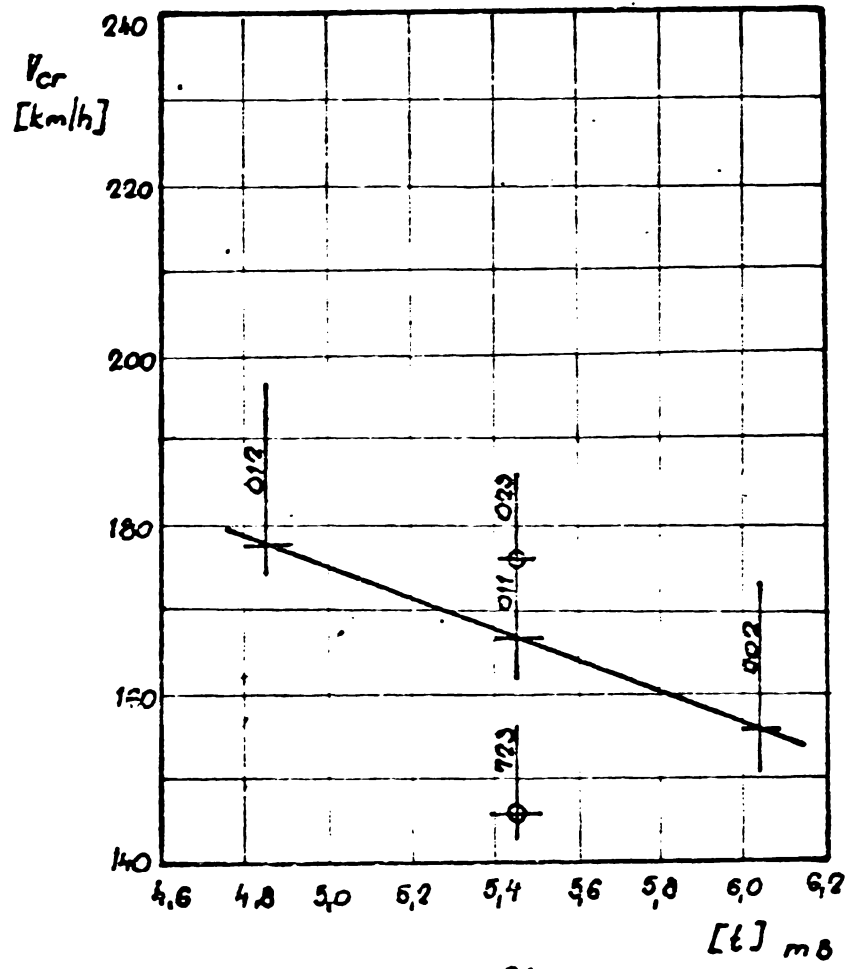


FIG. 34.

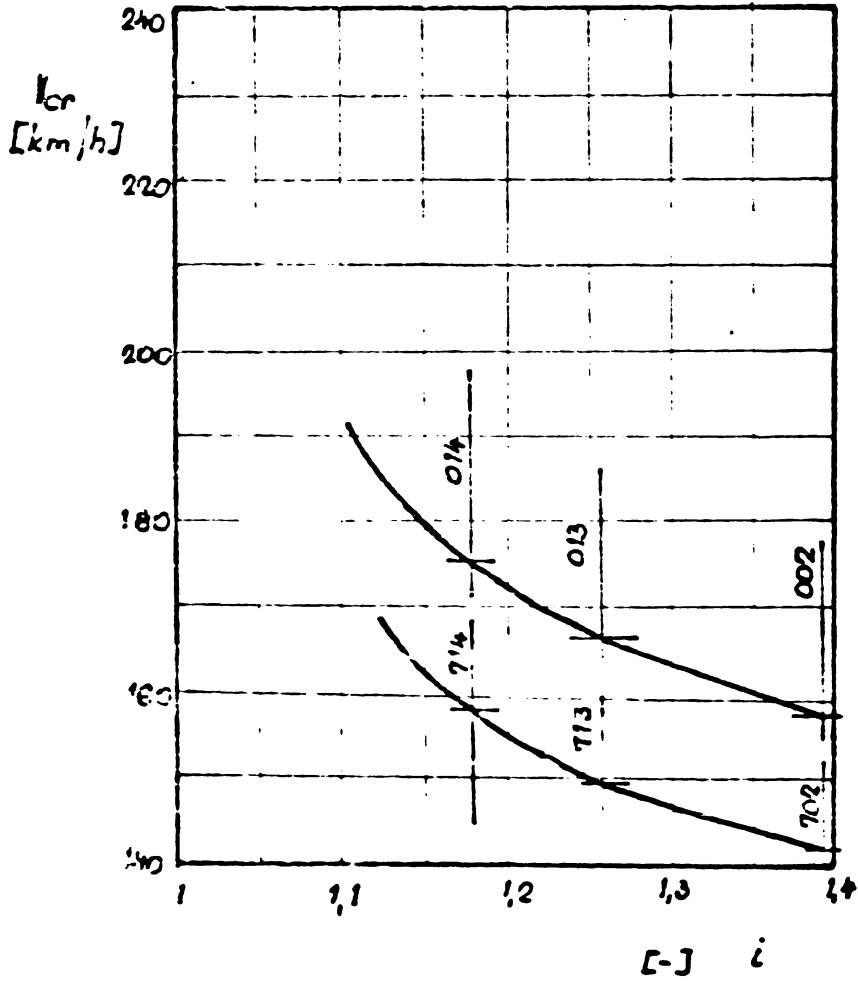


FIG. 35.

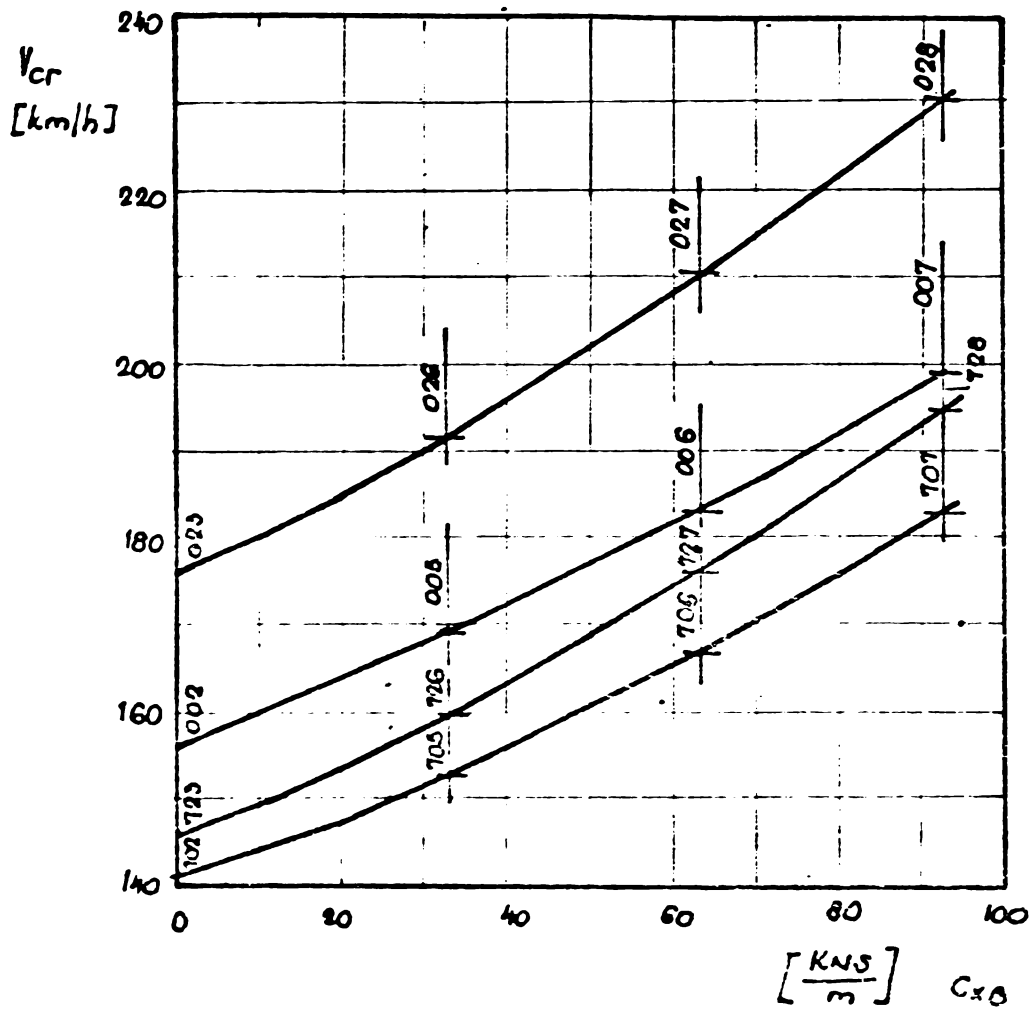


FIG. 36.

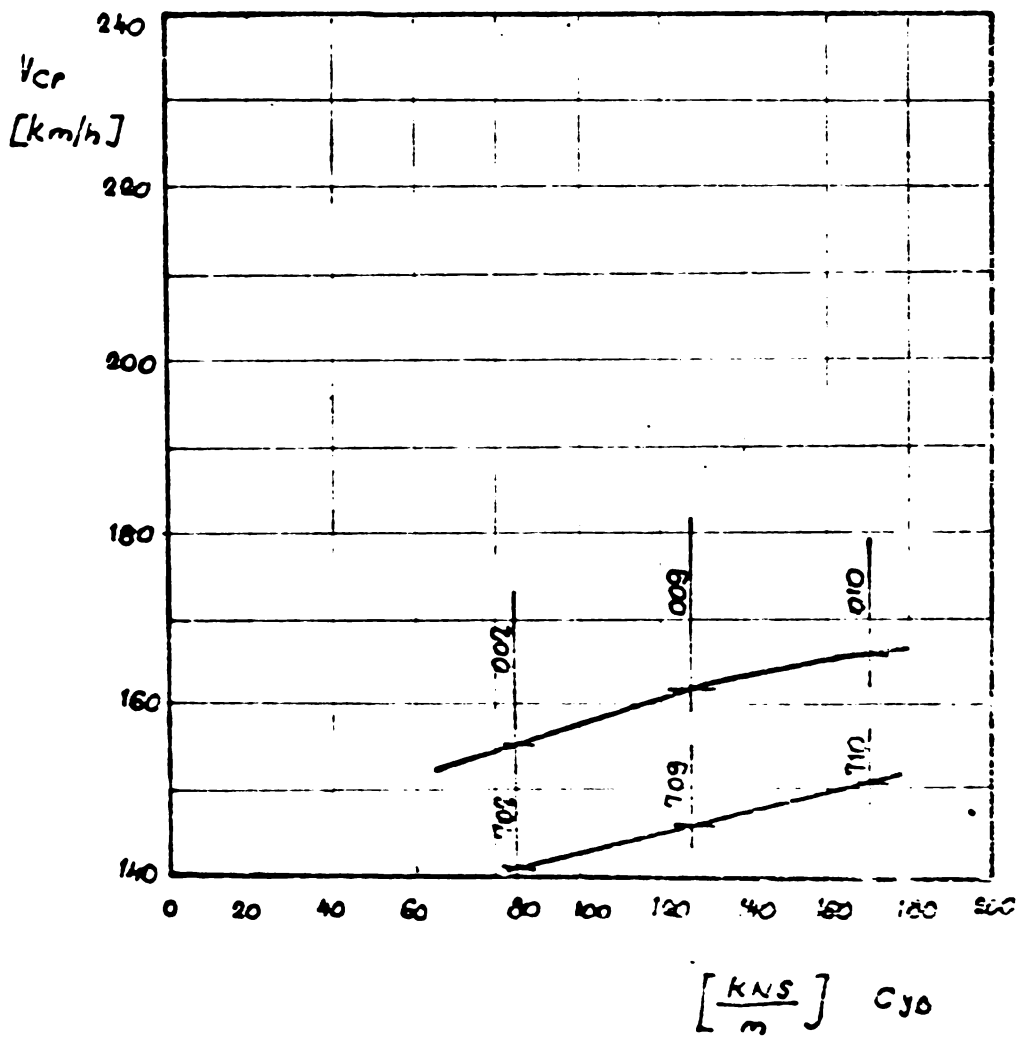


FIG. 37.

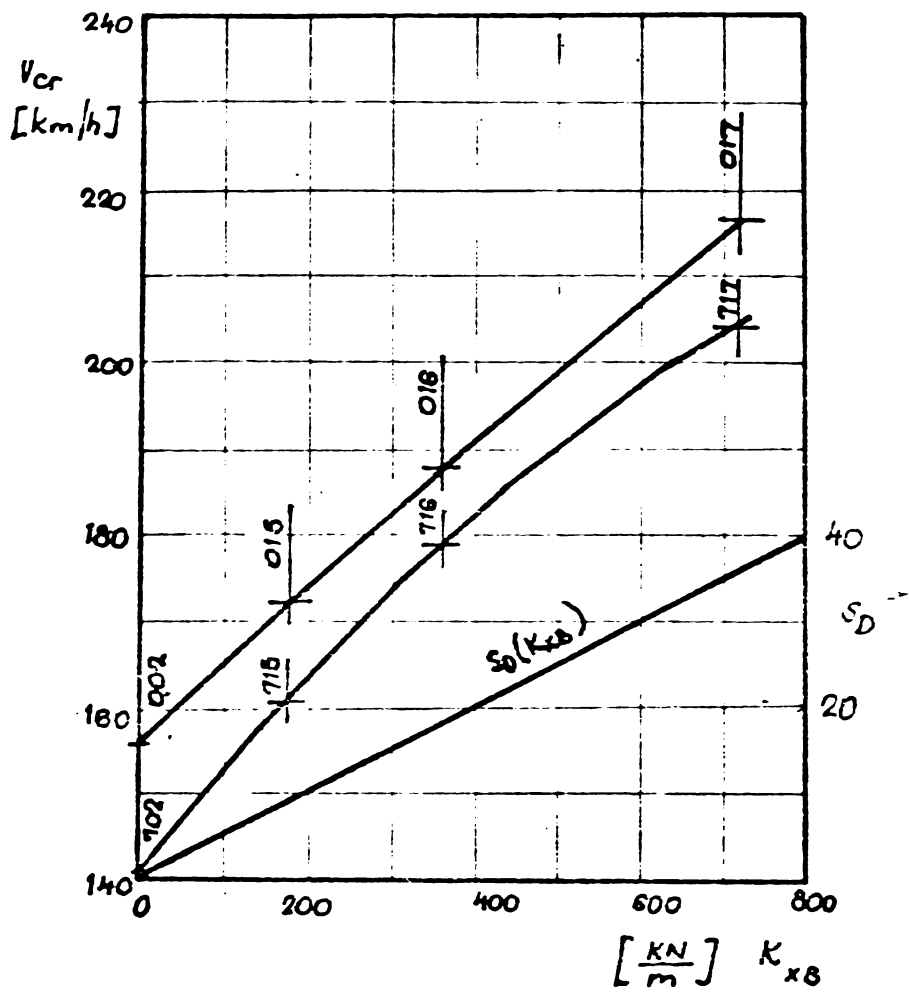


FIG. 38.

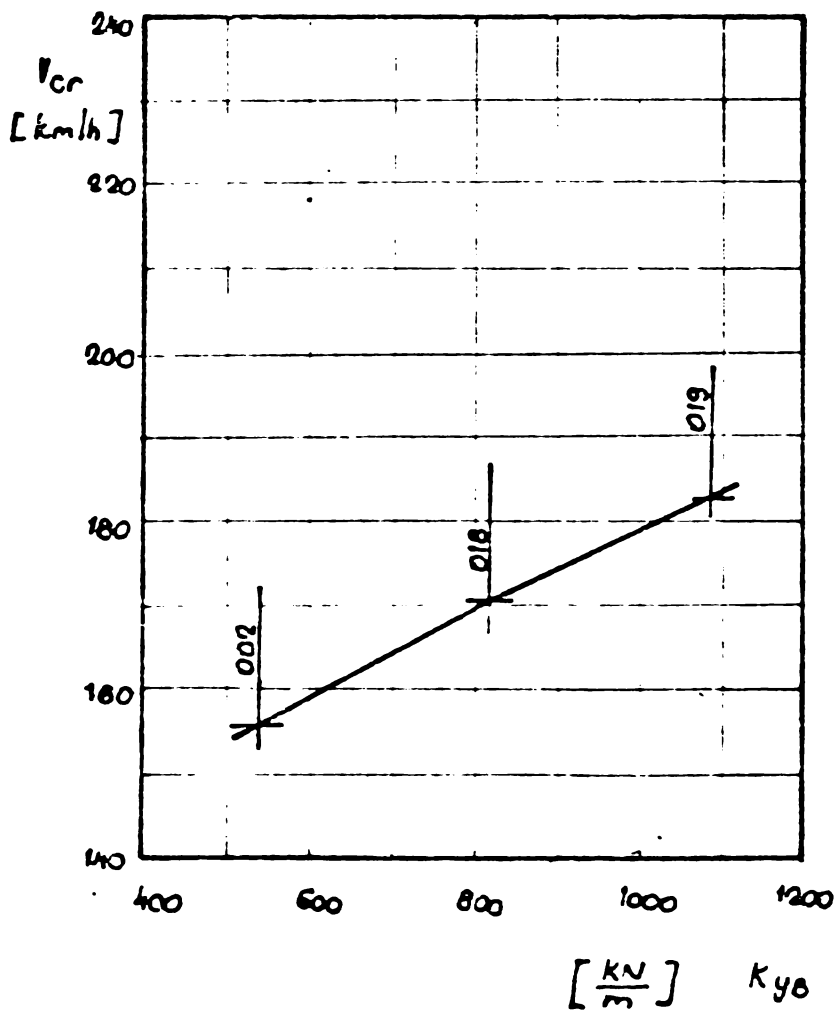


FIG. 39.

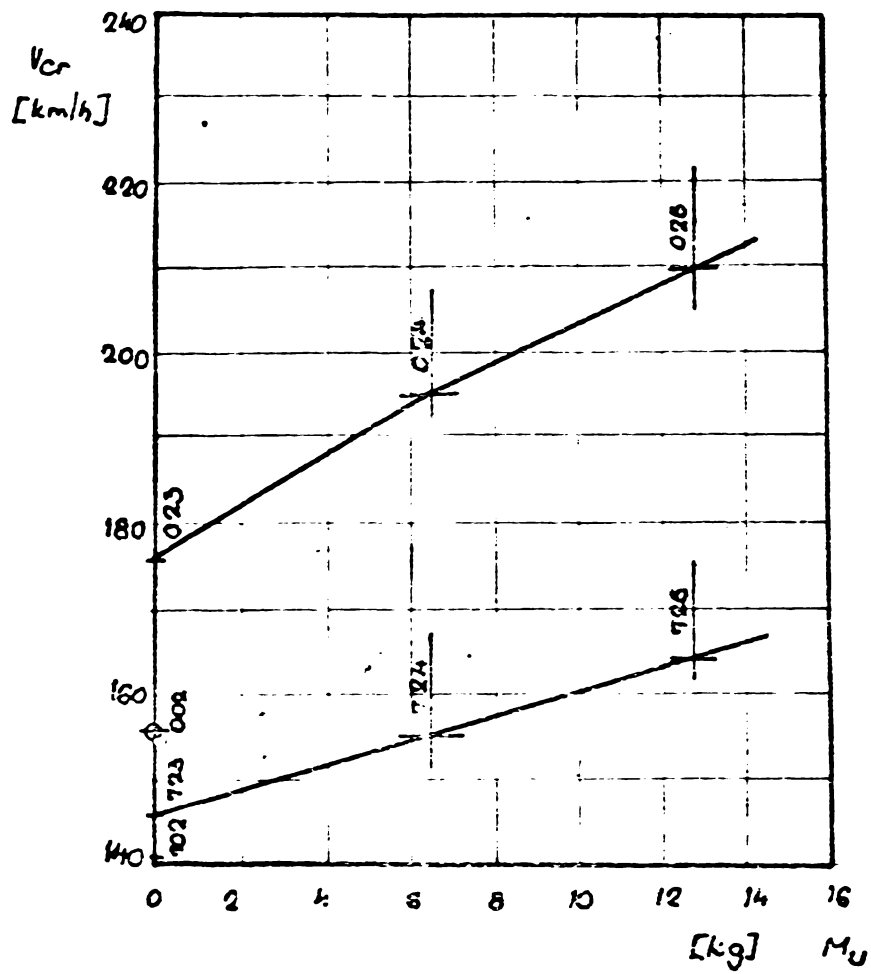


FIG. 40

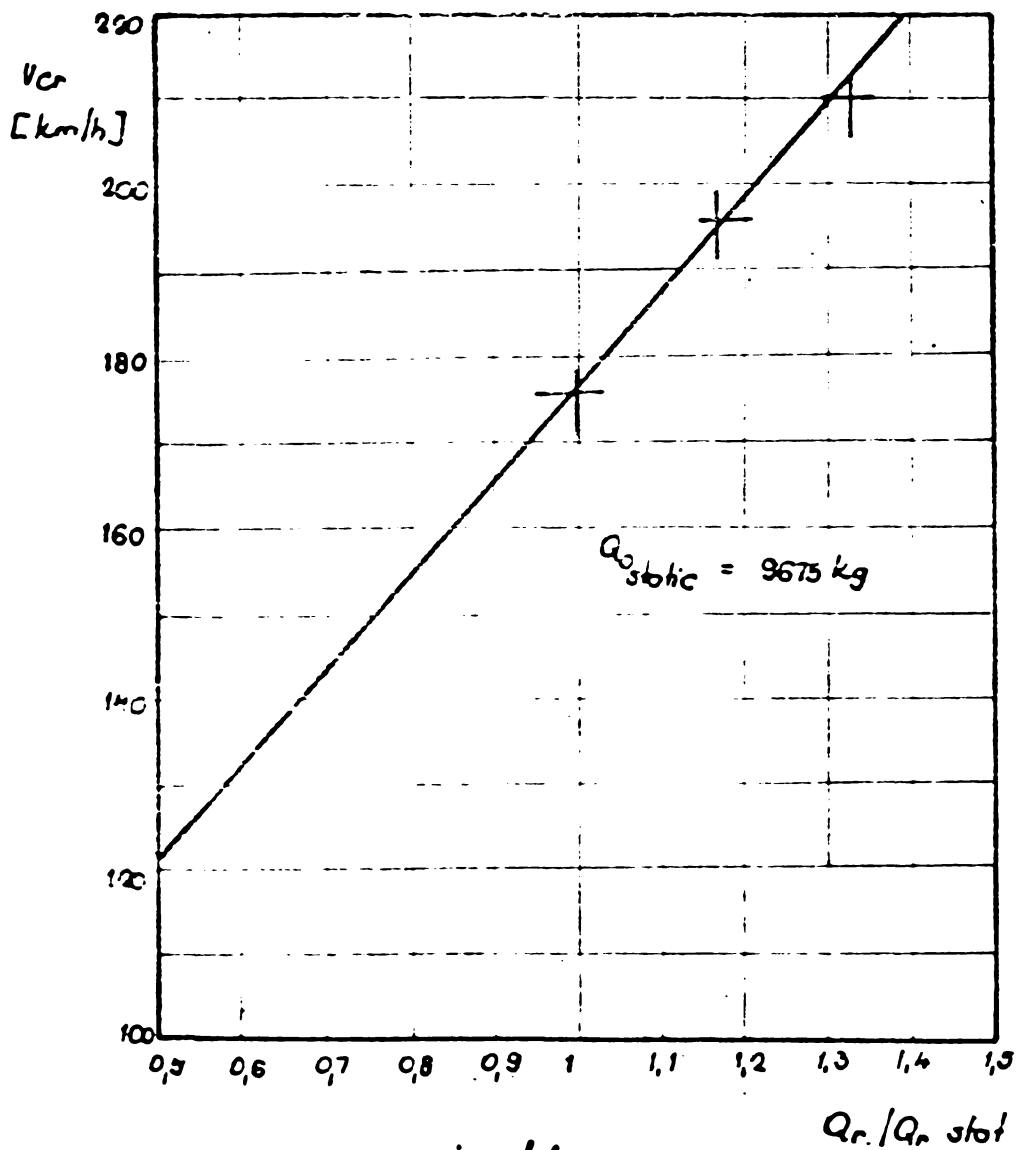
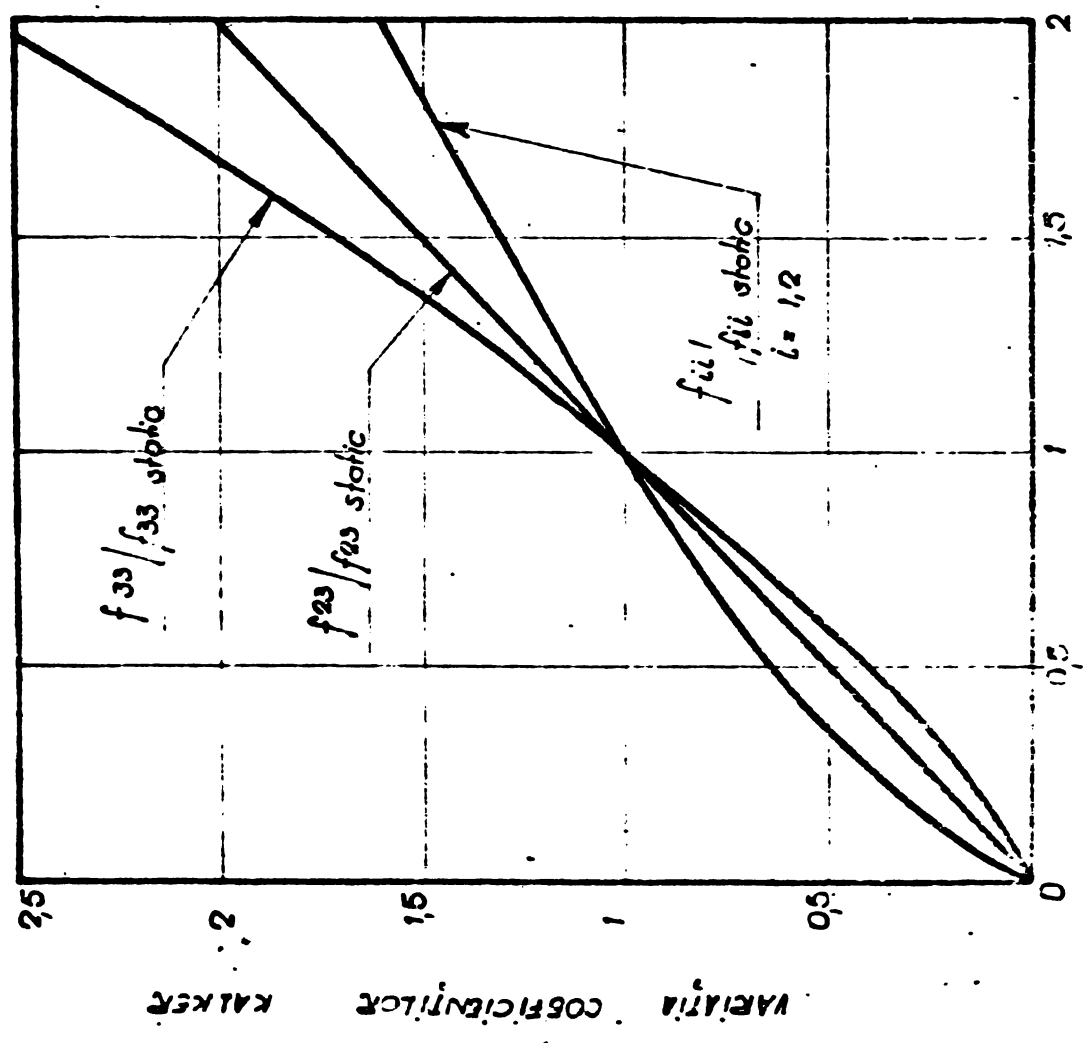
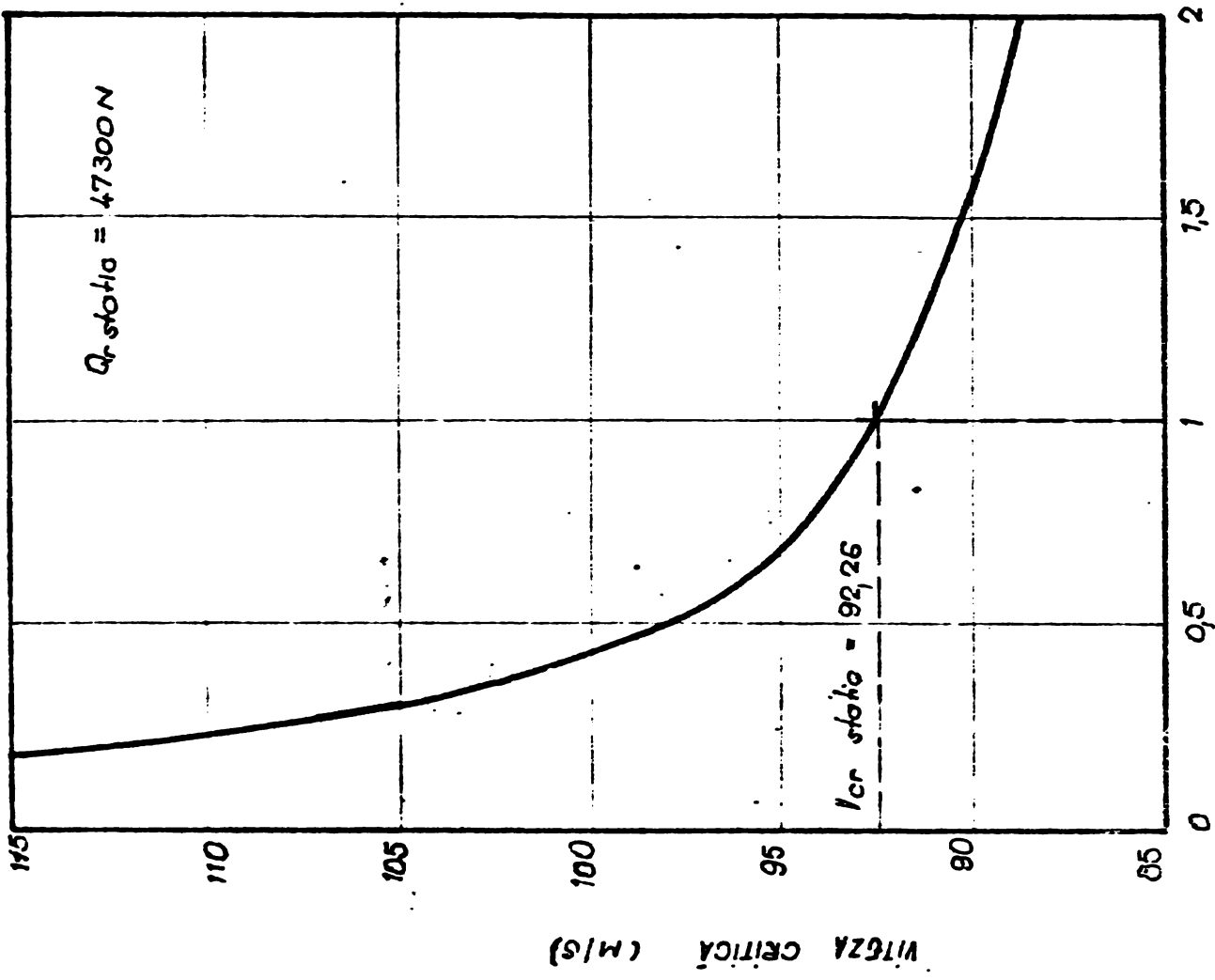


FIG. 41



a)

VARIATIJA SARCIUNI PE ROATA $K = \frac{Q_r}{Q_{r \text{ static}}}$



b)

FIG. 42

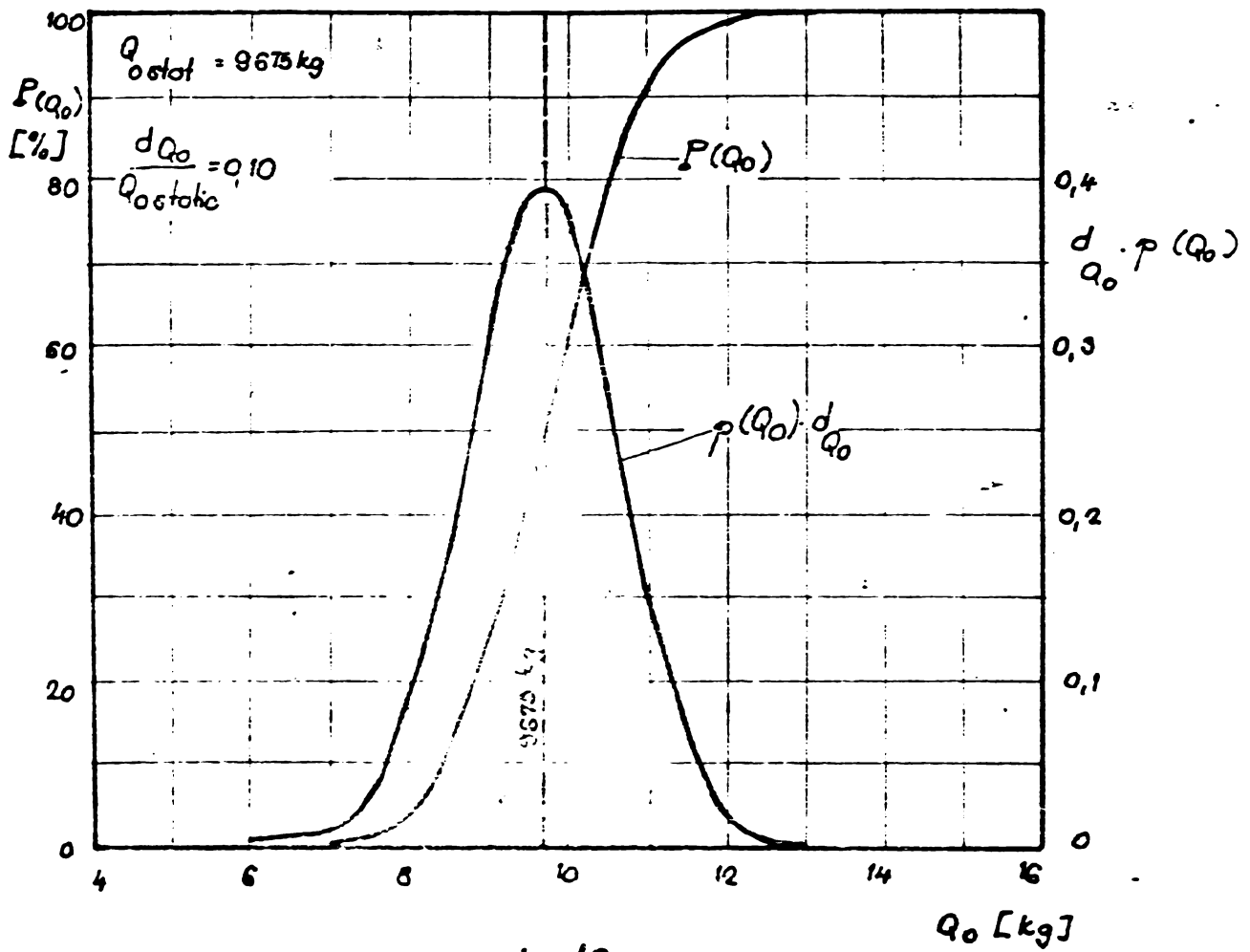


FIG. 43.

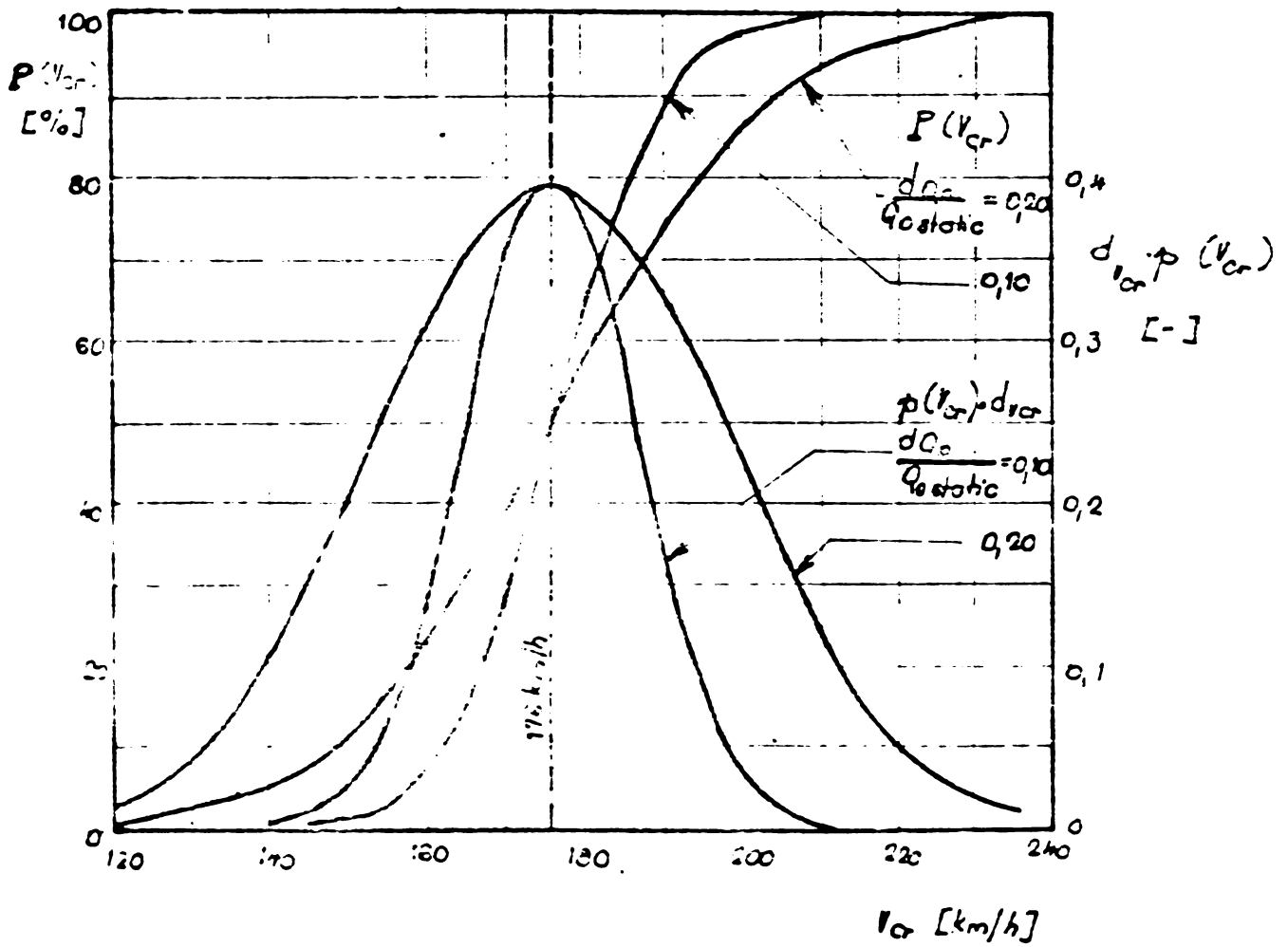


FIG. 44

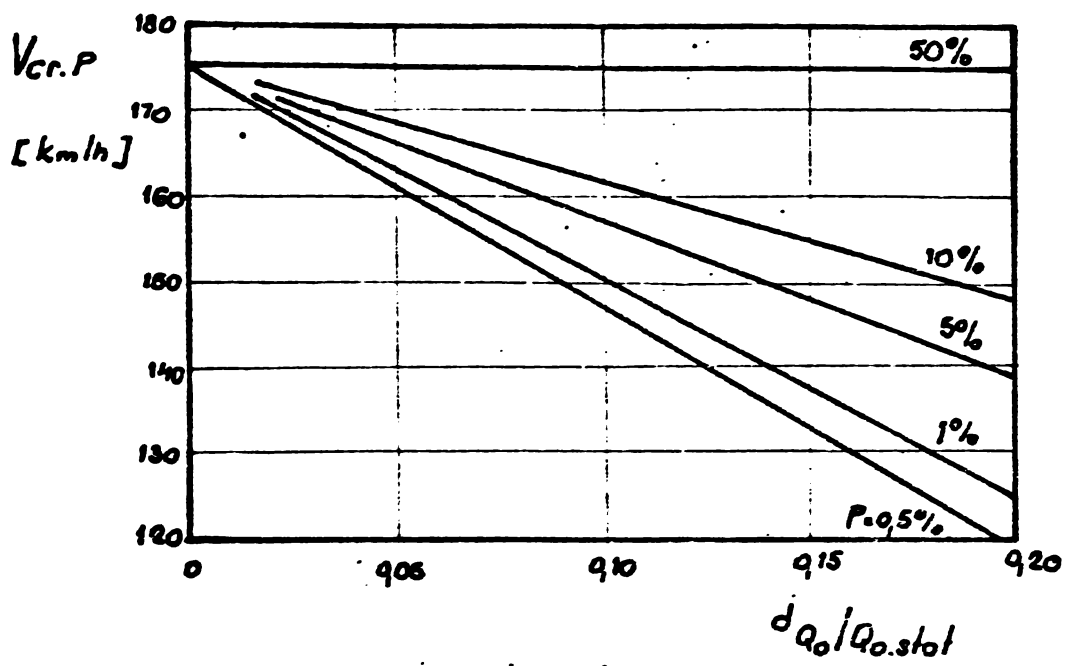


FIG. 45.

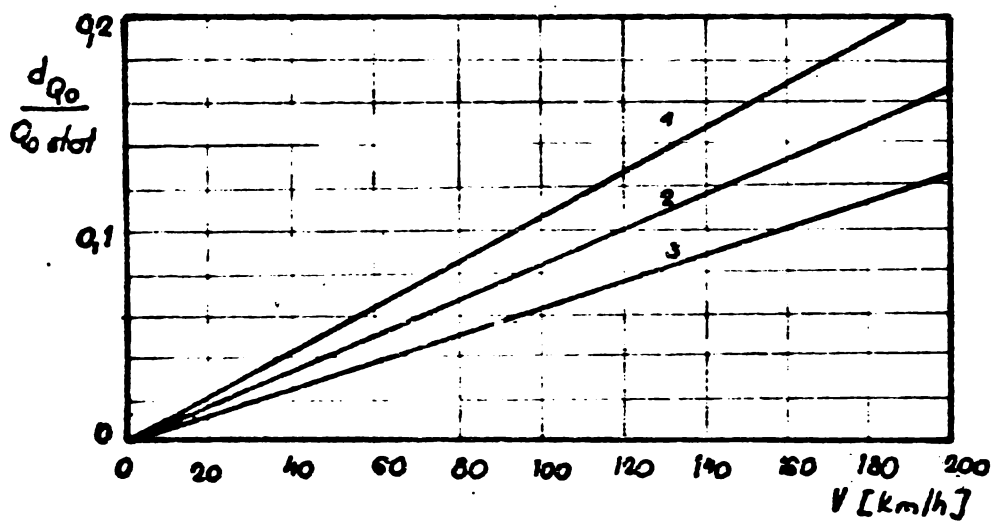


FIG. 46

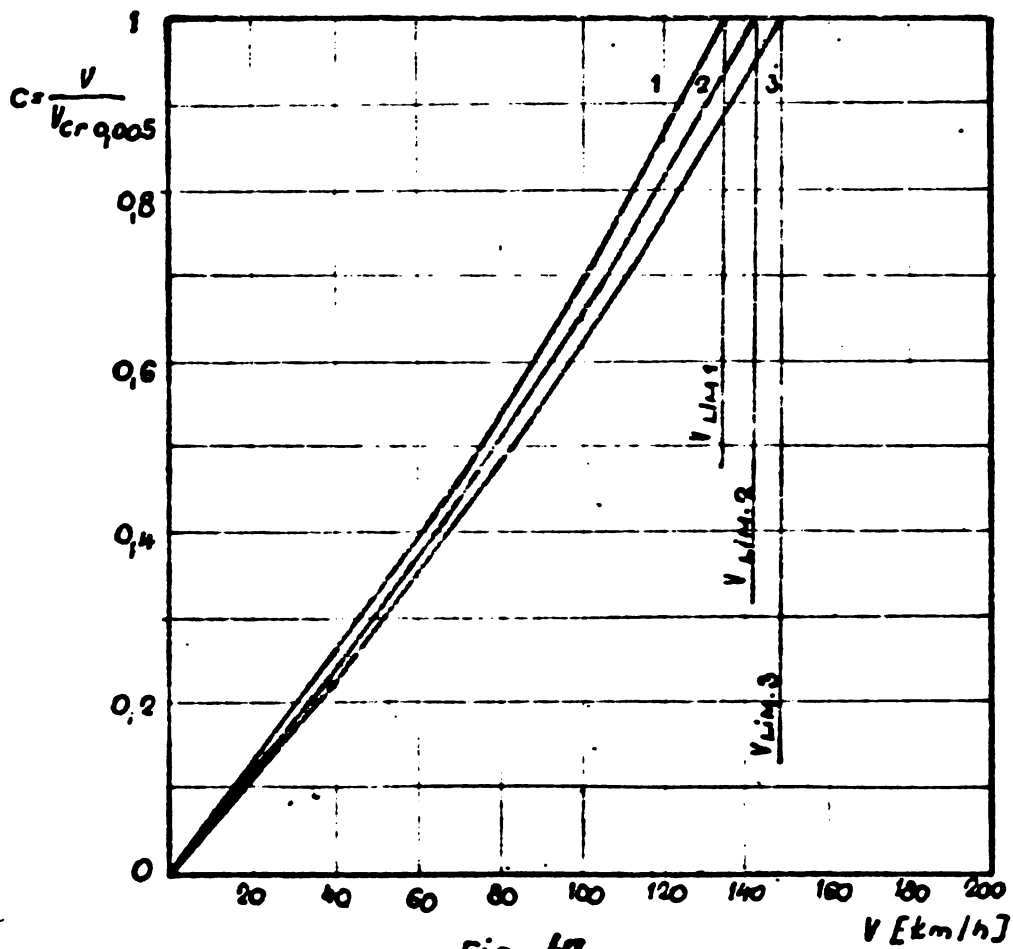
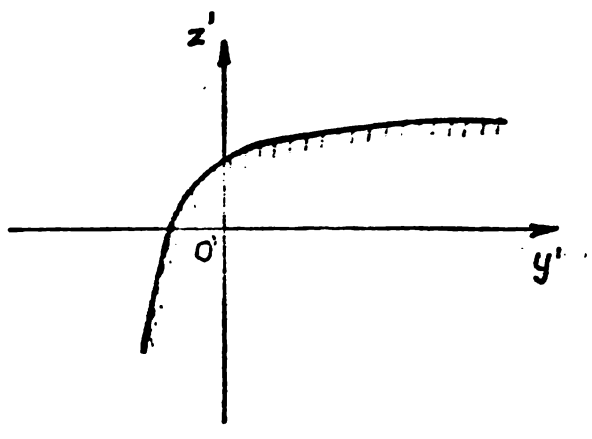
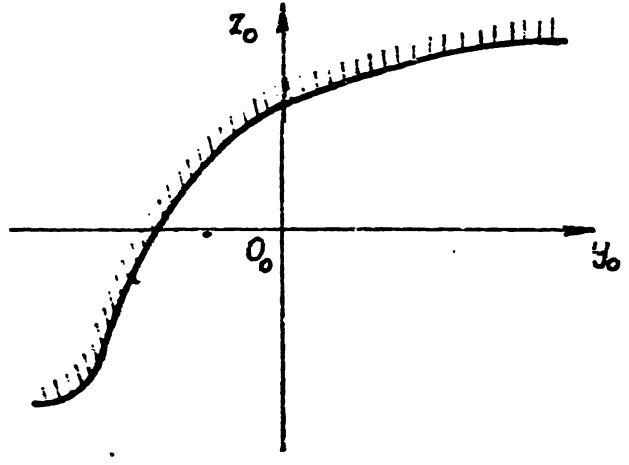


FIG. 47.



a)



b)

FIG. 48

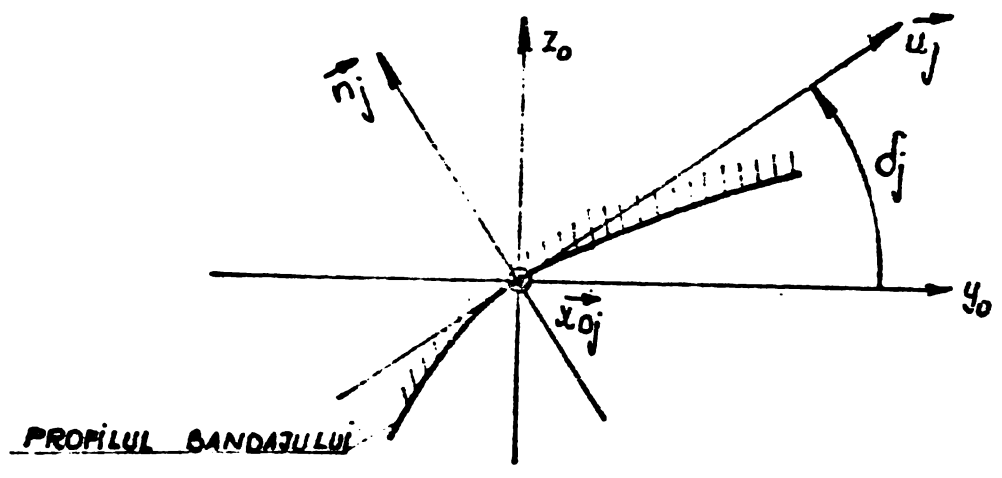


FIG. 49

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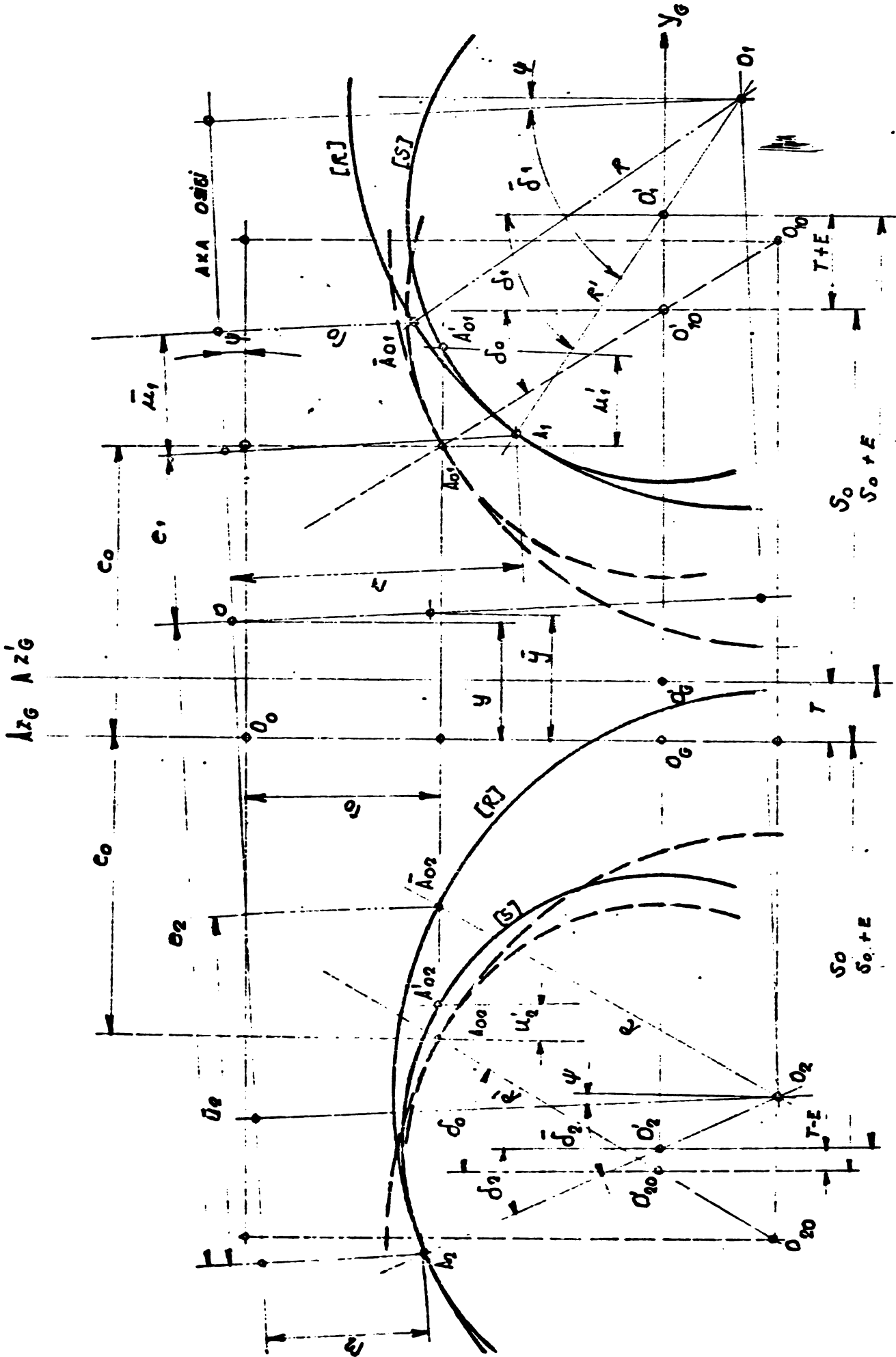


Fig.50

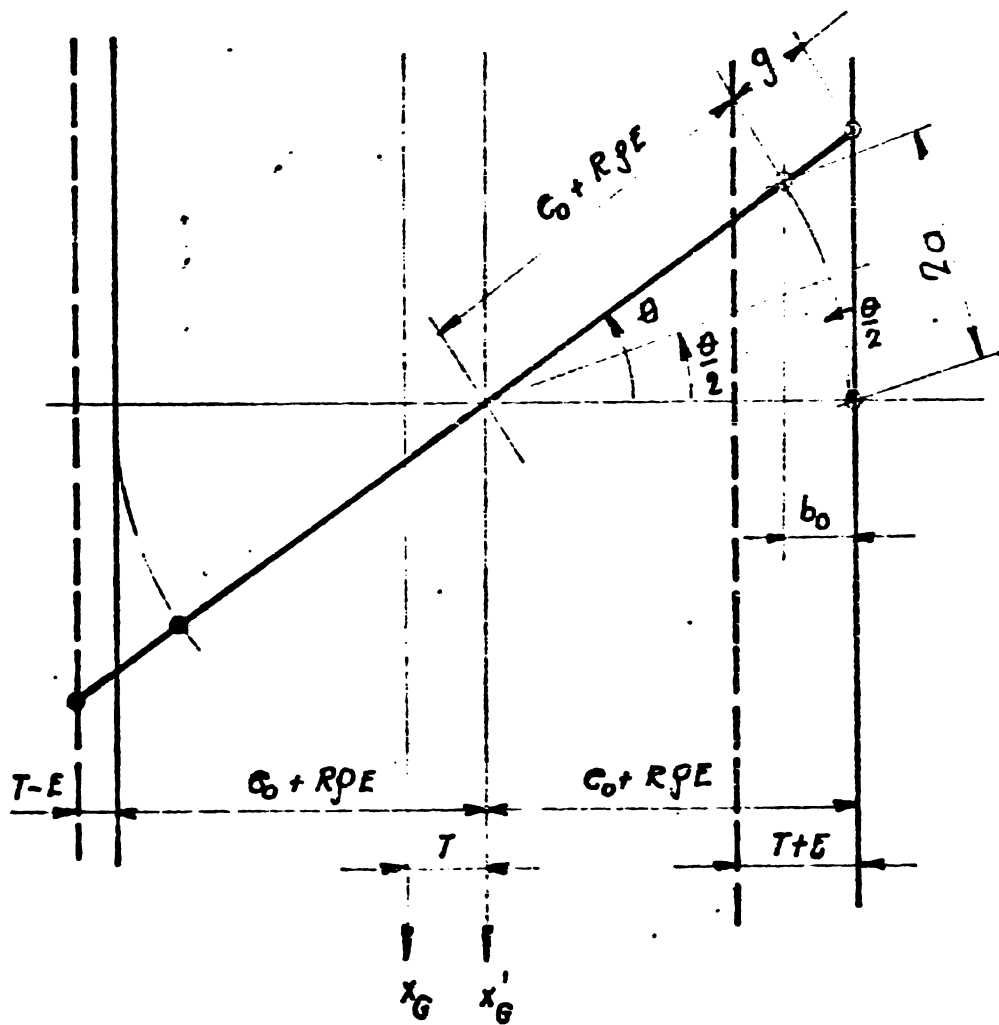


FIG. 51.

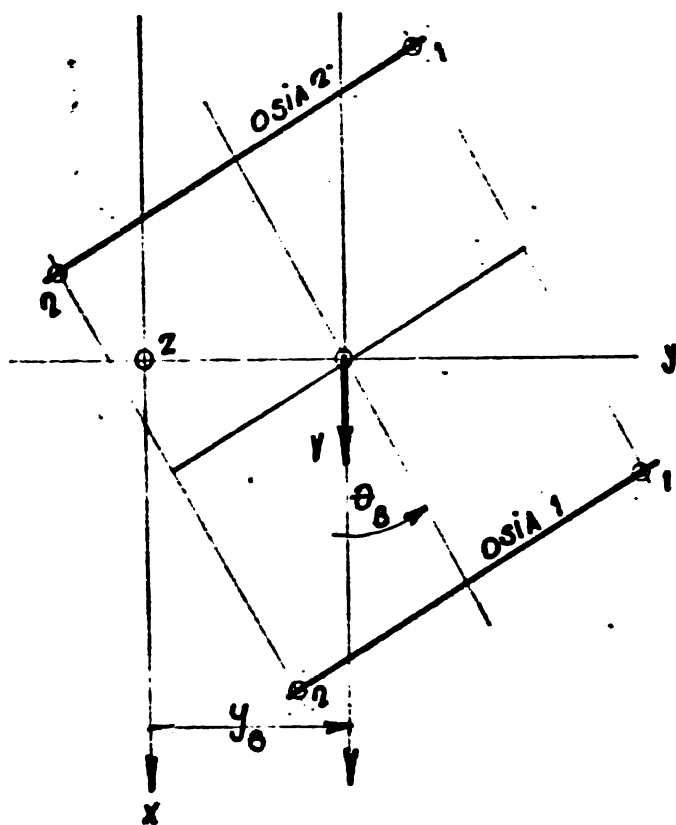
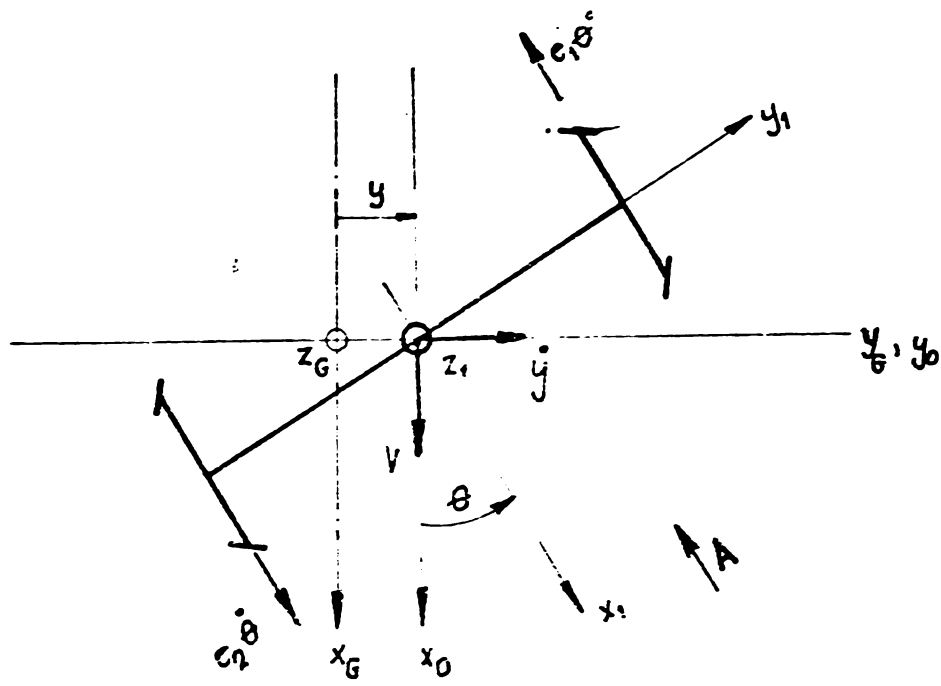
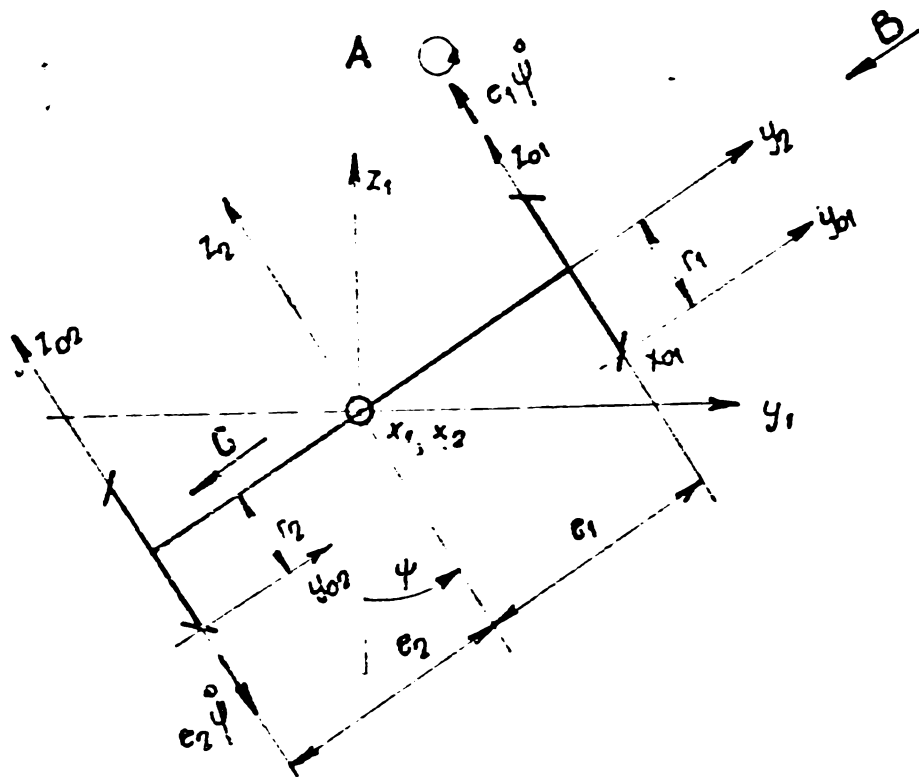


FIG. 52.

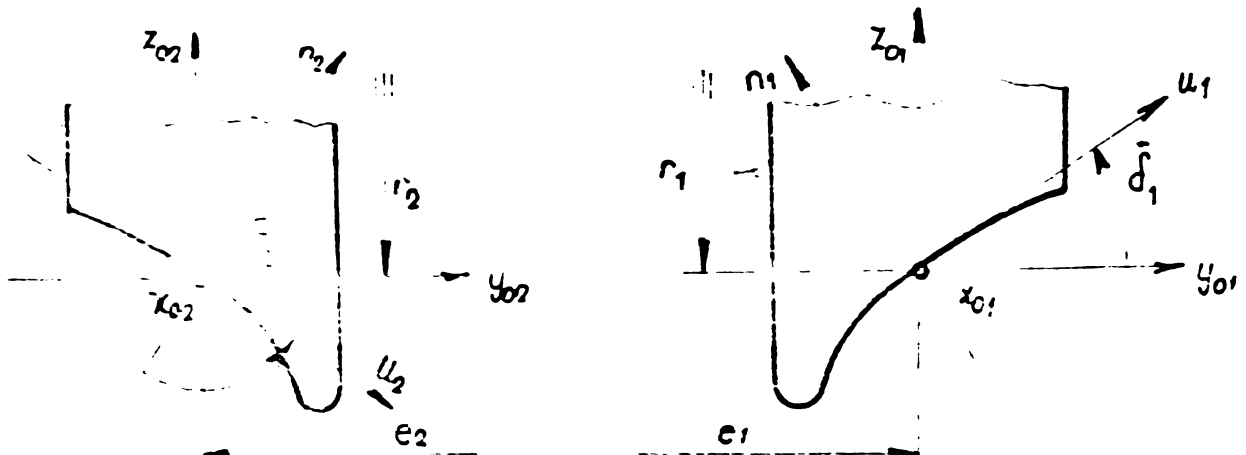
a)



b)



c, d



e, f

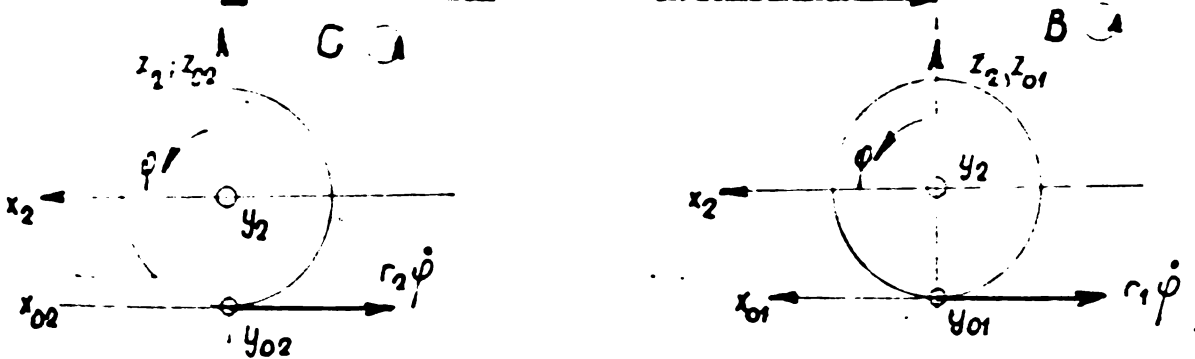
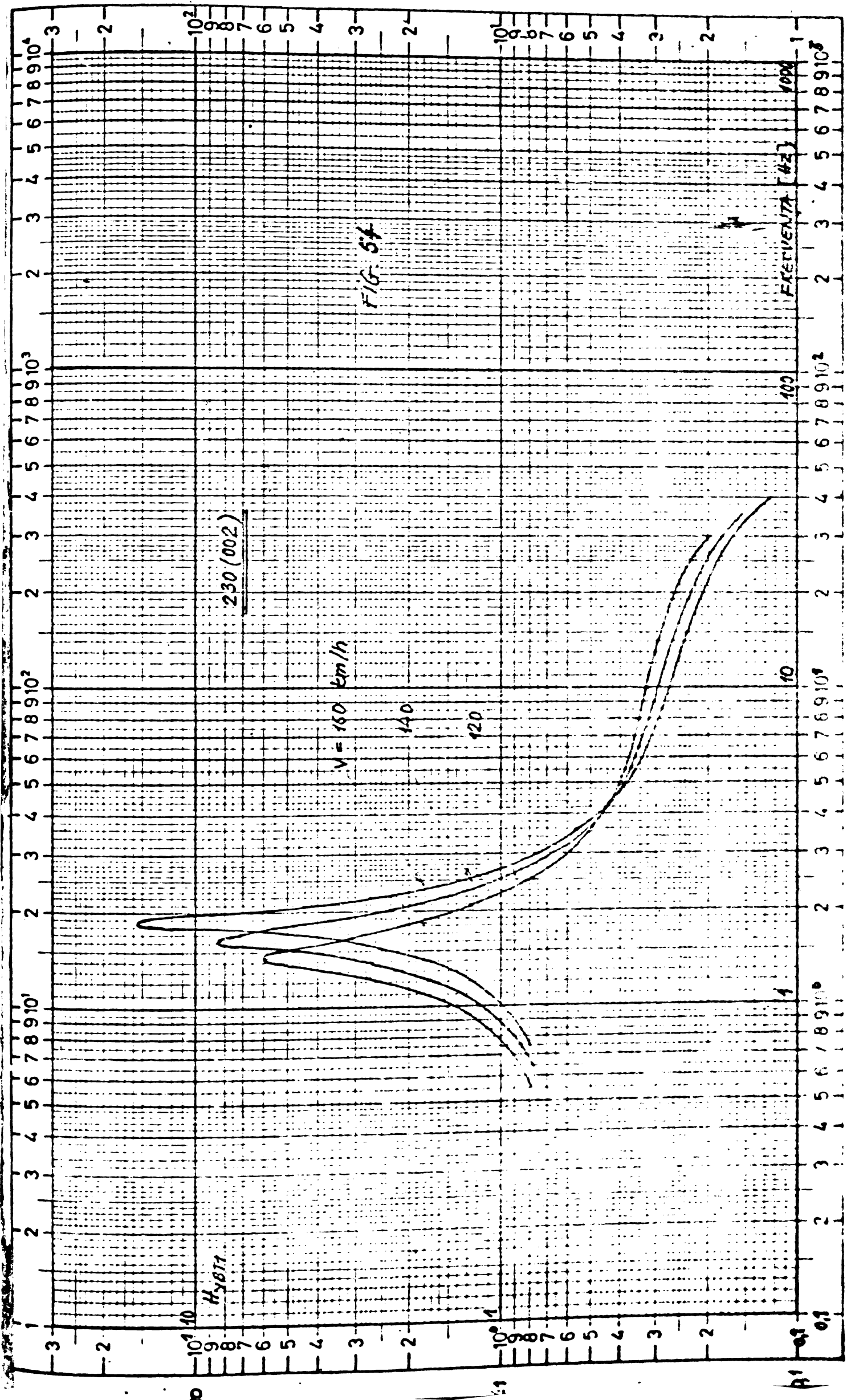
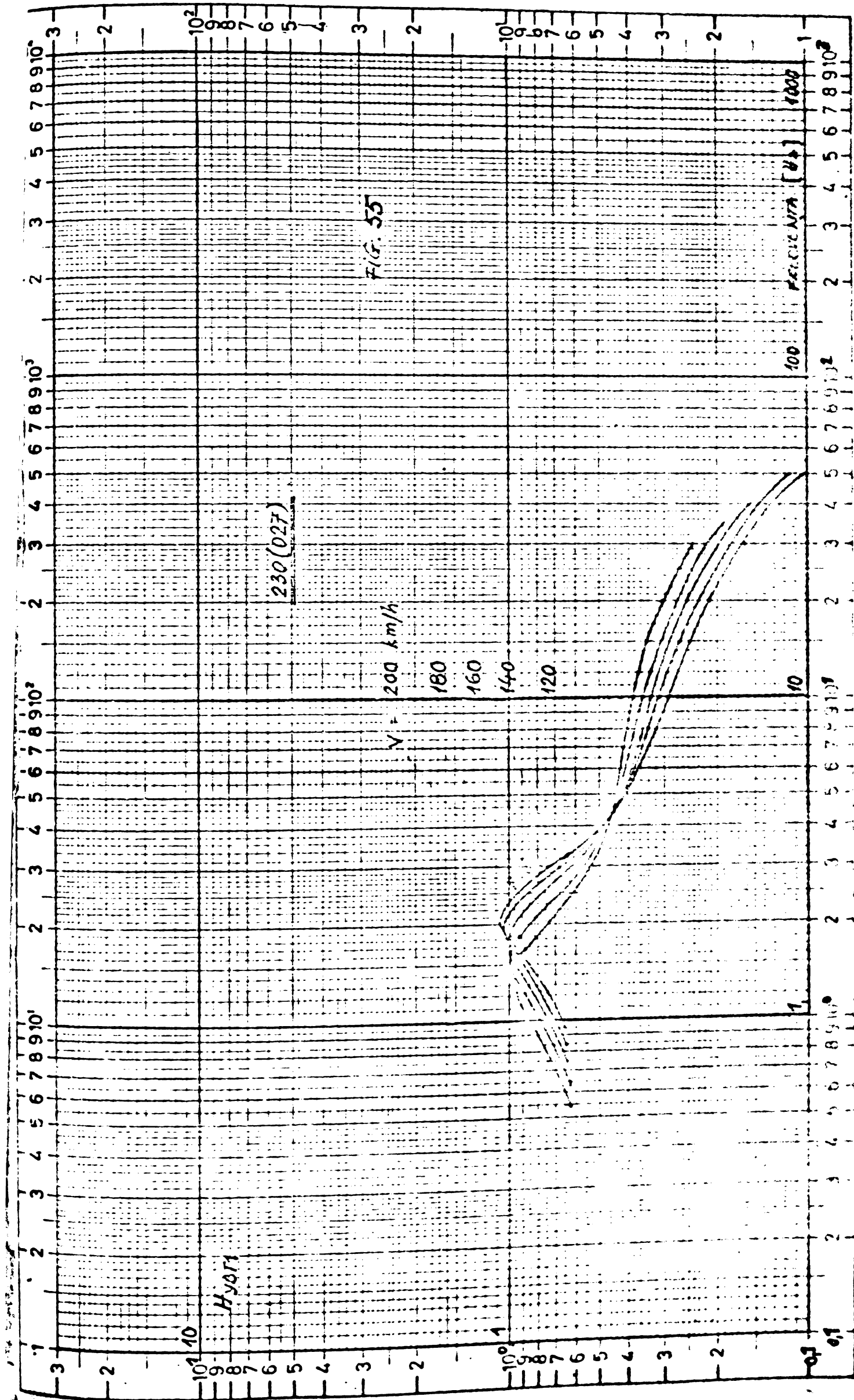


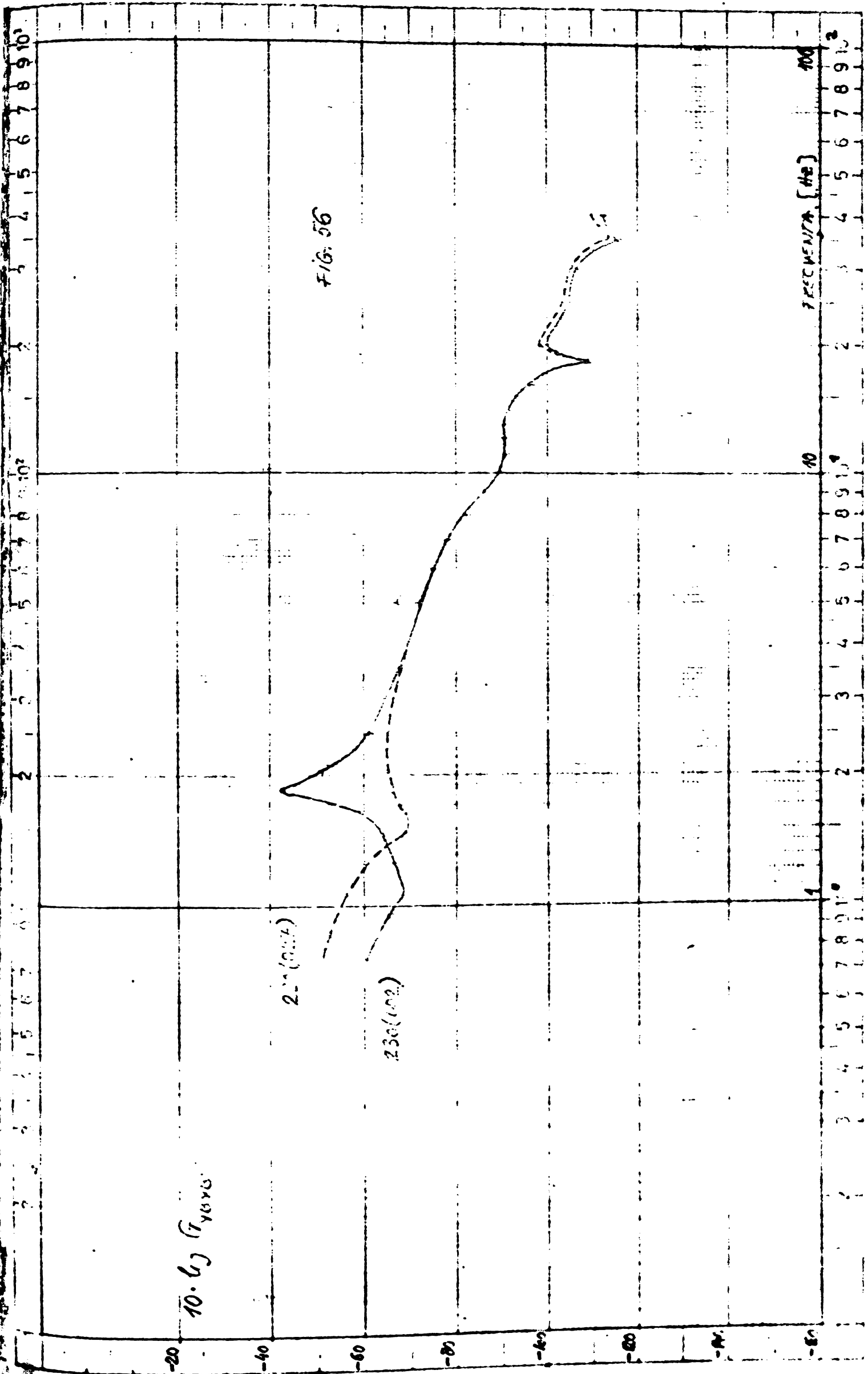
FIG. 53



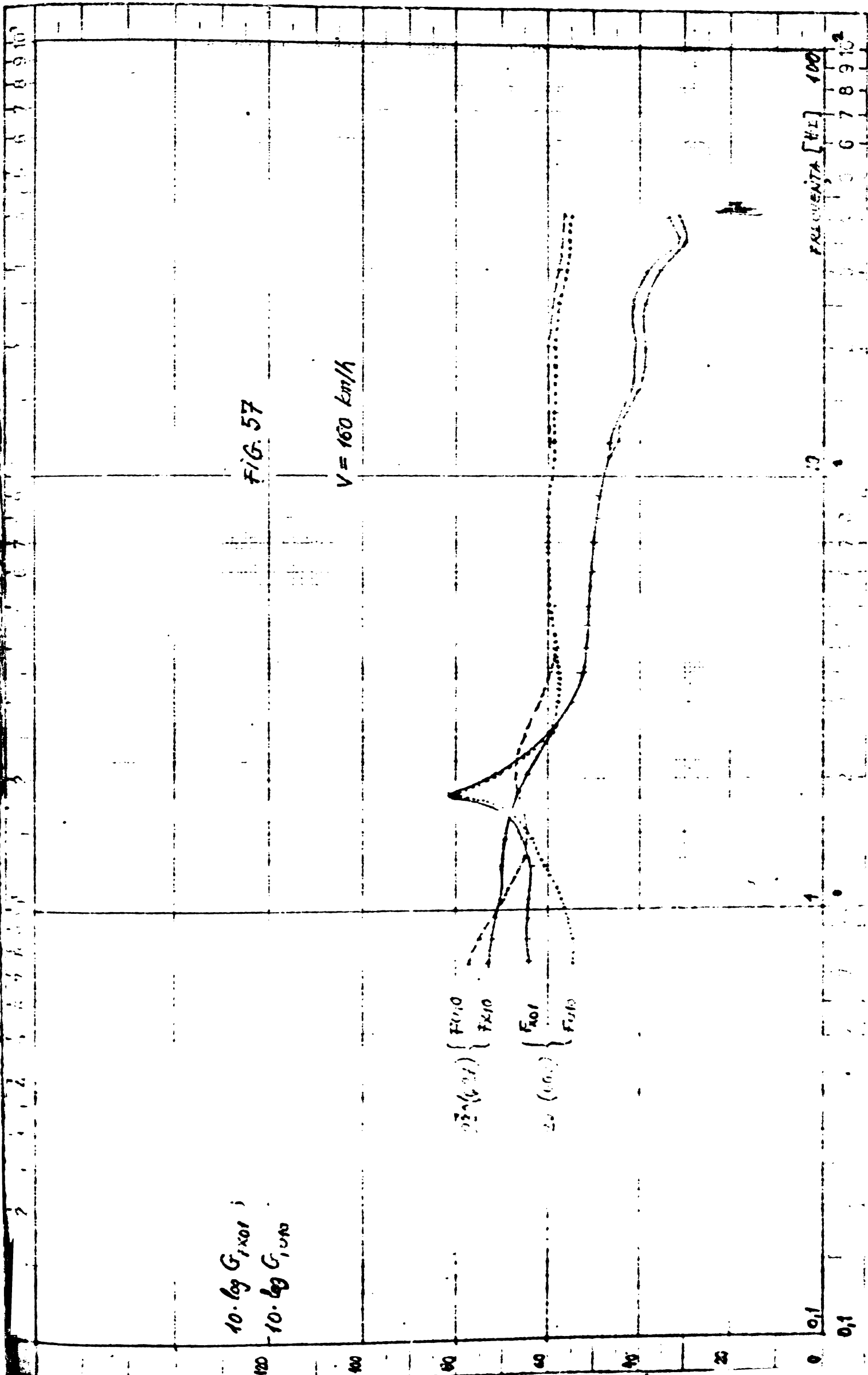
Munket tenjely logaritmus osztojú 1-1000-ig, illetve 1-300-ig.
 Csúcsig 5m/m.

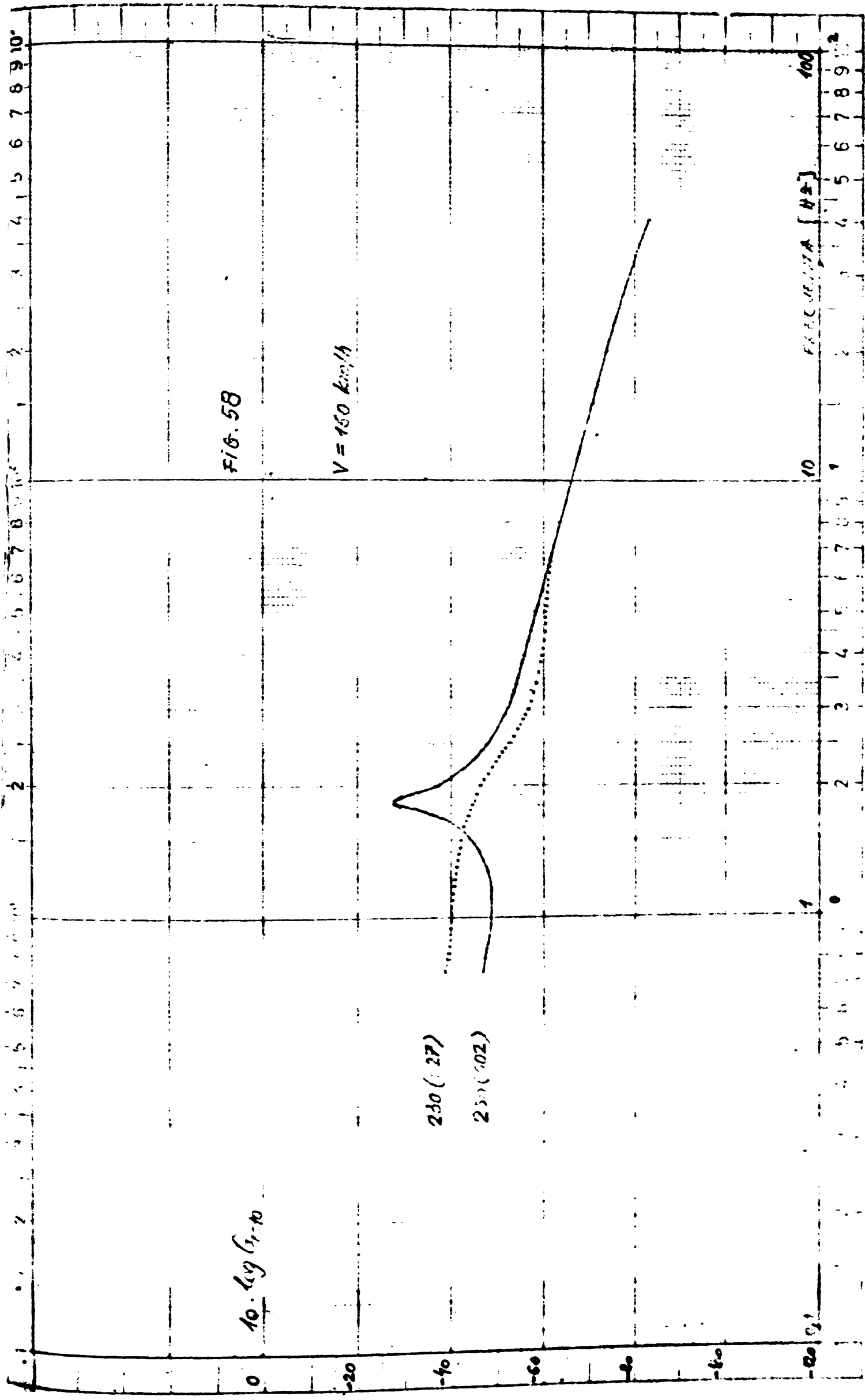


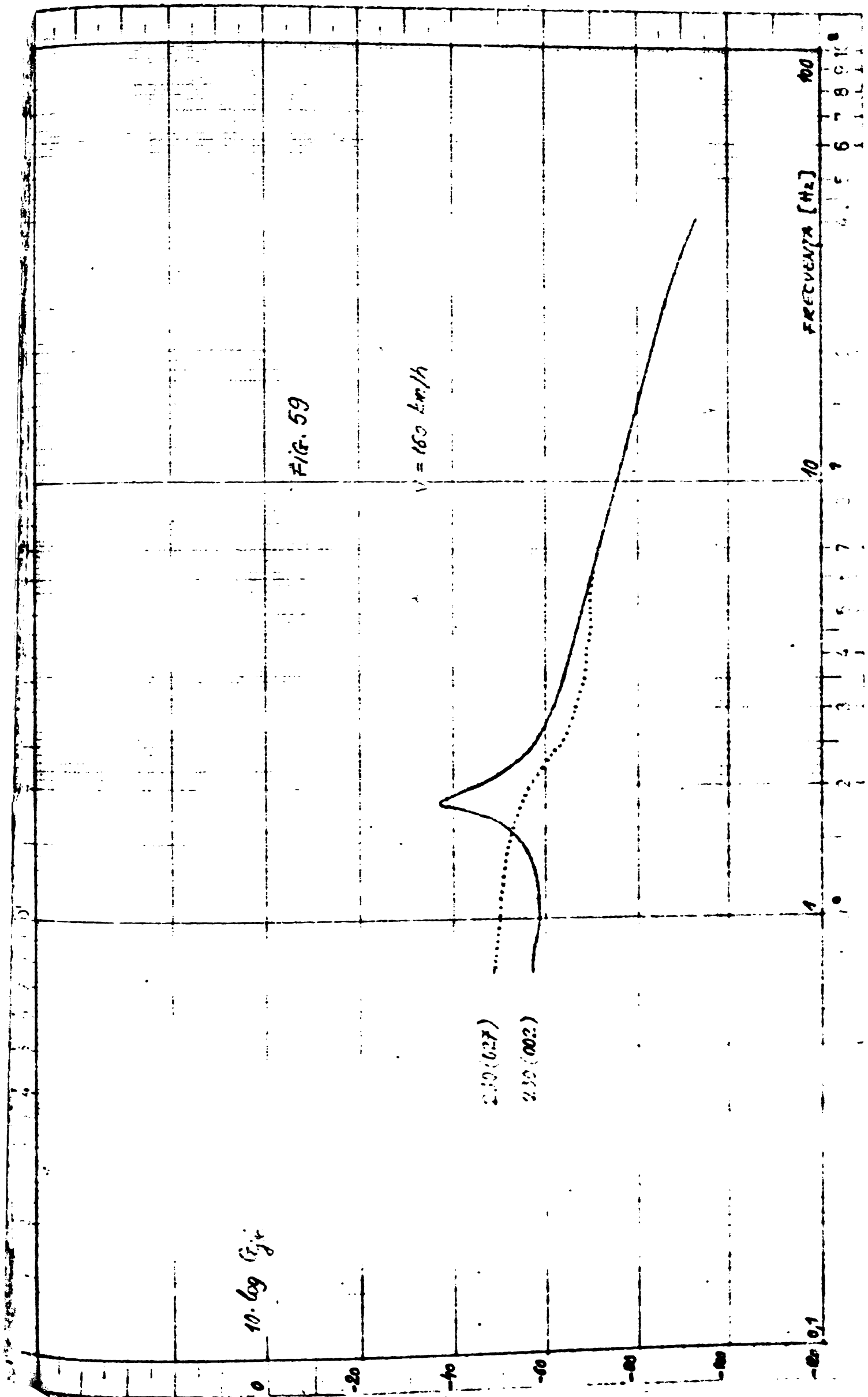
Munkáért kéri a Magyar Államok...
 Budapest, 1950. évi...
 1-1000-17. Műhely 1-300-19
 1 g/ny 62 5/min



Ar egynik lemezre lejtve a 222-es és a 230-as izotópok







BUPT

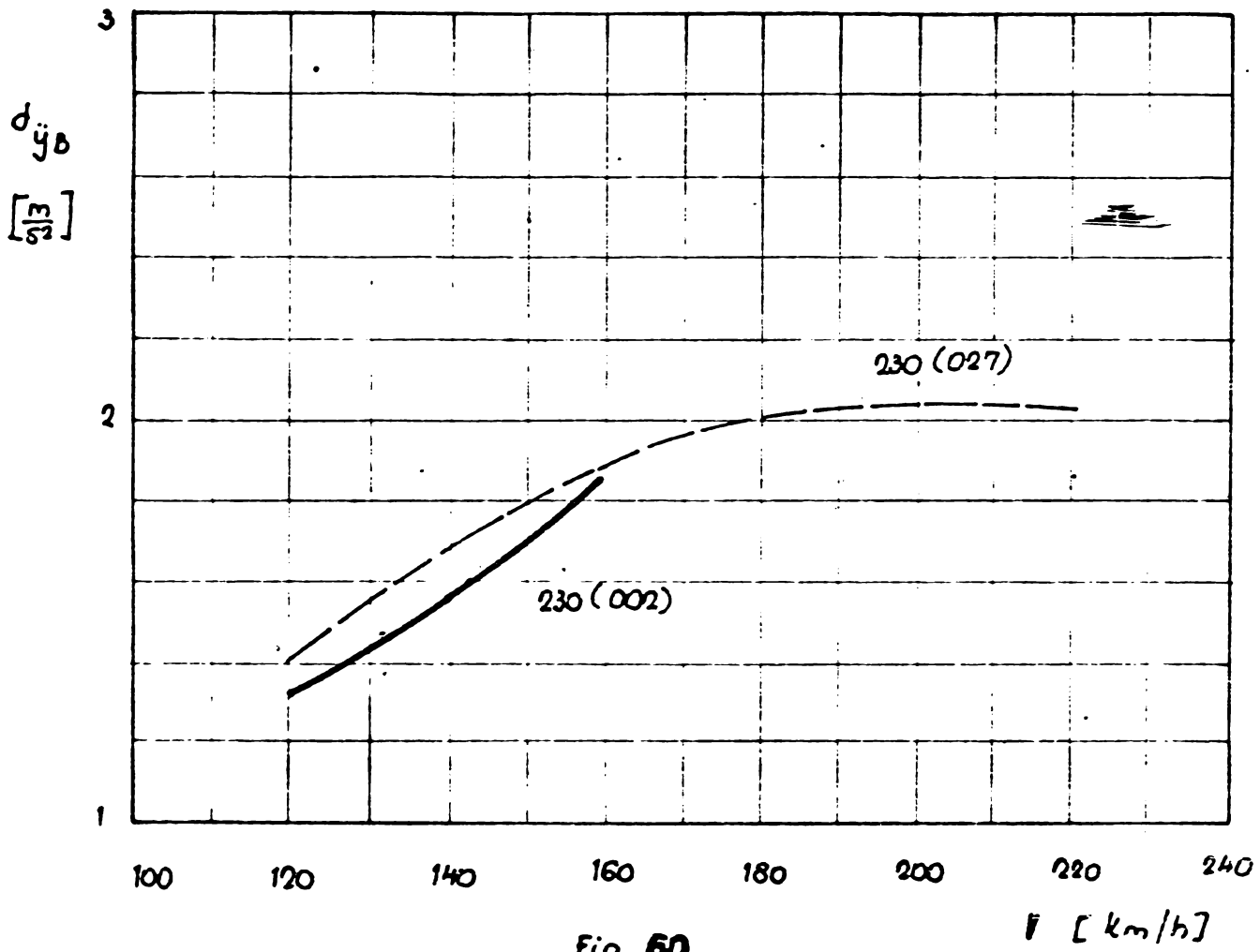


Fig. 60

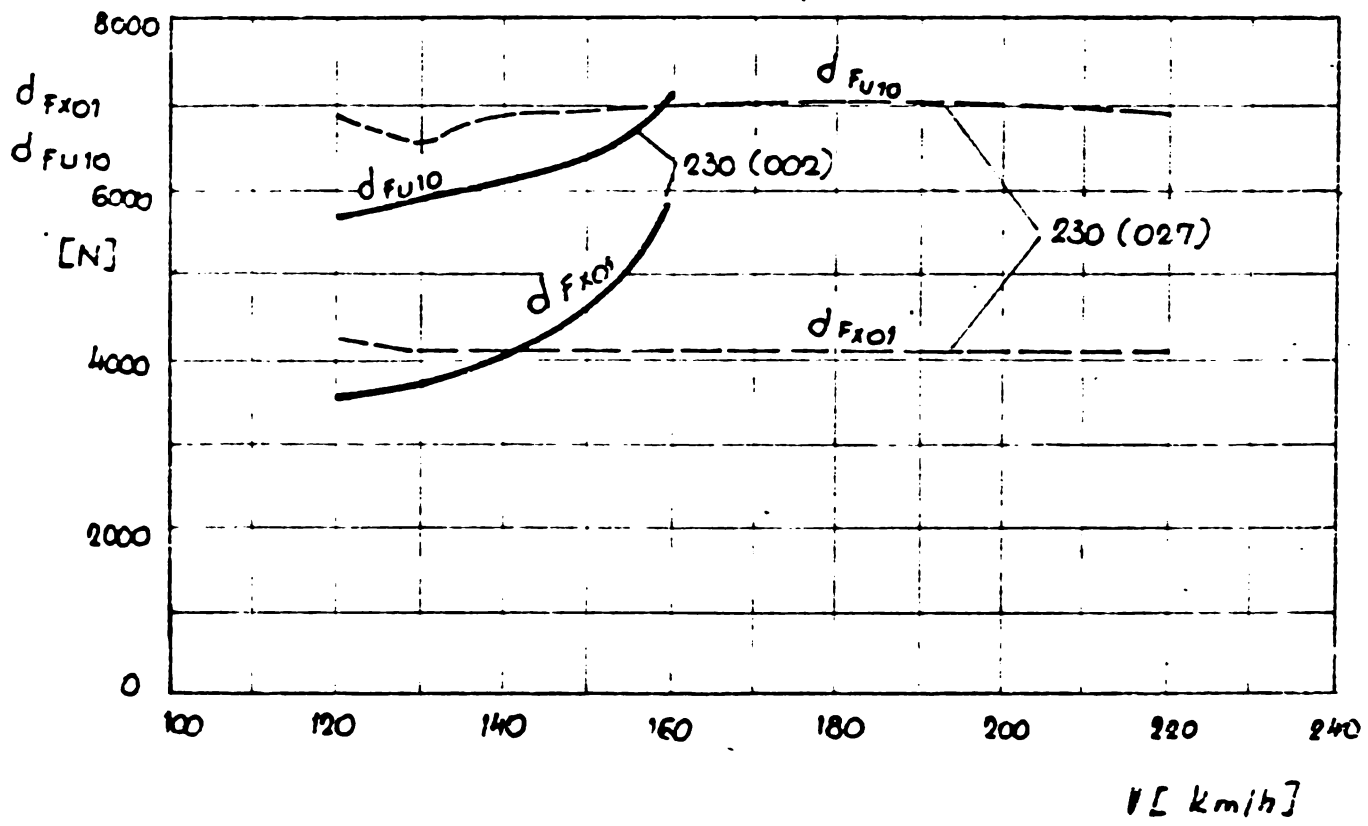
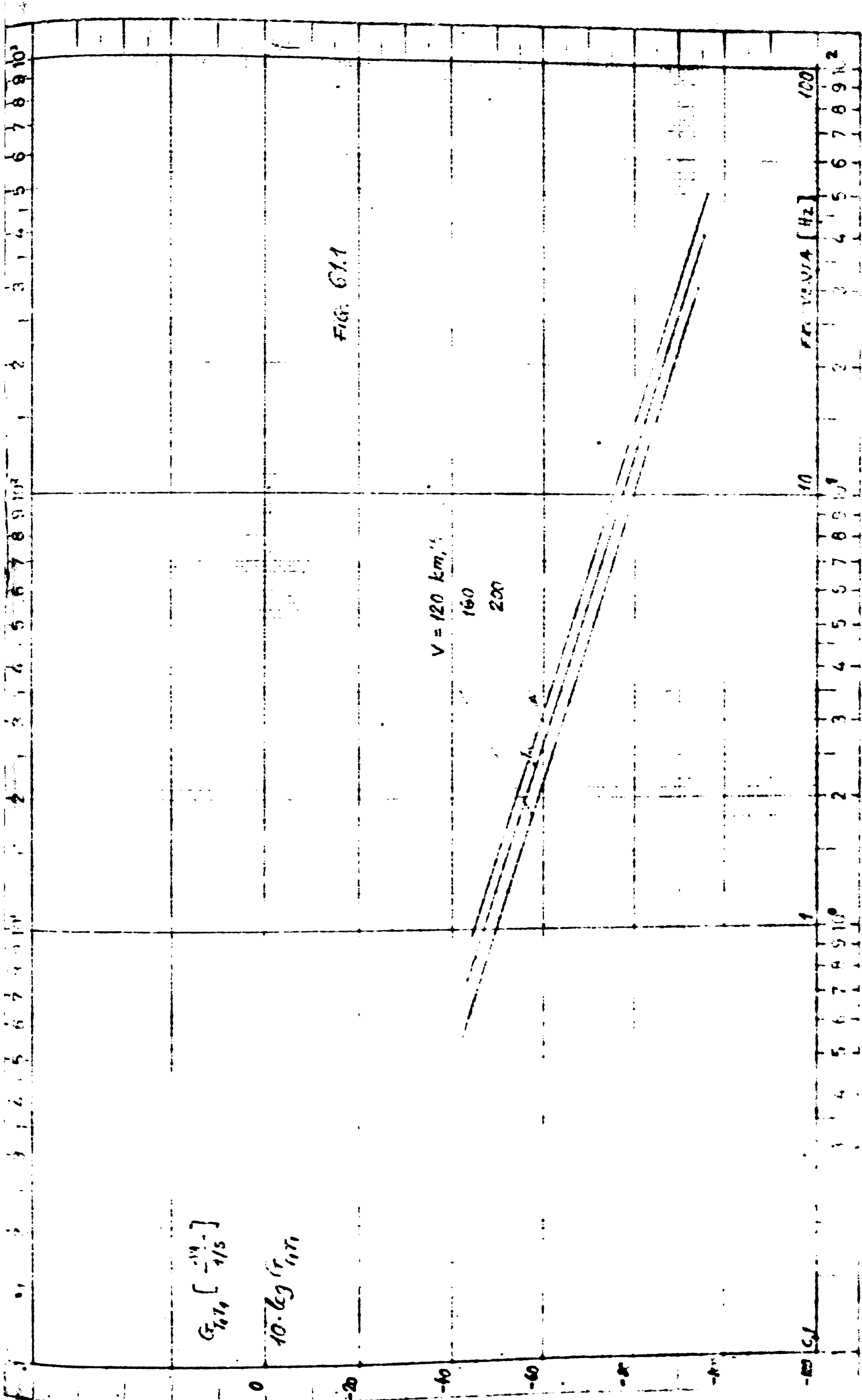


Fig. 61



ANALISIS KINETIKA DAN DYNAMIS PADA STRUKTUR

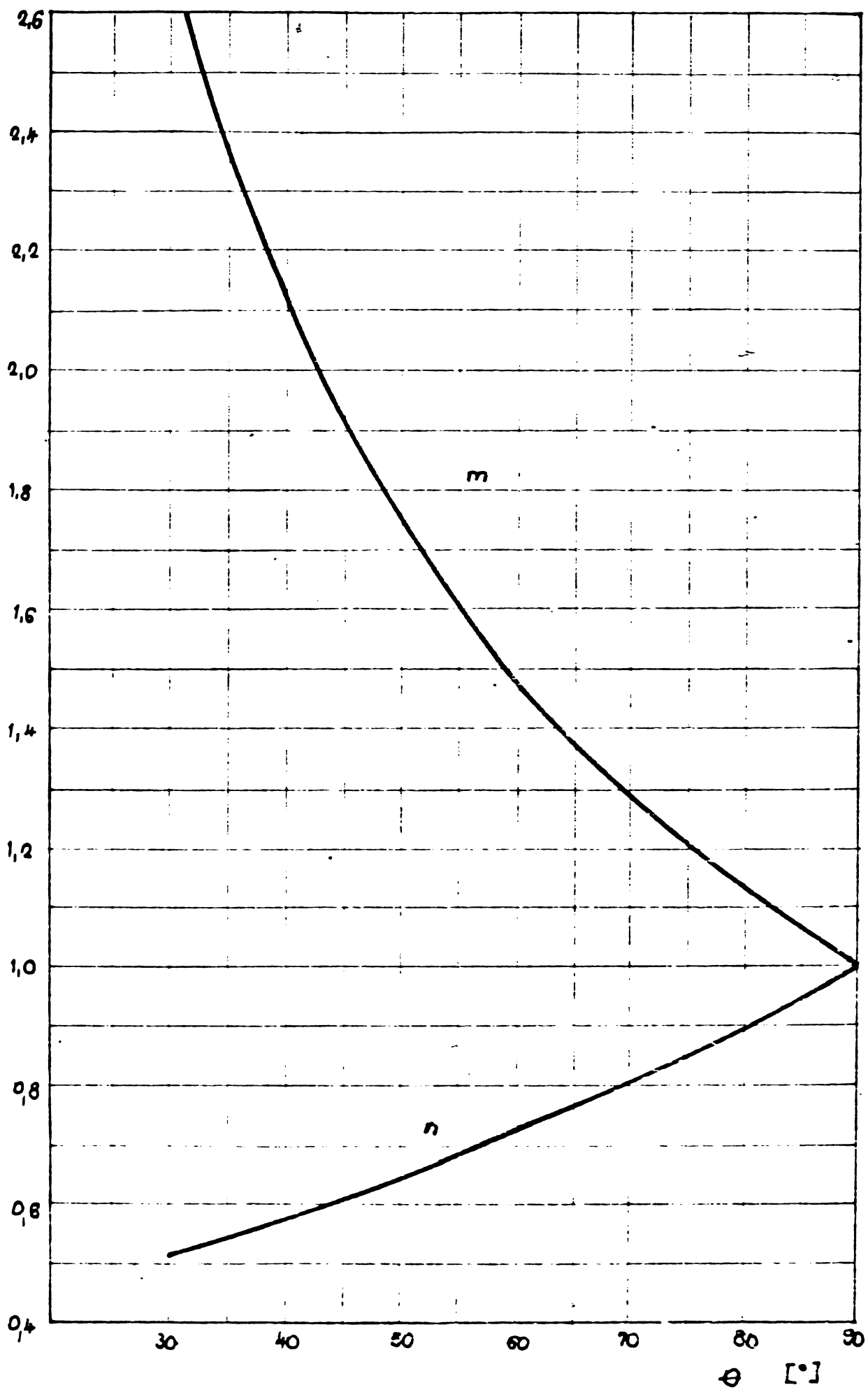
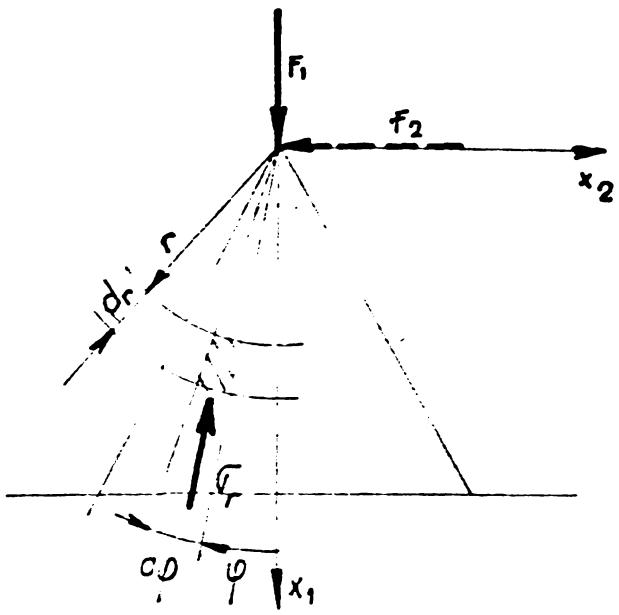
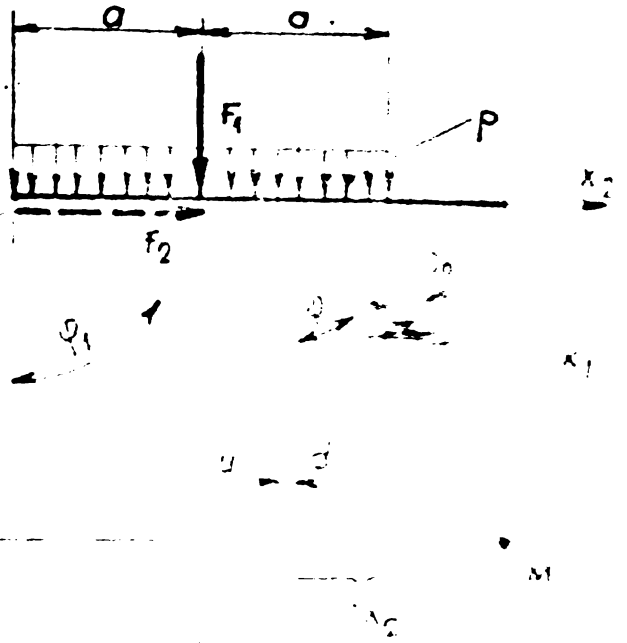


Fig. 62. / 119 /



a.



b.

FIG. 63

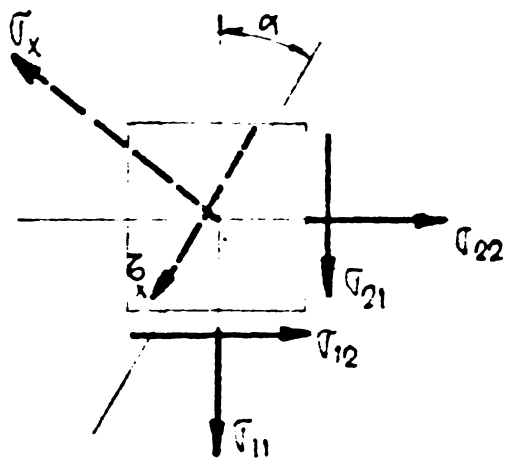
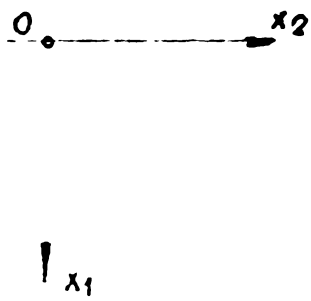
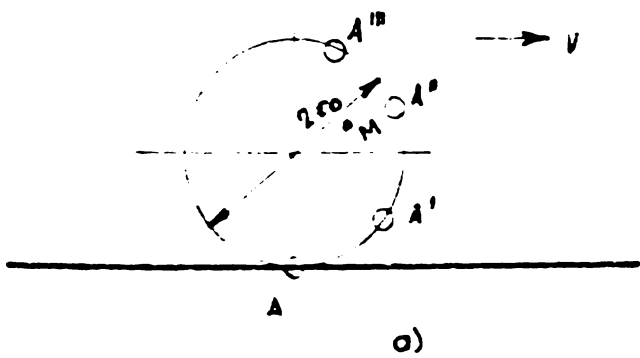
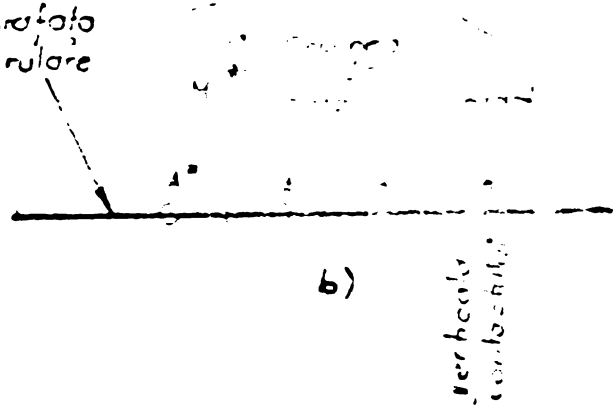


FIG. 64

roata de măsurare de
cercul de rulare



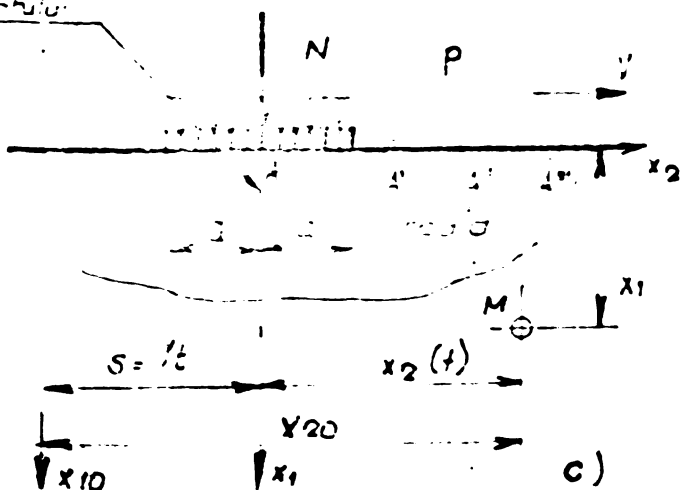
a)



b)

verhale
contactului

verhale
contactului



c)

FIG 65

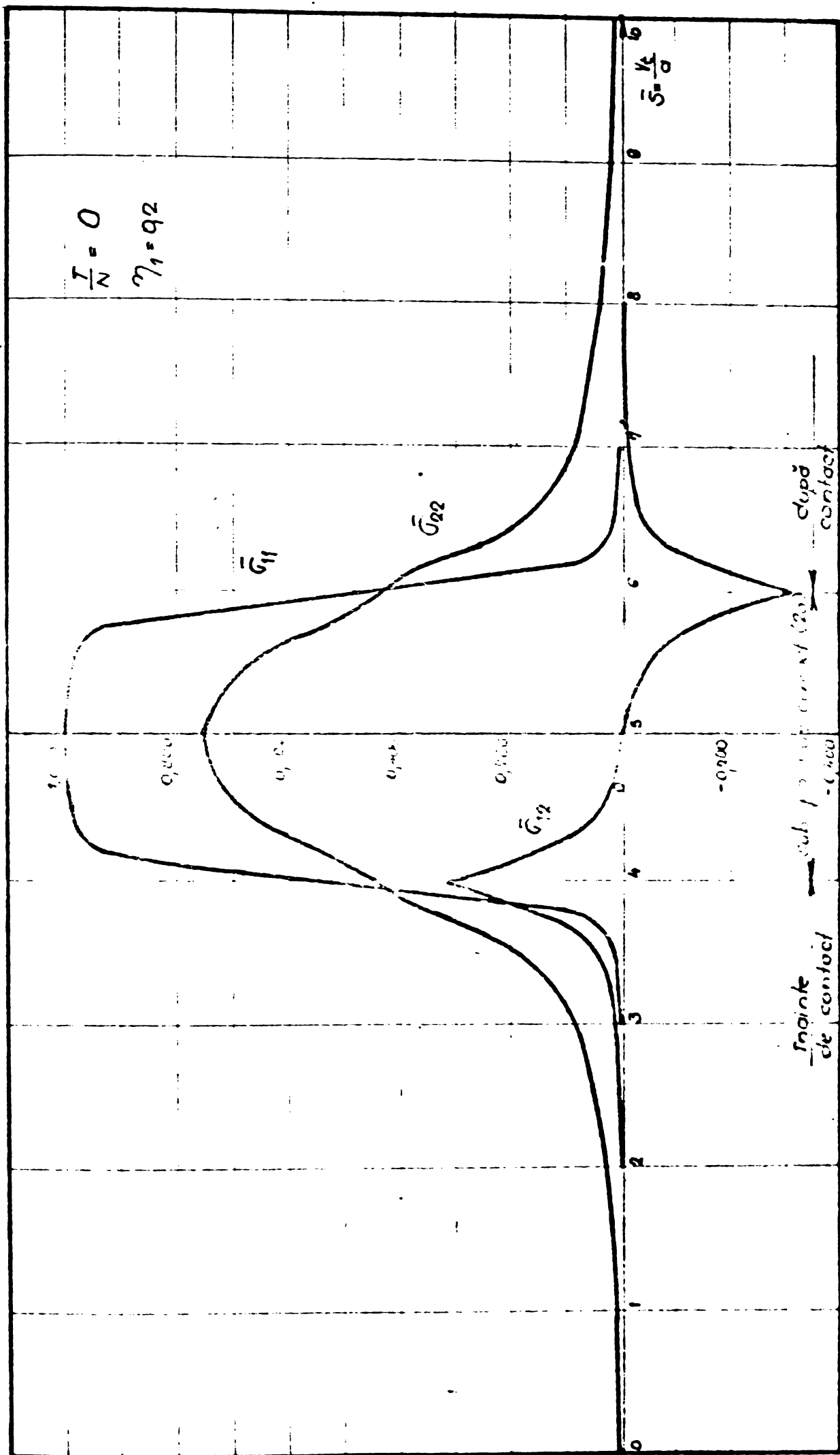


FIG. 66

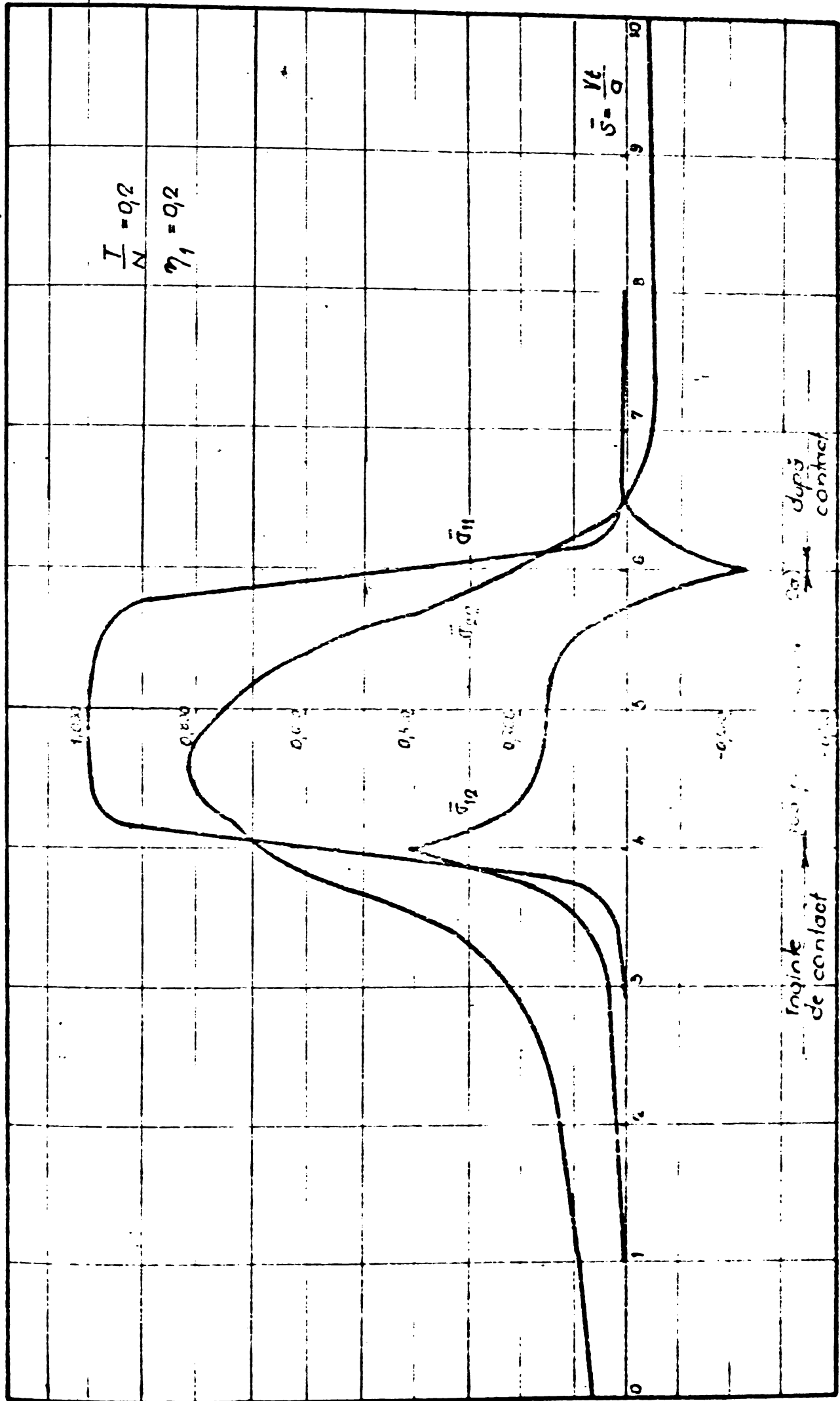


FIG. 67.

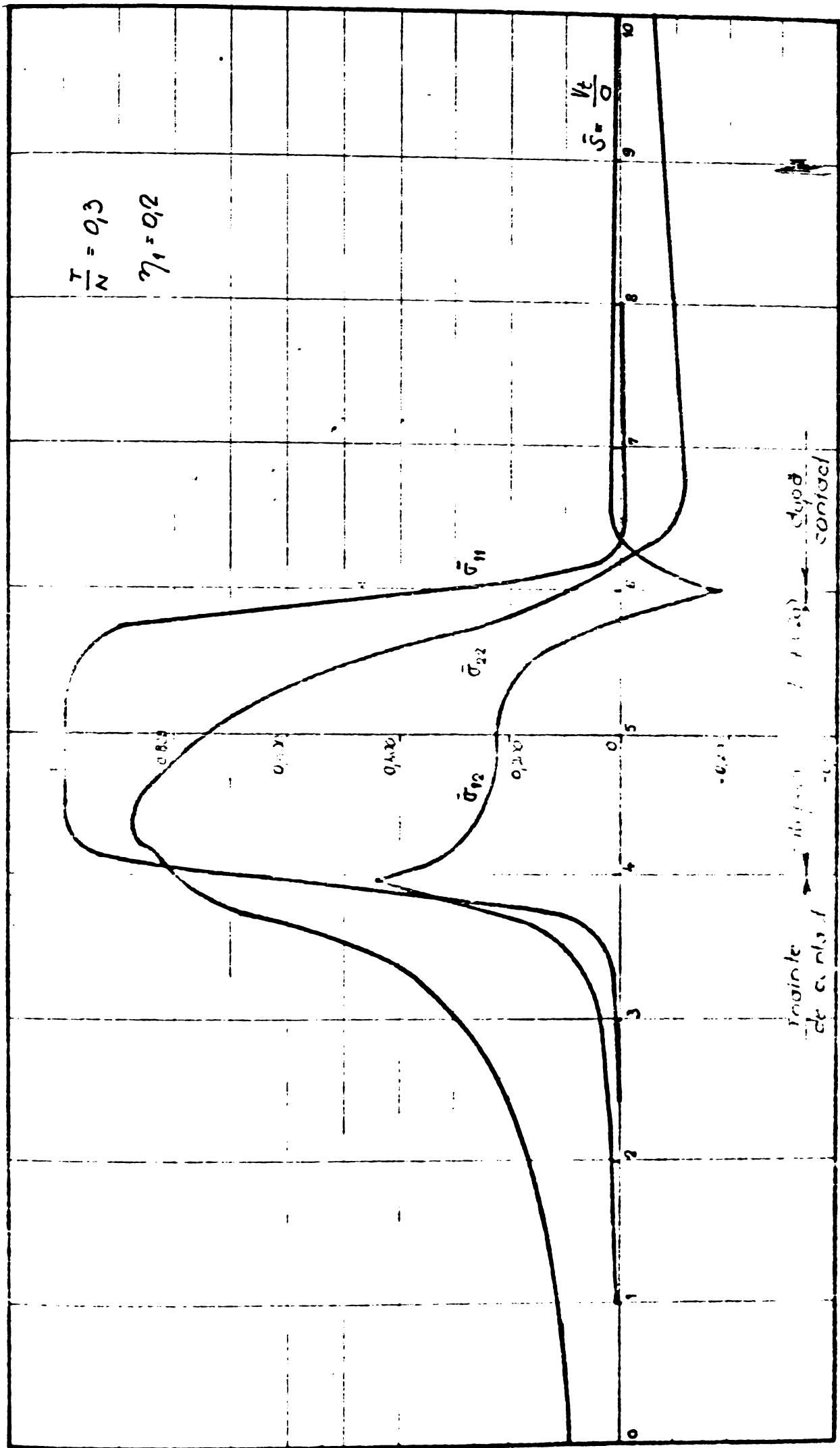


FIG. 68.

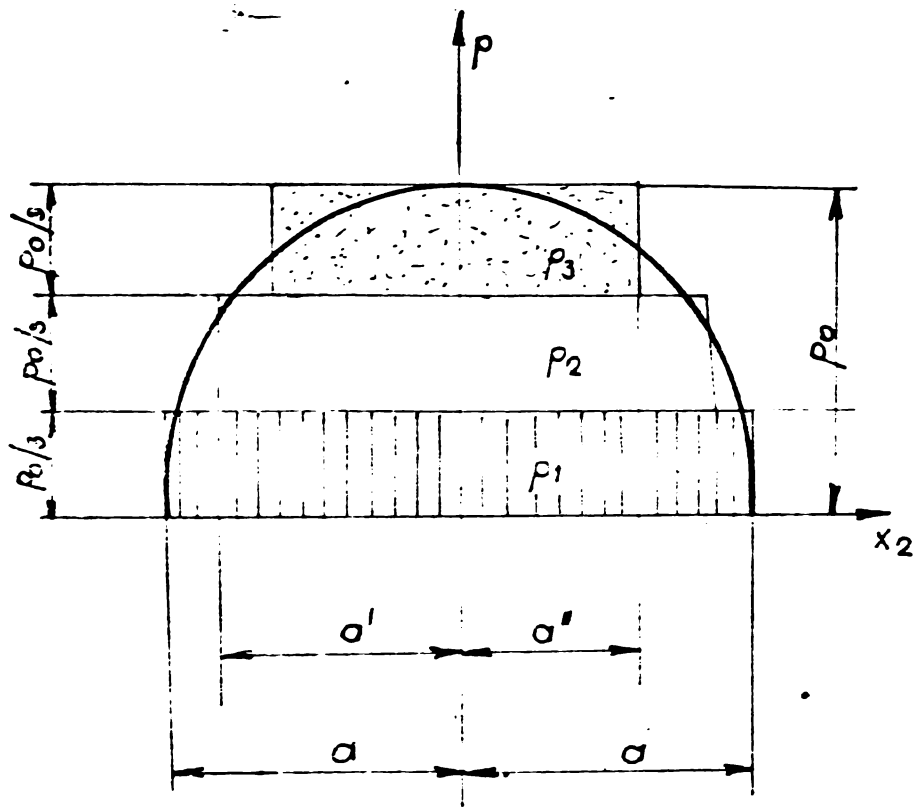


FIG. 69.

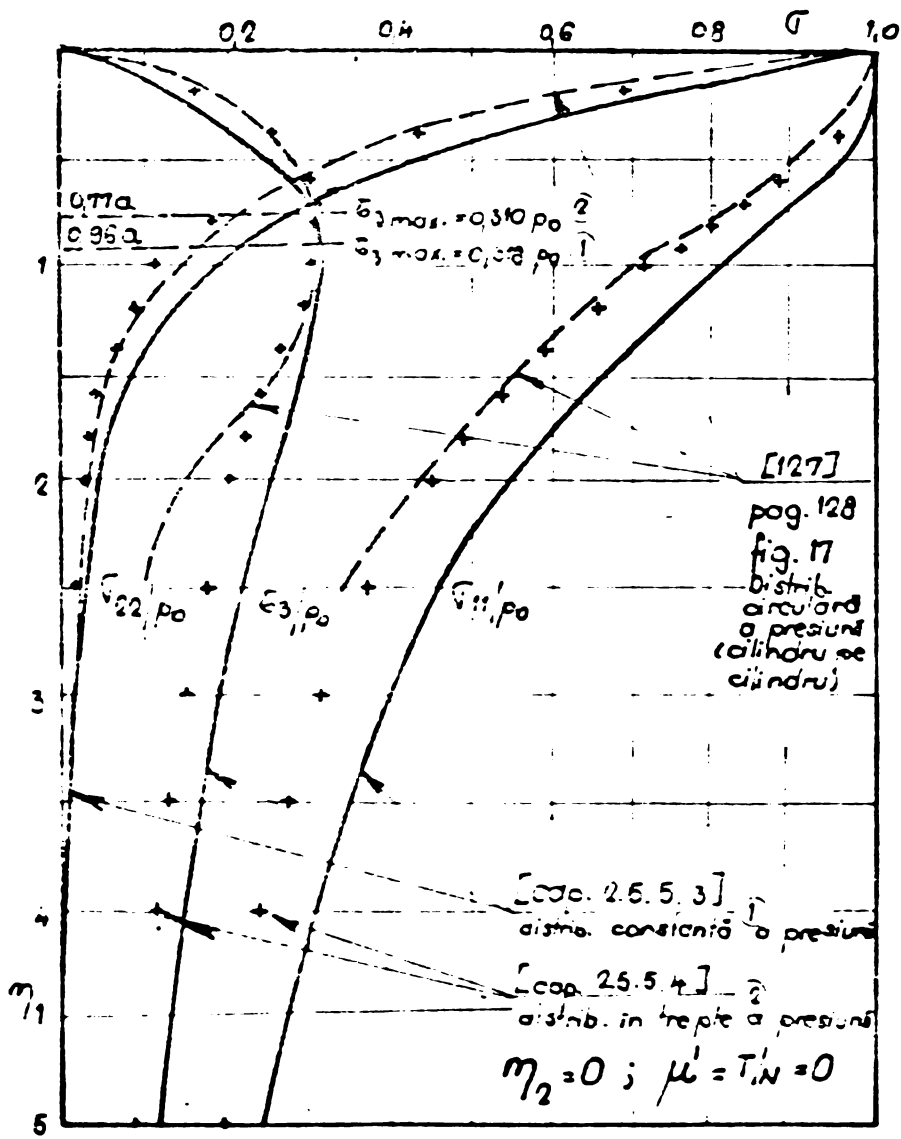


FIG. 70.

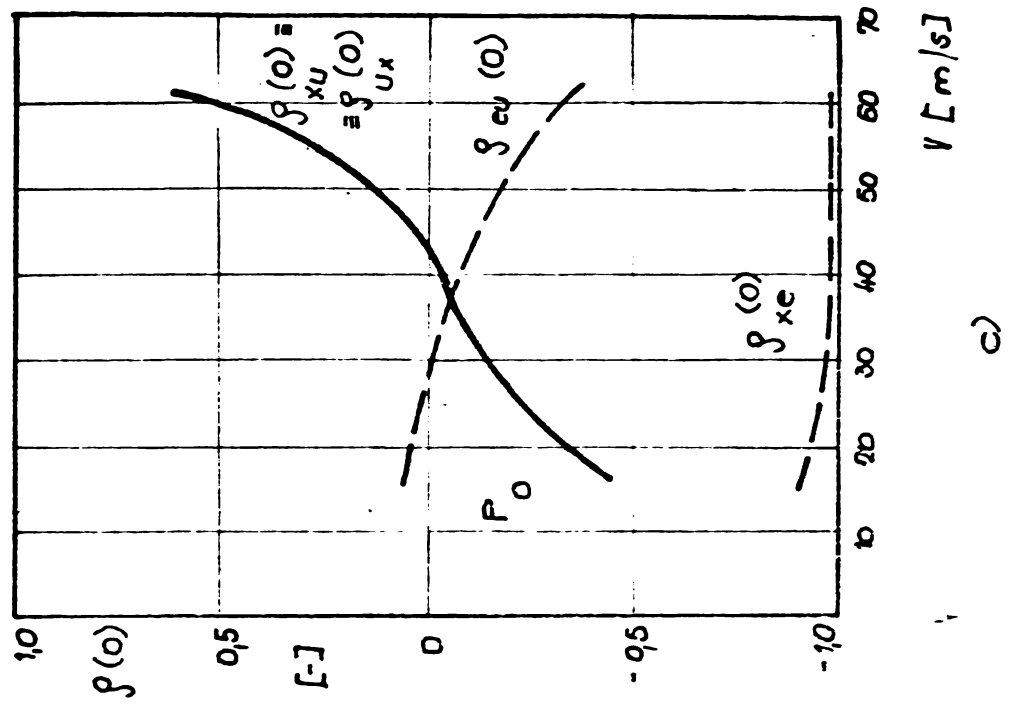
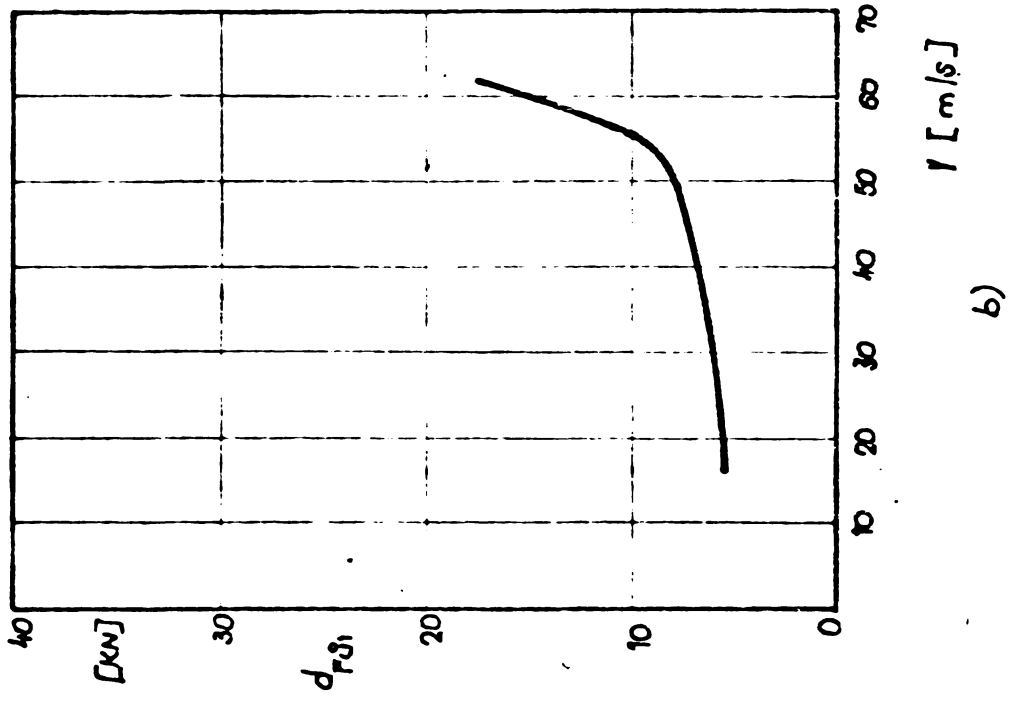
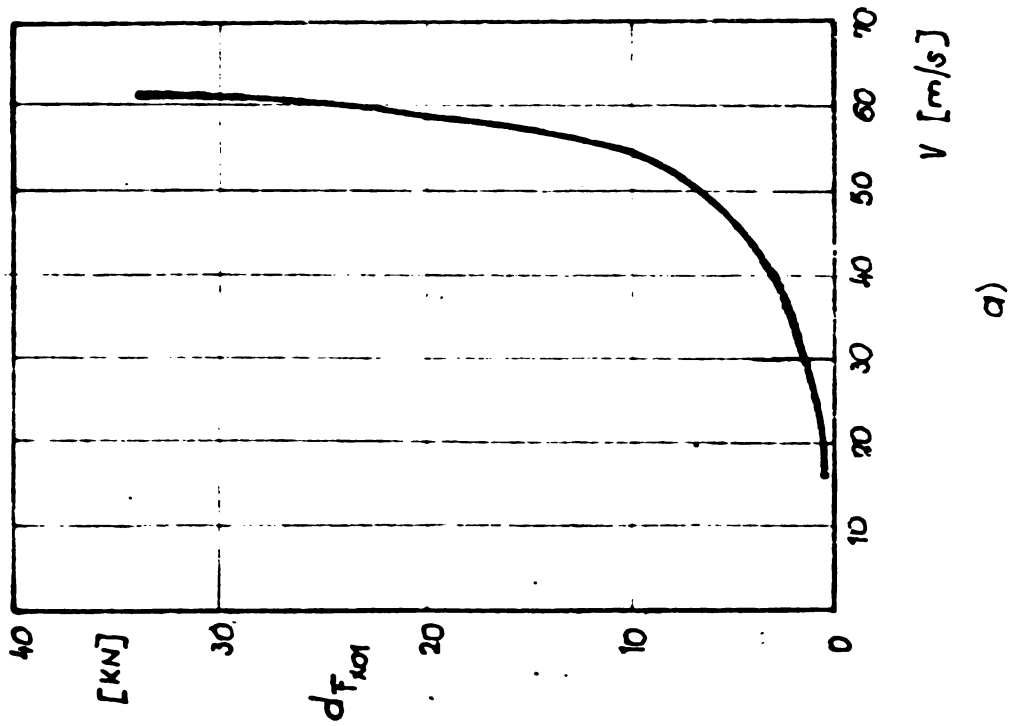
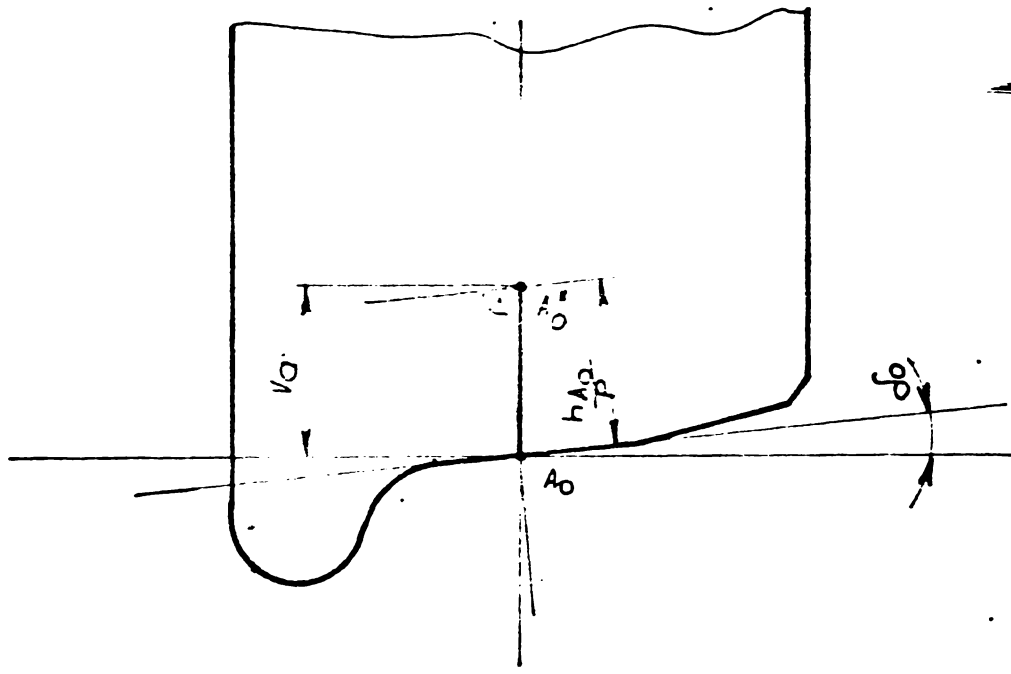
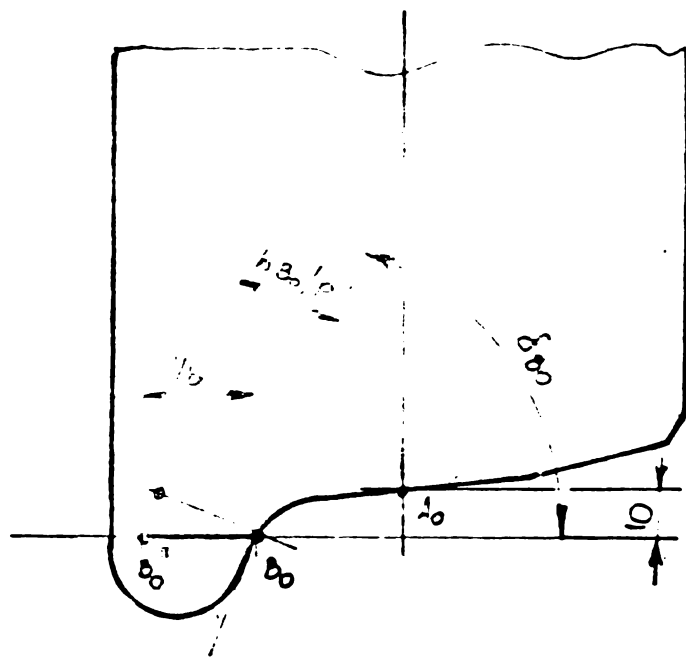


FIG. 71.



a)



b)

FIG. 72.

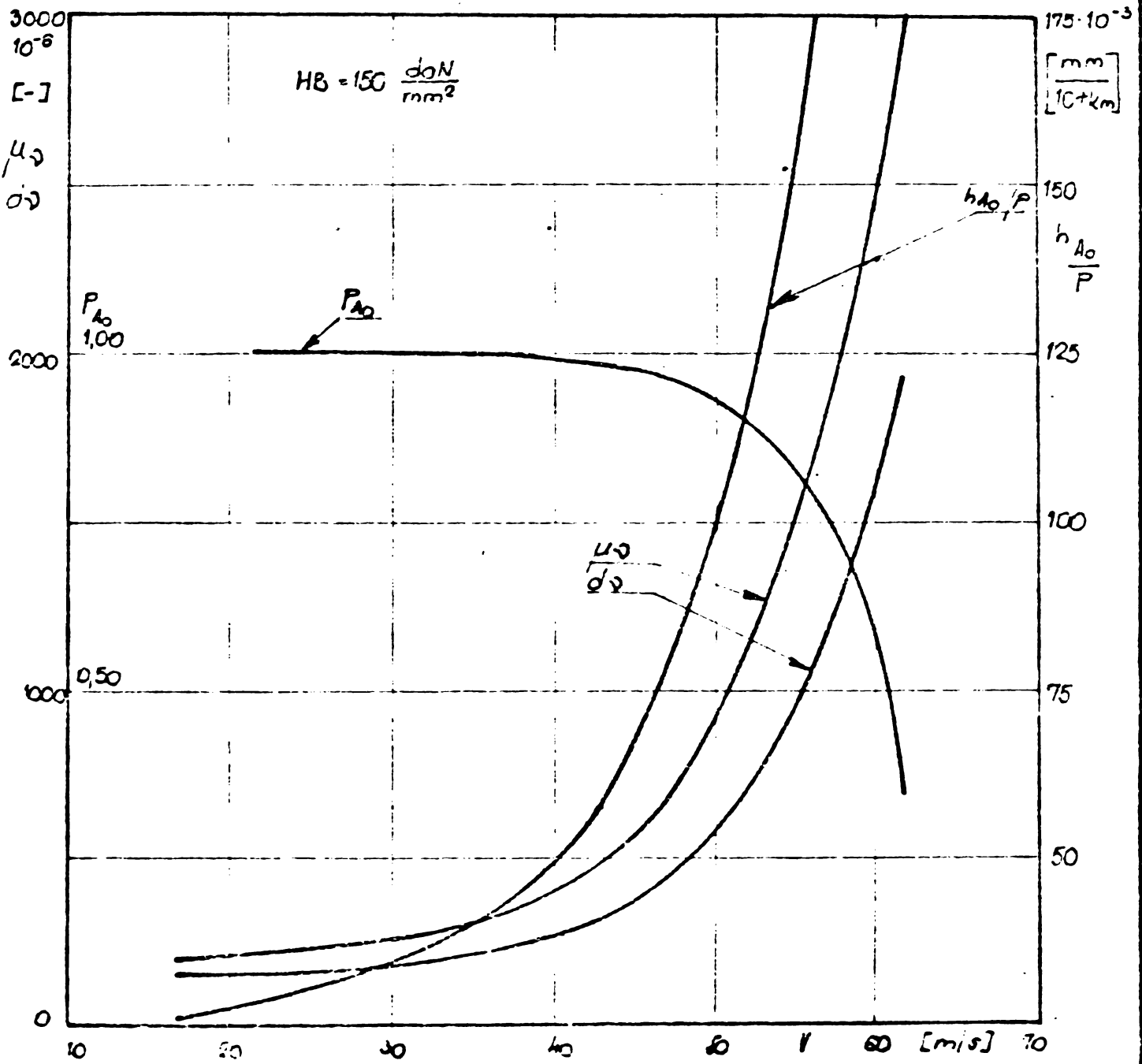


FIG. 73.

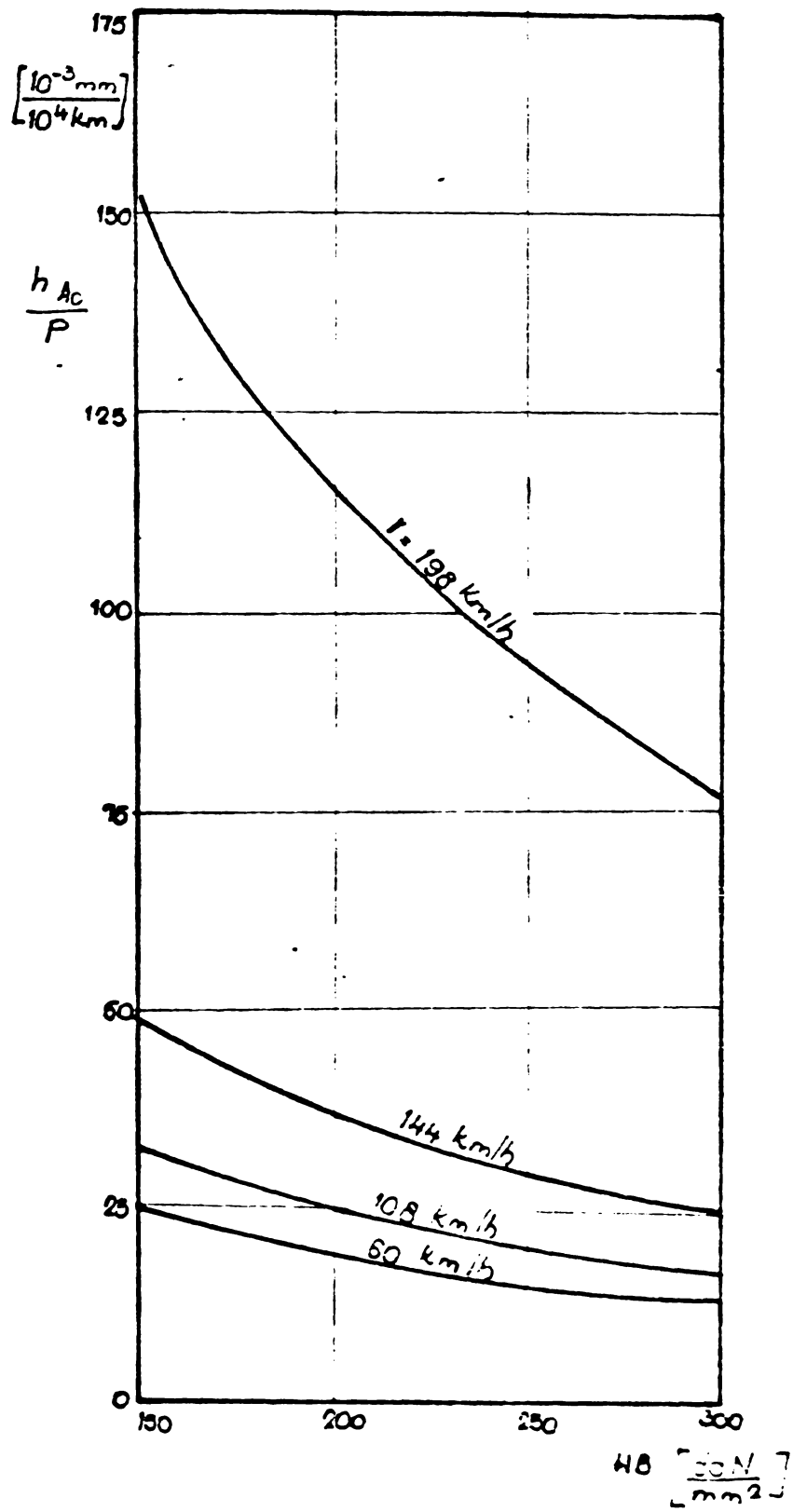
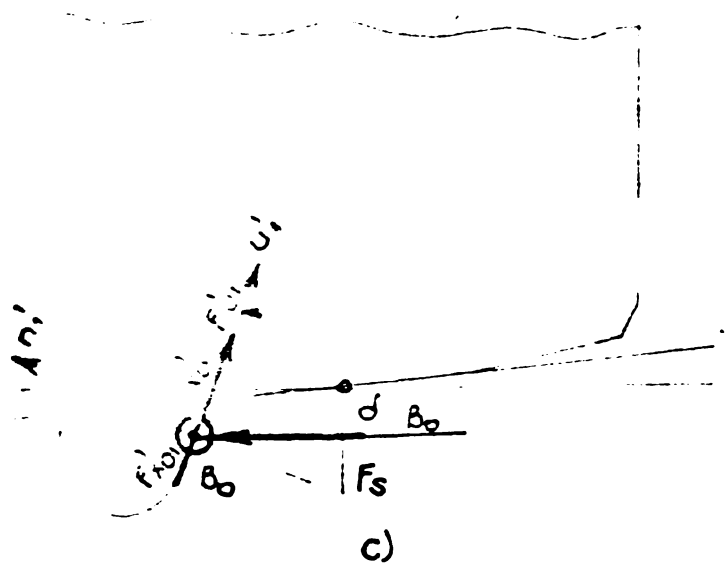
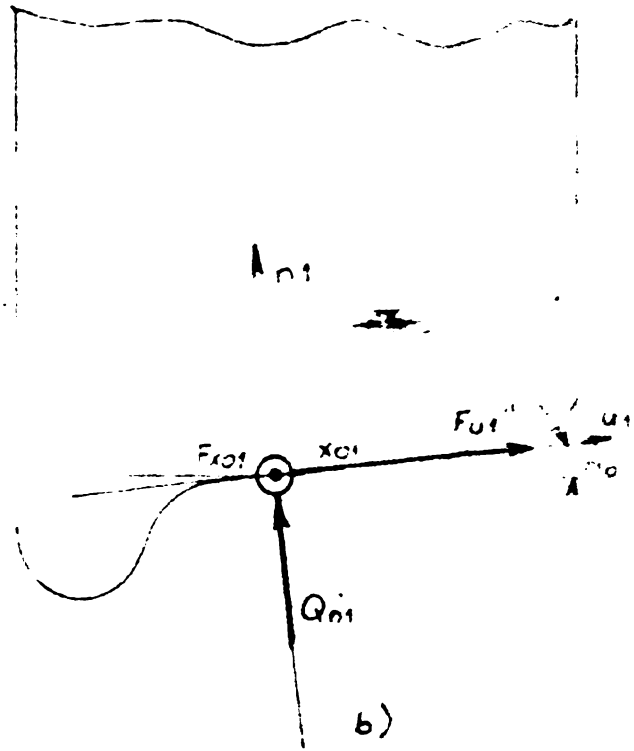
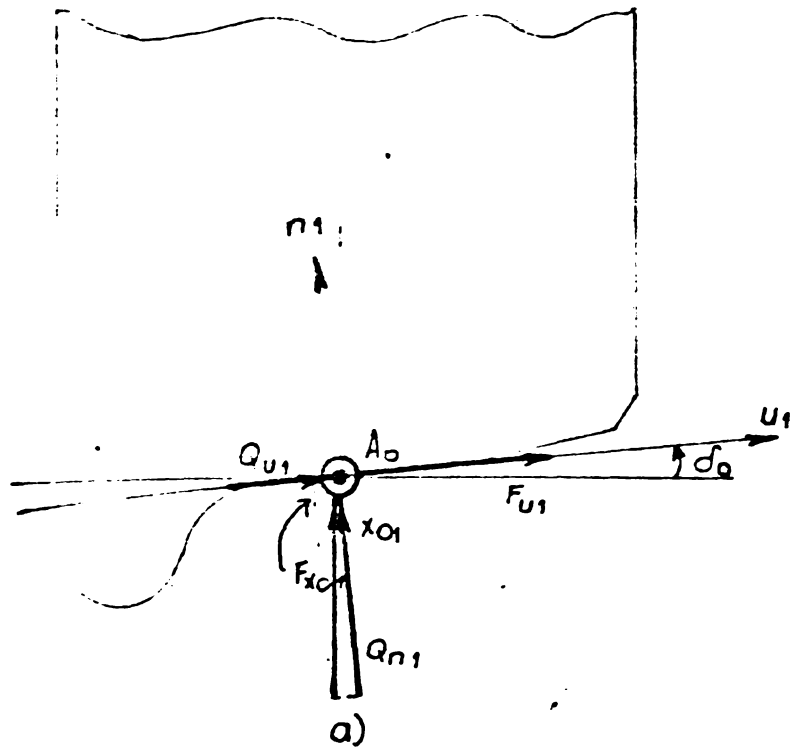


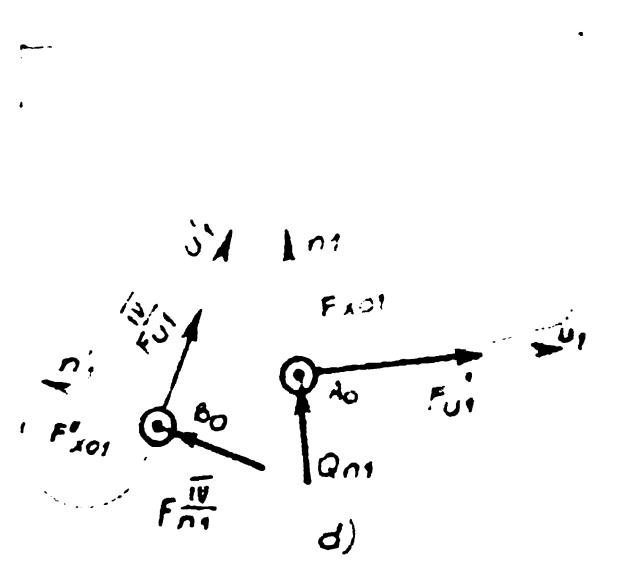
FIG. 74.

Sistemul de forțe

Sistemul rezultat



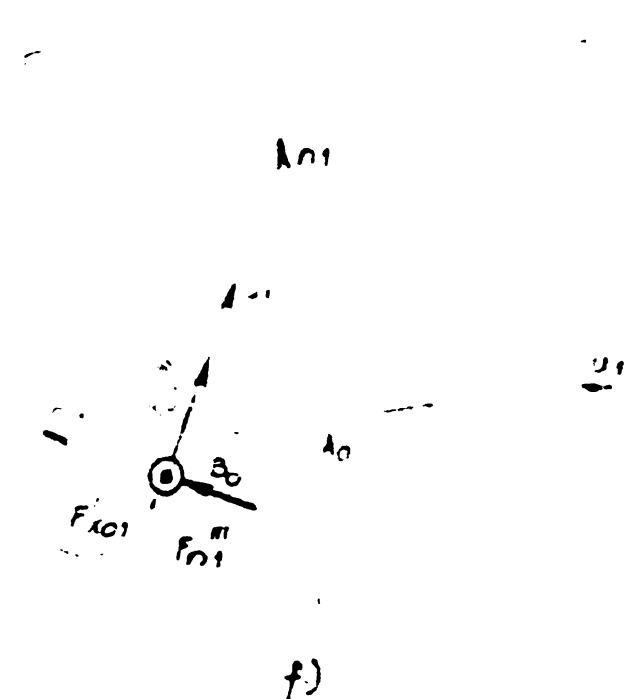
Biconditional



Biconditional

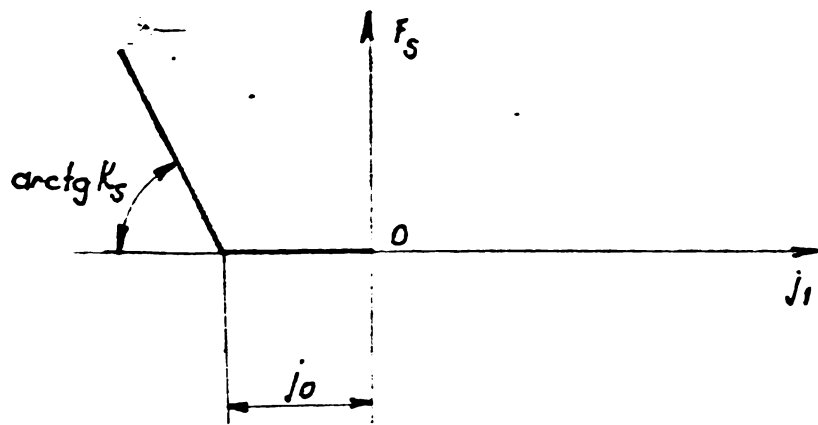


Monovalent

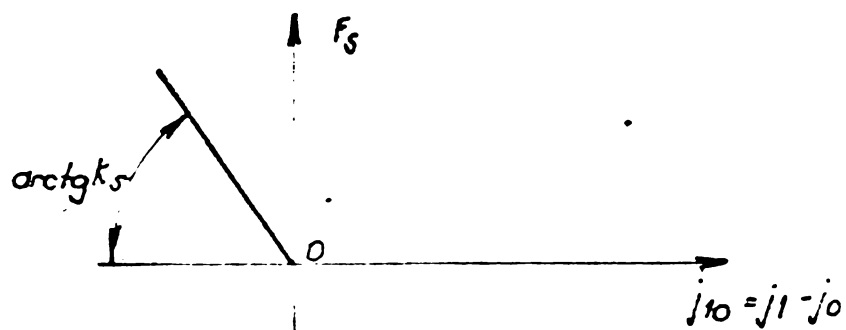


Monovalent

FIG. 75

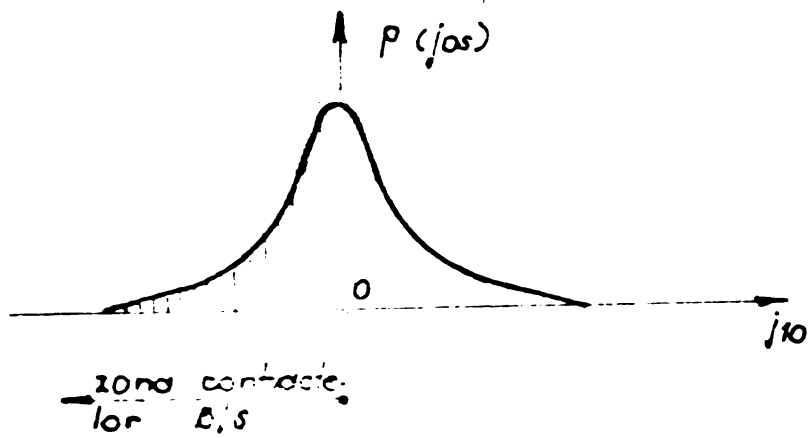


a.)

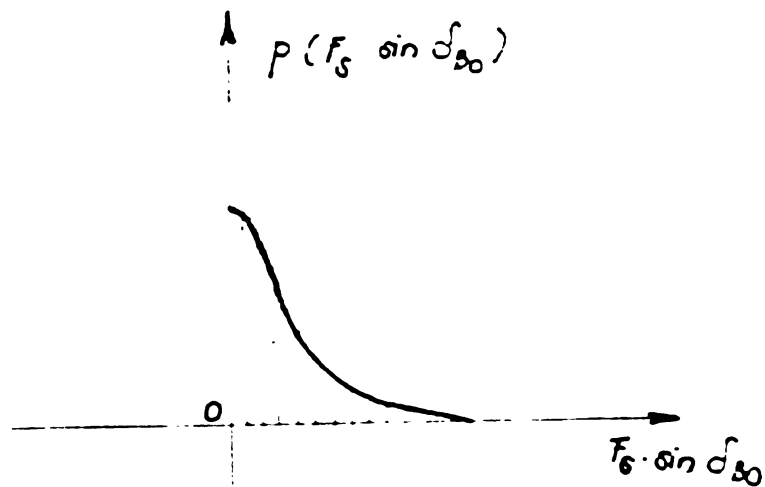


b.)

FIG. 76.



a)



b)

FIG. 77.

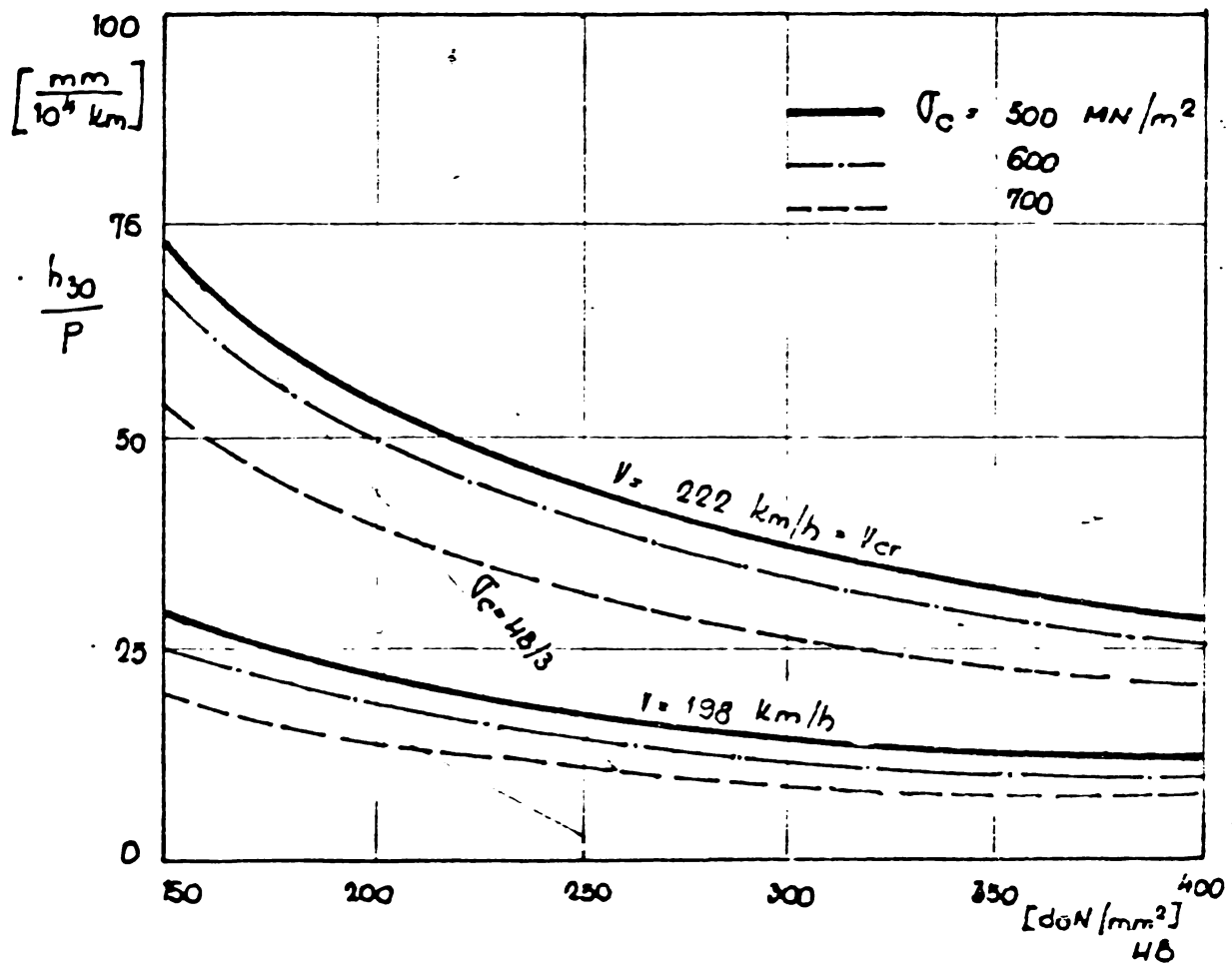


Fig. 78

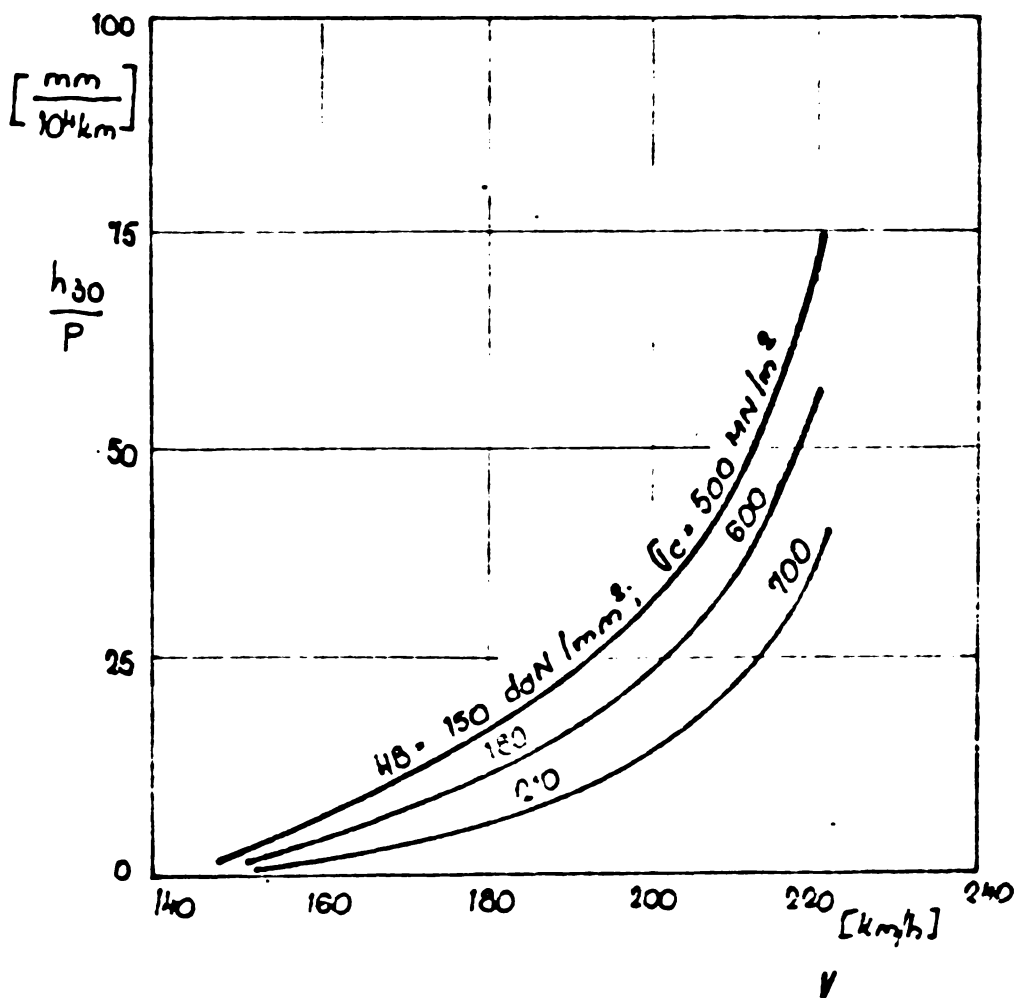


Fig. 79

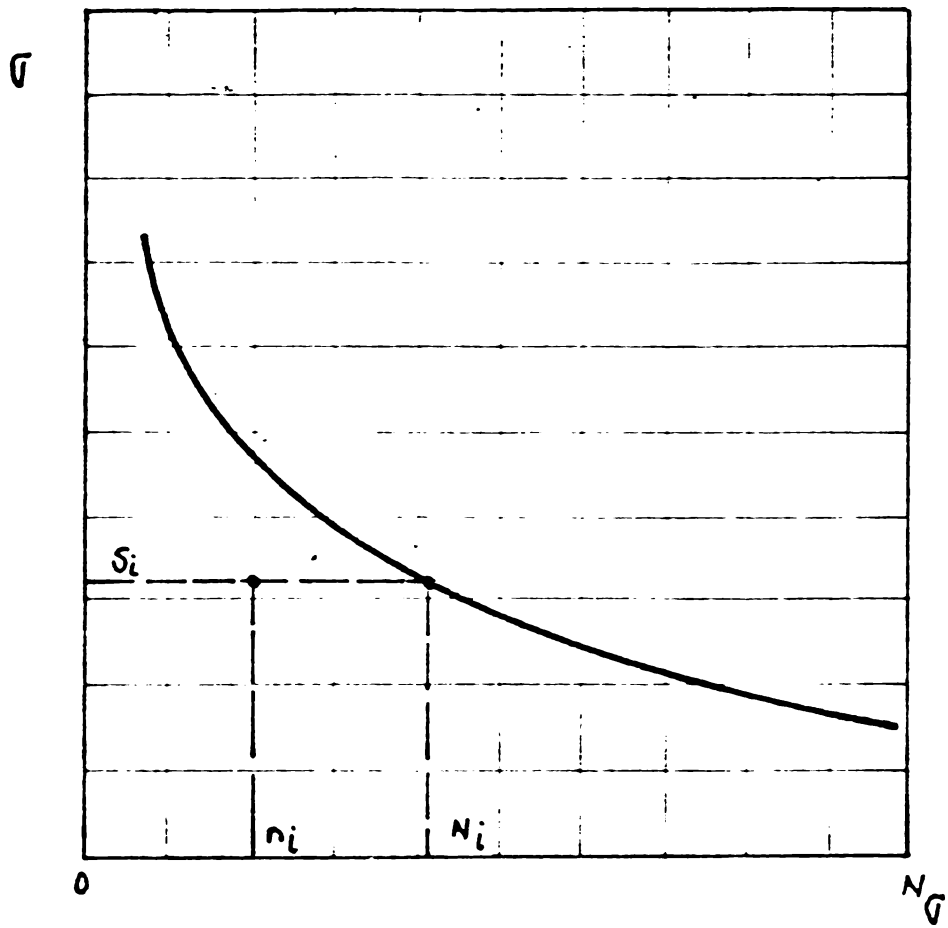


Fig. 80

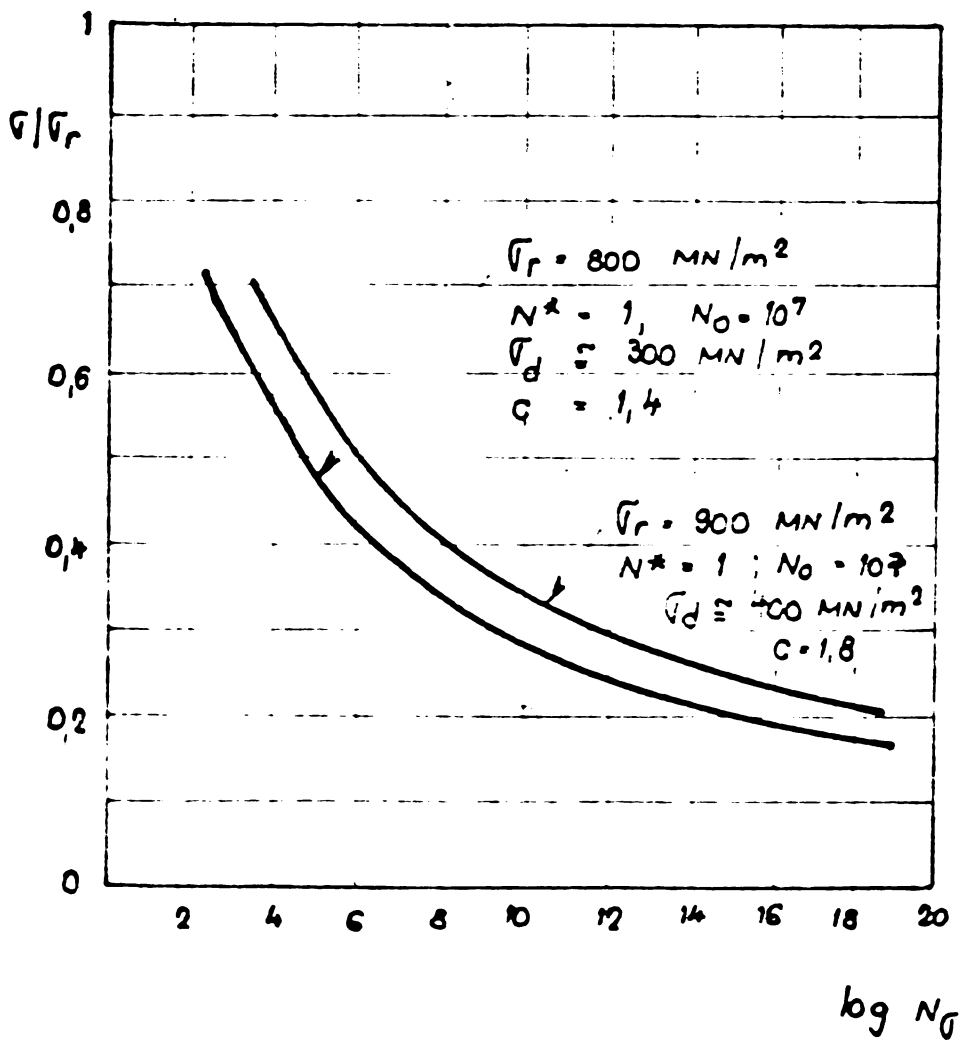
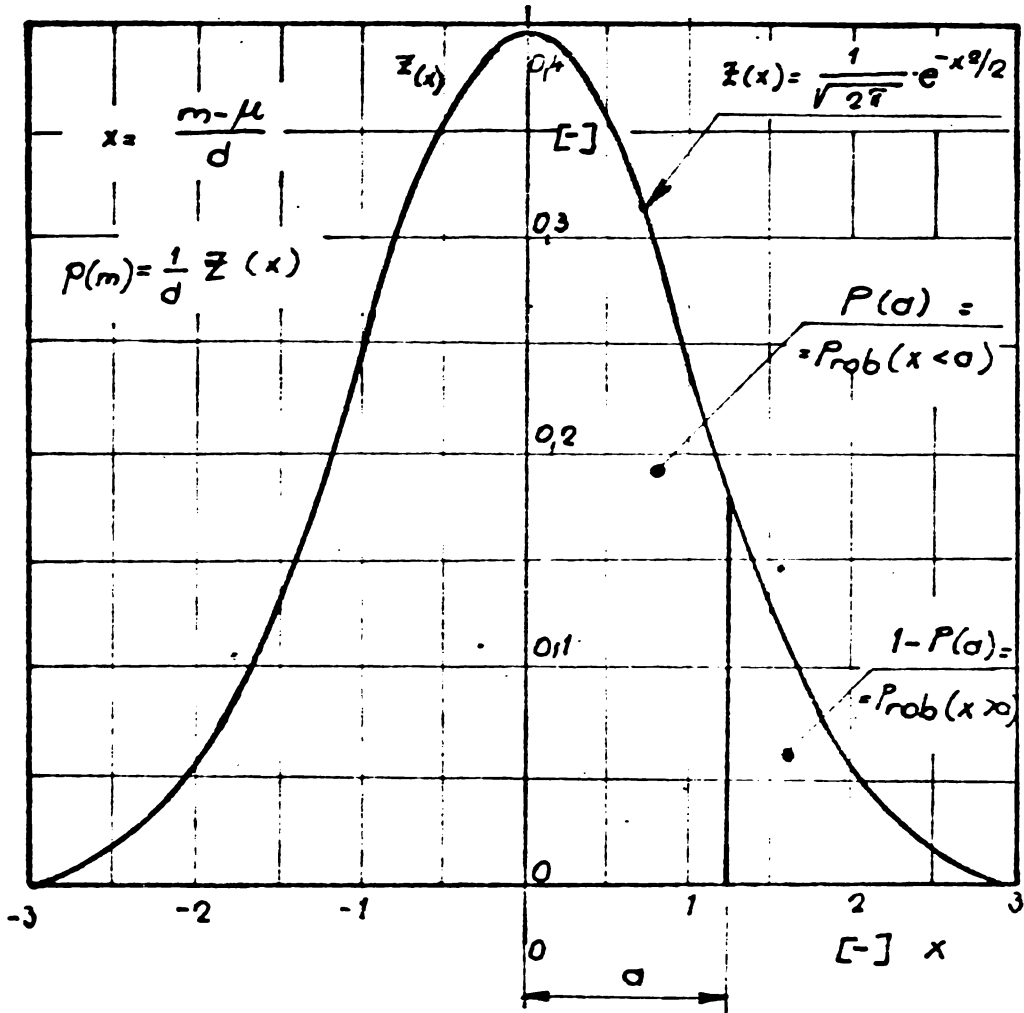
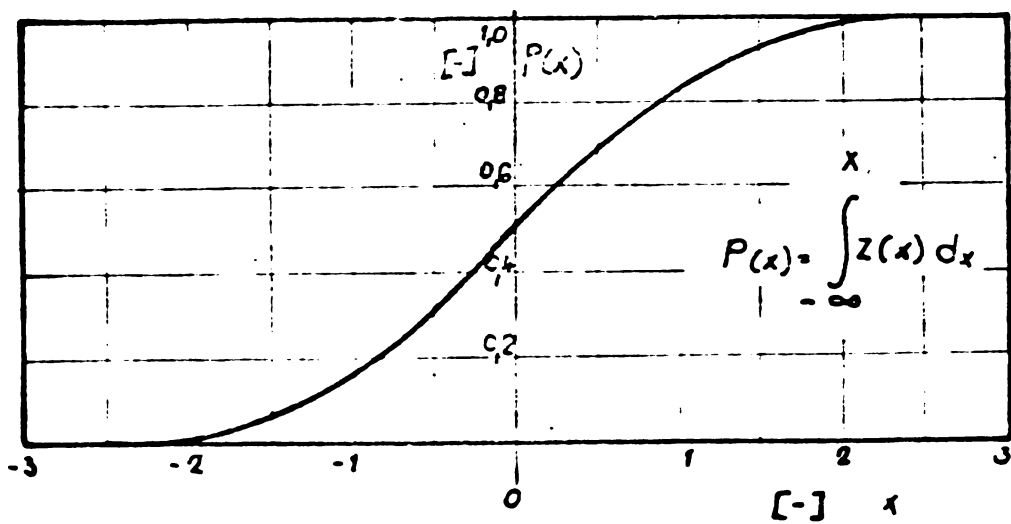


Fig. 81



a.)



b.)

FIG. 82.

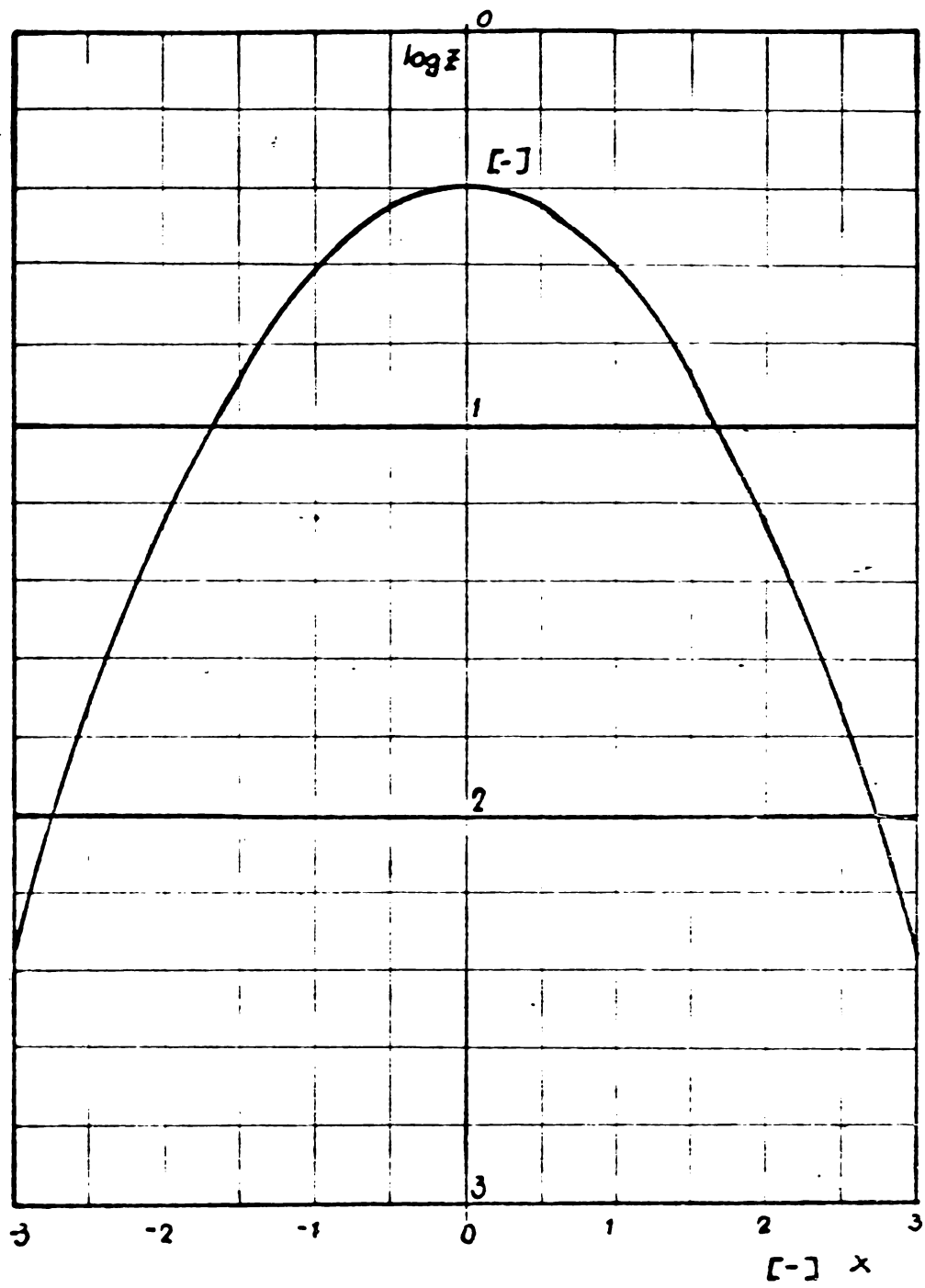


FIG. 83.

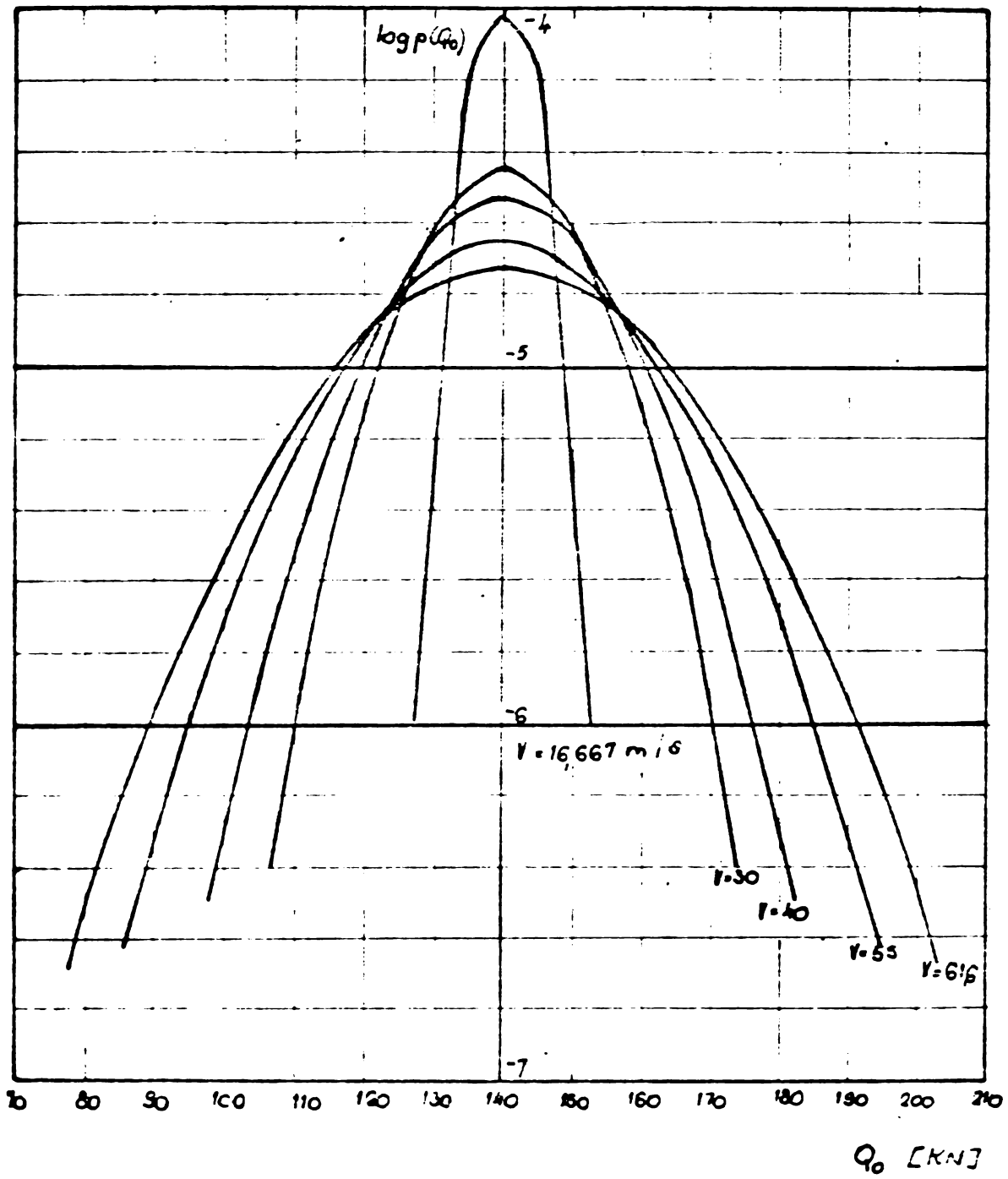


FIG. 84.

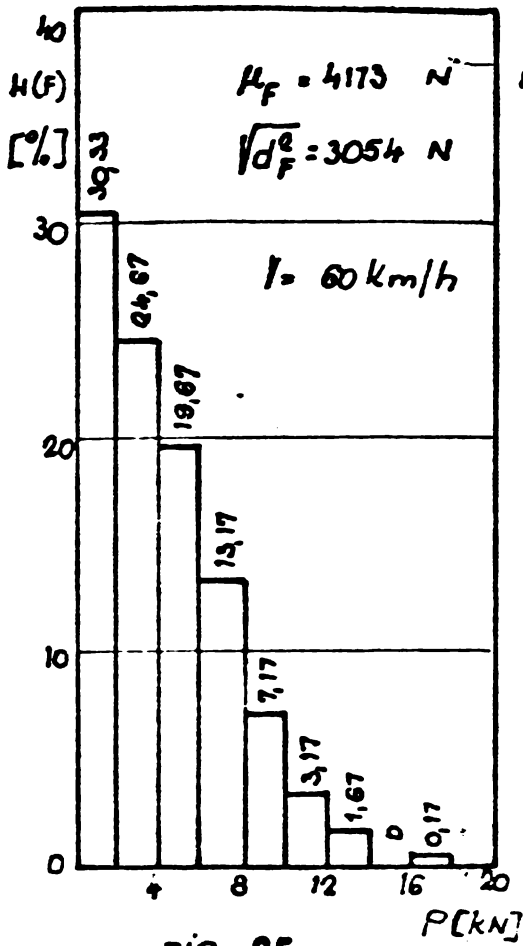


FIG. 85.

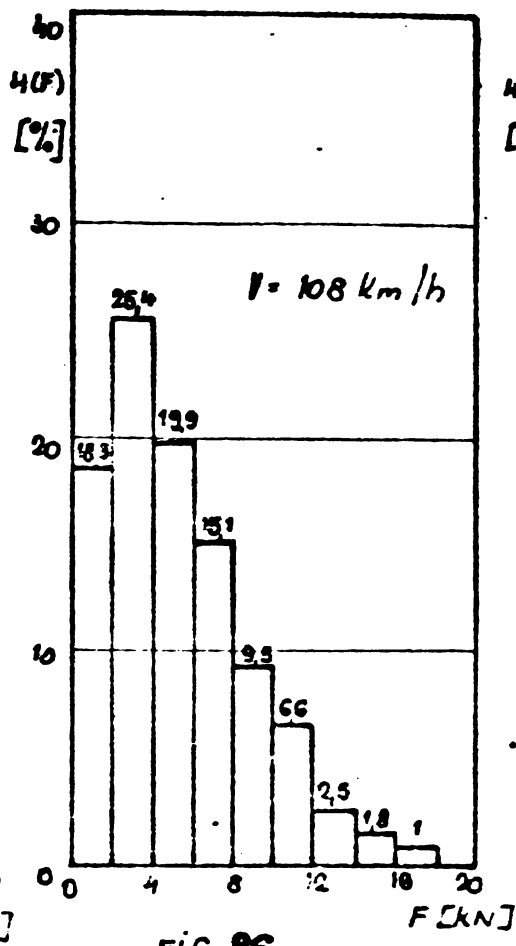


FIG. 86.

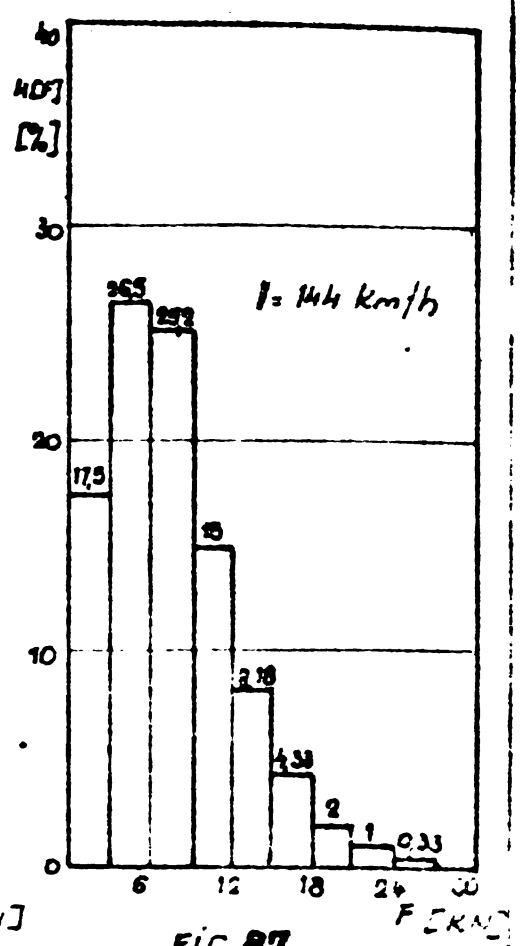


FIG. 87.

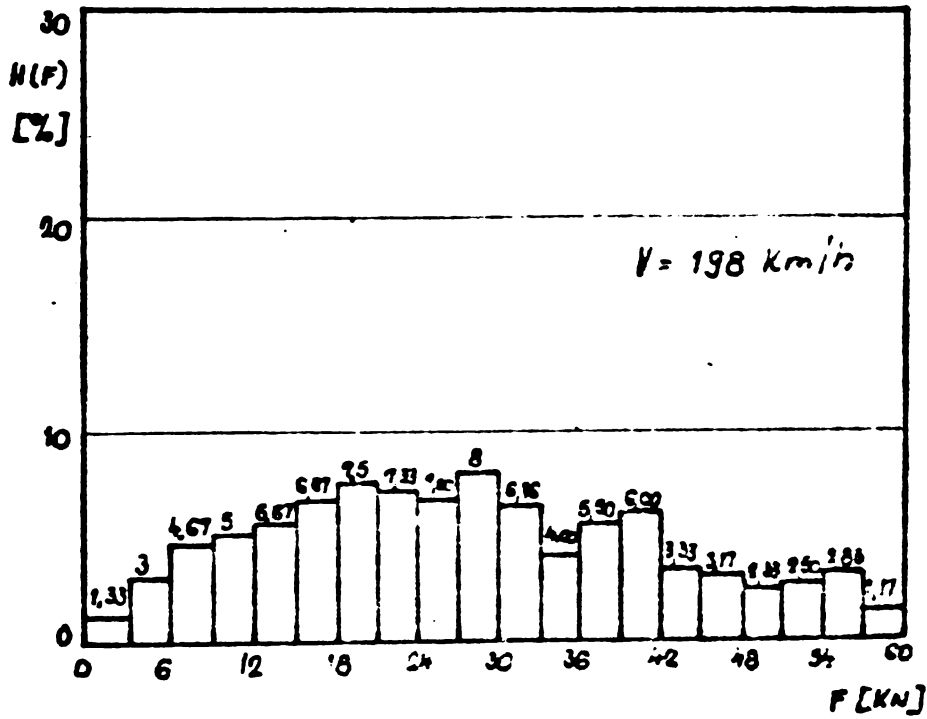


FIG. 88.

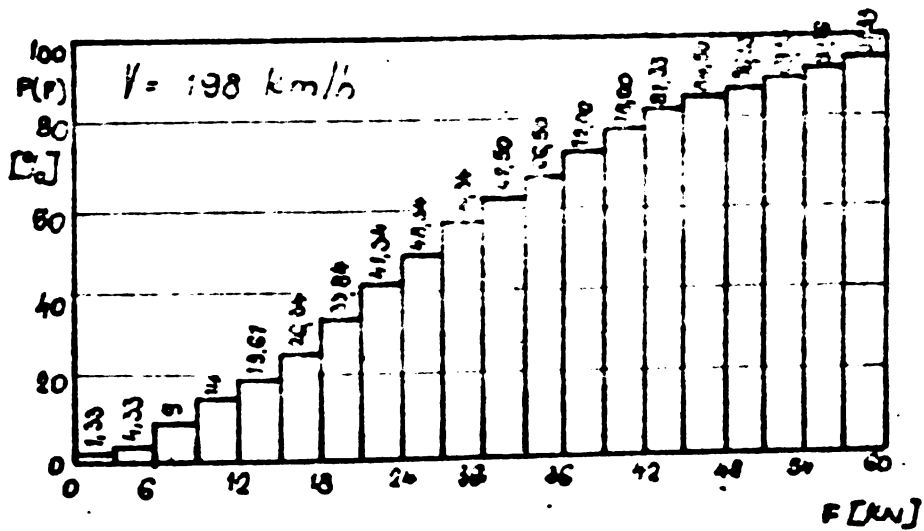
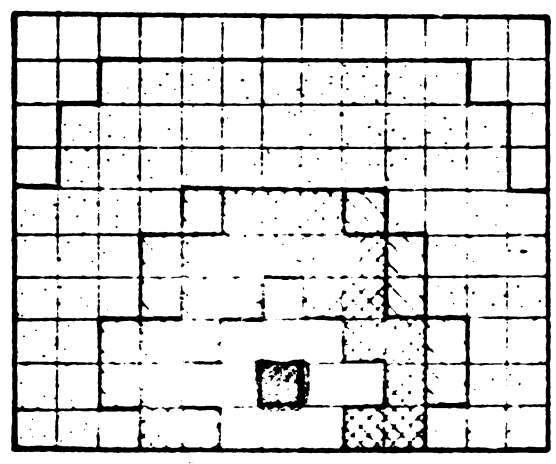
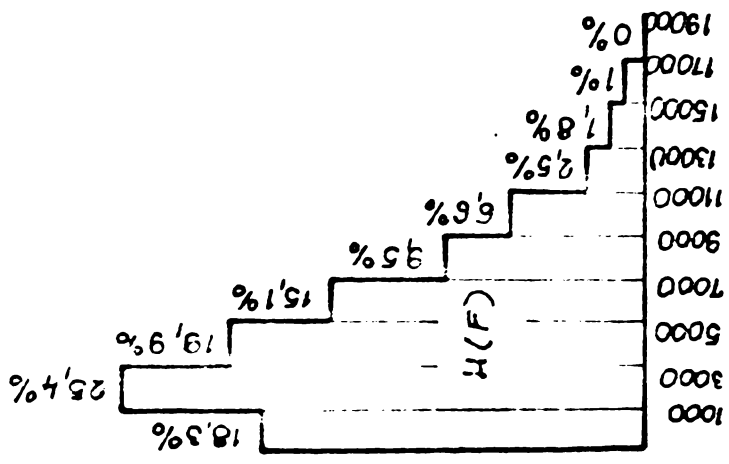
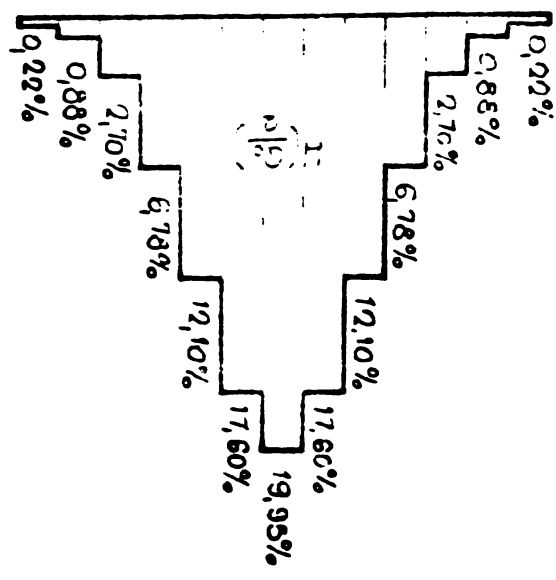


FIG. 89.



53200
56000
58800
61600
64400
67200
70000
72800
75600
78400
81200
84000
86800
89600
92400



$$\Delta F = 2000 \text{ [N]}$$

$$\Delta \frac{G^0}{2} = 2800 \text{ [N]}$$

LEGGENDA:

- H = 5,06%
- H = 3...5%
- H = 1...3
- H = 0,5...1
- H = 0,01...0,5
- H = <0,01

FIG. 90

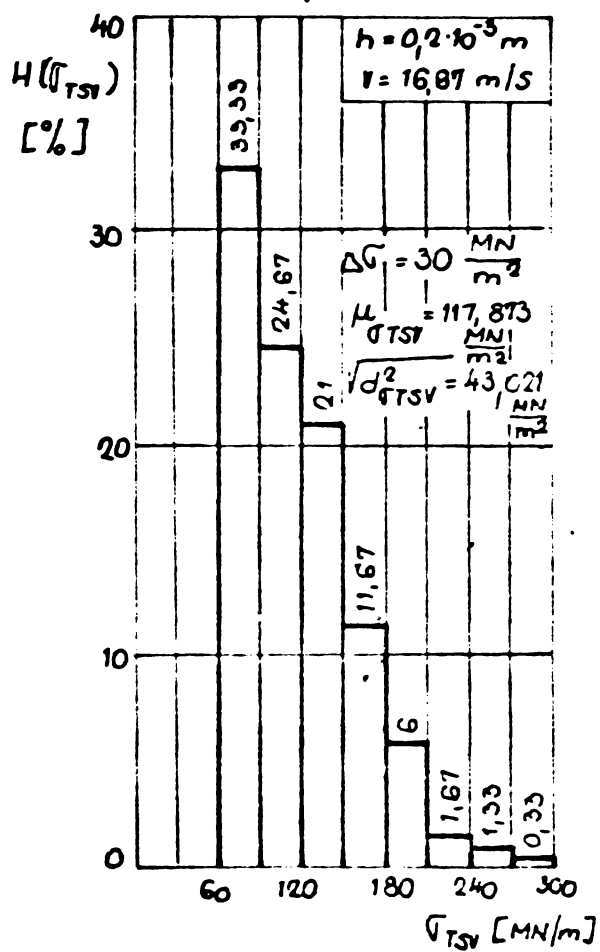


FIG. 91

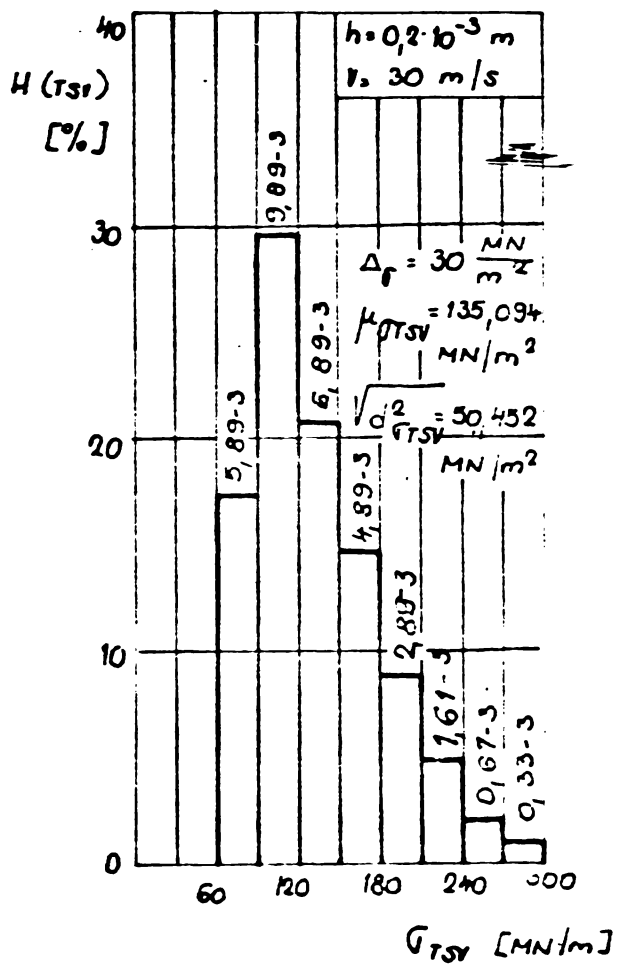


FIG. 92

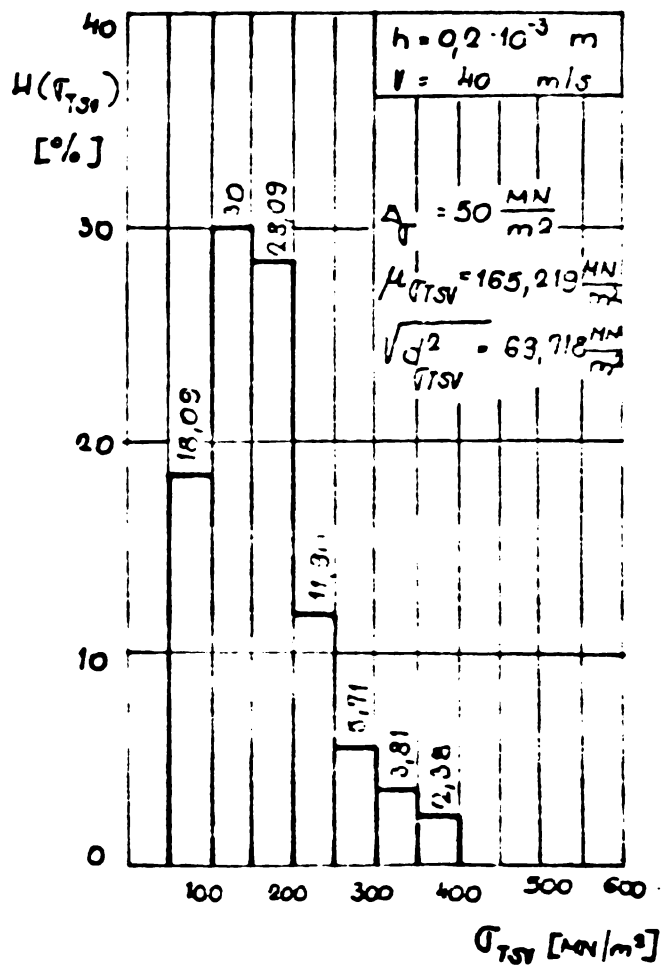


FIG. 93

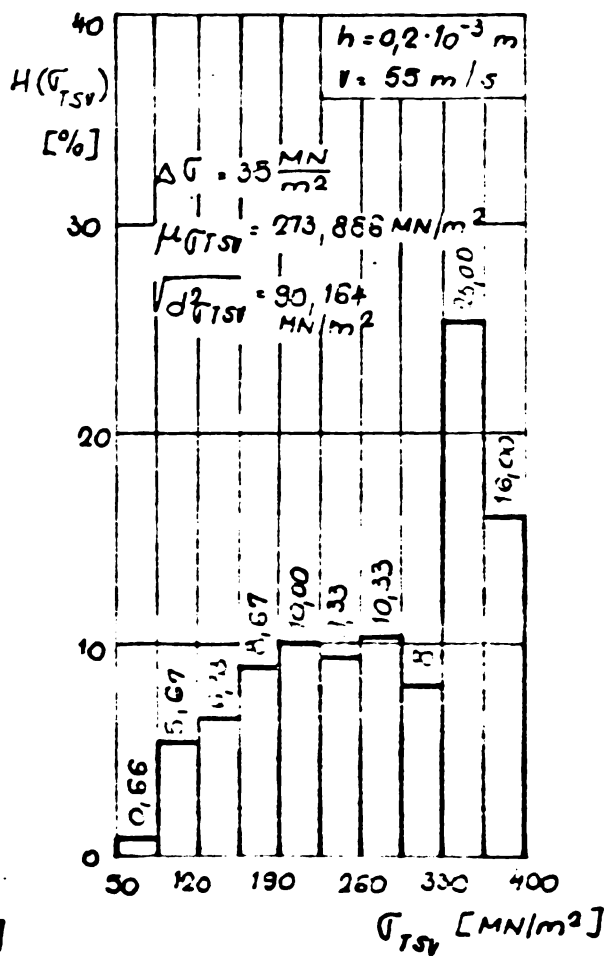


FIG. 94

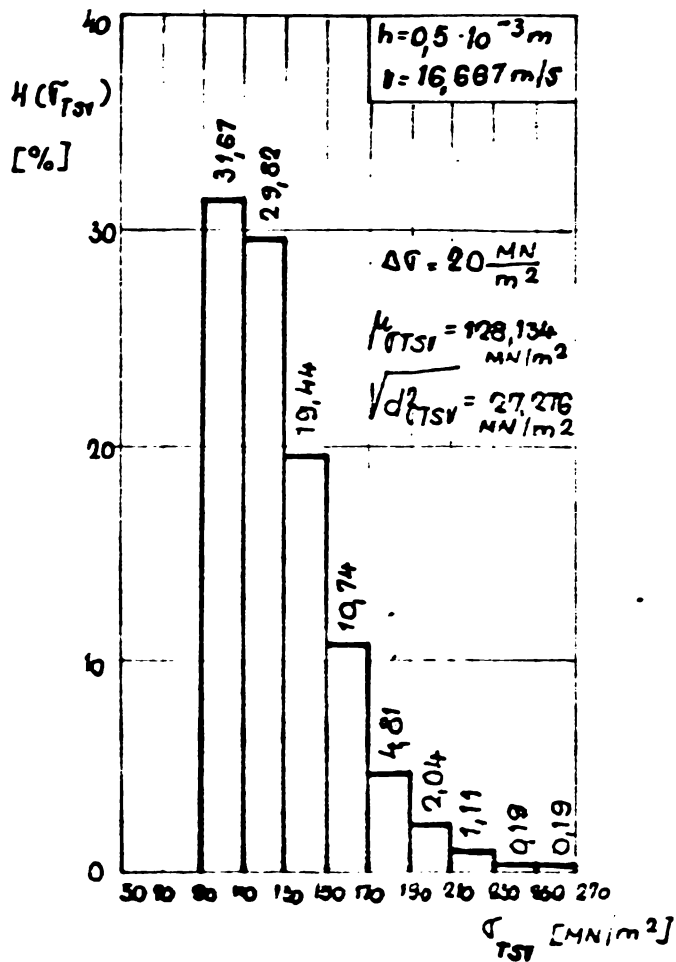


Fig. 95

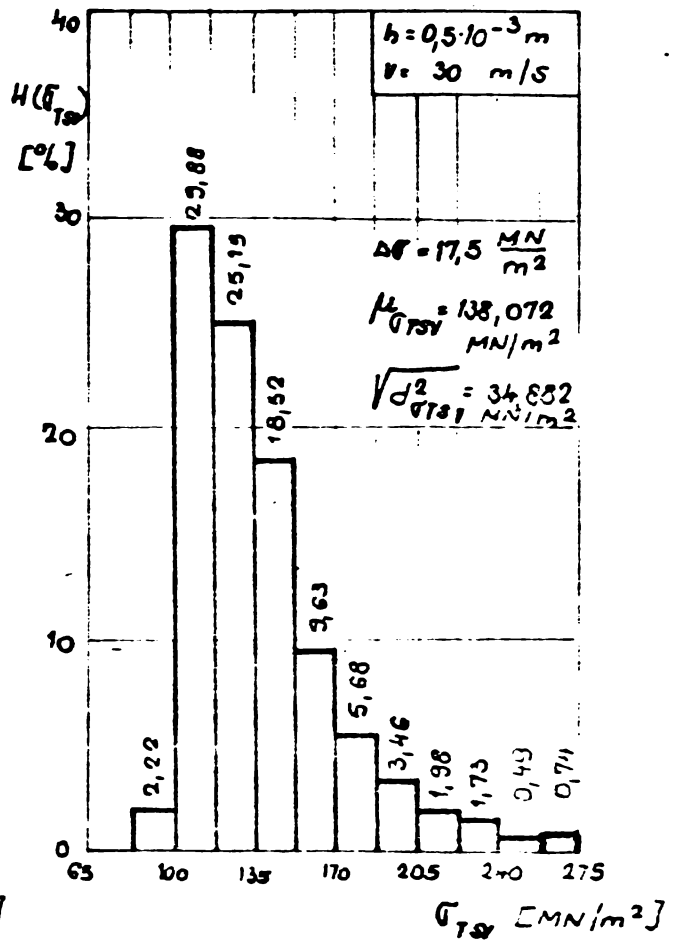


Fig. 96

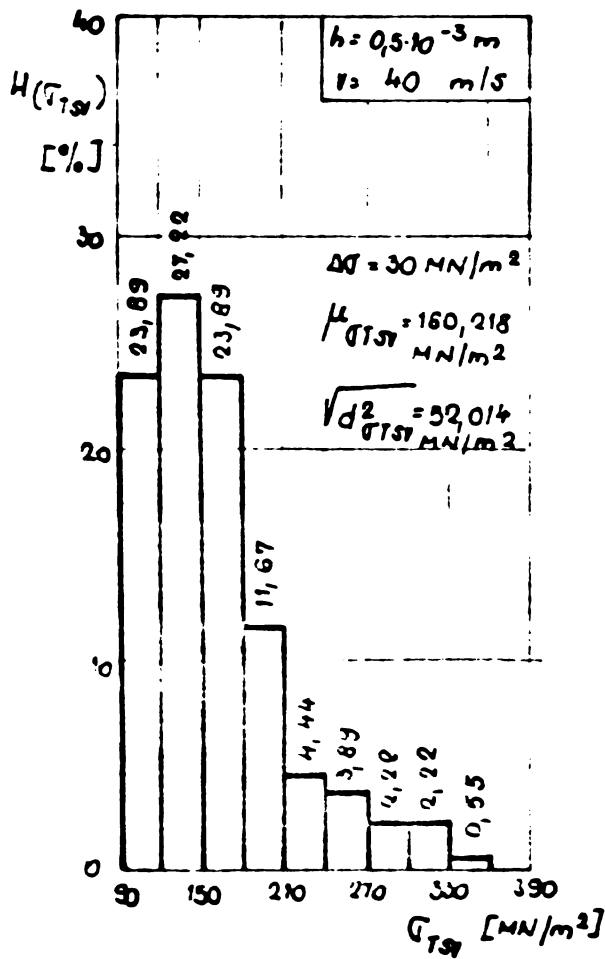


Fig. 97

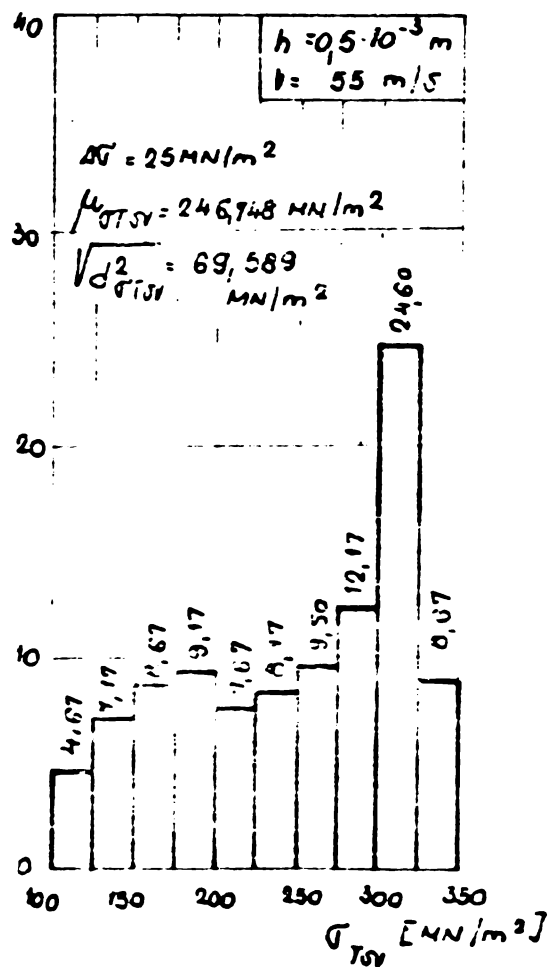


Fig. 98

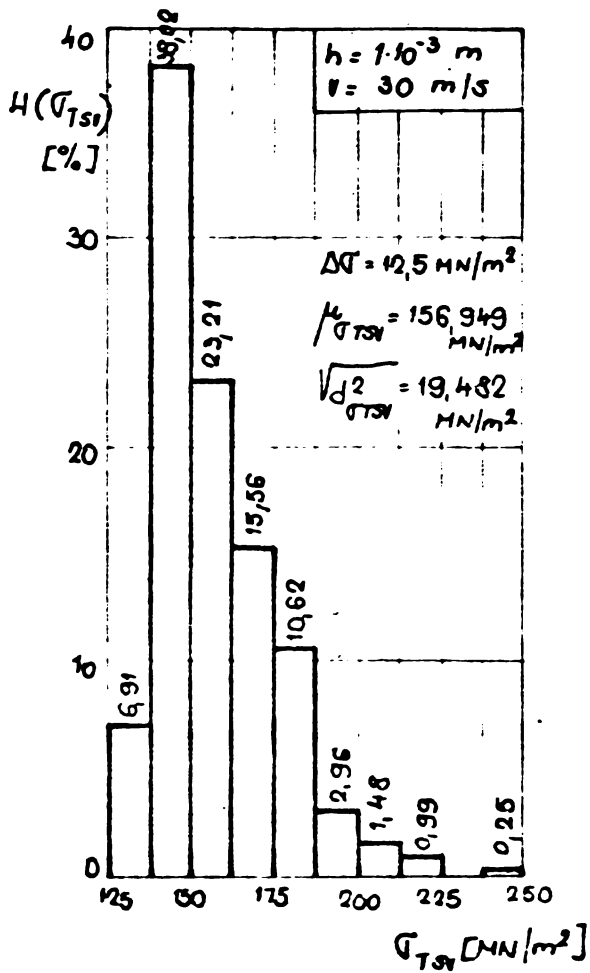


Fig. 99

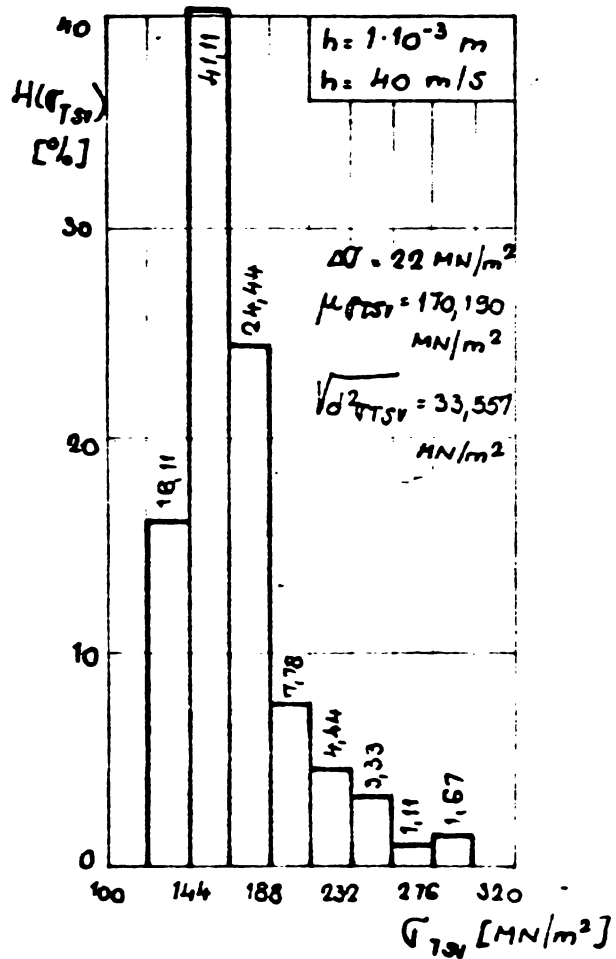


Fig. 100

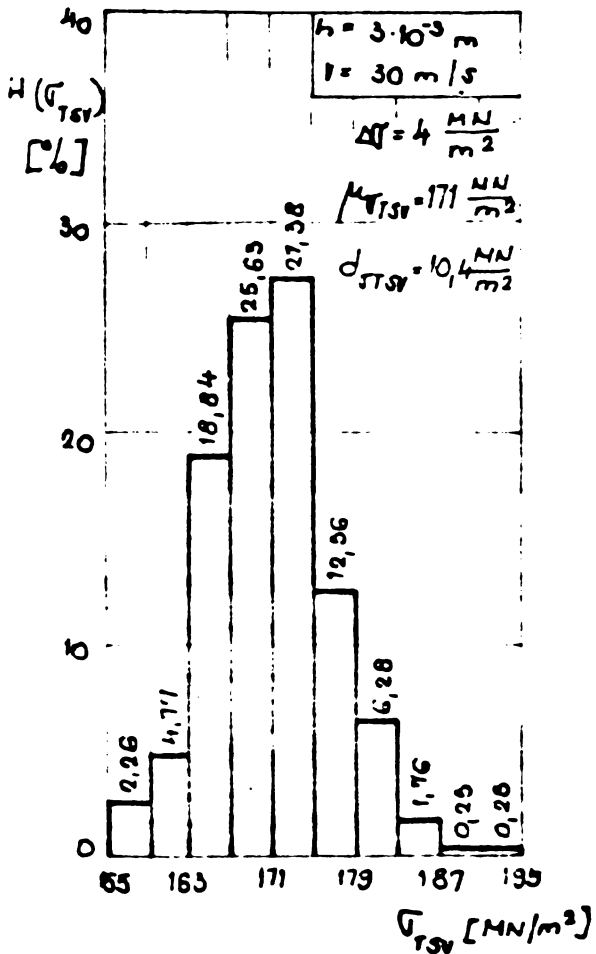


Fig. 101

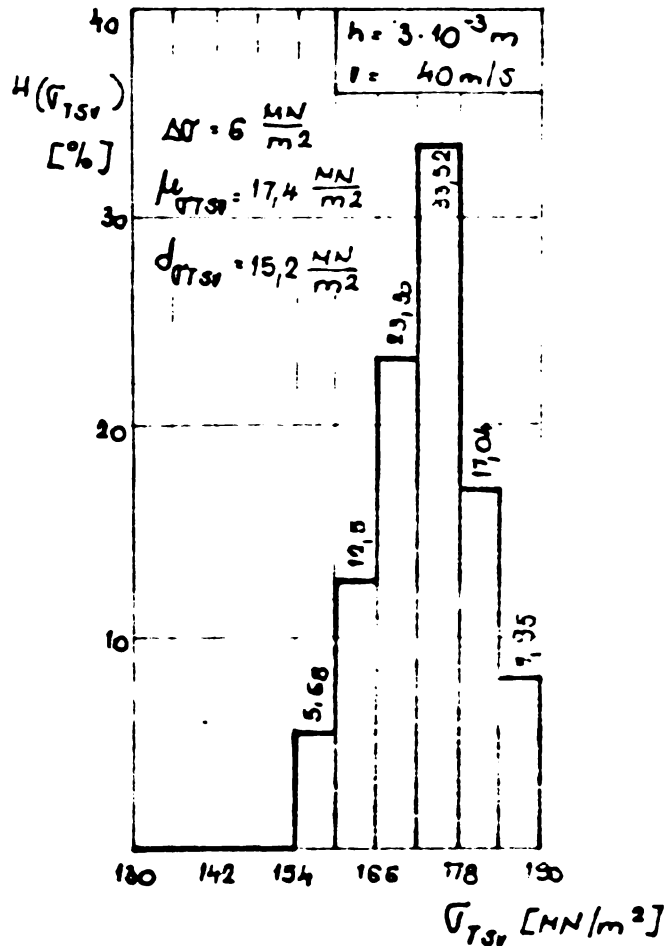
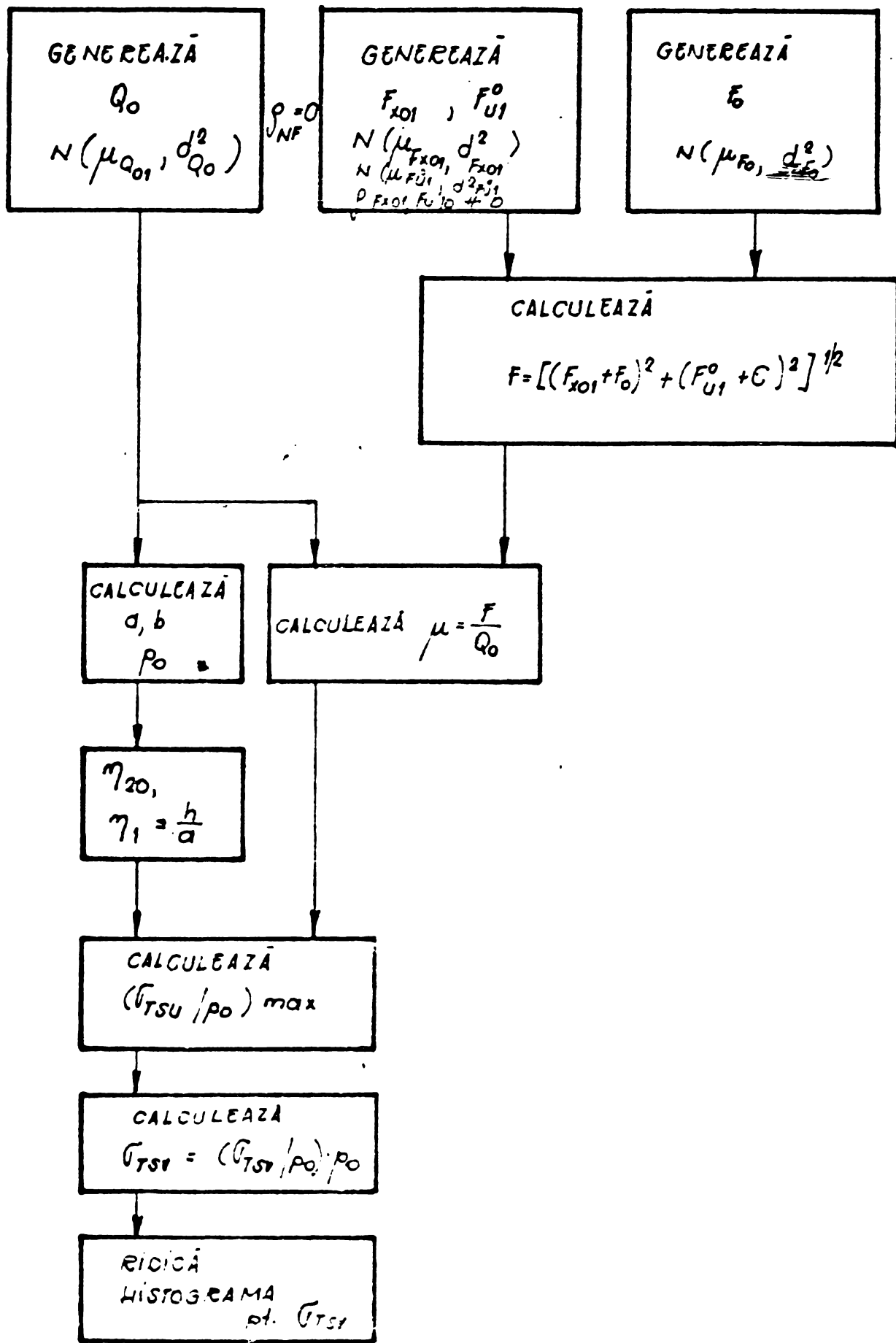


Fig. 102



CALCULUL HISTOGRAMEI VARIABILEI $\left(\frac{\sigma_{TSY}}{p_0}\right)_{max}$.
LA ADÎNCIMEA h SUB PATA DE CONTACT.

FIG. 103.

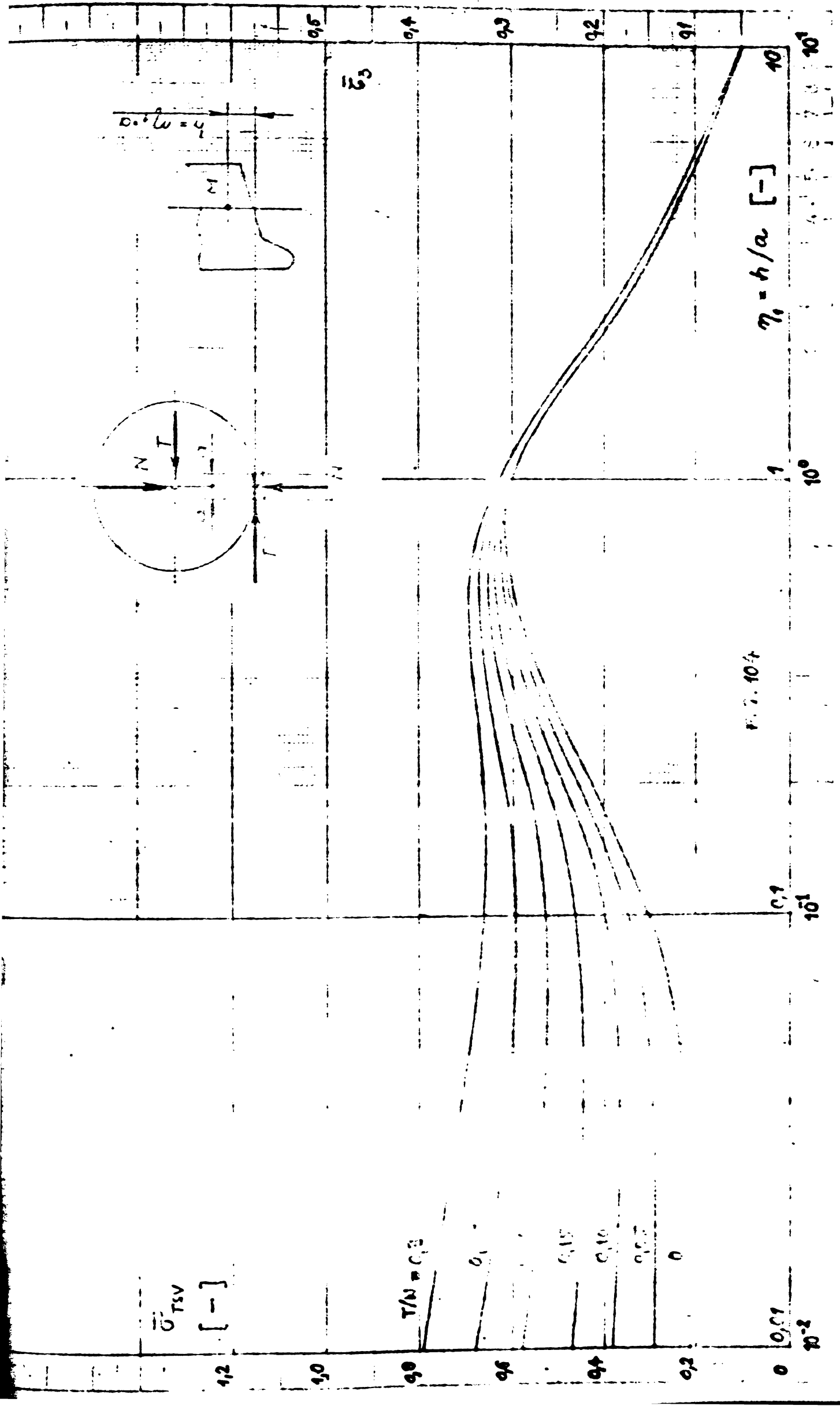
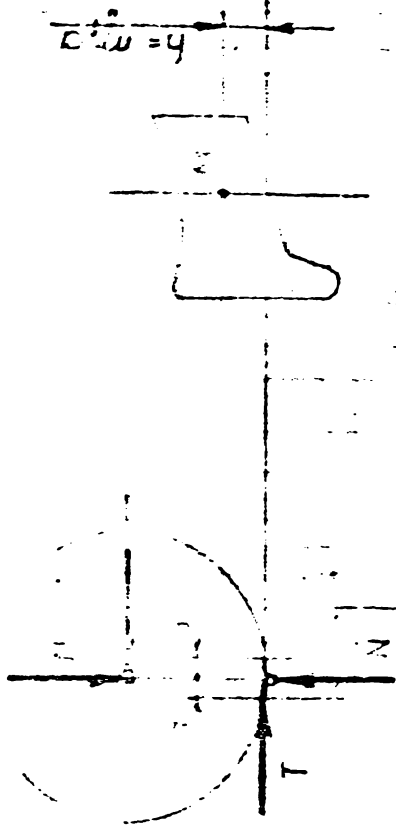


Fig. 104



$$\frac{T}{N} = 0,3 \quad 2N = Q_0 = 107500 \text{ N/osie}$$

$$N' = 0,200 \text{ m (simul)}$$

σ_{TSP}
[MPa]

PROFIL 1:20 STAS ; (B02)
PROFIL S-70 /123/ ; (P02)
PROFIL S 1002 022 ; (002)

$$\frac{T}{N} = 0$$

FIG. 104.a

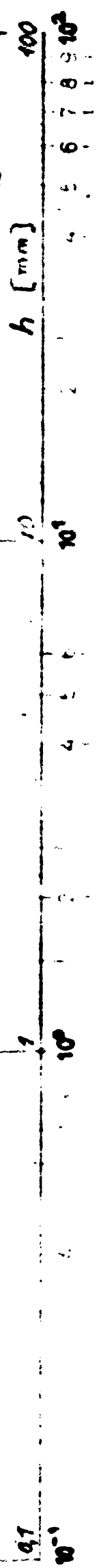


Fig 104.a

0.00

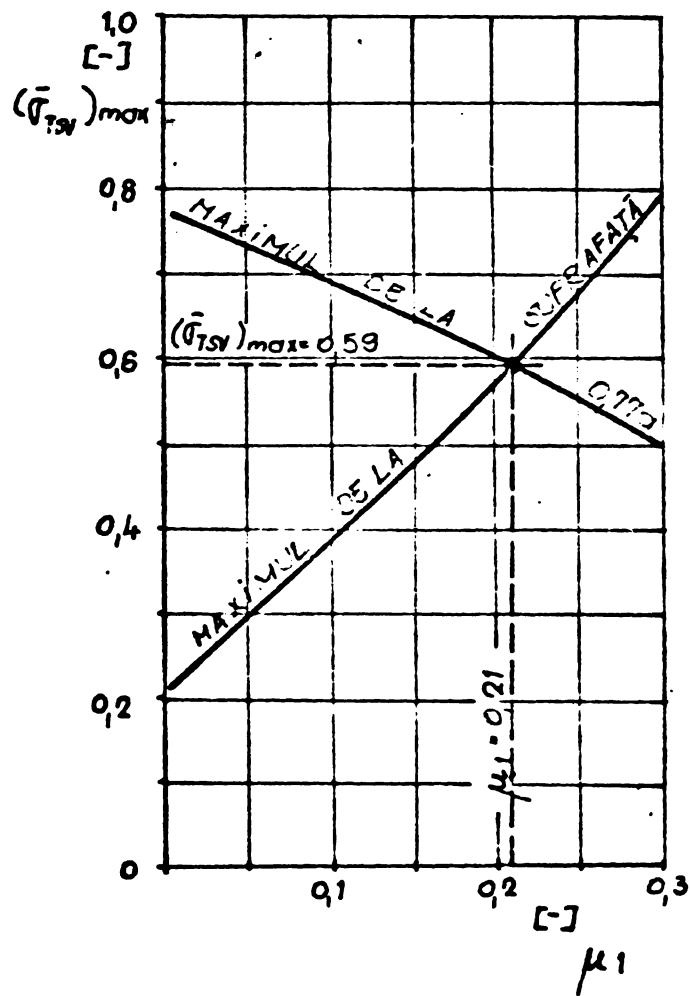


FIG. 105

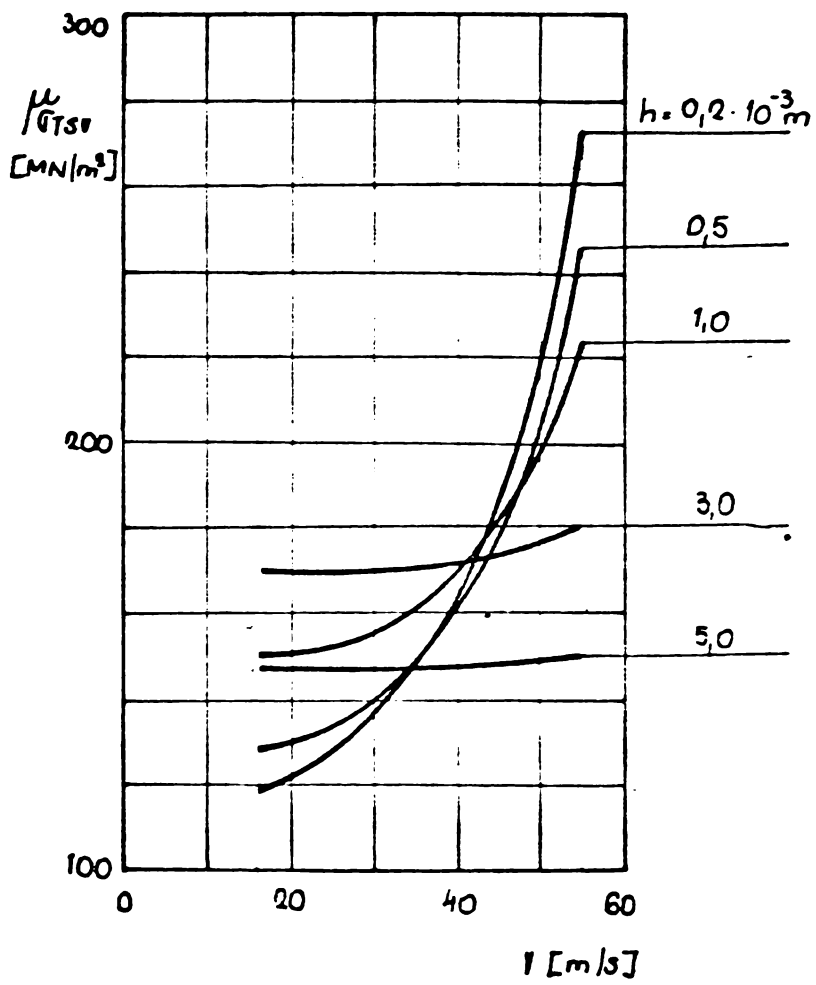


Fig. 106

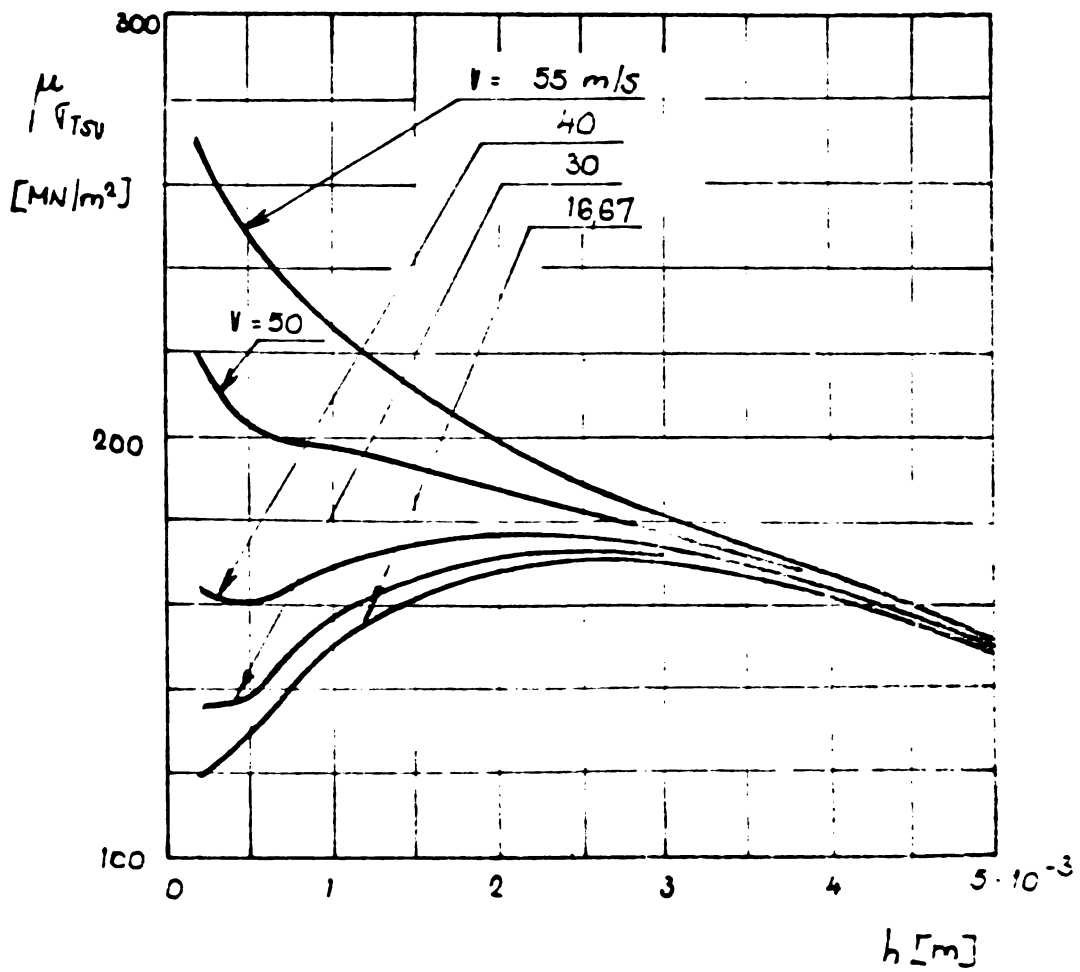


Fig. 107

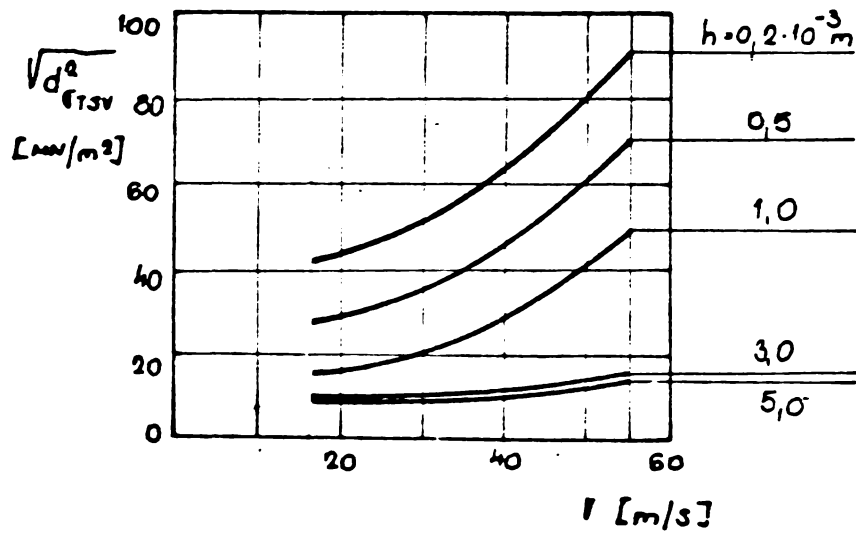


Fig. 108

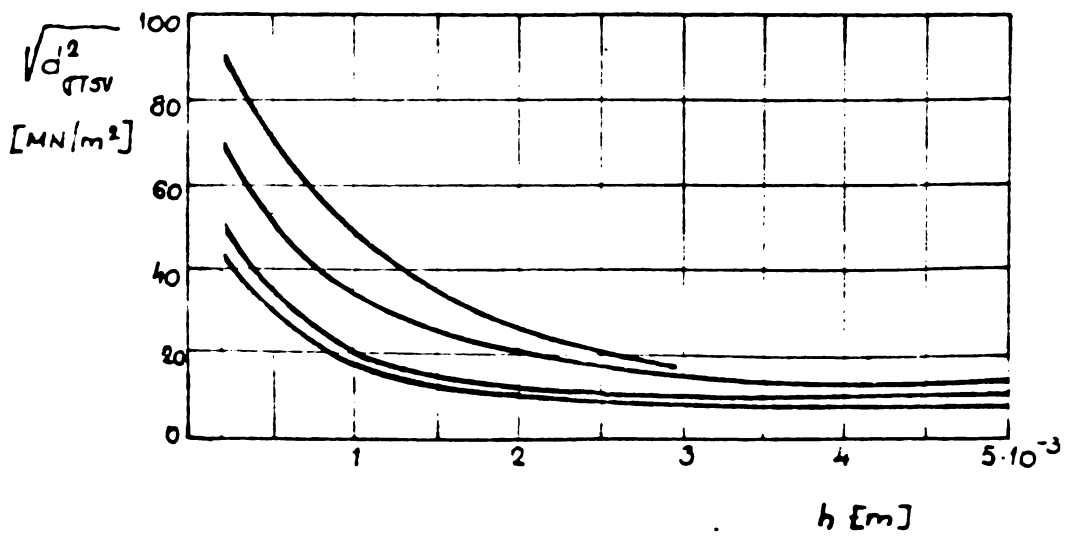


Fig. 109

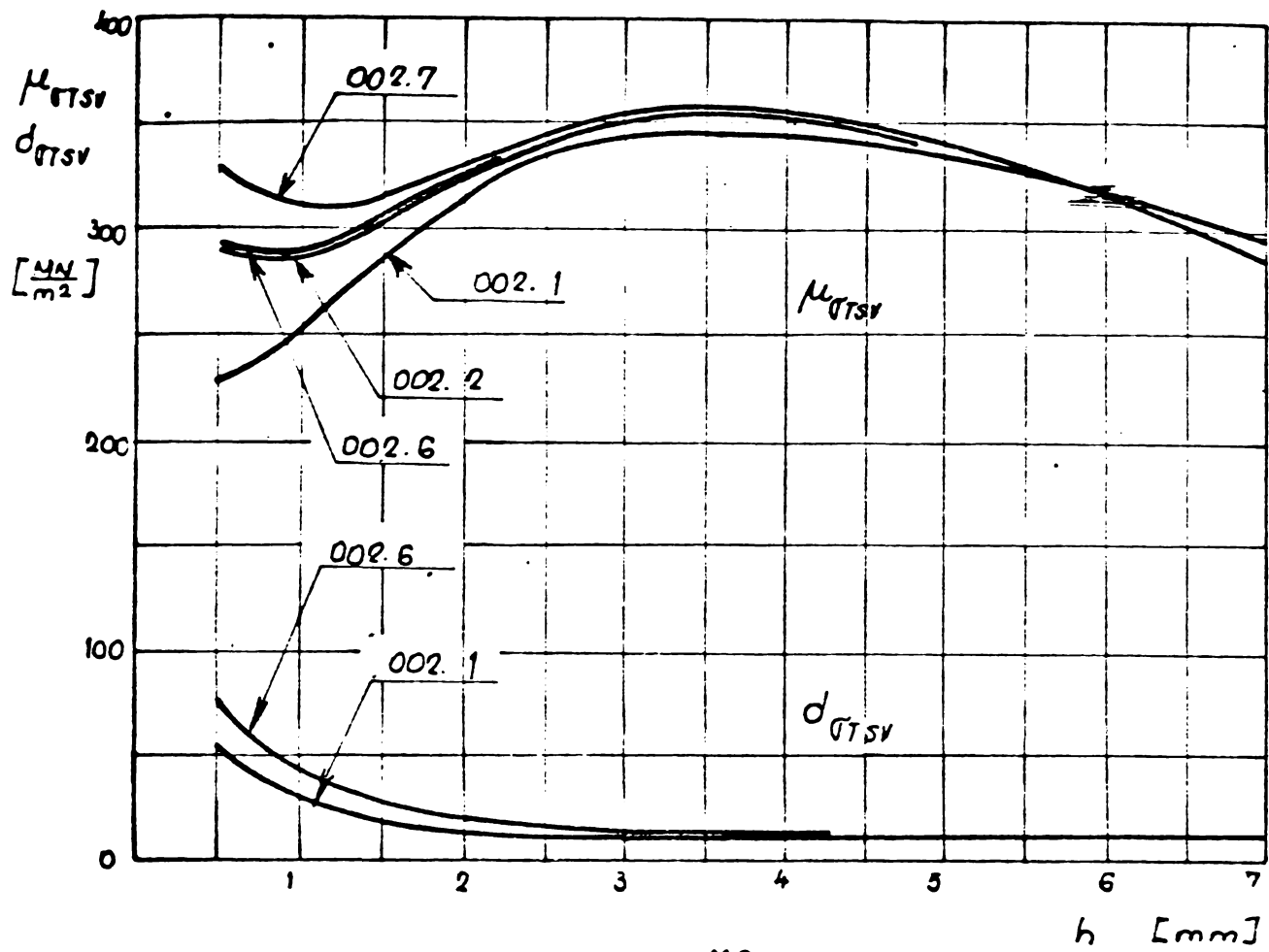


Fig. 110

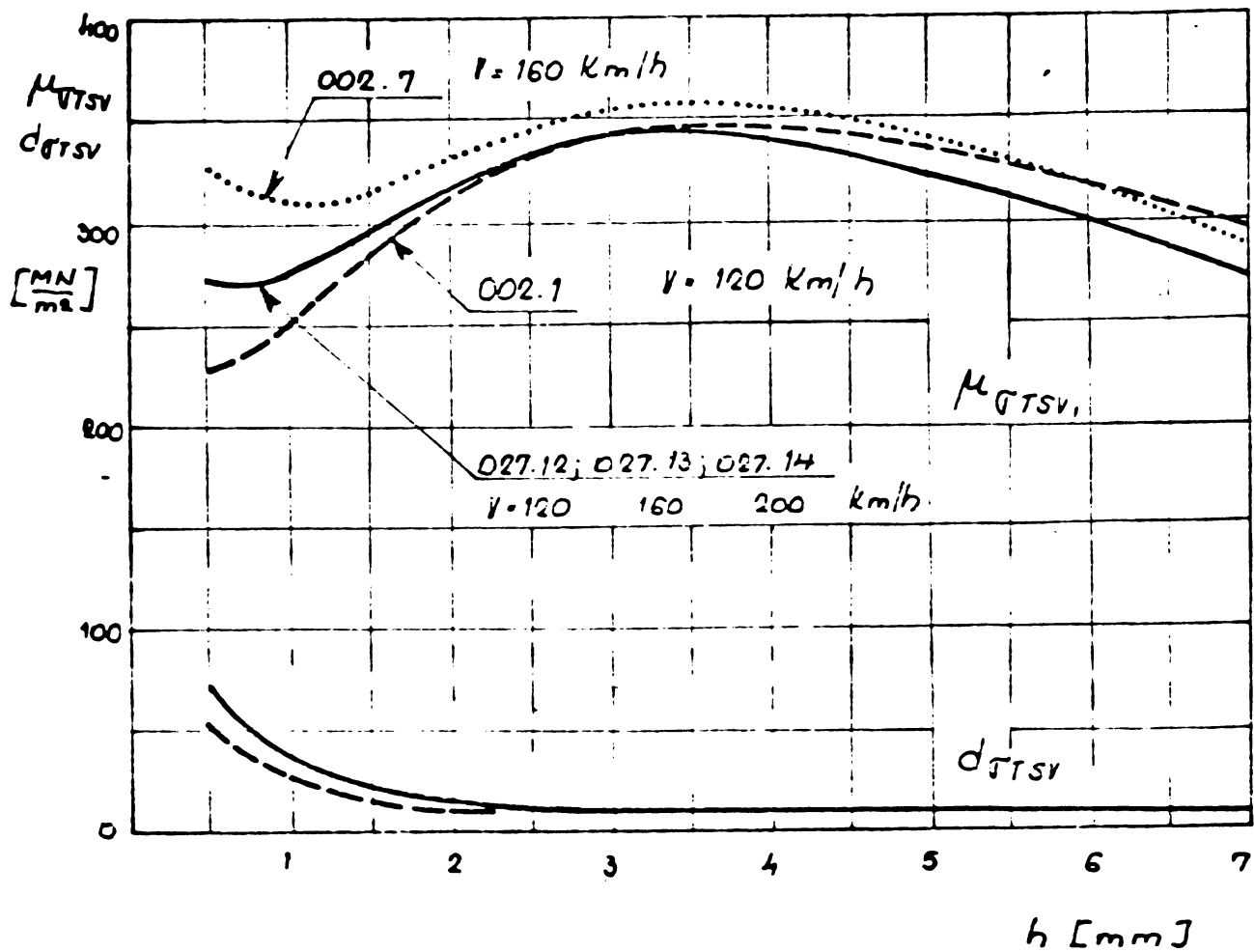


Fig. 111

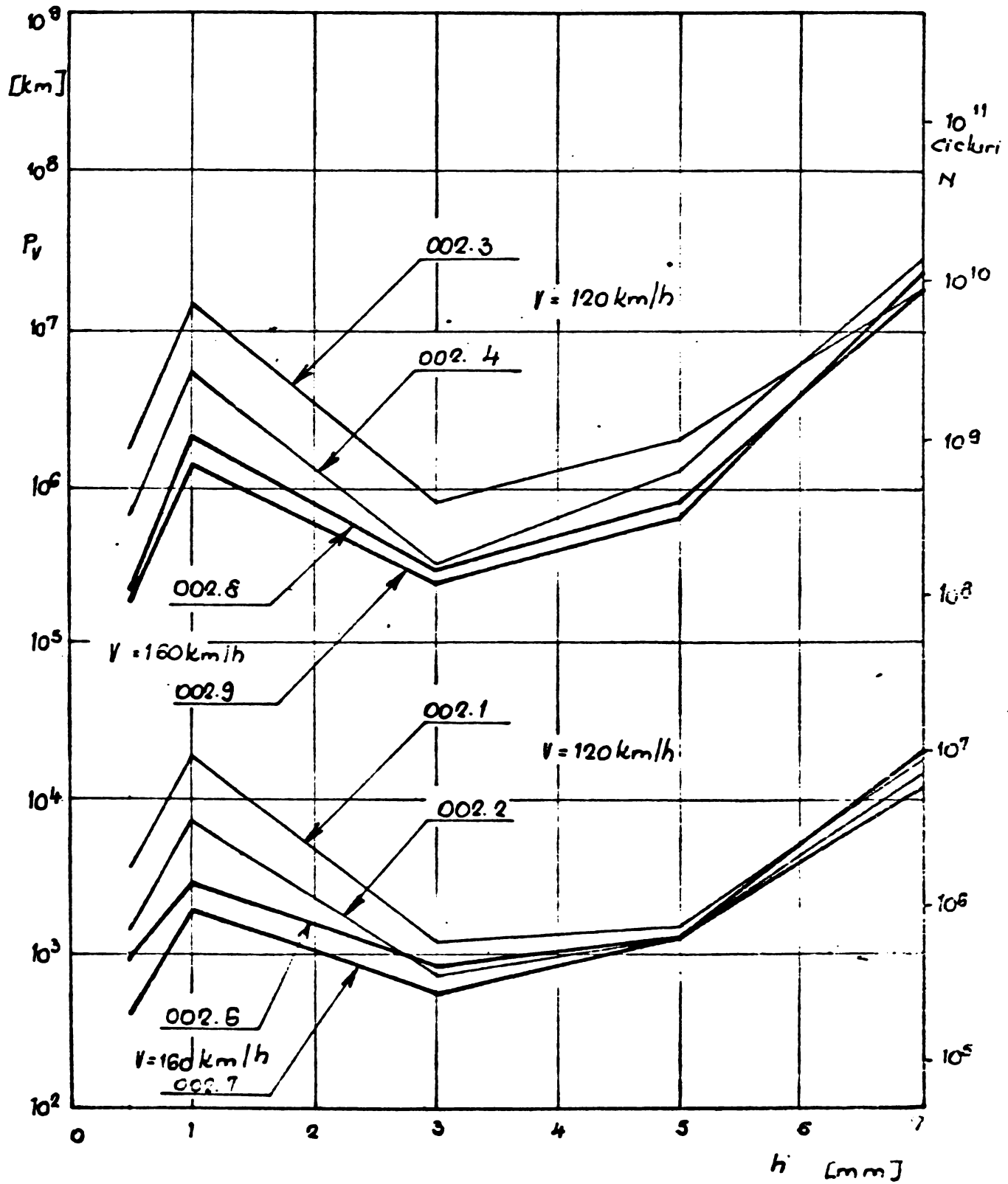


Fig 112

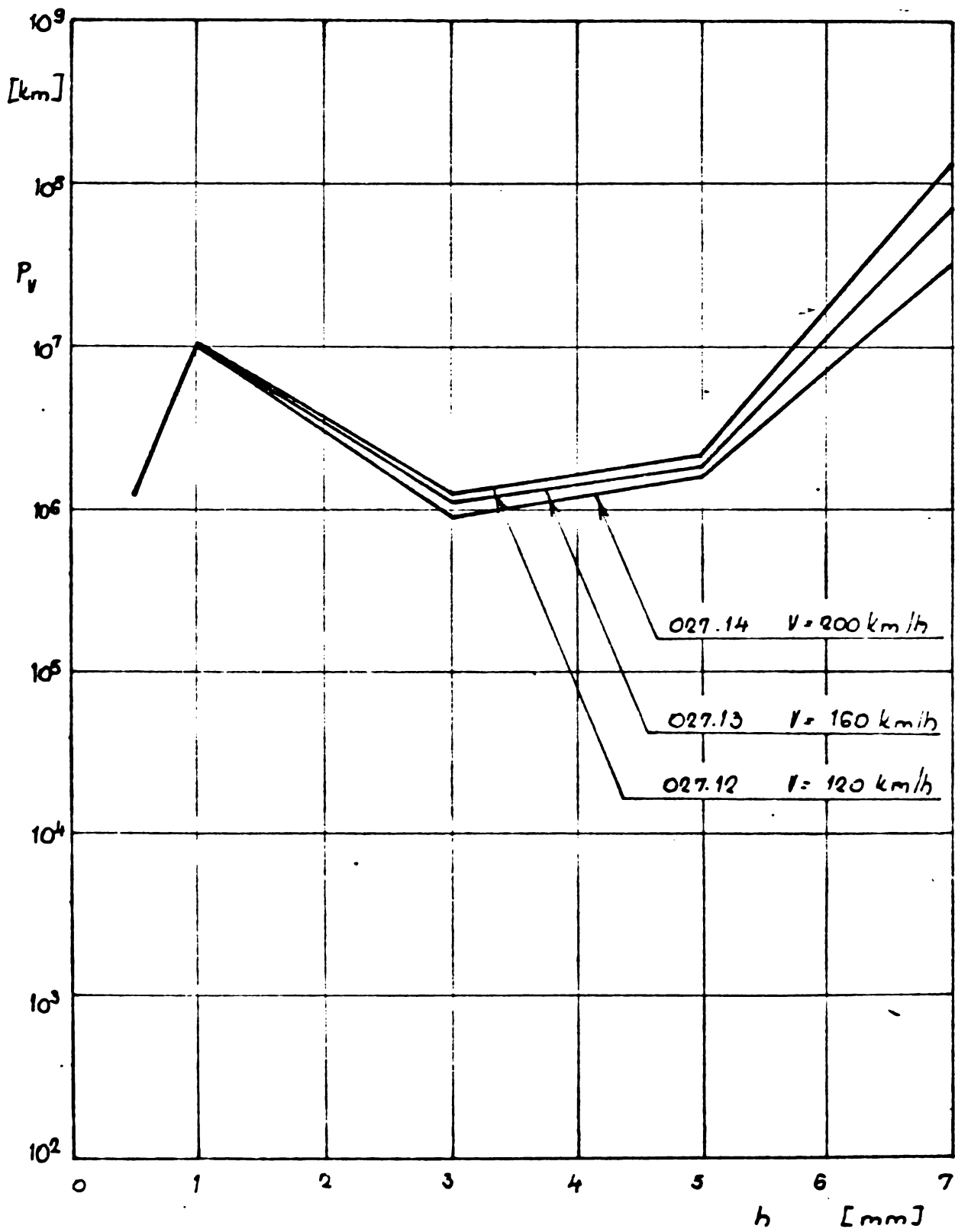


fig. 113

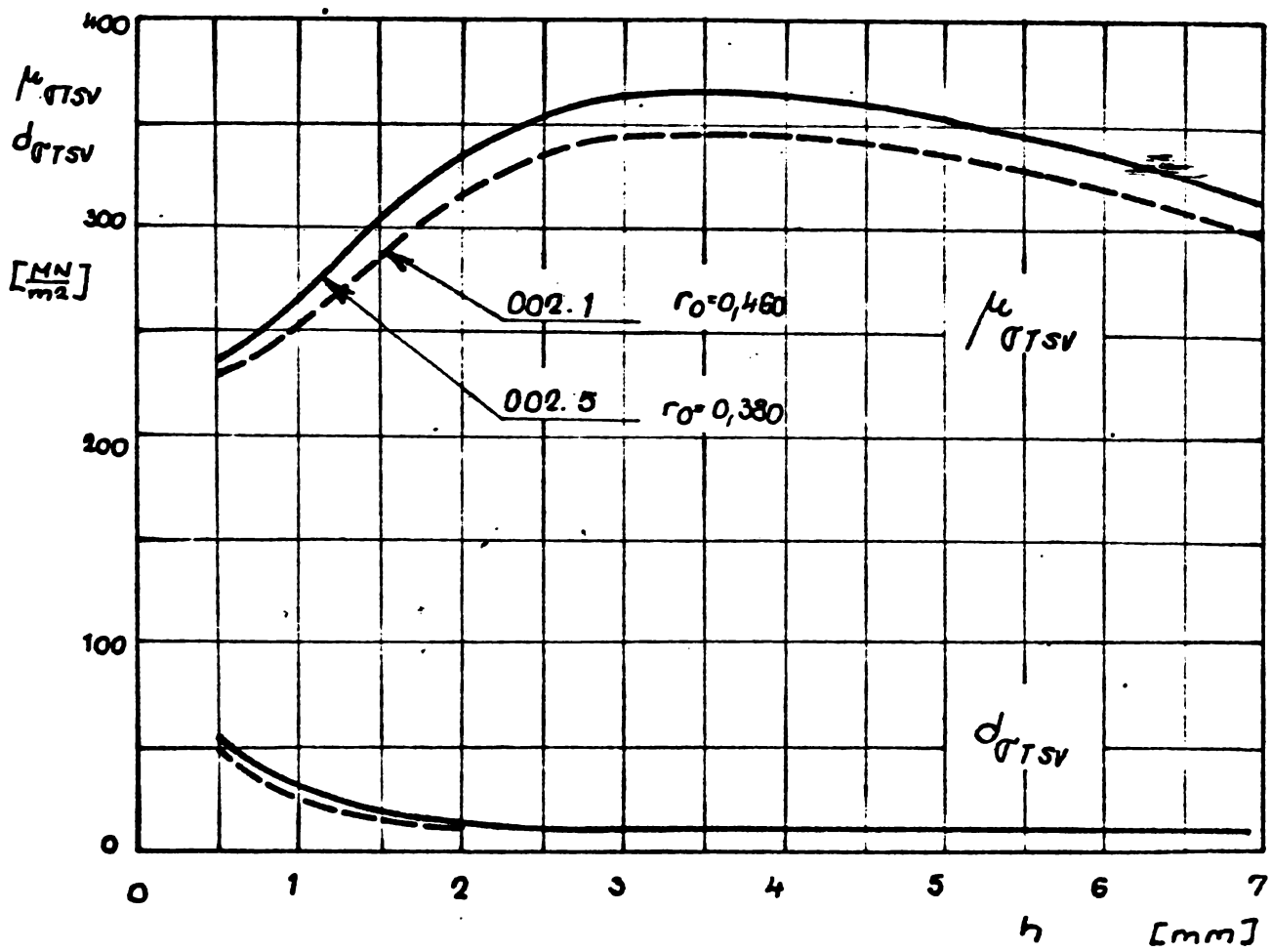


Fig. 114

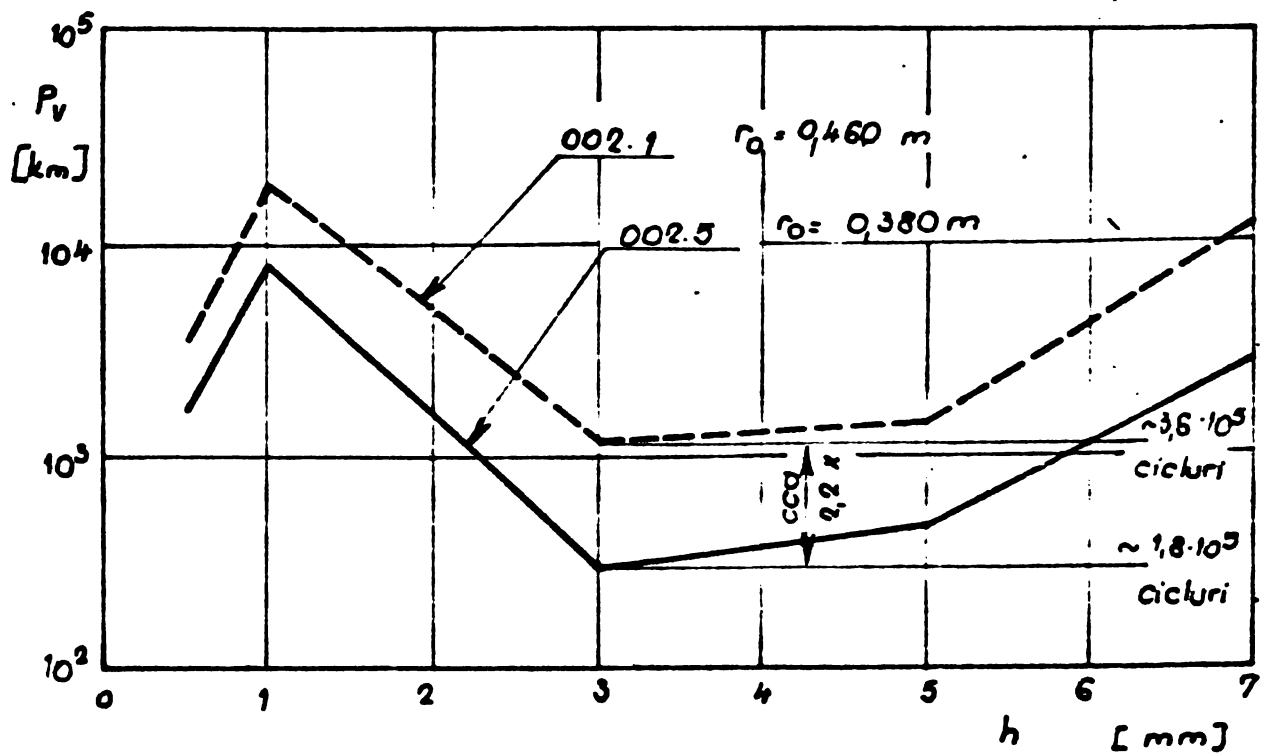


Fig. 115

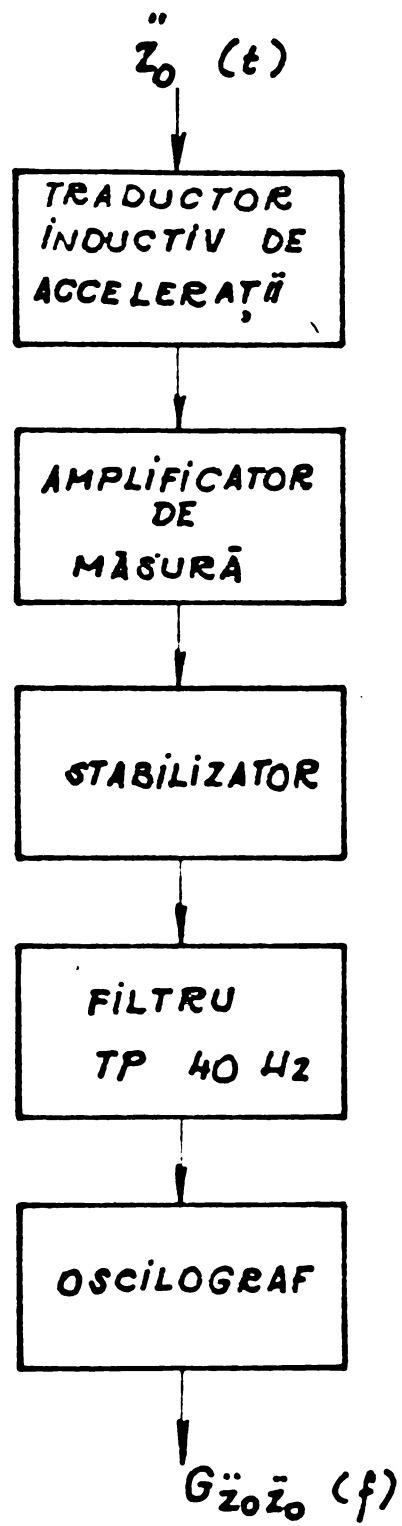


fig. 116

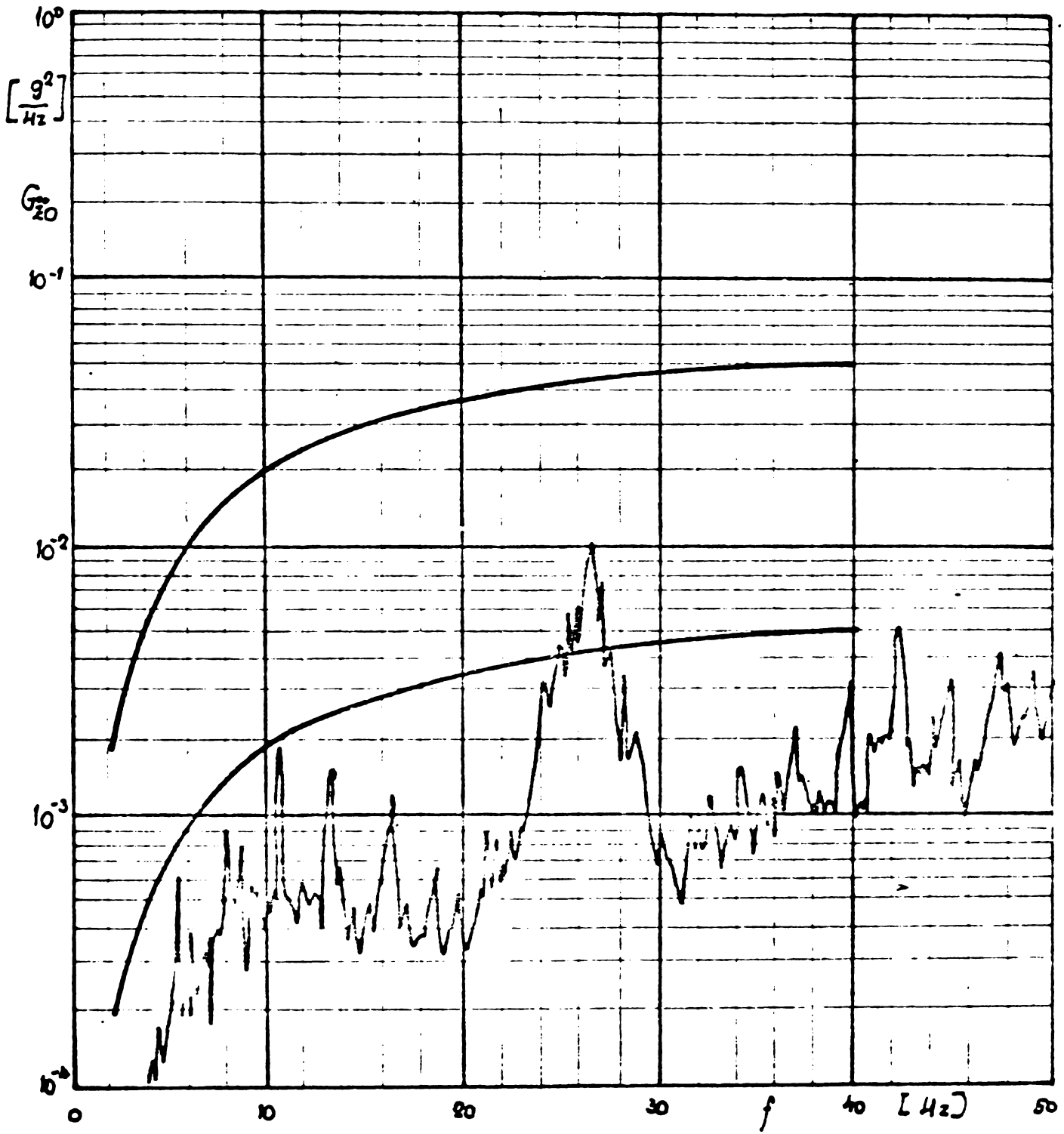


Fig. 117

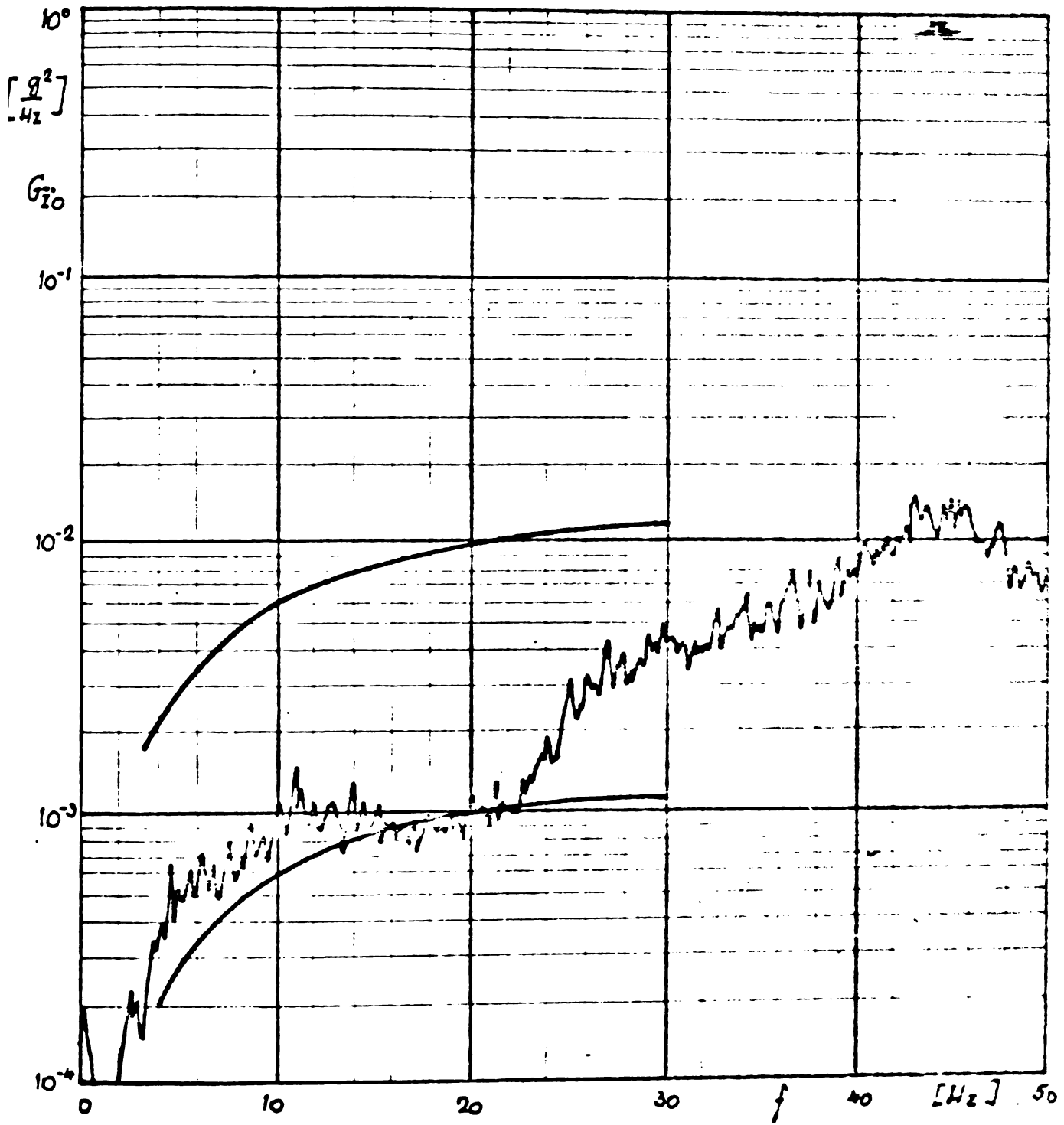
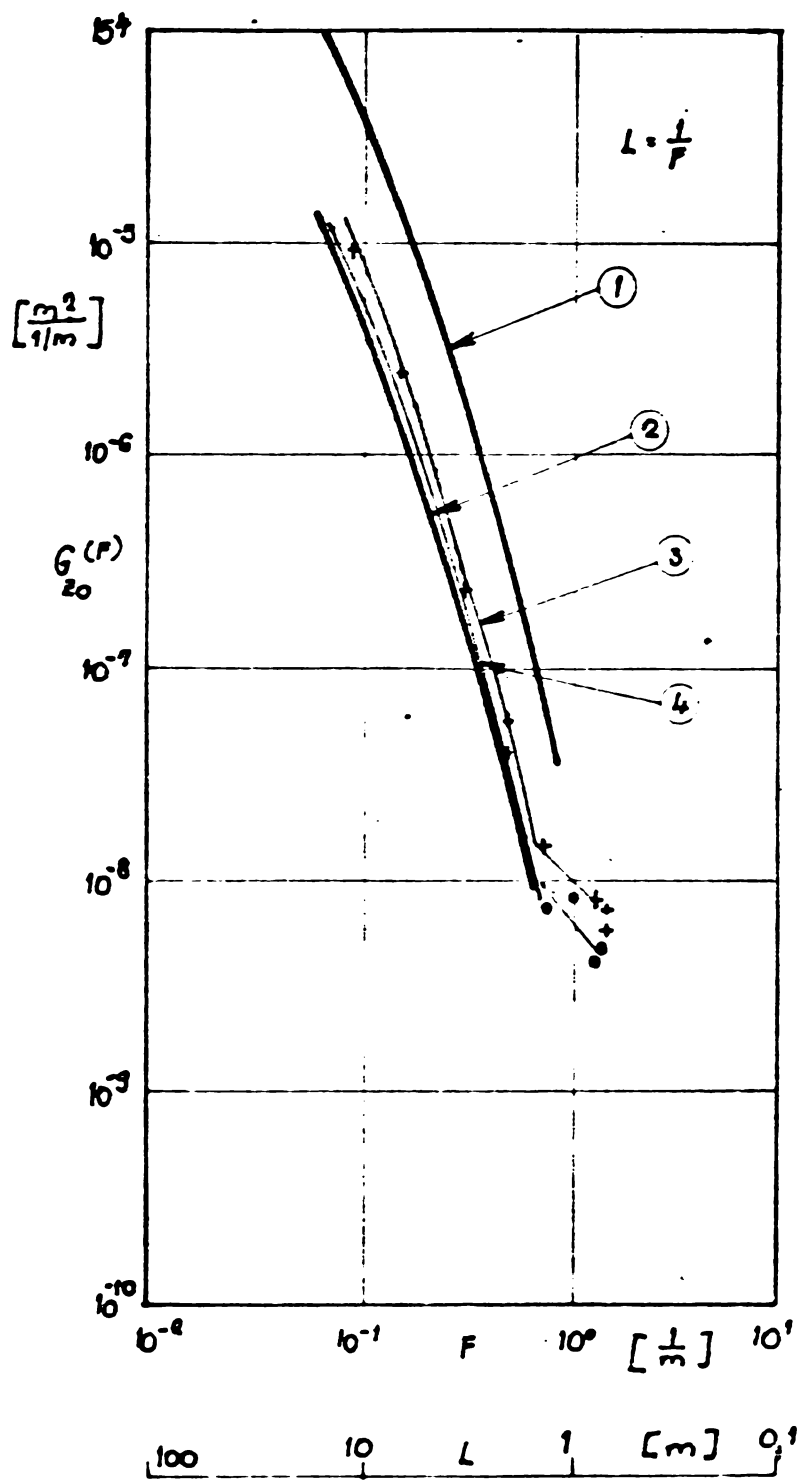


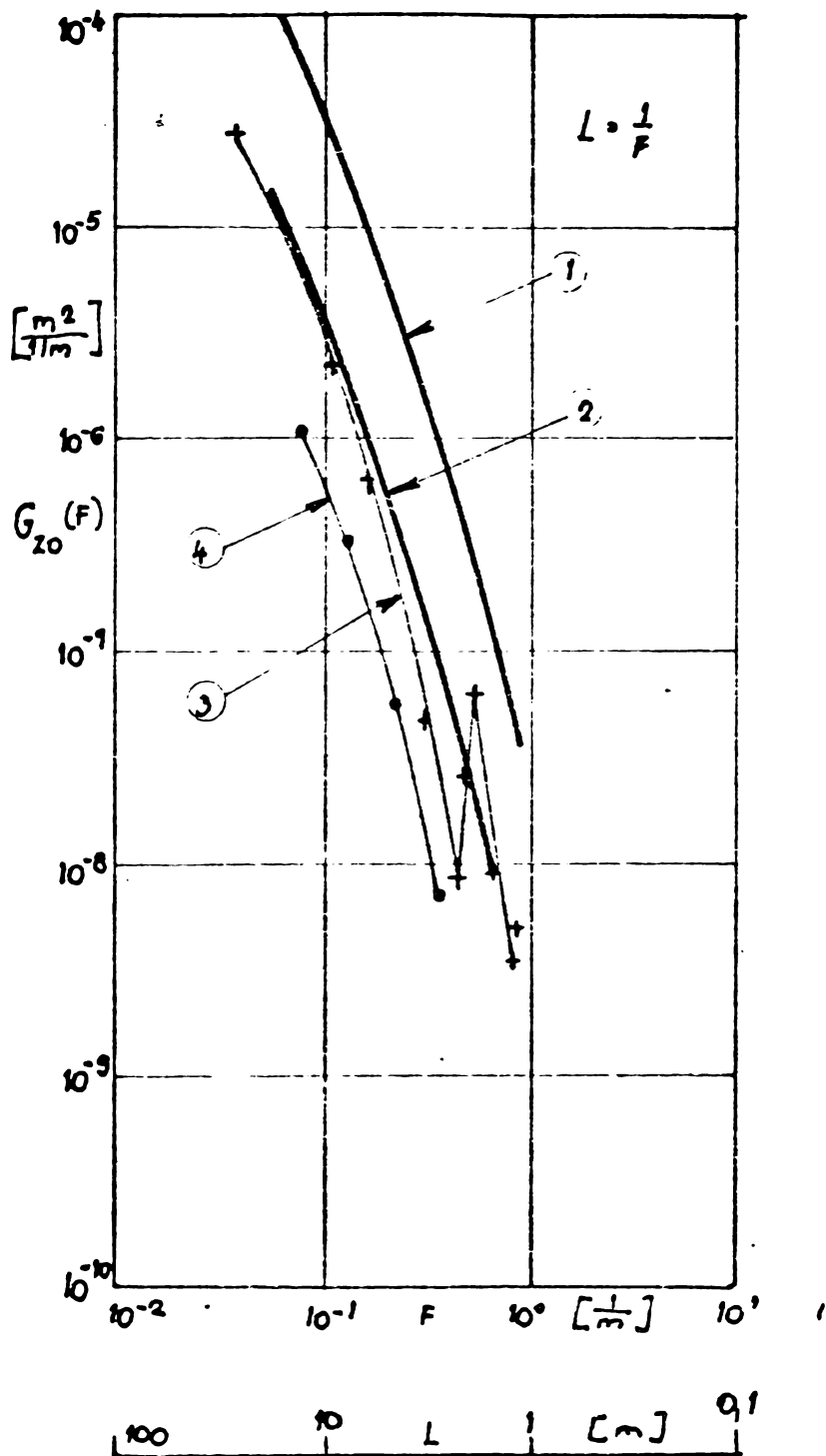
Fig. 118



- Legenda:
- ① Formula G_{20} ; cap 2.2 $K_{I20} = 1$
 - ② Formula G_{20} ; cap 2.2 $K_{I20} = 0,1$
 - ③ Însușirea maximelor ; BORDEAUX-PAUILLAC
 - ④ Însușirea minimeilor ; BORDEAUX-PAUILLAC

(③ și ④ prelucrate după măsurătorile în mers pe cutia de unsoare a vagonului cod 230)

Fig. 119



Legenda: 1. Formula G_{20} ; cap. 2.2. $K_{f20} = 1$
 2. Formula G_{20} ; cap. 2.2. $K_{f20} = 0,1$
 3. Înălțarea maximelor; ANGOULEME-POITIERS
 4. Înălțarea minimelor; ANGOULEME-POITIERS

(3) și (4) prelucrate după măsurători în mers pe
 cutia de unsoare a vagonului cod 230.

fig. 120

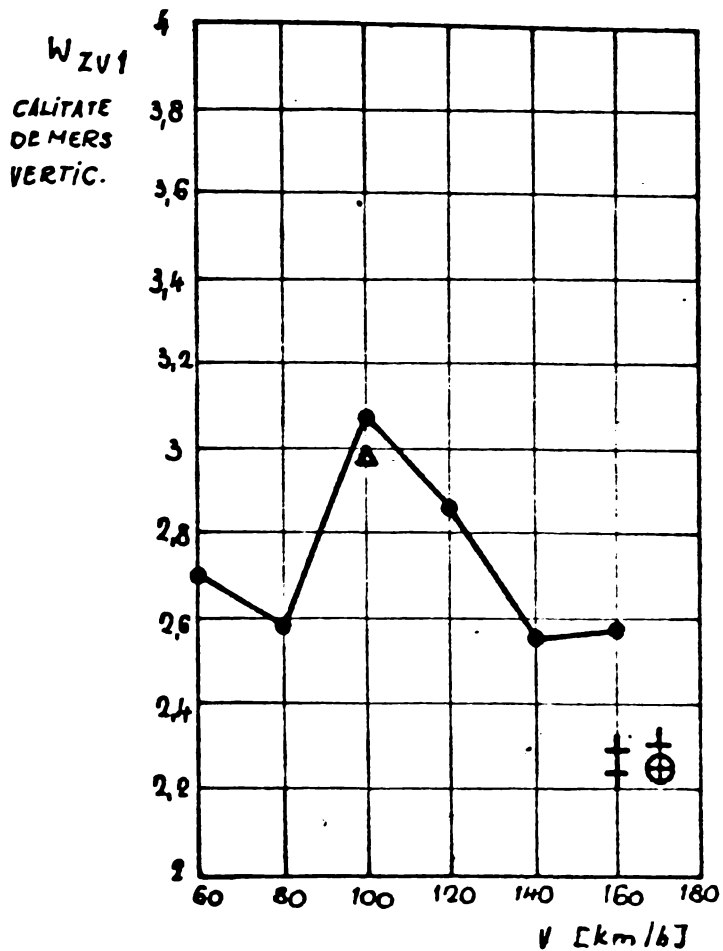


Fig. 121

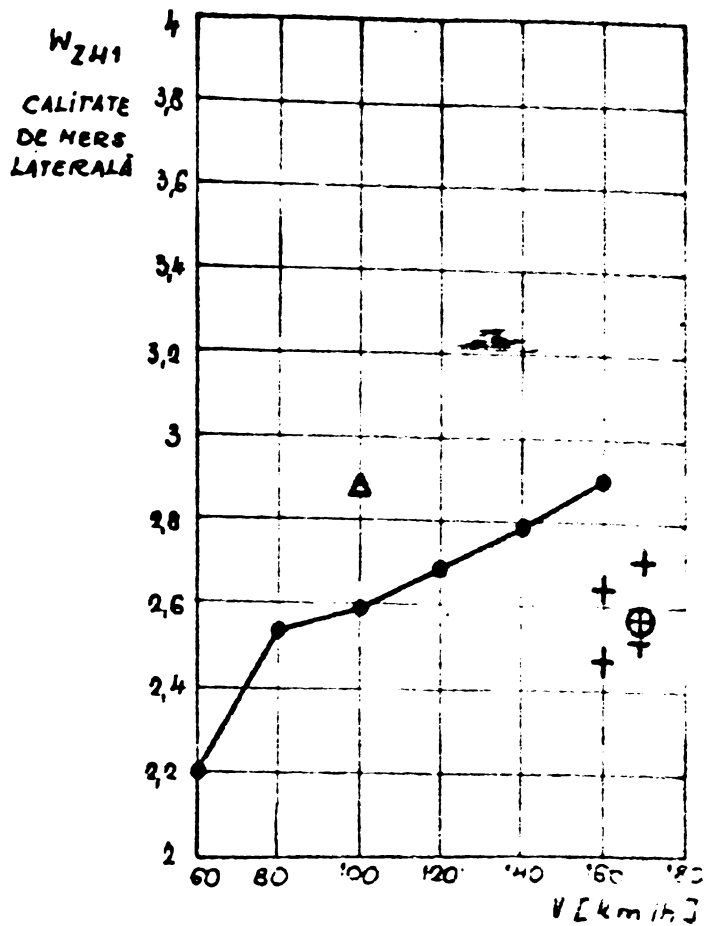


Fig 122

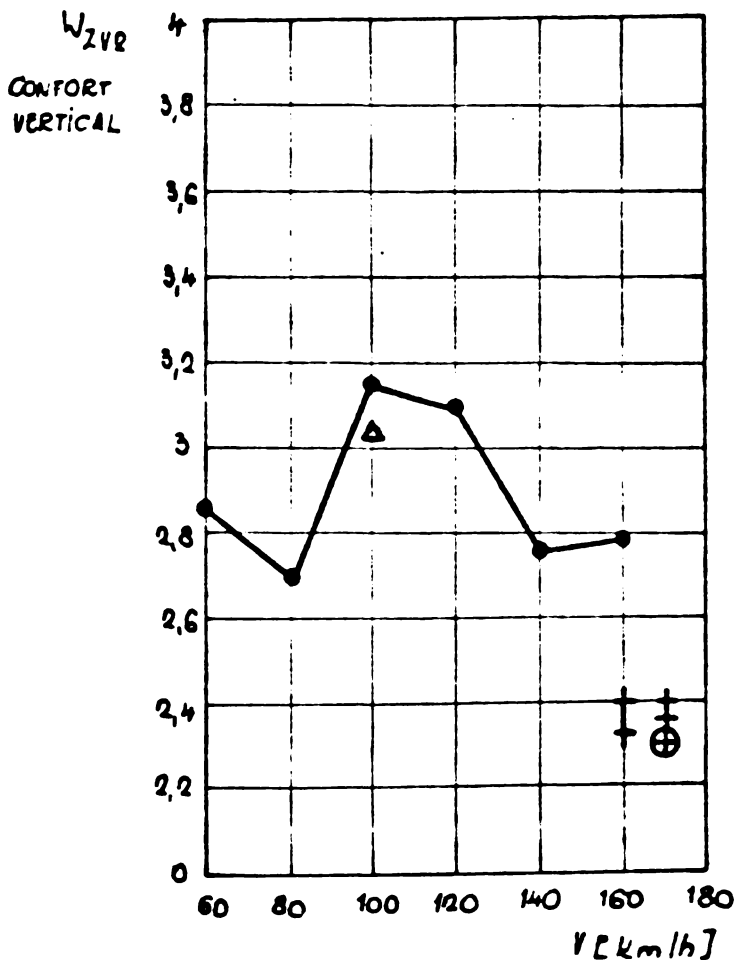


Fig. 123

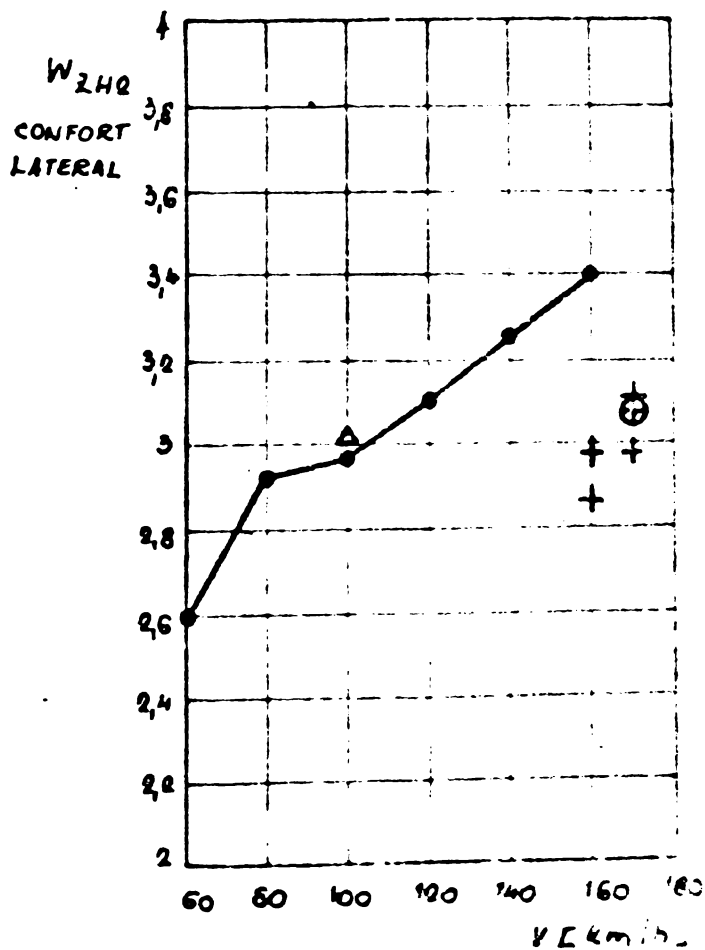


Fig 124

Legendă:

- VALORI MĂSURATE PE INELUL DE FĂUREI ÎN NOI. 1930
 - ⊕ VALORI MĂSURATE ÎNTRE ANGOULEME ȘI POITIERS
 - + VALORI MĂSURATE ÎNTRE FACTURE ȘI MORGEX
 - Δ VALORI MĂSURATE ÎNTRE BORDEAUX ȘI PAVILLAC
- ÎN MAI 1931 LA COPRELI.

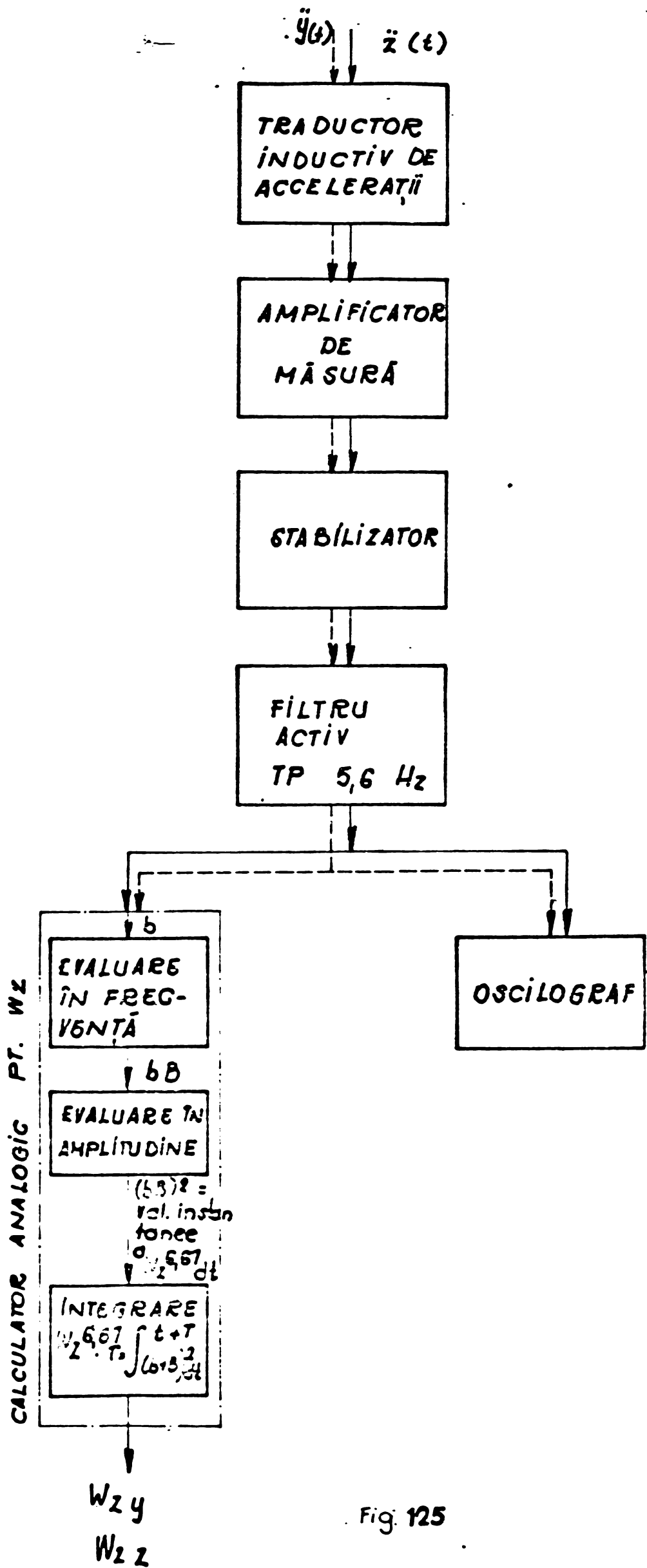
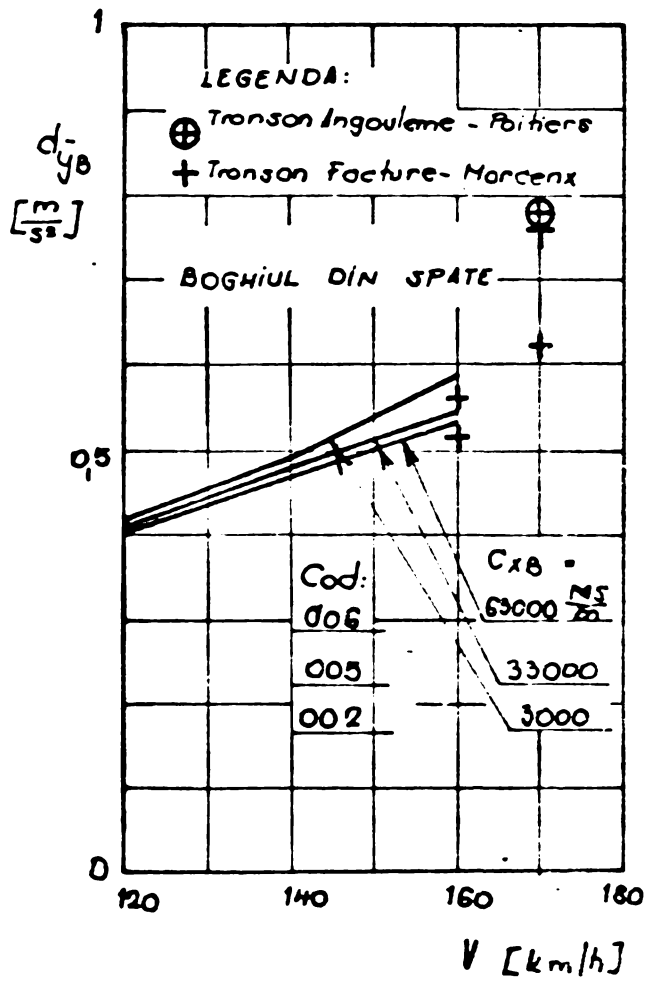
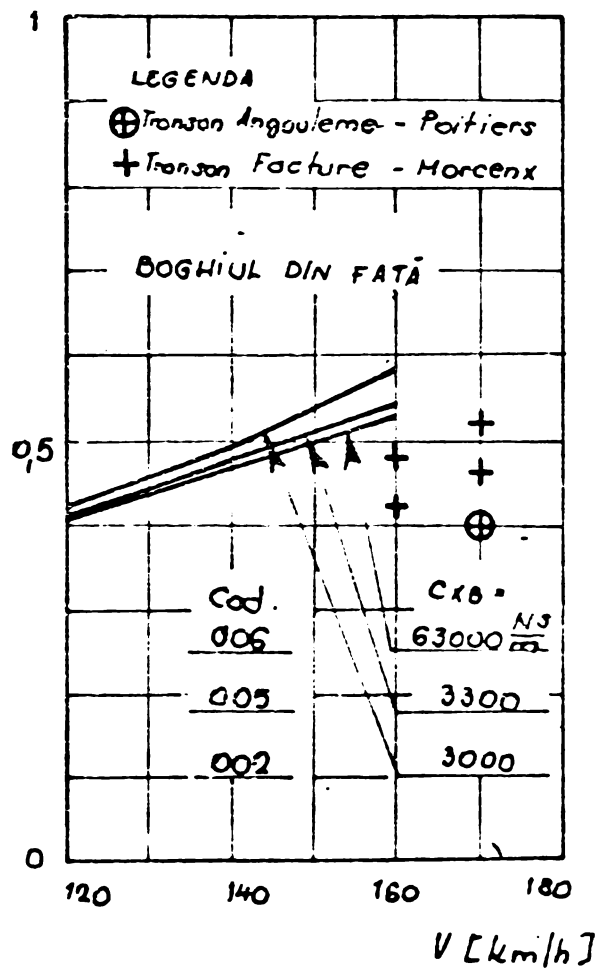


Fig. 125



b)



a)

Fig. 126

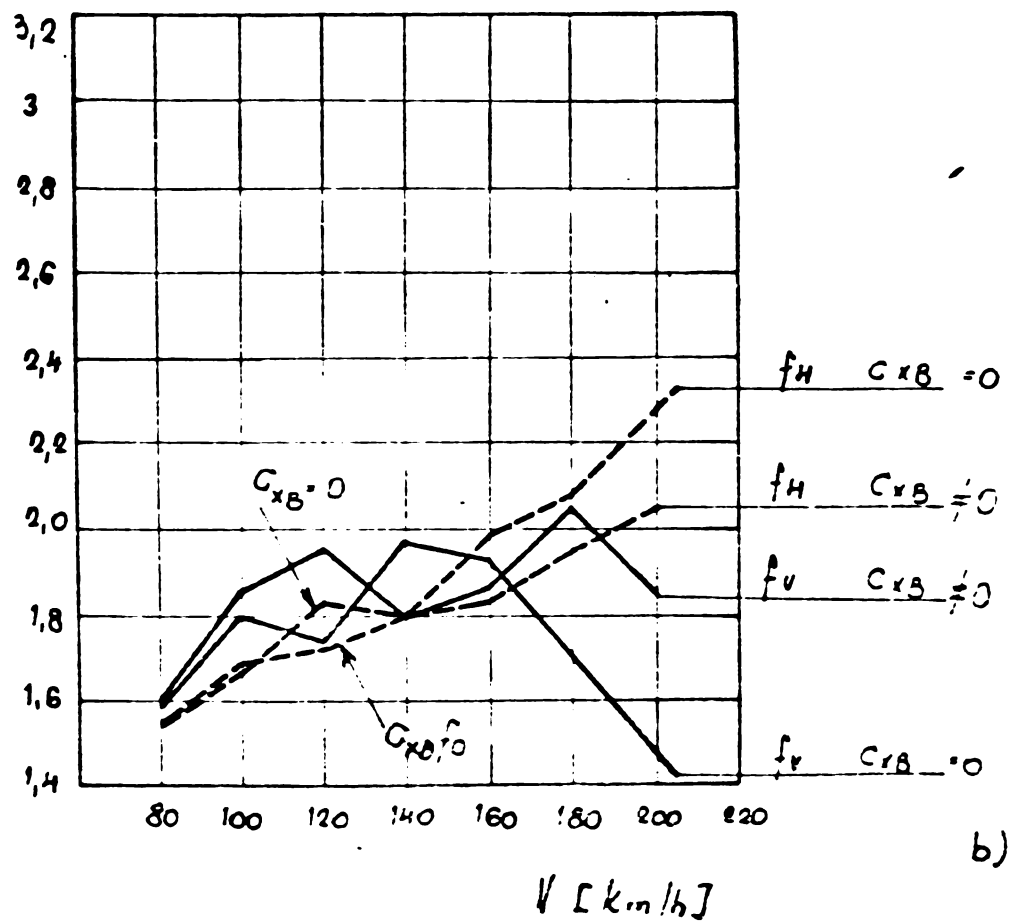
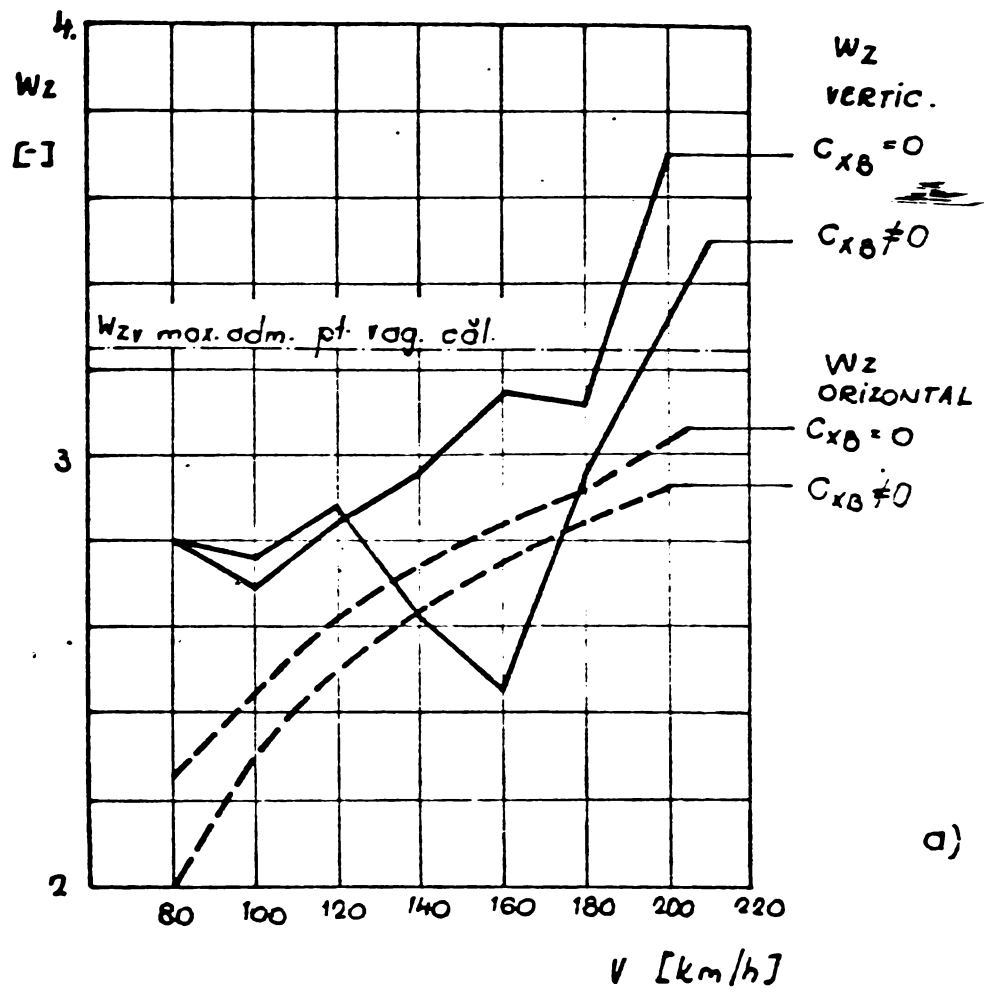


Fig. 127

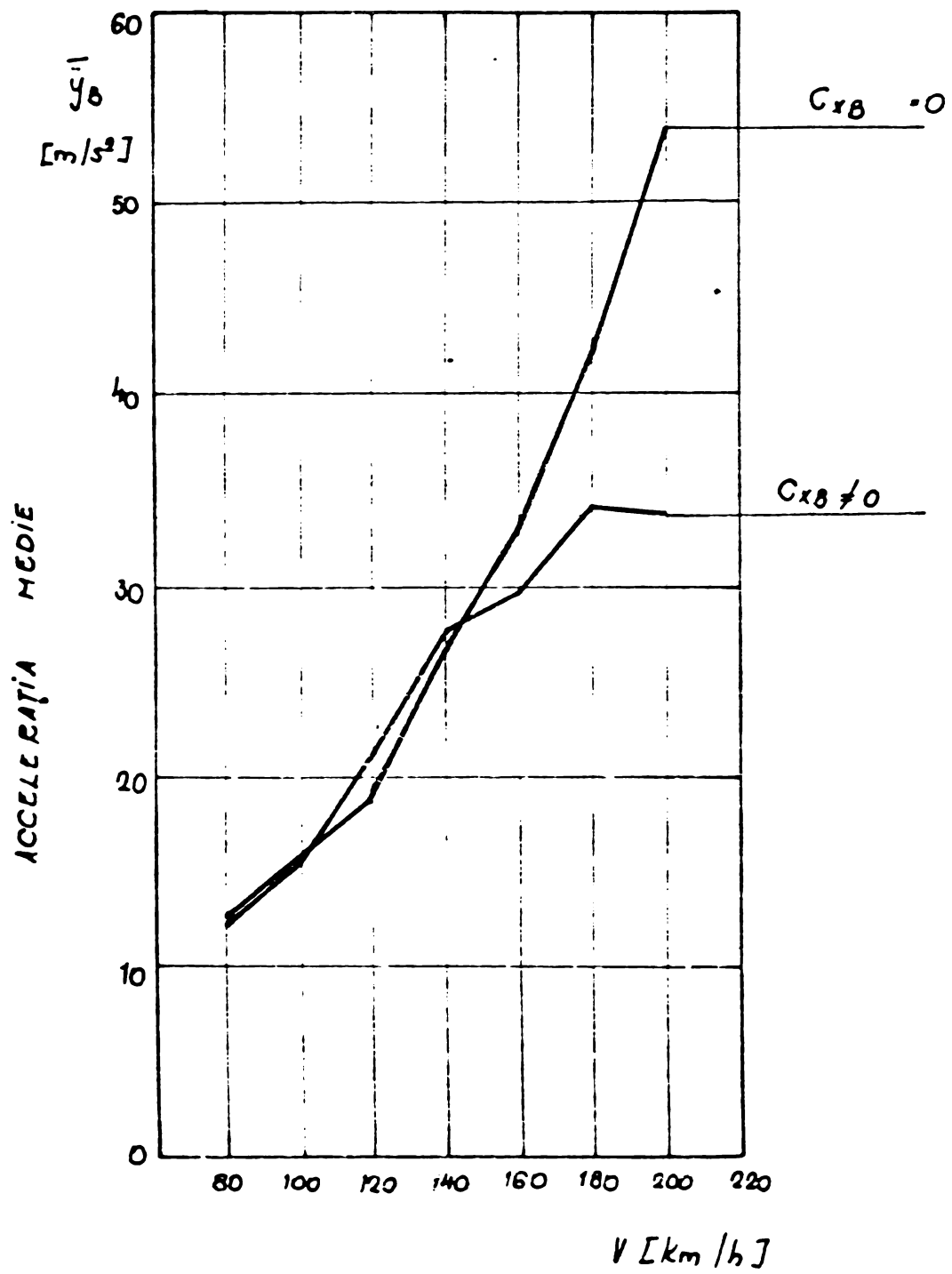


Fig. 128

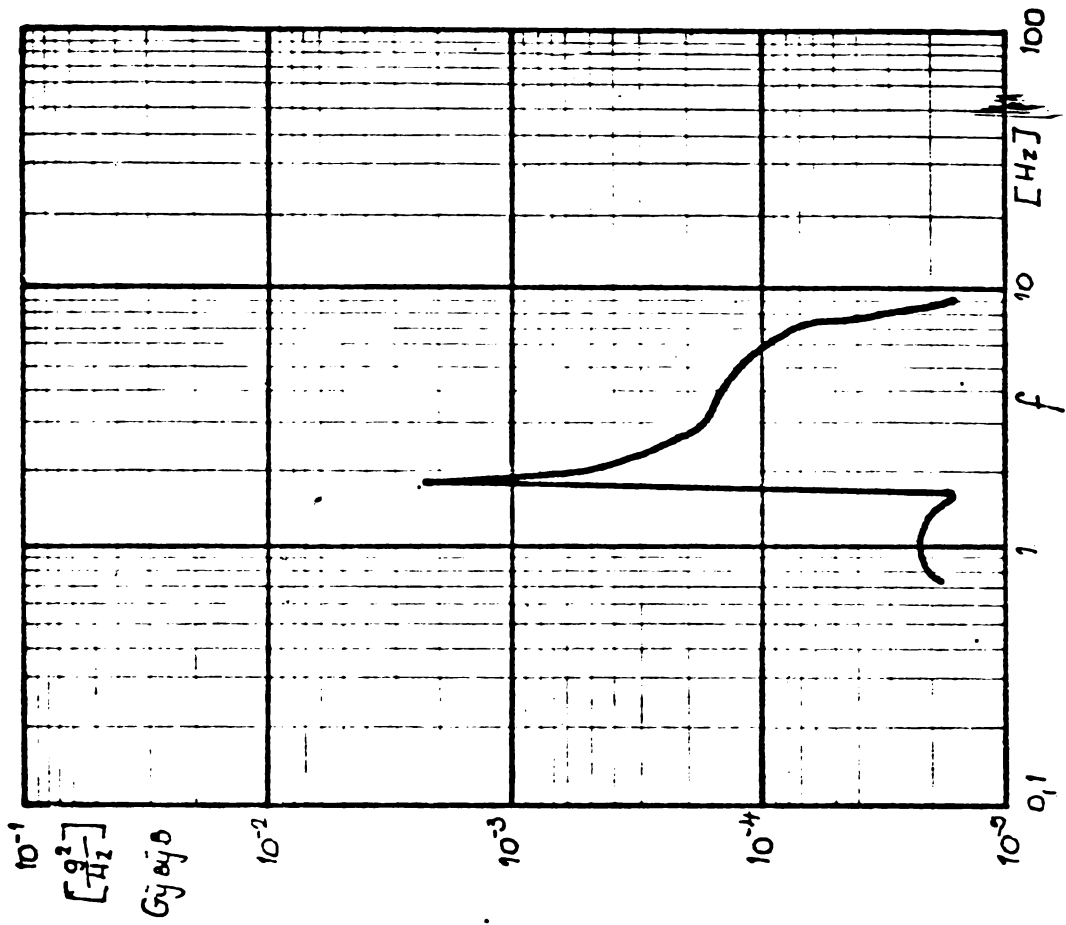


Fig. 129

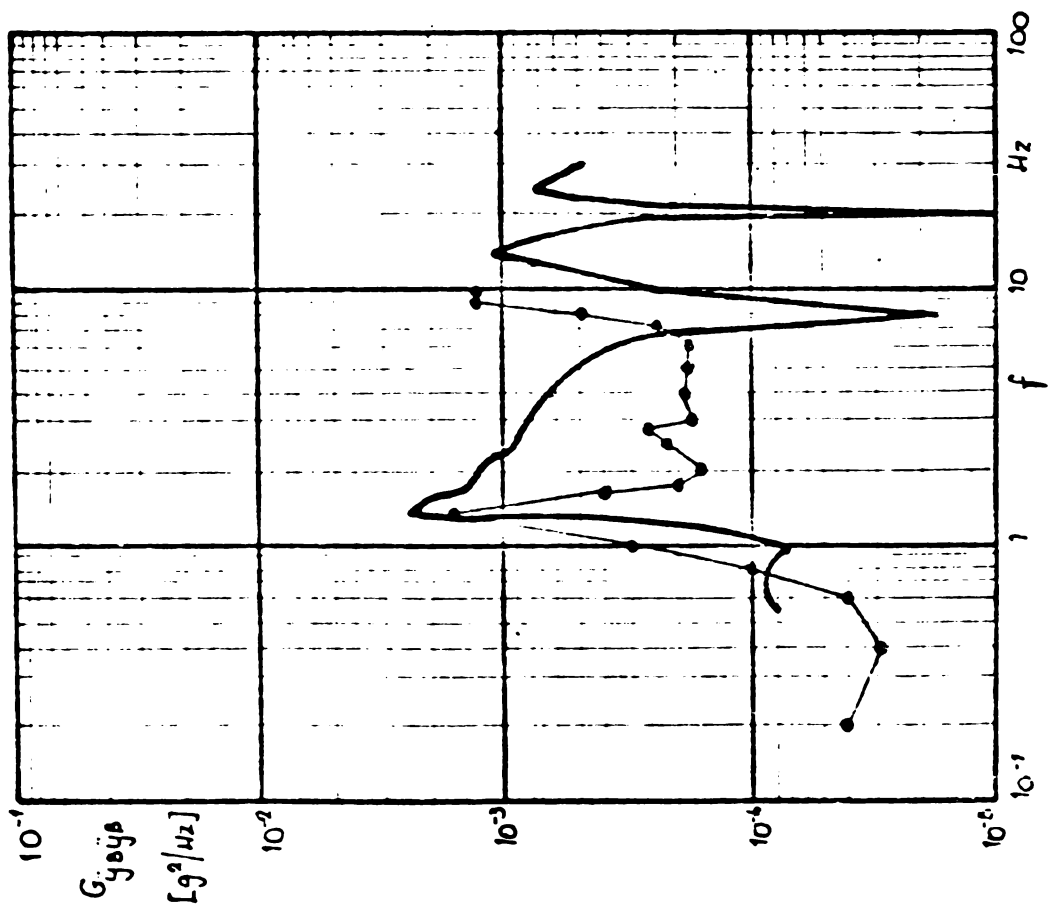
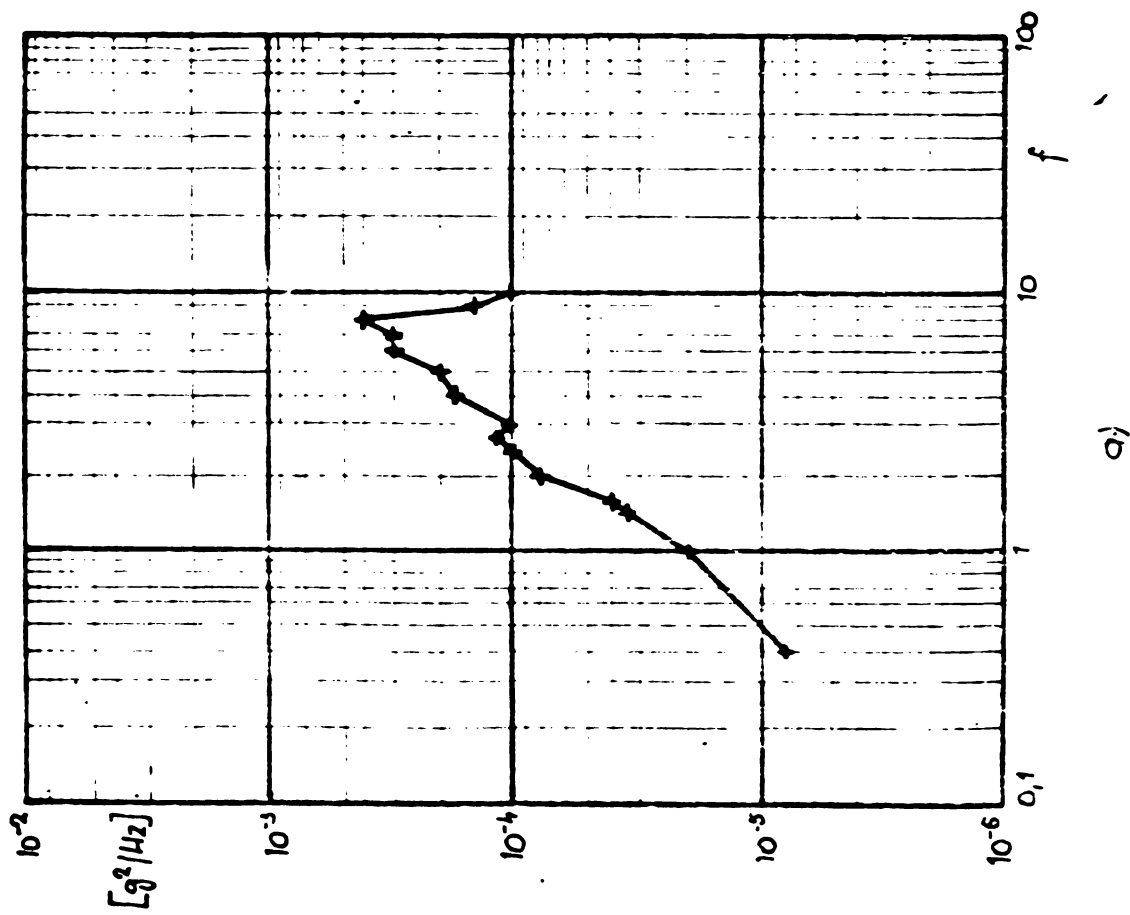
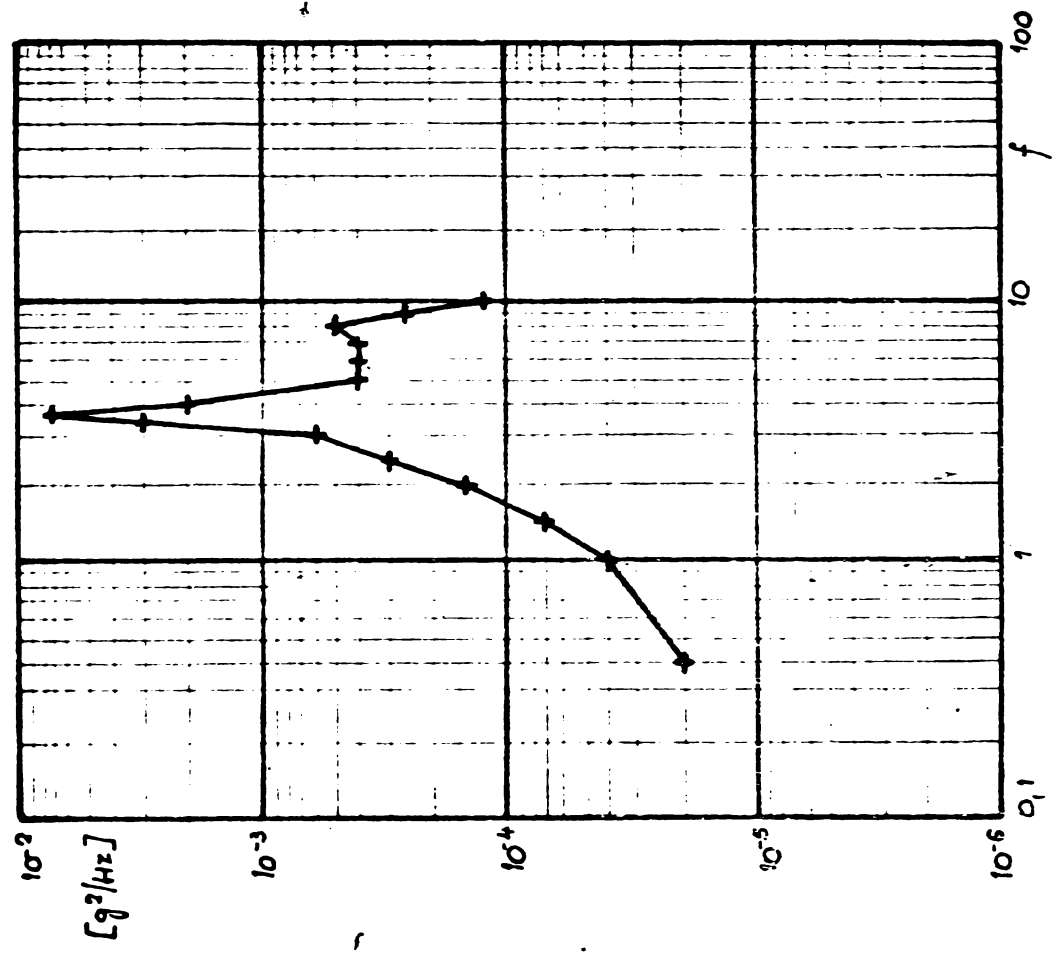


Fig. 131



a)



b)

Fig. 130

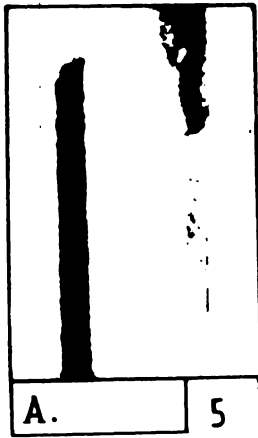
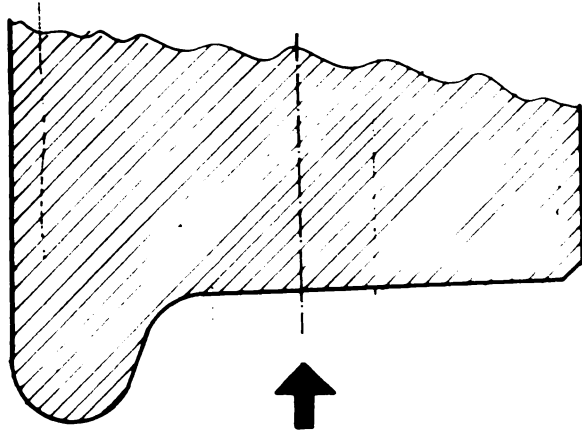


Fig. 132

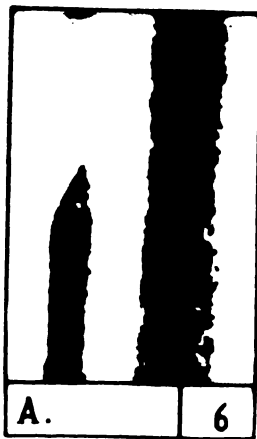
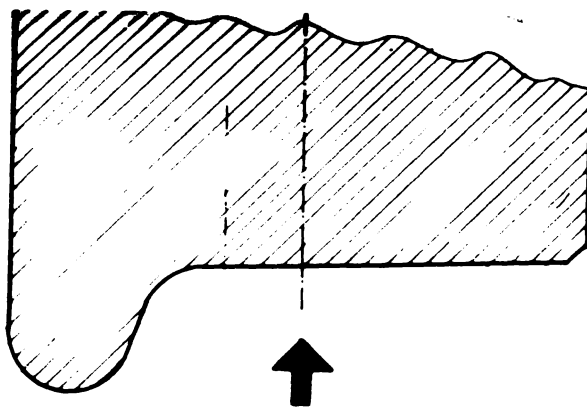
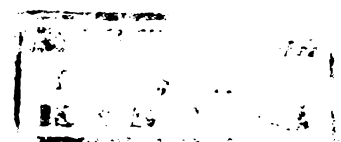


Fig. 133



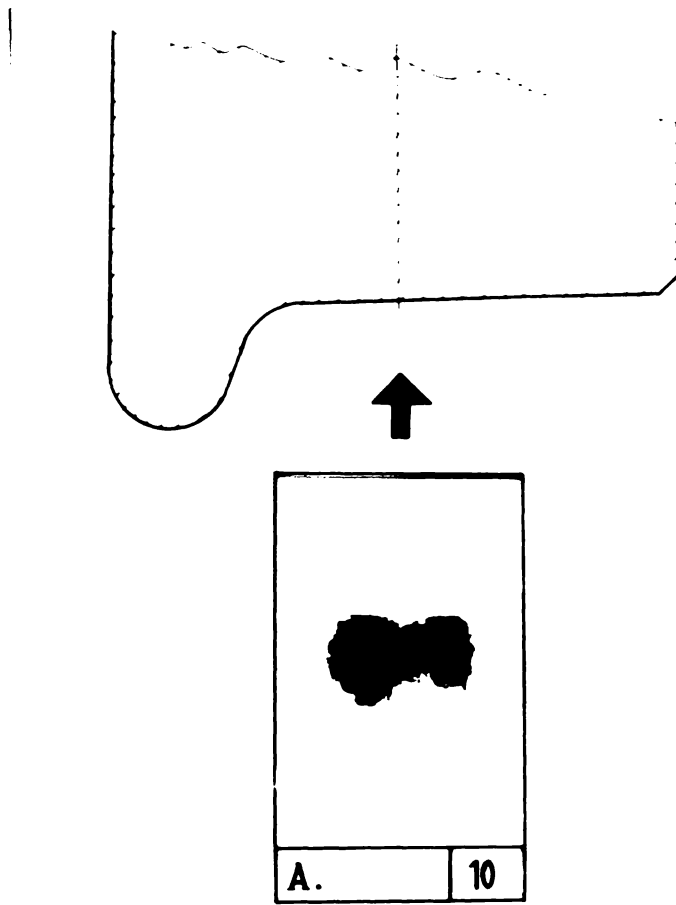


Fig. 134

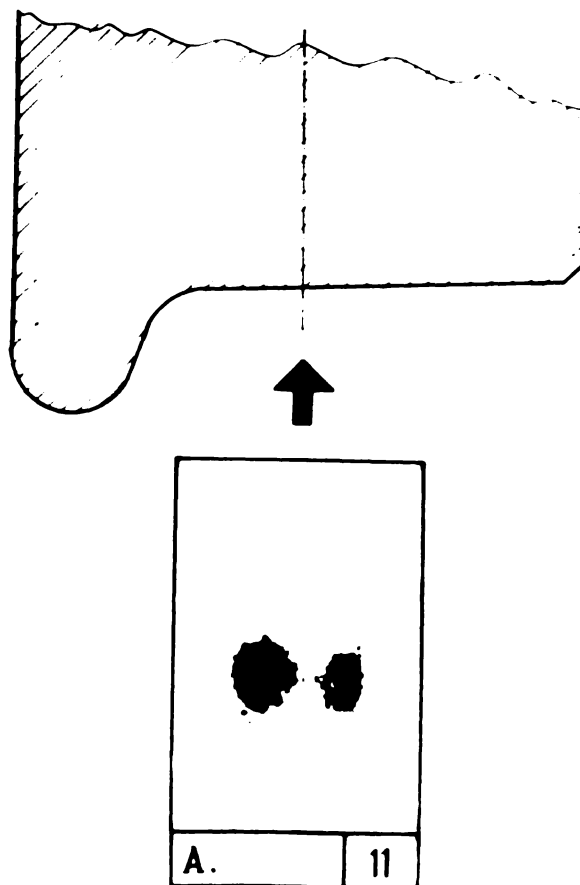


Fig. 135

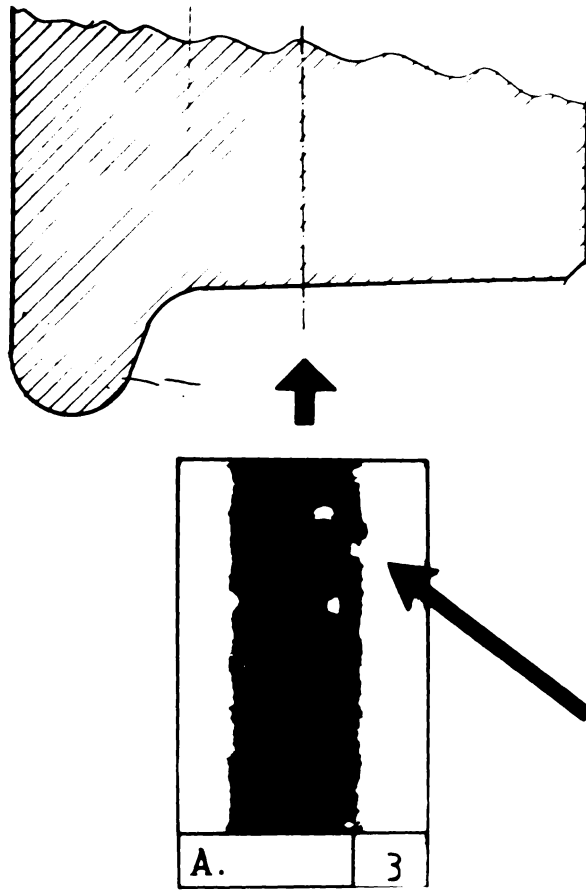


Fig. 136

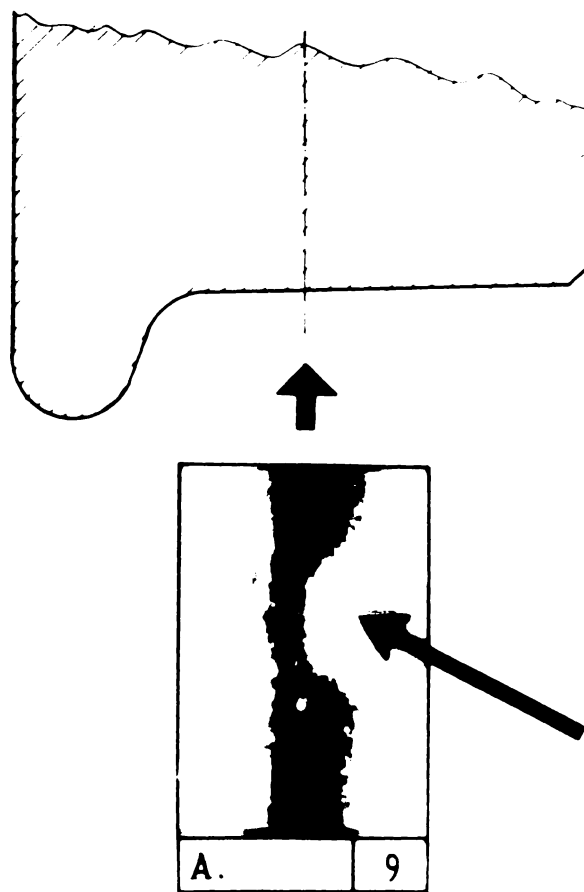


Fig. 137

Tipul vehiculului : LDE CoCo Seria : DA - 1319 Depoul : Arad Perioada serviciului : 7.02.80 - 15.01.81
 PARCUL SUI 250 x 10³ km

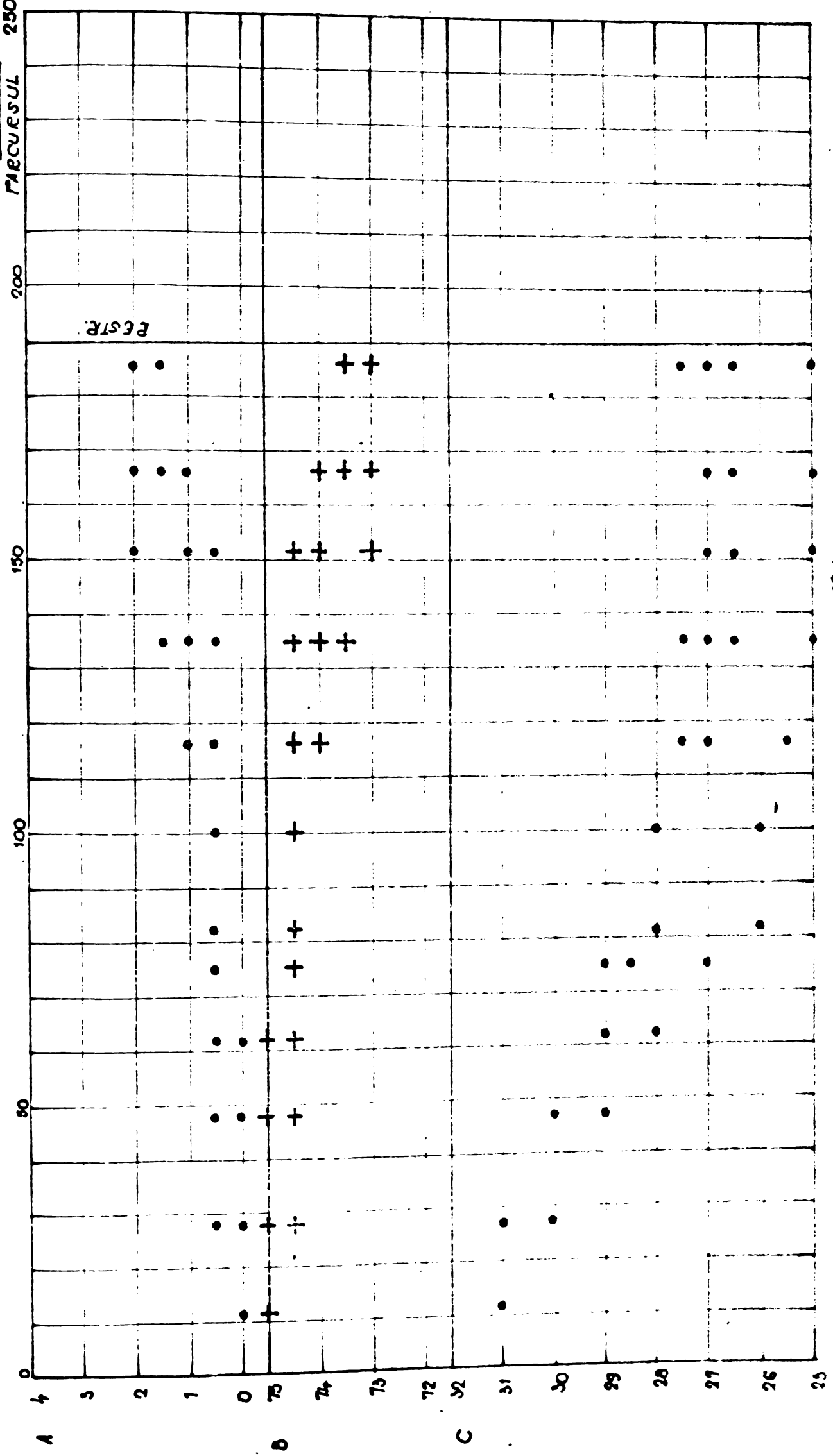


Fig 138

Perioada : 12.01.80 - 12.03.81
 Serviciul : Călători
 Tipul vehiculului : LDE Co-Co Senso : DA - 1340 Depoul : 1rod
 PARCUREA : 250 · 10³ km

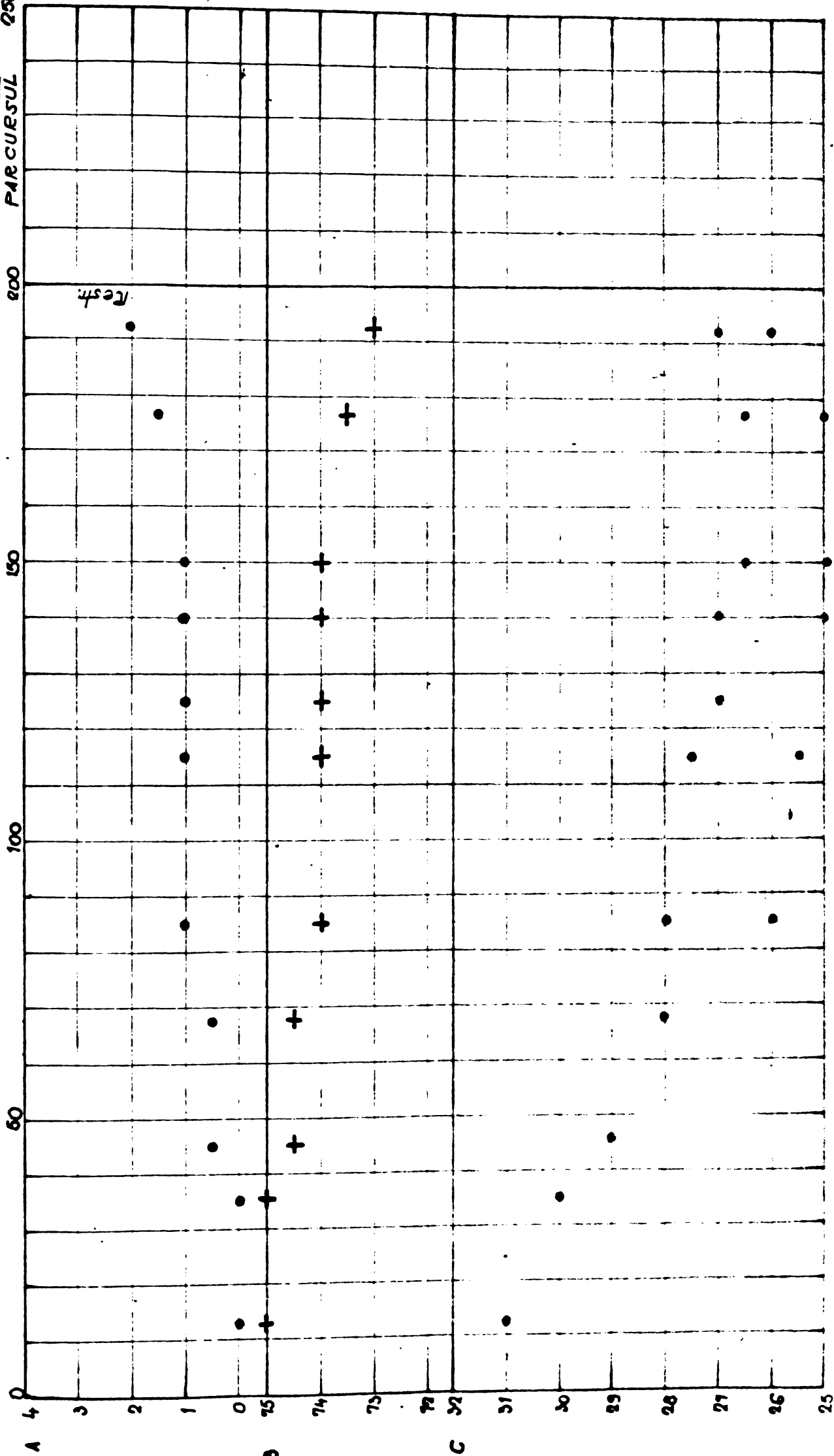


Fig 139

Tipul vehiculului : LDE Co-Co Seria : DA - 1340 Depoul : Arad Perioada Serviciul : Arad - Jasi 24.04.81 - 3.09.81
 Căldări

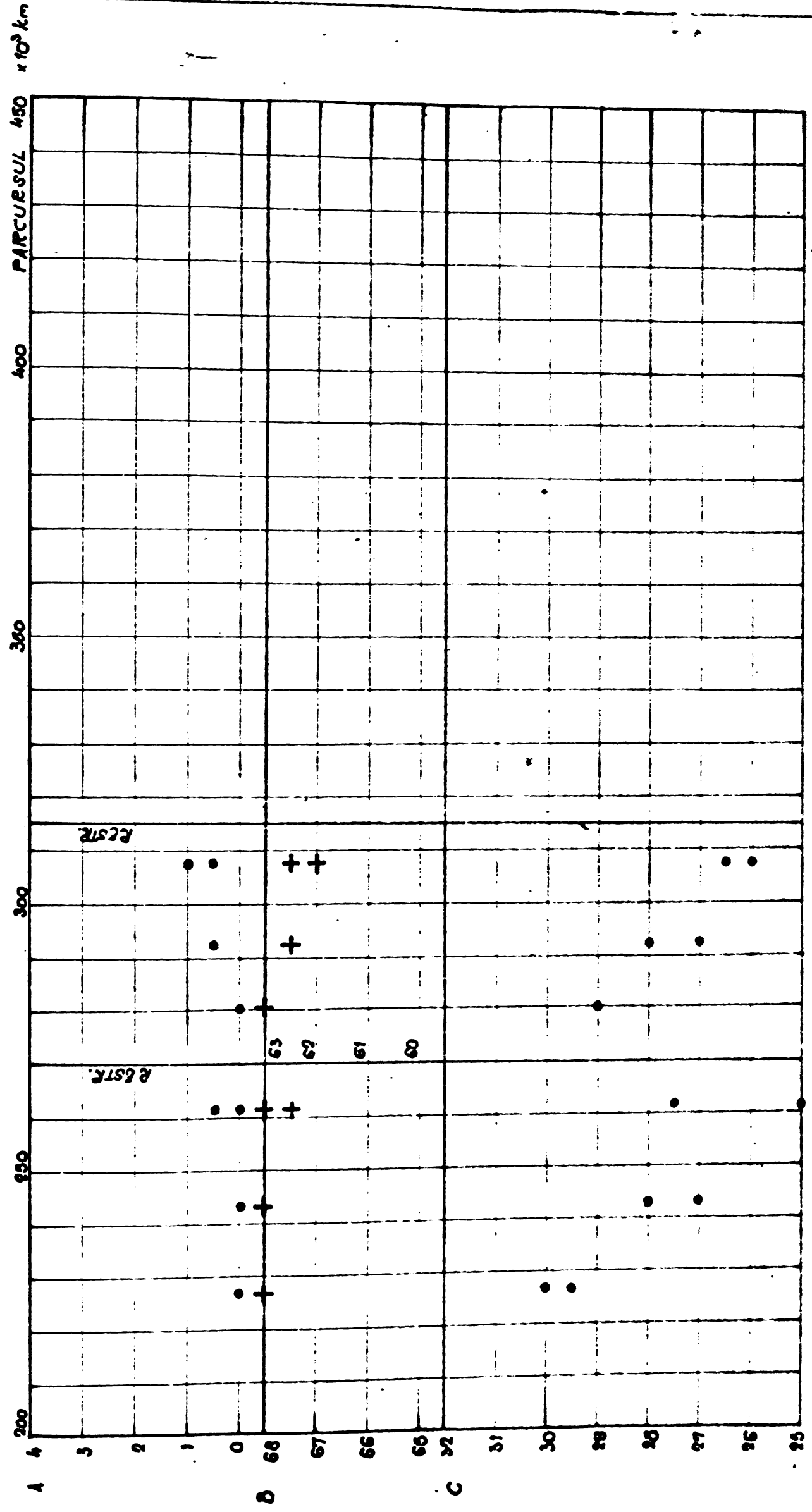


Fig. 140

Tipul vehiculului : LDE C₀ C₀ Seria : DA - 1346 Depoul : Arad Perioada : 29.05.80 - 23.09.81
 Serviciul : Călători Arad - Jasi

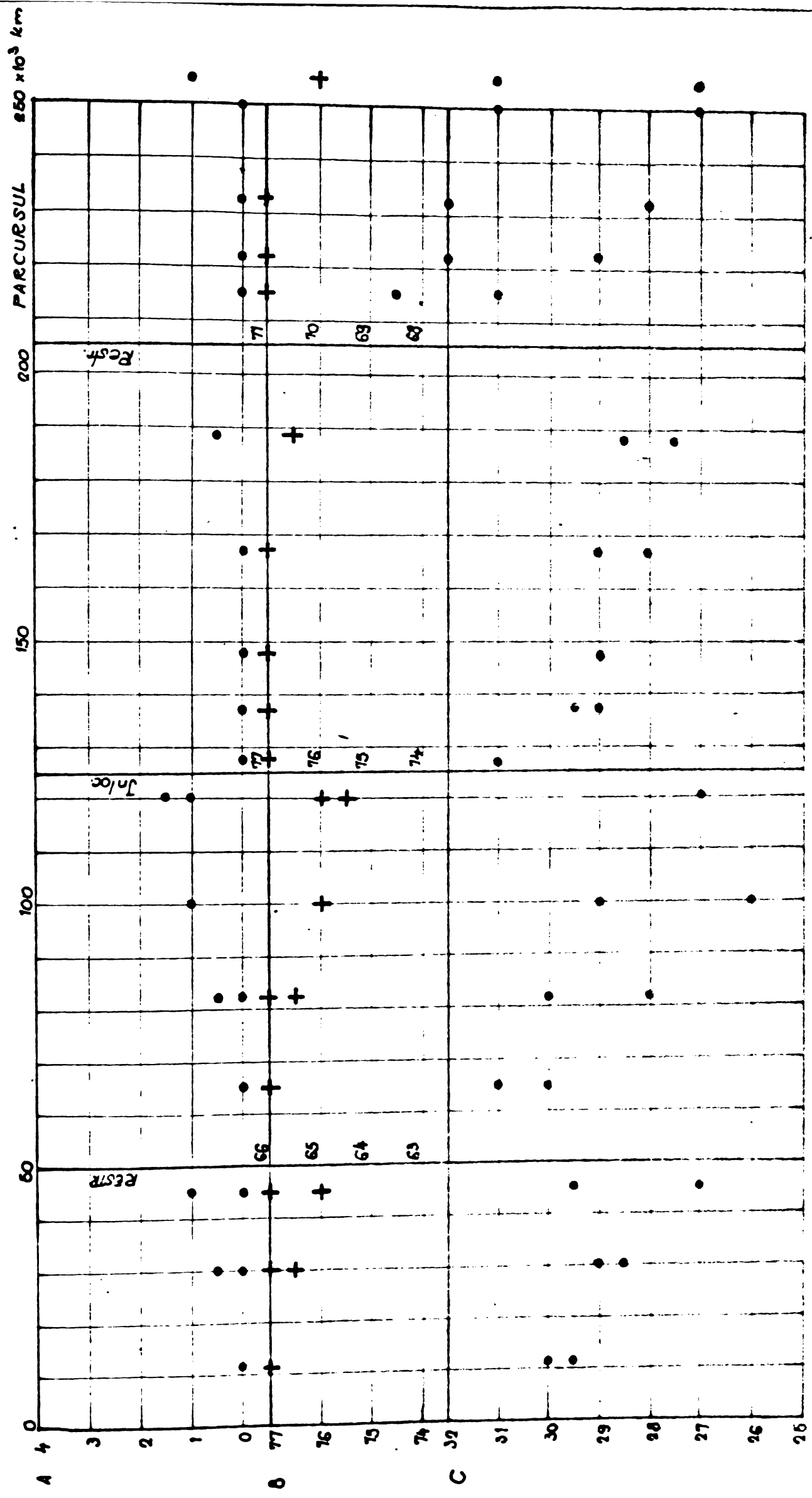


Fig. 141

Tipul rehiculului : LDE Co-Co Seria : DA - 1368 Depoul : Arad Perioada : 6. I. 81 - 26. IV. 81
 Că/6 toni Argod. Grăsoar 200 x 103 km
 PĂRCURSUL

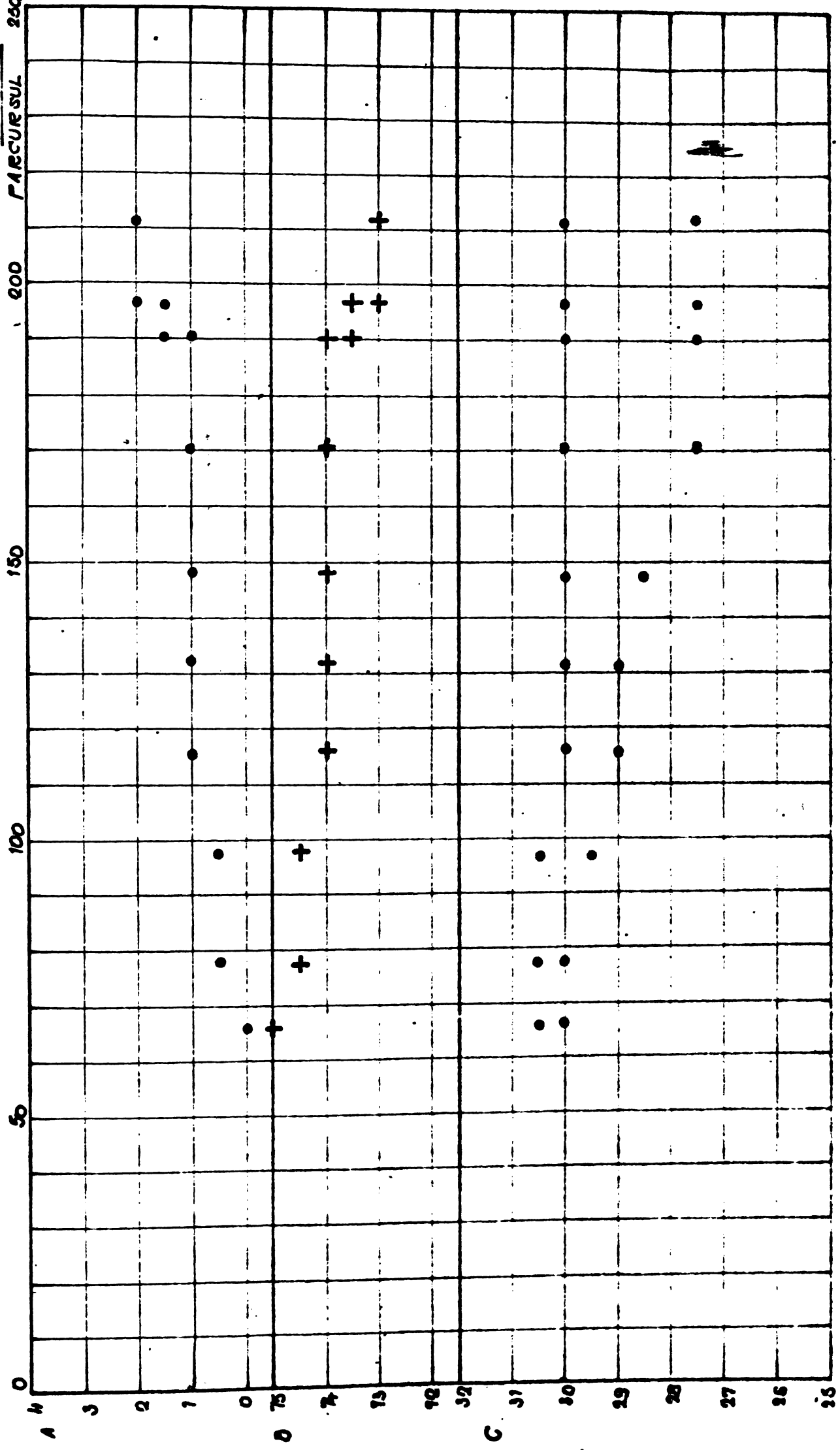


Fig. 142

Tipul vehiculului : LDH 8-0 Seria : DHC- 505 Depoul : Arad Perioada : 3.II.80 - 4.II.81
 Serviciul : Coldfoni Arad - Orad

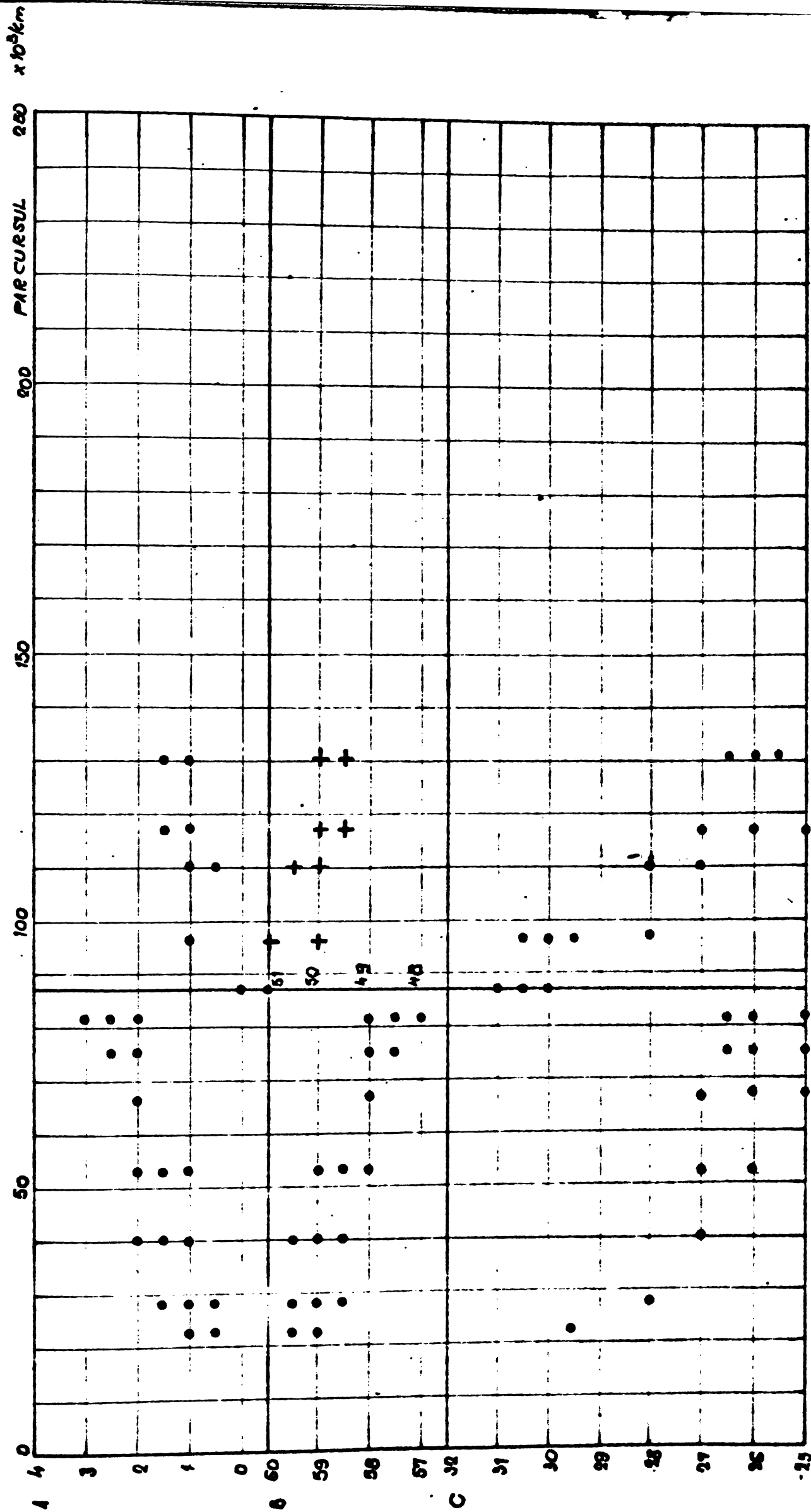


Fig. 143

Tipul vehiculului • LE C₀ C₀ Serio : EG 117 Depoul : Arod Perioada Serviciului : 1.11.80 - 2.11.81 Căldători Curbai-Oronesești PARCUREȘUL $250 \cdot 10^3 \text{ km}$

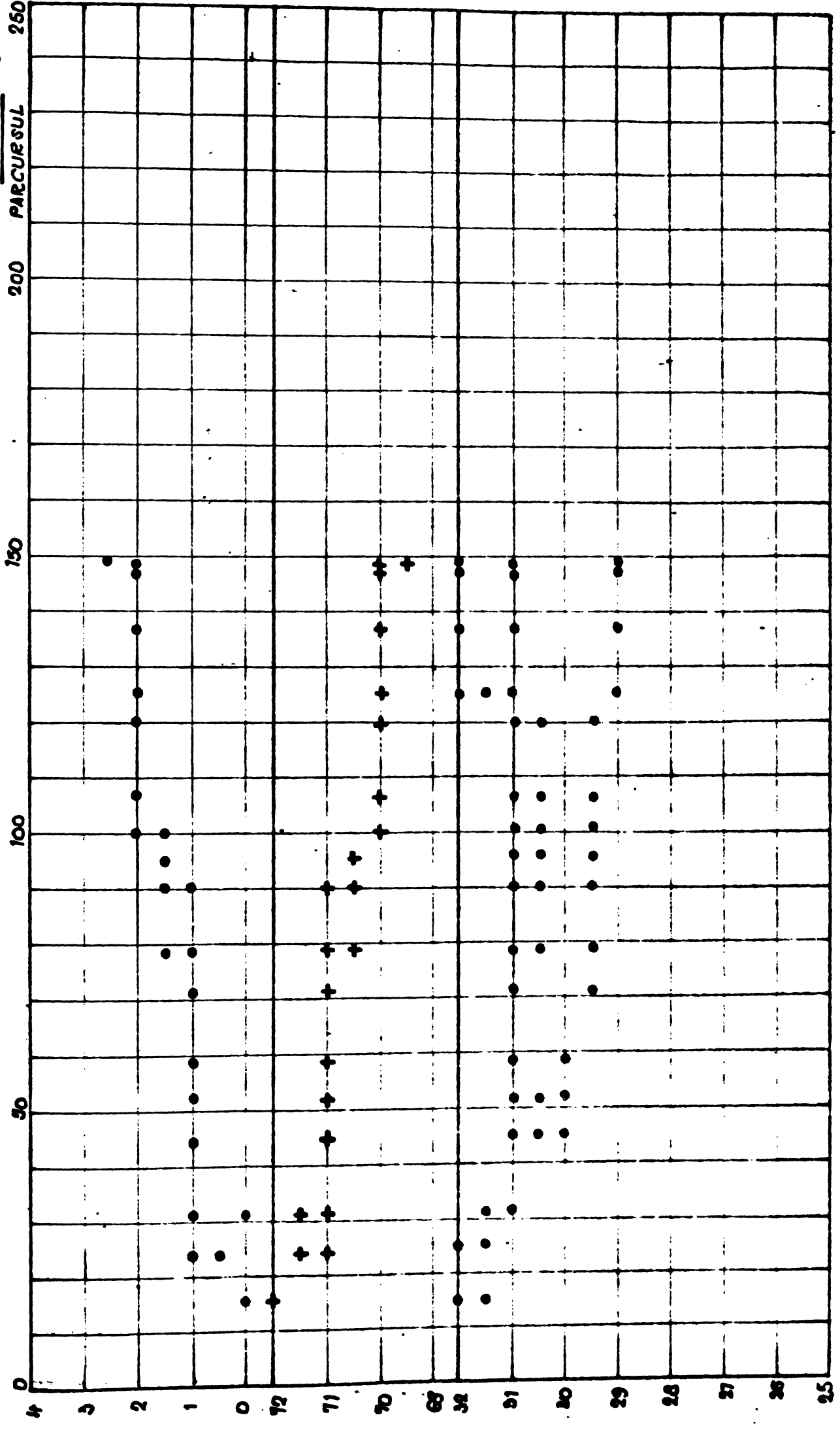


Fig. 144

Tipul vehiculului : LE Co-Co Serio : 41-0092-1 Depoul : Timișoara Perioada Serviciului : 28.1.79 - 26.1.80
 Călibroni Timiș-Croia 350 x 10³ km

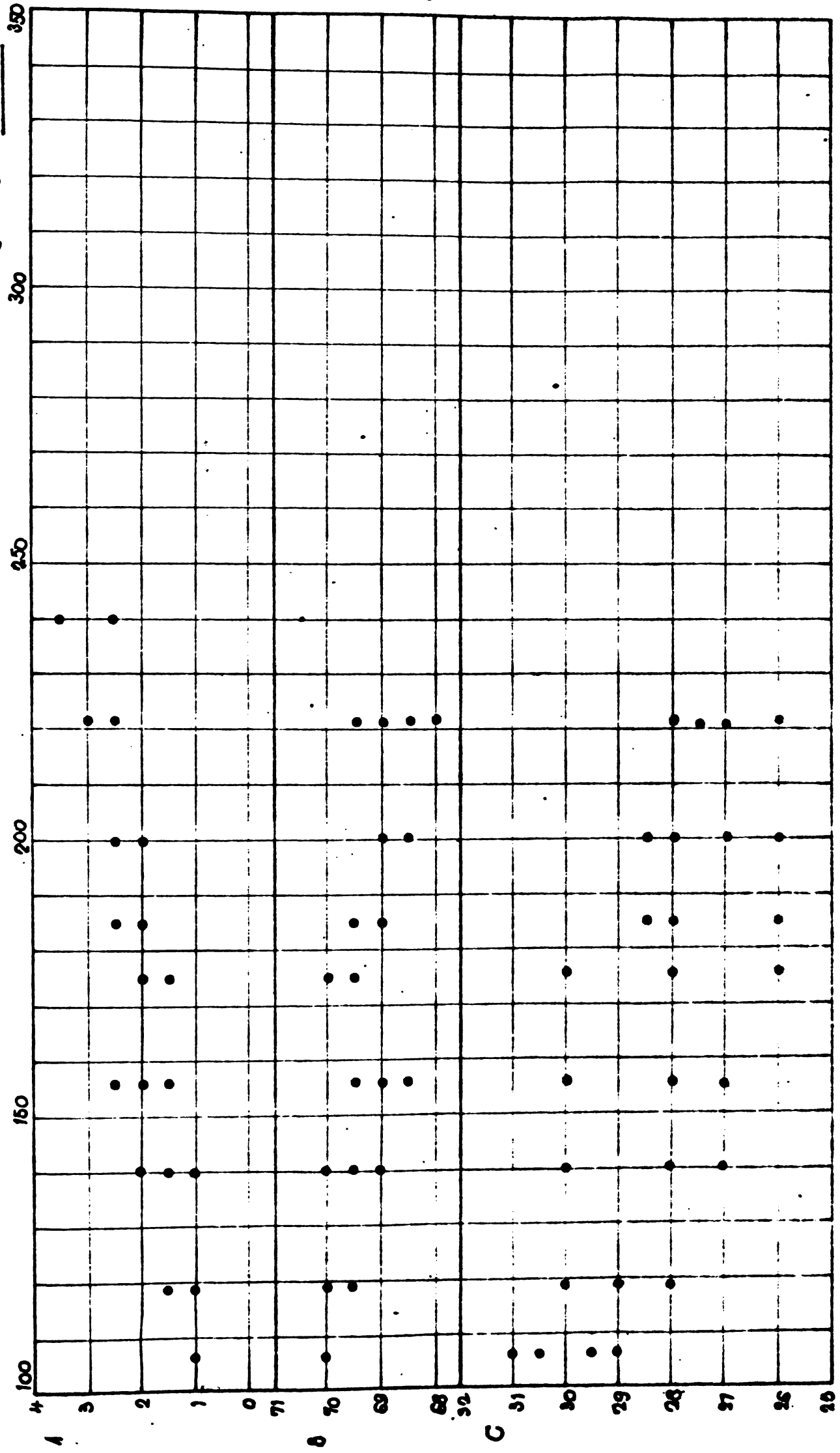


Fig. 145

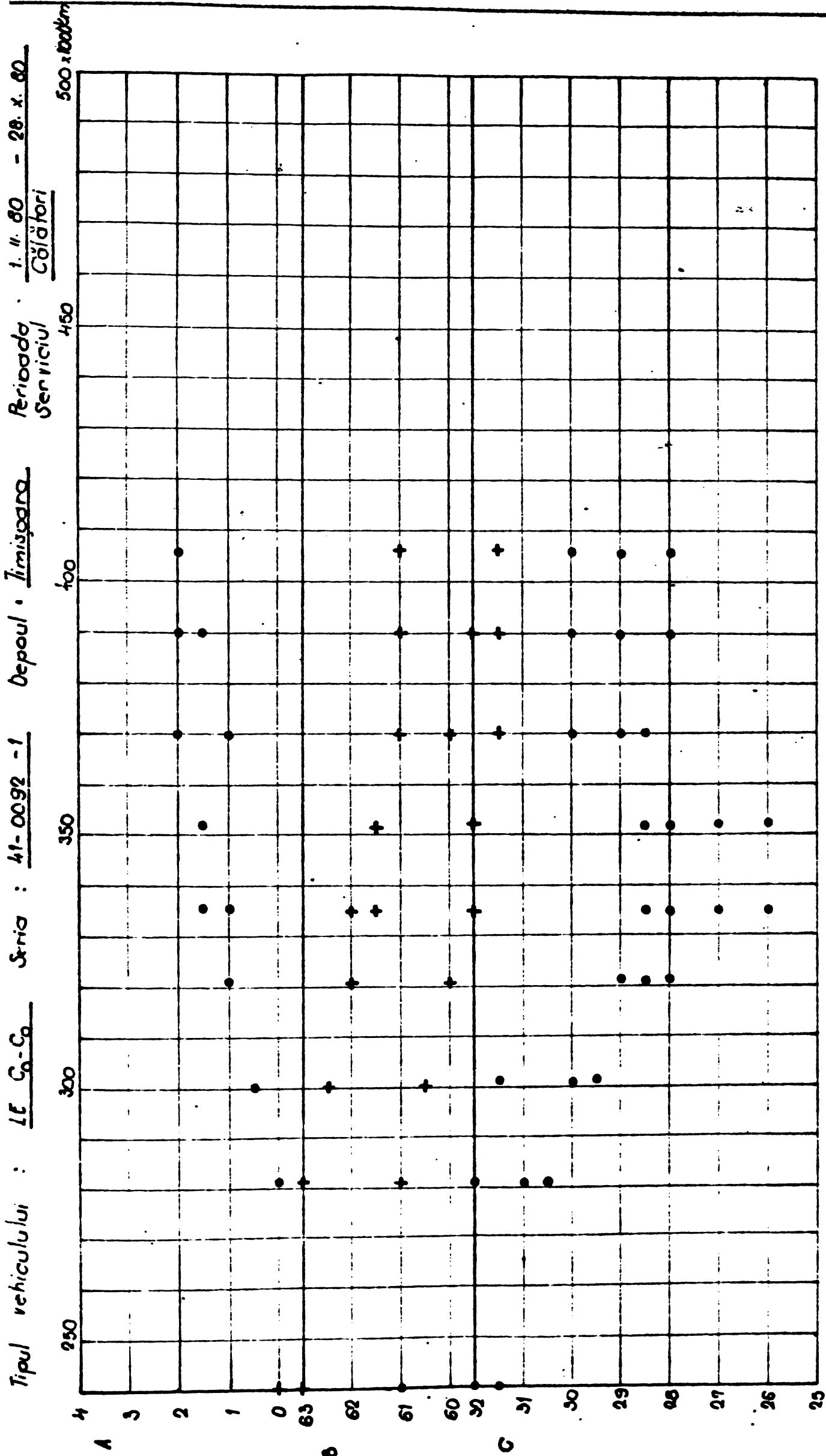


Fig. 146

Tipul vehiculului : LE G-6 Seria 40-0230-9 ; Depoul Timisoara
 Serviciul C - Serviciul Mf
 Perioada 2.V. 79 - 3.VI.80
 P [10³km]

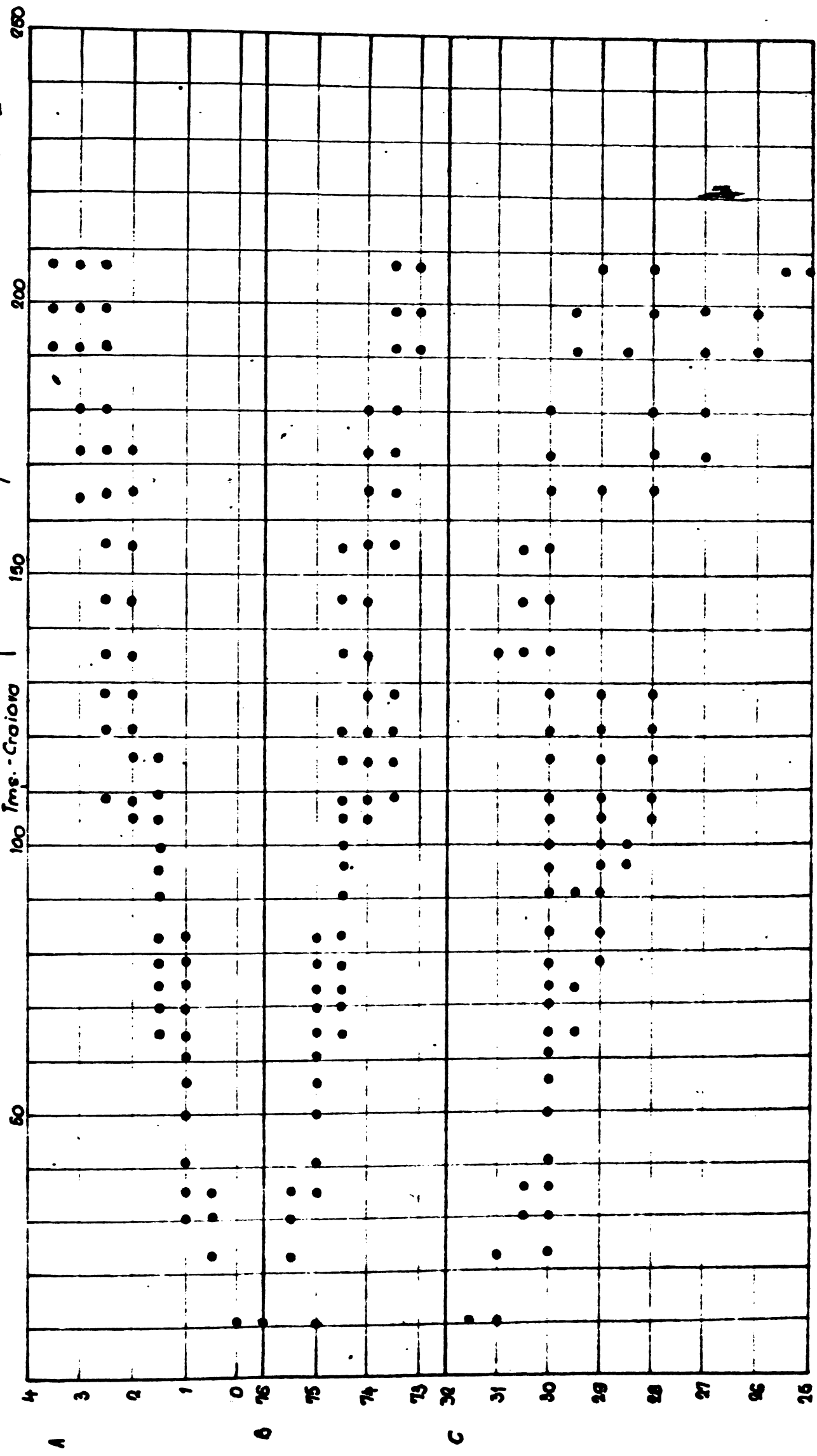
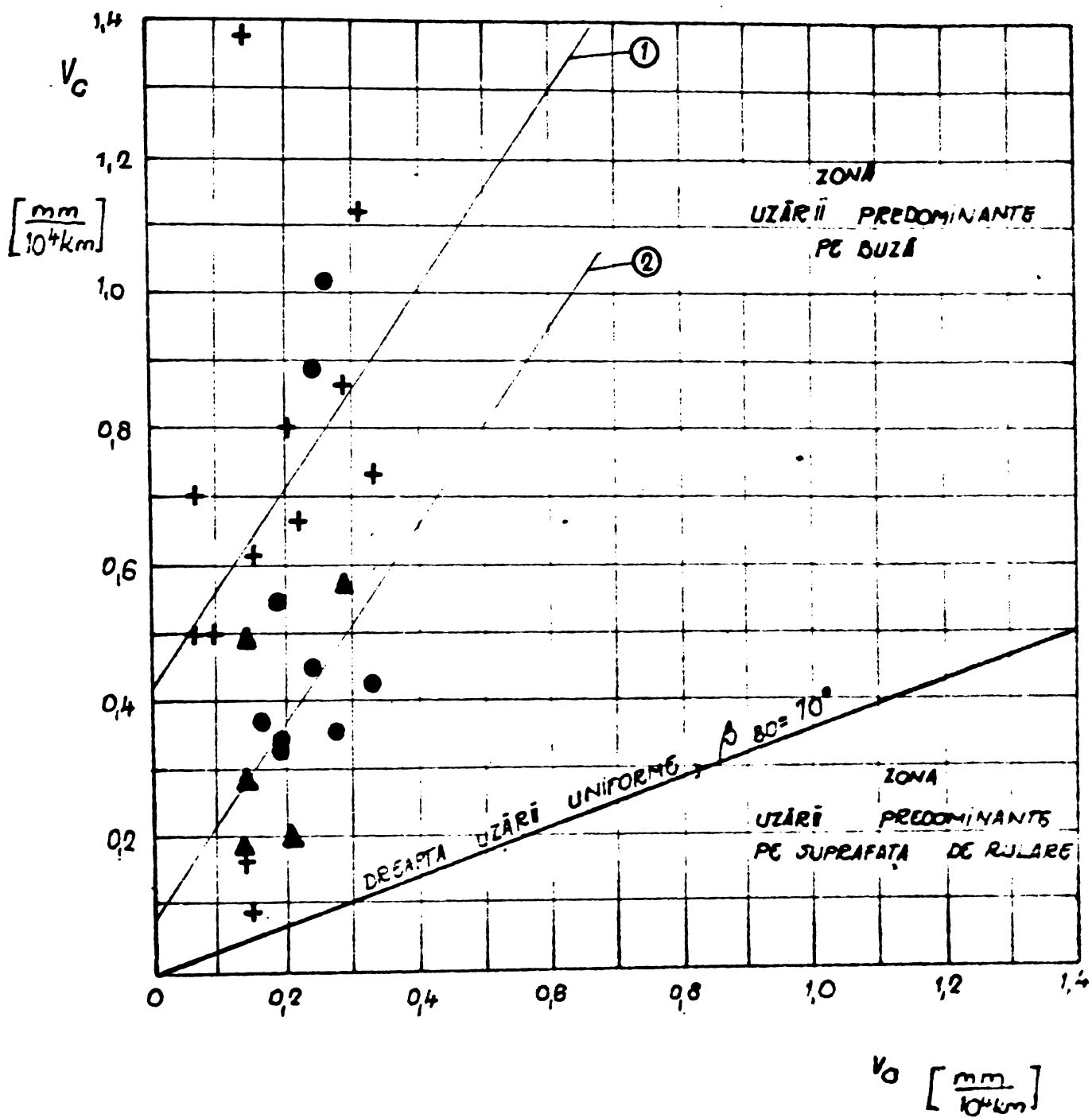


Fig. 147



ECUAȚIILE DE REGRESIE

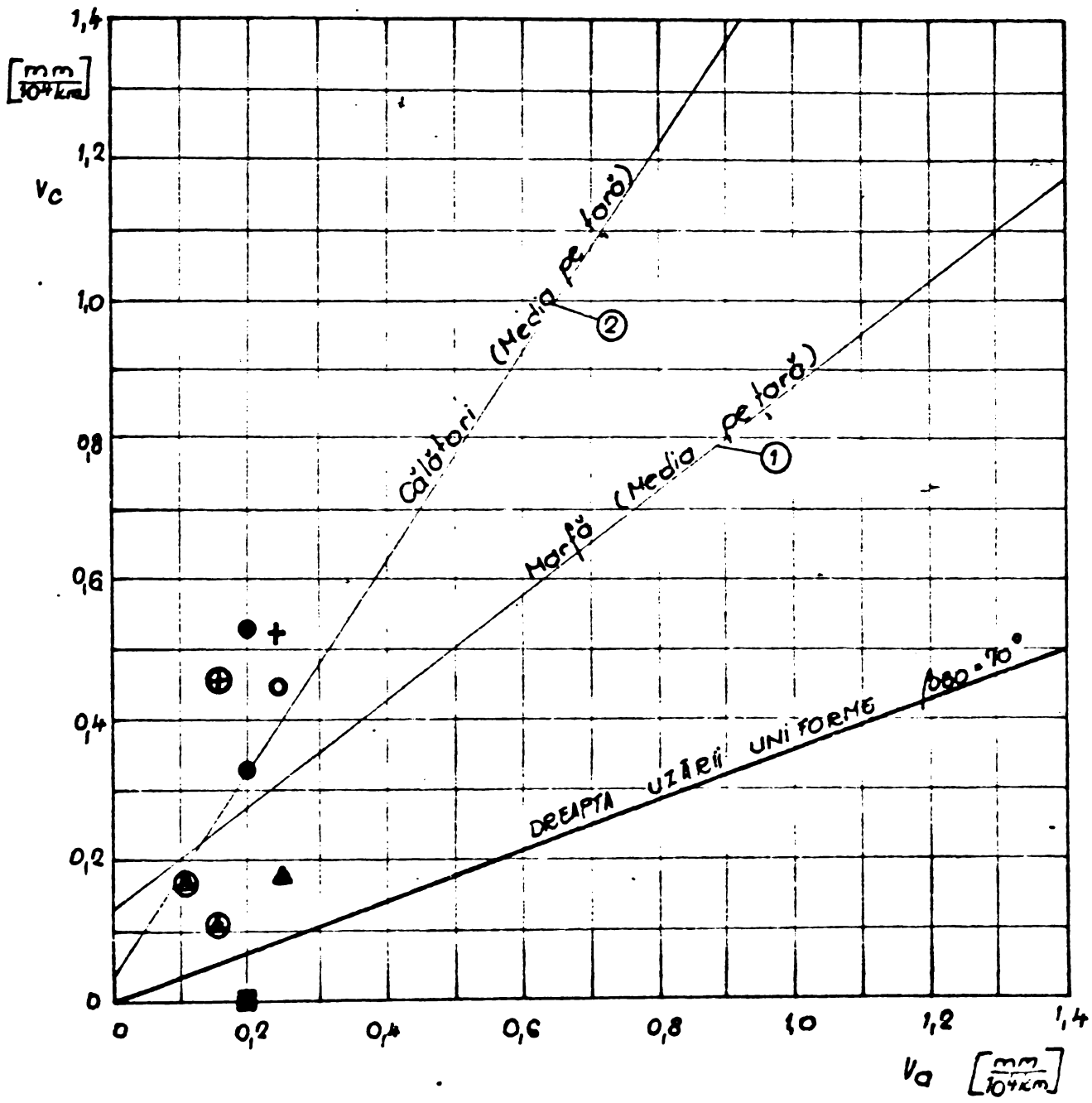
① $V_c = 1,490 \cdot V_0 + 0,413$ ($R = 0,312$) L DE

② $V_c = 1,456 \cdot V_0 + 0,0796$ ($R = 0,516$) LE

Legenda:

- + Locomotive diesel ; 1980-81 (Arod)
- ▲ Locomotive electrice 1980-81 (Arod, Timișoara)
- Puncte din 189/ 1977, cifre mediate

Fig. 148



DREPTILE DE REGRESIE

① $V_c = 0,731 \cdot V_a + 0,144$ în regim de marfă

② $V_c = 1,486 \cdot V_a + 0,041$ în regim de călători

Fig. 149

Legenda:

- | | | | | | |
|---|--------|----------------|-------|----|----------|
| + | Depoul | Brasov (Media) | regim | de | marfă |
| ⊙ | Depoul | Caransebes | regim | de | marfă |
| ▲ | Depoul | Craiova | regim | de | marfă |
| ■ | Depoul | Bucuresi | regim | de | marfă |
| ⊕ | Depoul | Brasov (Media) | regim | de | călători |
| ● | Depoul | Caransebes | regim | de | călători |
| ⊙ | Depoul | Craiova | regim | de | călători |

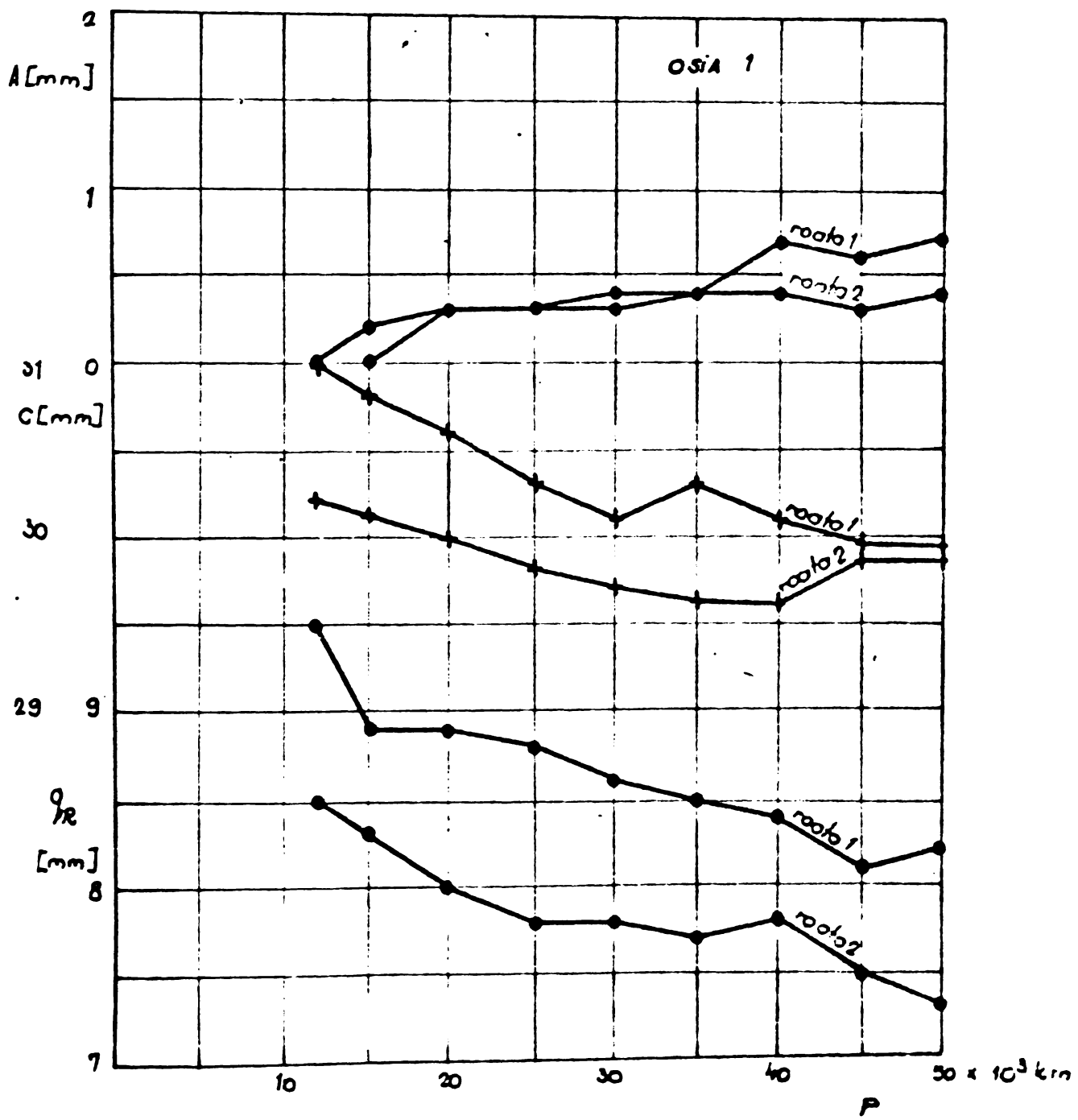


Fig. 50

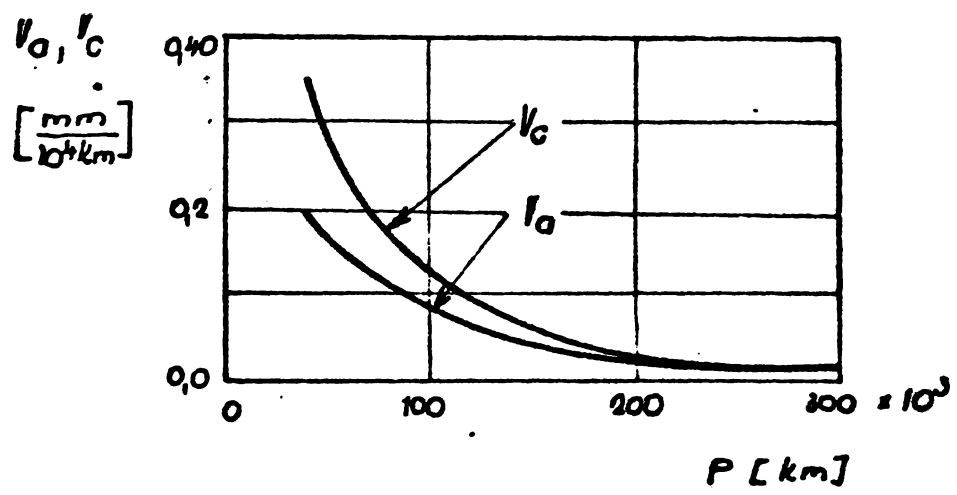


Fig. 151 . după 190 /



Fig. 152



.i . 193

Tabelul nr. 1.

Grupa	Cod	Definirea avariei în limba:			
		franceză	germană	engleză	română
1 Supra- fața de ru- lare și supra- fața buzei	10	-rayure -rainure	-Riefe -Rille	-scoring -grooving	-striații -renuri
	11	-méplat	-flachstelle	-flat	-loc plan
	12	-apport de metal	-Materialauf- tragung -Aufschweis- ungen	-built up wheel tread	-aport de metal -sudură
	13	-déplacement de metal	-Materialver- schiebung	-plastic flow	-deplasare de material
	14	-écaillage -cavité	-Grübchenbil- dung -Ausbrücke- lungen -Löcher	-shelling -cavities	-gropițe -solzi -cavități
	15	-exfoliation	-Abblättering	-spalling	-exfoliere
	16	-point chaud	-Brandflächen	-hot spot	-pată arsă
	17	-peau de crapaud et gercures -excoration	-Krötenhaut und Oberflä- chenrisse -Ausbrücke- lungen	-cracking and hair line cracks -spalling	-piele de broască -fisuri de suprafață -cojirea
	18	-criques termiques	-Wärmerisse	-thermal cracks	-fisuri termice
2 Coroa- na roții sau discul și banda- jul	20	-jante-ban- dage(JB) ou bandage(B) écrasé	-zerquetsch- ter Radkrans (K) od. Rad- reifen(R)	-spread whe- el rim with tyre(RT) or spread ty- re(T)	-strivirea coroanei ro- ții(C) sau a bandajul- ui(B)
	21	-JB ou B surchauffé	-Überhitzter K oder R	-overheated RT or T	-C sau B su- princălzit
	22	-B lâché	-looser R	-loose T	-B slăbit
	23	-JB ou B é- claté	-gesprunge- ner K od. R	-shattered RT or T	-C sau B crăpat
24	-rupture fra- gile de JB ou B par e- ffet d'en- taillé	-Bruch des K od. R infolge Kerbwirkung	-fracture of a RT or T due to not- ch effect	-ruperea fra- gile a C sau B datorită efectului de creșt.	
3 disc	30	-toile fisu- rée	-gerissene Radscheibe	-cracked wheel disc	-disc fisu- rat
4 butuc	40	-moyen de ro- ue fissuré	-gerissene Radnabe	-cracked hub	-butucul ro- ții fisurat

Tabelul nr. 2.a.

Nr. crt.	Denumirea masei	Simbol	Masa (Kg)	Buc. boghiu	Repartizarea masei pe		
					Osie montată	Cadru boghiu	Cutie
1	Cadru sudat boghiu	—	1308	1	—	1308	—
2	Trav. dansantă -cu suspensia	—	861	1	—	451	410
3	Conducerea osiei cu suspensia	—	333	1	192	141	—
4	Generator	—	225	1	—	225	—
5	Diverse	—	7	1	—	7	—
6	Total cadru boghiu (1+2+3+4+5)	—	2734	1	192	2132	410
7	Aparat de rulare	—	1600	2	3200	—	—
8	Frino pe boghiu	—	526	1	—	526	—
9	Total boghiu (6+7+7+8)	m_{ob}	6460	1	3392	2658	410
10	Masa suspendată pe treapta I	m_{ca}	2658	1	—	2658	—
11	Masa suspendată pe treapta II.	m_{ro}	410	1	—	—	410
12	Masa suspendată a osiei montate	m_o	$\frac{3392}{2}$	2	1696	—	—

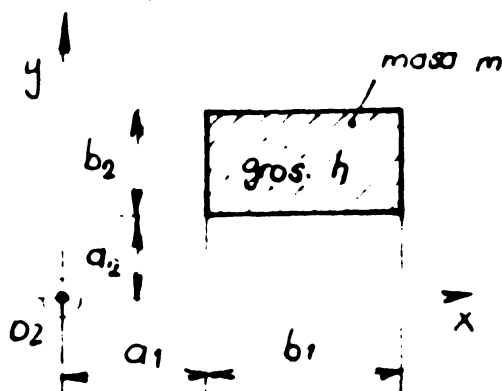
Tabelul nr. 2. b.

Nr. crt.	Denumirea masei	Simbol	buc. vagon	masa (Kg)	Repartizarea masei pe		
					Osie montată	Cadru boghiu	Cutie
1	Tara vagon	M_0	1	43000			
2		m_0	4	1696	1696	—	—
3		m_{TD}	2	410	—	—	410
4		m_{CB}	2	2658	—	2658	—
5	Masa totală a boghiului $m_{OB} = 2m_0 + m_{TD} + m_{CB}$	m_{OB}	2	6460	3392	2658	410
6	Masa totală a cutiei amenajate $M_C = M_0 - 2m_{OB}$	M_C	1	30080	—	—	30080
7	Masa utilă la încărcare 50% $(2 \cdot 36 \cdot 80 + 7500) : 2$	M_{U50}	1	$\frac{13260}{2}$	—	—	6630
8	Masa utilă la încărcare 100%	M_{U100}	1	13260	—	—	13260
9	Masa repartizată pe osie (vagon gol)	M_{Q0}	4	10750	—	—	—
10	Masa repartizată pe o osie, 50% încărc.	M_{Q050}	4	12408	—	—	—
11	Masa repartizată pe o osie, 100% încărc.	M_{Q0100}	4	14065	—	—	—
12	Masele modelului mecanic pt. OSC. VERTICALE	m_0	4	1696	1696	—	—
		m_1	2	2658	—	2658	—
		m_2^{gol}	1	30900	—	—	30900
		$m_2^{50\%}$	1	37530	—	—	37530
		$m_2^{100\%}$	1	44160	—	—	44160
13	Masele modelului mecanic pt. OSC. LATERALE	m_B	2	6090	—	—	—
		m_S^{gol}	2	15450	—	—	—
		$m_S^{50\%}$	2	18765	—	—	—
		$m_S^{100\%}$	2	22080	—	—	—

Tabelul nr. 3

nr. i	Masa m_i a elementului		Cotele [mm]				I_{zi} [kg·m ²]	Buc. bogh. n_i	Obs
	Simbol	Valoare [kg]	a_{1i}	a_{2i}	b_{1i}	b_{2i}			
1	$m^{(1)(1)}$	$\frac{1}{4} \cdot 691$	900	0	200	1960	394,538	1	Formula *)
2	$m^{(1)(2)}$	$\frac{1}{4} \cdot 263$	0	326	900	140	28,171	1	*)
3	$m^{(1)(3)}$	$\frac{1}{4} \cdot 105$	610	466	65	1494	54,351	1	*)
4	$m^{(1)(4)}$	$\frac{1}{4} \cdot 172$	0	1960	1100	73	188,761	1	*)
5	$m^{(1)(5)}$	$\frac{1}{4} \cdot 77$	0	875	700	100	19,631	1	*)
6	$\frac{1}{4} m^{(1)}$	$\frac{1}{4} \cdot 1308$	—	—	—	—	685,452	4	***)
7	$\frac{1}{4} m^{(2)}$	$\frac{1}{4} \cdot 451$	850	0	300	470	121,898	4	*)
8	$\frac{1}{4} m^{(3)}$	$\frac{1}{4} \cdot 333$	1000	1250	—	—	219,328	4	***)
9	$\frac{1}{4} m^{(4)}$	$\frac{1}{4} \cdot 232$	1000	0	—	—	58,000	4	***)
10	$\frac{1}{4} m^{(5)}$	$\frac{1}{4} \cdot 708$	0	1184	1150	133	355,072	4	*)
11	$\frac{1}{4} m^{(6)}$	411	680	842	136	816	894,897	4	*)
12	$\frac{1}{4} m^{(7)}$	115	480	888	110	523	215,187	4	*)
13	$\frac{1}{4} m^{(8)}$	$\frac{1}{4} \cdot 388$	1000	1250	—	—	248,563	4	***)
14	$\frac{1}{4} m^{(9)}$	$\frac{1}{4} \cdot 526$	610	875	—	—	149,611	4	***)
15	m_0	6050	—	—	—	—	11767	1	Suma $\sum_{i=1}^{14} I_{zi}$ = 11767

Formula *)

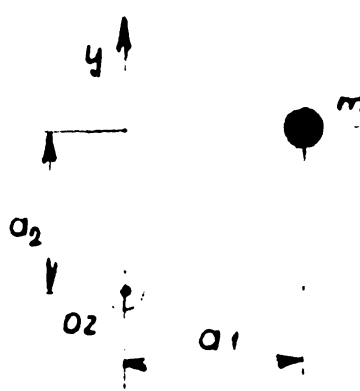


$$I_z = \frac{m}{3b_1b_2} [A_1b_2^3 + A_2b_1^3]$$

$$A_1 = (a_1 + b_1)^3 - a_1^3$$

$$A_2 = (a_2 + b_2)^3 - a_2^3$$

Formula **)



$$I_z = m(a_1^2 + a_2^2)$$

Formula ***)

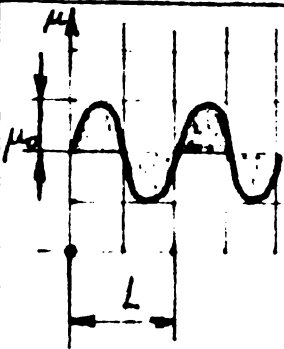
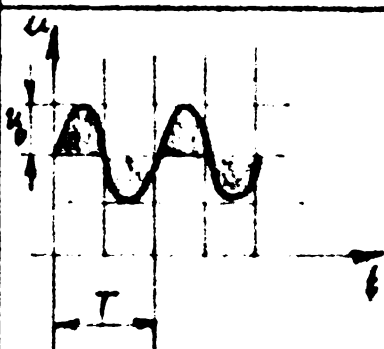
$$I_{z0} = \sum_{i=1}^n I_{zi}$$

$$\frac{1}{4} m^{(1)} + m^{(1)(1)} + m^{(1)(2)} + m^{(1)(3)} + m^{(1)(4)} + m^{(1)(5)}$$

$$I_{z0} = \sum_{i=1}^{14} n_i I_{zi}$$

$$m_Q = \sum_{i=1}^{14} m_i n_i$$

Tabelul nr. 4

Nr. art.	Denumirea	OSCILAȚIA	
		Spațială	Temporală
1	Forma oscilației		
2	Ecuația și variabila independentă	$u = u_0 \sin -\Omega s$ s: spațiul	$u = u_0 \sin \omega t$ t: timpul
3	Amplitudinea	u_0	u_0
4	Pulsatia	Ω	ω
5	Perioada	$L = \frac{2\pi}{\Omega}$ lungimea de undă	$T = \frac{2\pi}{\omega}$
6	frevența	$f = \frac{1}{L} = \frac{\Omega}{2\pi}$	$f = \frac{1}{T} = \frac{\omega}{2\pi}$
7	Durata ciclului	2π	2π
8	Densitatea spectrală de putere (DSP) unilaterala	$G(\Omega) = \frac{1}{2\pi} G(F)$	$G(\omega) = \frac{1}{2\pi} G(f)$
9	Relații de legătură	$s = v \cdot t$ $L = v \cdot T$ $v \cdot \Omega = \omega$ $v \cdot f = f$ $\frac{1}{v} G(\Omega) = G(\omega)$ $\frac{1}{v} G(F) = G(f)$	

Tabelul nr.5

Parametrul	Simb.	cod (002)	cod (702)	cod (802)	UM
- masa ramei bogh.	m_B	6050	6050	6050	kg
- masa susținută de boghiu	m_B	15450	15450	15450	kg
- moment de inerție	I_{zB}	11800	11800	11800	kgm^2
- punctul de aplicație pt. k_x și k_y	b	1,300	1,300	1,300	m
- jumătate ampatam.	l	1,250	1,250	1,250	m
- acceler. gravitaț.	g	cca. 10	cca. 10	cca. 10	m/s^2
- coef. amortizare	c_{xB}	3000	3000	3000	Ns/m
- " "	c_{yB}	84835	84835	84835	Ns/m
- rigidit. suspensie	k_{xB}	0	0	0	
- " "	k_{yB}	544900	544900	544900	N/p
- raza profil roată	R	0,300	0,500	0	m
- " " gină	R'	0,200	0,200	0,200	m
- " cerc rulare	r_0	0,460	0,460	0,460	m
- unghiul profil.	δ_0	0,0335	0,0568	0,0500	rad
- poziția cerc rul.	e_0	0,750	0,750	0,750	m
- conicitate efect.	λ_0	0,1035	0,0996	0,0523	-
- funcție contact	f_0	10,3470	3,5843	0,0690	rad/m
- " "	f_1	3,0903	1,7530	1,0450	-
- " "	f_2	5,3525	1,9524	0,0720	-
- " "	H_0	1,0210	1,0360	1,0320	-
- " "	ρ	10,0000	3,3333	0	1/m
- coef. kalker	f_{11}	5.260.500	4.196.000	3.484.000	N
- " "	f_{22}	4.484.000	3.582.000	2.805.000	N
- " "	f_{23}	9.626	6.698	4.327	Nm
- " "	f_{33}	53	34	33	Nm^2
- coef. de frecare	μ	0,3	0,3	0,3	-
- viteza critică	V_{cr}	43,53 157,71	39,12 140,83	36,44 131,20	m/s km/h
- sarcina pe osie	Q_0	10750	10750	10750	kg
- semiaxele elipsei de contact	a b	5,213 5,950	4,633 5,526	6,163 3,543	mm mm
- pres. de contact	p_0	827	1002	1175	MN/m^2

Tabelul nr. 6.

	DENUMIREA	I	II
1.	Sarcina pe rotă	Q_{rI}	Q_{rII}
2.	Semi-axa elipsei de contact	$a_I = \alpha (Q_{rI})^{1/3}$ $b_I = \beta (Q_{rI})^{1/3}$	$a_{II} = \alpha \cdot (Q_{rII})^{1/3}$ $b_{II} = \beta \cdot (Q_{rII})^{1/3}$
3.	Media geometrică a semi-axelor	$c_I = \sqrt{a_I b_I}$	$c_{II} = \sqrt{a_{II} b_{II}}$
4.	Excentricitatea elipsei de contact	$\frac{a_I}{b_I} = \frac{\alpha}{\beta}$	$\frac{a_{II}}{b_{II}} = \frac{\alpha}{\beta}$
5.	Relația de similitudine	$\frac{a_I}{b_I} = \frac{a_{II}}{b_{II}}$	
6.	Consecințele relației de similitudine	<p>- similitudinea coeficienților KALKER normali:</p> $C_{ijI}^* = C_{ijII}^*$ <p>- similitudinea coeficienților de pseudoalunecare după KALKER:</p> $\frac{f_{11II}}{f_{11I}} = \frac{G \cdot c_{II}^2 \cdot c_{11}^*}{G \cdot c_I^2 \cdot c_{11}^*} = \frac{c_{II}^2}{c_I^2} = \left(\frac{Q_{rII}}{Q_{rI}}\right)^{1/3}$ $\frac{f_{22II}}{f_{22I}} = \frac{G \cdot c_{II}^3 \cdot c_{22}^*}{G \cdot c_I^3 \cdot c_{22}^*} = \frac{c_{II}^3}{c_I^3} = \left(\frac{Q_{rII}}{Q_{rI}}\right)^{1/3}$ $\frac{f_{23II}}{f_{23I}} = \frac{G \cdot c_{II}^3 \cdot c_{23}^*}{G \cdot c_I^3 \cdot c_{23}^*} = \frac{c_{II}^3}{c_I^3} = \left(\frac{Q_{rII}}{Q_{rI}}\right)^{1/3}$ $\frac{f_{33II}}{f_{33I}} = \frac{G \cdot c_{II}^4 \cdot c_{33}^*}{G \cdot c_I^4 \cdot c_{33}^*} = \frac{c_{II}^4}{c_I^4} = \left(\frac{Q_{rII}}{Q_{rI}}\right)^{4/3}$	

Tabelul nr. 7

γ_{201}	γ_{21}	φ_1
----------------	---------------	-------------

$$=$$

0	$\frac{H_0}{V}$	0	$-\frac{E_0}{V}$	$-\frac{\lambda_0}{G}$	0
0	0	0	0	0	-1
0	0	0	$\frac{1}{V}$	$-\frac{\lambda_0}{R G G}$	0

$$\cdot$$

$\dot{\gamma}$	$\dot{\theta}$	γ	θ
----------------	----------------	----------	----------

$$+$$

0	$-\frac{1}{V}$	0	$\frac{R G G_0}{G}$
0	$-\frac{1}{V}$	0	0
0	0	0	$\frac{F}{G}$

$$\cdot$$

$\dot{\gamma}$	\dot{E}	T	E
----------------	-----------	-----	-----

$$+$$

0	0	$-\frac{d_0}{G}$
---	---	------------------

γ_{202}	γ_{22}	φ_2
----------------	---------------	-------------

$$=$$

0	$\frac{H_0}{V}$	0	$\frac{E_0}{V}$	$\frac{\lambda_0}{G}$	0
0	0	0	0	0	-1
0	0	0	$\frac{1}{V}$	$-\frac{\lambda_0}{R G G}$	0

$$\cdot$$

$\dot{\gamma}$	$\dot{\theta}$	γ	θ
----------------	----------------	----------	----------

$$+$$

0	$-\frac{1}{V}$	0	$-\frac{R G G_0}{G}$
0	$-\frac{1}{V}$	0	0
0	0	0	$-\frac{F}{G}$

$$\cdot$$

$\dot{\gamma}$	\dot{E}	T	E
----------------	-----------	-----	-----

$$+$$

0	0	$\frac{d_0}{G}$
---	---	-----------------

Tabelul nr. 8

$$\begin{array}{c}
 \gamma_{\text{nor}} \\
 \gamma_{\text{ur}} \\
 \Phi_{\text{ur}}
 \end{array}
 =
 \begin{array}{c}
 \frac{e_0}{V} \quad \frac{-\lambda_0}{V} \quad \frac{-\lambda_0 l}{V} \\
 \frac{h_0}{V} \quad \frac{h_0 l}{V} \quad -1 \\
 0 \quad \frac{1}{V} \quad \frac{-\lambda_0 l}{R_0 d_0}
 \end{array}
 \cdot
 \begin{array}{c}
 \frac{\gamma_c}{\theta_s} \\
 \frac{\dot{\theta}_s}{\theta_s} \\
 \gamma_s \\
 \theta_s
 \end{array}
 +
 \begin{array}{c}
 0 \quad 0 \\
 \frac{-1}{V} \quad \frac{-1}{V} \\
 0 \quad 0
 \end{array}
 \cdot
 \begin{array}{c}
 \frac{\lambda_c}{R_0 d_0} \\
 0 \\
 \frac{\lambda_c}{R_0 d_0}
 \end{array}
 +
 \begin{array}{c}
 \frac{\gamma_c}{\theta_s} \\
 \frac{\dot{\theta}_s}{\theta_s} \\
 \gamma_s \\
 \theta_s
 \end{array}
 +
 \begin{array}{c}
 0 \quad 0 \\
 \frac{-1}{V} \quad \frac{1}{V} \\
 0 \quad 0
 \end{array}
 \cdot
 \begin{array}{c}
 \frac{-\lambda_0}{R_0 d_0} \\
 0 \\
 \frac{\lambda_0}{R_0 d_0}
 \end{array}
 +
 \begin{array}{c}
 \frac{\gamma_c}{\theta_s} \\
 \frac{\dot{\theta}_s}{\theta_s} \\
 \gamma_s \\
 \theta_s
 \end{array}
 +
 \begin{array}{c}
 0 \quad 0 \\
 \frac{-1}{V} \quad \frac{1}{V} \\
 0 \quad 0
 \end{array}
 \cdot
 \begin{array}{c}
 \frac{\lambda_c}{R_0 d_0} \\
 0 \\
 \frac{\lambda_c}{R_0 d_0}
 \end{array}
 +
 \begin{array}{c}
 0 \\
 0 \\
 \frac{-d_0}{r_0}
 \end{array}
 +
 \begin{array}{c}
 0 \\
 0 \\
 \frac{d_0}{r_0}
 \end{array}$$

Tabelul nr. 9

$$\begin{array}{c}
 \begin{array}{|c|c|c|} \hline 0 & 0 & \frac{-d_0}{r_0} \\ \hline \end{array} \\
 + \\
 \begin{array}{|c|c|c|} \hline \dot{T}_2 & \dot{E}_2 & T_2 \\ \hline \end{array} \cdot \\
 \begin{array}{|c|c|c|c|c|} \hline \frac{R_2 d_0}{r_0} & 0 & \frac{S}{r_0} & \frac{\lambda_0}{r_0} & 0 \\ \hline 0 & -\frac{1}{V} & 0 & \frac{\lambda_0}{R_2 d_0} & 0 \\ \hline -\frac{1}{V} & 0 & 0 & 0 & 0 \\ \hline \end{array} \\
 + \\
 \begin{array}{|c|c|c|c|} \hline \dot{\gamma}_0 & \dot{\theta}_0 & \gamma_0 & \theta_0 \\ \hline \end{array} \cdot \\
 \begin{array}{|c|c|c|c|c|} \hline \frac{\lambda_0 l}{r_0} & -1 & \frac{\lambda_0 l}{R_2 d_0} & -\frac{\lambda_0}{r_0} & 0 \\ \hline 0 & 0 & -\frac{\lambda_0}{R_2 d_0} & \frac{S}{V} & -\frac{\theta_0 l}{V} \\ \hline \frac{\theta_0}{V} & -\frac{\theta_0 l}{V} & \frac{1}{V} & \frac{\theta_0}{V} & 0 \\ \hline \end{array} \\
 = \\
 \begin{array}{|c|c|c|} \hline \gamma_{2021} & \gamma_{221} & \phi_{221} \\ \hline \end{array}
 \end{array}
 \qquad
 \begin{array}{c}
 \begin{array}{|c|c|c|} \hline 0 & 0 & \frac{d_0}{r_0} \\ \hline \end{array} \\
 + \\
 \begin{array}{|c|c|c|} \hline \dot{T}_2 & \dot{E}_2 & T_2 \\ \hline \end{array} \cdot \\
 \begin{array}{|c|c|c|c|c|} \hline \frac{R_2 d_0}{r_0} & 0 & -\frac{S}{r_0} & -\frac{\lambda_0}{r_0} & 0 \\ \hline 0 & \frac{1}{V} & 0 & \frac{\lambda_0}{R_2 d_0} & 0 \\ \hline -\frac{1}{V} & 0 & 0 & 0 & 0 \\ \hline \end{array} \\
 + \\
 \begin{array}{|c|c|c|c|} \hline \dot{\gamma}_0 & \dot{\theta}_0 & \gamma_0 & \theta_0 \\ \hline \end{array} \cdot \\
 \begin{array}{|c|c|c|c|c|} \hline -\frac{\lambda_0 l}{r_0} & -1 & \frac{\lambda_0 l}{R_2 d_0} & \frac{\lambda_0}{r_0} & 0 \\ \hline 0 & 0 & -\frac{\lambda_0}{R_2 d_0} & \frac{S}{V} & -\frac{\theta_0 l}{V} \\ \hline \frac{\theta_0}{V} & -\frac{\theta_0 l}{V} & \frac{1}{V} & \frac{\theta_0}{V} & 0 \\ \hline \end{array} \\
 = \\
 \begin{array}{|c|c|c|} \hline \gamma_{2022} & \gamma_{222} & \phi_{222} \\ \hline \end{array}
 \end{array}$$

Tabelul nr. 10

$$f = \begin{bmatrix} c_{11}^* & 0 & 0 \\ 0 & c_{22}^* & c \cdot c_{23}^* \\ 0 & -c \cdot c_{23}^* & c^2 \cdot c_{33}^* \end{bmatrix} \cdot c^2 \cdot G$$

(După /126/)

$$G = E / (2 \cdot (1 + \nu)) = 0,08077 \cdot 10^6 \text{ MN/m}^2$$

$$E = 0,21 \cdot 10^6 \text{ MN/m}^2$$

$$\nu = 0,3$$

$$c = \sqrt{a \cdot b} = 5,569 \cdot 10^{-3} \text{ m}$$

$$a = 5,213 \cdot 10^{-3} \text{ m} \text{ semiaxa după } x \text{ a petei}$$

$$b = 5,950 \cdot 10^{-3} \text{ m} \text{ " " } y \text{ "}$$

$$a/b = 0,8762$$

a, b se calculează după relațiile lui Hertz, vezi tabelul nr.

$$\begin{aligned} c_{11}^* &= 4,2 && \text{coeficienții adimensionali de PA și spin} \\ c_{22}^* &= 3,58 && \text{după /126/} \\ c_{23}^* &= 1,38 \\ c_{33}^* &= 1,36 \end{aligned}$$

Matricea coeficienților Kalker calculați pentru un coeficient de frecare de 0,3:

$$f = \begin{bmatrix} 5,2605 \cdot 10^6 & 0 & 0 \\ 0 & 4,4840 \cdot 10^6 & 9,6258 \cdot 10^3 \\ 0 & -36,55 \cdot 10^3 & 52,225 \end{bmatrix} ; [N]$$

Datele numerice se referă la modelul nr.002 (v.paragr. 2.4)

Tabelul nr. 11

$$\underline{M}_H =$$

$1/20$	0
0	-20

$$\underline{C}_H =$$

$2/20 \cdot \frac{d_0}{V}$	$4/20 \cdot \frac{d_0}{V}$
$-1/20 \cdot \frac{d_0}{V}$	$2/20 \cdot \frac{d_0^2}{V} +$ $+ 4/20 \cdot \frac{d_0^2}{V} +$ $+ 1/20 \cdot \frac{d_0^2}{V} + 1/23 \cdot \frac{1}{V}$

$$\underline{K}_H =$$

$2/20 \cdot \frac{d_0}{V} + k_{y0}$ $- 1/20 \cdot \frac{d_0}{V}$	$- 4/20 \cdot \frac{d_0}{V}$
$1/20 \cdot \frac{d_0^2}{V}$ $- 1/20 \cdot \frac{d_0^2}{V}$	$- m_0 g \frac{d_0^2}{V} - \frac{d_0^2}{V} (-1)$ $+ 2k_{x0} \frac{d_0^2}{V}$ $- 1/20 \cdot \frac{d_0^2}{V} (-1)$

$\underline{M}_E =$	0	0	0	0
$\underline{Q}_E =$	$\frac{2}{\sqrt{3}} \frac{m \lambda_0}{k E_0}$	$-\frac{2}{\sqrt{3}} \frac{m \lambda_0}{k E_0}$	0	0
$\underline{K}_E =$	$m_2 g_0$ $-\frac{m \lambda_0}{k E_0}$ $\frac{m_2 g_0}{14} + \frac{e_0 \lambda_0}{14} - m_2 g_0 (1 + \frac{e_0 \lambda_0}{14})$ $-\frac{2}{k E_0} \frac{\lambda_0}{\sqrt{3}} (\frac{1}{23} (1 + \frac{1}{23})) + \frac{\lambda_0}{k E_0} (1 + \frac{1}{23})$	$m_2 g_0 -$ $-\frac{m \lambda_0}{k E_0}$	$-\frac{1}{4} \frac{m_2 g_0 \beta}{10}$ $-\frac{1}{4} \frac{m_2 g_0 \beta^2}{10}$	$-\frac{1}{4} \frac{m_2 g_0 \beta}{10}$ $\frac{1}{4} \frac{m_2 g_0 \beta^2}{10}$

$$\begin{bmatrix} H_{UYB} \\ H_{UFA} \\ H_{UEN} \\ H_{UIN} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ M_{11} \\ M_{12} \end{bmatrix} \cdot \begin{bmatrix} H_{UYB} \end{bmatrix} + \begin{bmatrix} 0 \\ M_{21} \\ 0 \\ 0 \end{bmatrix}$$

H_{SIG} =

H_{2E}

H _{T1YC}	H _{T2YC}	H _{T3YC}	H _{T4YC}	H _{T5YC}
H _{T1FC}	H _{T2FC}	H _{T3FC}	H _{T4FC}	H _{T5FC}
H _{T1FN}	H _{T2FN}	H _{T3FN}	H _{T4FN}	H _{T5FN}
H _{T1FW}	H _{T2FW}	H _{T3FW}	H _{T4FW}	H _{T5FW}
H _{T1E}	H _{T2E}	H _{T3E}	H _{T4E}	H _{T5E}
H _{T1JA}	H _{T2JA}	H _{T3JA}	H _{T4JA}	H _{T5JA}

H_{SIG} =

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

H_{2E}

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Tabelul nr. 13

COD		OSIE MONTATĂ					Obs.
	UM	liteză V					
	m/s Km/h	18,67 60	30 108	40 144	55 198		
$d^2_{Q_0}$	$16^6 N^0$	17,640	125,440	196,000	331,240		
d_{Q_0}/μ_{Q_0}	-	0,03	0,08	0,10	0,13		
$d_{p_{101}}$	10^{-8}	26,3	78,9	180	820		
$d_{p_{01}}$	10^{-8}	274	312	370	630		
$P_{p_{101} \cdot p_{01}}$	-	-0,455	-0,155	-0,033	-0,255		
d_{e_1}	mm	1,89	3,85	8,39	16,28		
μ_{ψ}	10^{-6}	211	269	401	1522		
d_{ψ}	10^{-6}	163	196	272	972		
P_{40}	-	1	1	0,999	0,844		
h_{10}/P	$\frac{10^{-3} \text{ mm}}{10^4 \text{ Km}}$						
l_0							
HB - 150		25,6	32,8	48,9	154,8		< BV 1
HB - 200		19,2	24,6	36,675	116,1		BV 1
HB - 220		17,5	22,4	33,3	105,5		BV 2
HB - 240		16	20,5	30,6	96,8		LV
HB - 300		12,8	16,4	24,5	77,4		> LV
HB - 75		192	247	368	1168		REBUT

$\mu_{Q_0} = 140000 \text{ N}$; $P_{201} = P_{01} = 0$; $\mu_{e_1} = e_0 = 9750 \text{ m}$

Tabelul nr. 14

COD		OSIE MONTATĂ					Obs
	UM	Viteza v					
	m/s km/h	16,67 60	30 108	40 144	55 198	61 222	
d_{q0}^2	$10^6 N^2$	17,640	125,440	196,000	331,240	441,000	
d_{q0}/μ_{q0}	-	0,03	0,08	0,10	0,13	0,15	
d_{j10}	mm	0,200	0,650	1,400	6,400	11,000	
$\frac{h_{80}}{P}$	$\frac{mm}{10^4 km}$						
lo:							
HB = 150		0	0	~ 0	32,188	74,058	< 8V1
200		0	0	~ 0	24,141	55,541	8V1
250		0	0	~ 0	19,313	44,423	8V2
300		0	0	~ 0	16,094	37,028	> LV
350		0	0	~ 0	13,785	31,738	"
400		0	0	~ 0	12,071	27,771	"

$\mu_{q0} = 140000 N$; $\mu_{j0} = 0$; $f_0 = 3 \cdot 10^{-3} m$;
 $k_0 = 60 \cdot 10^{-6}$; $\alpha = 4,8 \cdot 10^{-2}$; $\rho = 500 \frac{MN}{m^2}$; $K_s = 14 \cdot 10^8 \frac{N}{m}$; $\sigma_{80} = f_0$.

Tabelul nr. 15

$\frac{Q_p}{2}$ la mijlocul intervalului	$H(\frac{Q_p}{2})$	F la mijlocul intervalului [N]									
		1000	3000	5000	7000	8000	11000	12000	15000	17000	18000
		H (F)					in [%]				
[N]	[%]	18,3	25,4	19,9	15,1	9,5	6,8	2,5	1,8	1	0
63200	0,22	4,086	5,588	4,878	8,388	2,09	1,482	0,55	0,395	0,88	
65000	0,88	18,104	22,352	17,812	13,288	8,36	5,808	2,20	1,584	0,88	
68800	2,70	42,41	52,58	57,73	49,77	28,88	17,82	8,75	6,26	2,70	
61600	6,48	118,584	164,592	128,332	87,848	61,66	42,77	18,20	11,804	6,48	
64400	12,10	221,430	307,34	240,73	182,71	114,88	73,88	32,25	21,78	12,10	
67200	17,80	322,080	447,04	339,84	265,76	167,2	118,18	44,0	31,82	17,80	
70000	19,95	365,085	502,73	397,01	301,88	183,52	131,67	48,88	35,81	19,95	
72800	17,80	322,080	447,04	339,84	265,76	167,2	118,18	44,00	31,82	17,80	
75600	12,10	221,430	307,34	240,73	182,71	114,82	73,88	32,25	21,78	12,10	
78400	6,48	118,584	164,59	128,332	87,848	61,66	42,77	18,20	11,804	6,48	
81200	2,70	42,41	52,58	57,730	49,77	28,88	17,82	8,75	6,26	2,70	
84000	0,88	18,104	22,35	17,81	13,288	8,36	5,808	2,2	1,584	0,88	
86800	0,22	4,086	5,588	4,878	8,388	2,08	1,482	0,58	0,395	0,88	

Tabelul nr. 16

COD		OSIE MONTATA					Obs.
	UM	Viteza V					
	m/s km/h	16,87 60	30 108	40 144	55 198		
$\mu_{a0/2}$	[N]	70000	70000	70000	70000		
$d_{a0/2}$	[N]	2100	5600	7000	9100		
$\mu_{F_{R01}}$	[N]	0	0	0	0		
$d_{F_{R01}}$	[N]	500	1700	3200	10422		
$\mu_{F_{U10}}$	[N]	0	0	0	0		
$d_{F_{U10}}$	[N]	5200	5900	6800	9418		
$\rho_{F_{R01} F_{U10}}$	-	-0,455	-0,150	-0,033	0,255		
μ_{F_0}	[N]	0	0	0	0		
d_{F_0}		0	0	0	0		
G_F		0	0	0	0		

T
16

Tabelul nr. 17

Modelul		230 (002)				
Cod		1	2	3	4	5
v	m/s	33	33	33	33	33
	km/h	120	120	120	120	120
$Q_0/2$	N	53750	53750	53750	53750	53750
	N	4300	4300	4300	4300	4300
	-	0,08	0,08	0,08	0,08	0,08
F_{x01}	N	0	0	0	0	0
	N	3564	3564	3564	3564	3564
F_{U10}	N	701	701	701	701	848
	N	5663	5663	5663	5663	5663
$\rho_{F_{x01} F_{U10}}$	-	- 0,469	0,469	0,469	0,469	0,469
C_F	N	0	0	0	0	0
F_0	N	0	8063	0	8063	0
	N	0	250	0	250	0
σ_r	MN/m ²	800	800	200	900	800
C	-	1,4	1,4	1,8	1,8	1,4
N^*	-	1	1	1	1	1
h	1	3	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$
	2	3	1	1	1	1
	3	3	3	3	3	3
	4	3	5	5	5	5
	8	3	7	7	7	7
f_{23}	Nm	9625	9625	9625	9625	9625
d_0	rad	0,0335	0,0335	0,335	0,335	0,335
r_0	m	0,460	0,460	0,460	0,460	0,380
R'	m	0,200	0,200	0,200	0,200	0,200
R	m	0,300	0,300	0,300	0,300	0,300

Tabelul nr.17 (continuare)

Modelul		230 (002)				
Cod		6	7	8	9	10
v	m/s km/h	44,4 160	44,4 160	44,4 160	44,4 160	
$Q_0/2$	N	53750	53750	53750	53750	
	N	5912	5912	5912	5912	
	-	0,110	0,110	0,110	0,110	
F_{x01}	N	0	0	0	0	
	N	5803	5803	5803	5803	
F_{u10}	N	701	701	701	701	
	N	7131	7131	7131	7131	
$\rho_{F_{x01} F_{u10}}$	-	0,660	0,660	0,660	0,660	
C_F	N	0	0	0	0	
F_0	N	0	8063	0	8063	
	N	0	250	0	250	
G_r	MN/m ²	800	800	900	900	
C	-	1,4	1,4	1,8	1,8	
N^*	-	1	1	1	1	
h	1	3	$0,5 \cdot 10^{-3}$	$0,6 \cdot 10^{-3}$	$0,6 \cdot 10^{-3}$	$0,9 \cdot 10^{-3}$
	2	3	1	1	1	1
	3	3	3	3	3	3
	4	3	5	5	6	6
	5	3	7	7	7	7
f_{23}	Nm	9625	9625	9625	9625	
d_0	rad	0,0335	0,0335	0,0335	0,0335	
r_0	3	0,460	0,460	0,460	0,460	
R'	3	0,200	0,200	0,200	0,200	
R	3	0,300	0,300	0,300	0,300	

Tabelul 17 (continuare)

Modelul		230(027)				
Cod		11	12	13	14	15
v	m/s km/h		33 120	33 160	33 200	33 220
$Q_0/2$	Z Z -		48375 3870 0,08	48375 5321 0,11	48375 6772 0,14	48375 7498 0,155
F_{x01}	Z Z		0 4241	0 4160	0 4137	0 4153
F_{u10}	Z Z		701 6959	701 6998	701 6984	701 6928
$\rho_{F_{x01} F_{u10}}$	-		0,432	0,418	0,415	0,417
C_F	Z		0	0	0	0
F_0	Z Z		0 0	0 0	0 0	0 0
σ_r	MN/m ²		900	900	900	900
C	-		1,8	1,8	1,8	1,8
N^*	-		1	1	1	1
h	1	m	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$	$0,5 \cdot 10^{-3}$
	2	m	1	1	1	1
	3	m	3	3	3	3
	4	m	5	5	5	5
	5	m	7	7	7	7
f_{23}	Nm		9625	9625	9625	9625
d_0	rad		0,0335	0,0335	0,0335	0,0335
r_0	m		0,460	0,460	0,460	0,460
R'	m		0,200	0,200	0,200	0,200
R	m		0,300	0,300	0,300	0,300

Tabelul nr. 18

Nr. crt.	Identificarea traseului	Viteza tren încercare	Caracterizarea căii
1.	Poitiers - Angouleme calea 2, PK 385 - 375 Aliniament	170 km/h	<p>Vechime : 21 ani Şine - uic 50 sudate - transoane de 18 m - uic 50 cu eclise transoane de 36 m Ecartament : 1435 mm Nivelment : val. curente : 4 mm Variația săgeții: pe 10 m : 4 mm Calitatea căii : bună</p>
2.	Bordeaux - Pauillac calea U, PK 26-37 Aliniament	100 km/h	<p>Vechime : 53-54 ani Şine - ciuperă dublă asimetrică, cu eclise transoane de 88 m 44 kg/m Traversă - din lemn 1450 / km Ecartament : 1442 mm Nivelment : val. curente 7 mm excepțional 12 mm Variația săgeții : 7 mm în aliniament Calitatea căii : mediocră</p>

Tabelul nr. 19

Nr. crt.	Identificarea	Viteza trenului de încercare	Caracteristicile căii
1.	Florești Prahova - Buda firul 1 ; km 71-79 aliniament	80 ÷ 205 km/h	<p>Vechime : 7 zile după amenajarea pt. 200 km/h</p> <p>Săgețile laterale: în medie 4 mm max. 9 mm</p> <p>Variația ec cartamentului: în medie 2 mm max. 3 mm</p> <p>Denivelări în lungul căii: în medie 3,6 mm max. 7 mm</p> <p>Calitatea căii: bună și f. bună</p>

Tabelul nr. 20

Nr. crt.	Nr. ampara td	Siten- tio E/S	VEHICULUL			SINA		Tipul foii
			Tipul	Raza cero rulare	Profil	Tipul	Profil	
1	5	2	Wagon compartimentat 01:31 bagaj ESP GREGIA, gal	0,460	S1002 nou	~45 kg/m Bua Triaj	uzat mediu	hinie cola cu indigo
2	6	2	"	0,460	S1002 nou	"	uzat puternic	hinie cola cu indigo
3	10	1	"	0,460	S1002 nou	~45 kg/m ICPTT	uzat	hinie albă SERO1 cu indigo
4	11	1	"	0,460	S1002 nou	"	uzat	hinie cola cu indigo
5	3	2	Locomotivă manevră B'	0,375	de uzură	"	uzat puternic	hinie albă SERO1 cu indigo
6	9	2	Wagon de marfă 2 osi	0,500	de uzură	~45 kg/m	uzură medie	hinie schiță

Tabelul nr. 21

Nr. crt.	Locomotiva, seria	$P_i - P_{iH}$	$\Delta A = A_{iH} - A_i$	$\Delta G = G_{i+1} - G_i$	$V_d = \frac{\Delta A}{\Delta R} \cdot 10^4$	$V_c = \frac{\Delta C}{P_c} \cdot 10^4$
		km	mm	mm	mm / 10^4 km	mm / 10^4 km
1	DA 1319	11000-82000	0,5	5	0,070	0,704
2	DA 1319	82000-185000	1,5	1	0,146	0,097
3	DA 1340	0-110000	1	5,5	0,091	0,500
4	DA 1340	228000-262000	0,5	5	0,139	1,390
5	DA 1340	262000-307000	1	3	0,222	0,667
6	DA 1346	10-45000	1	3	0,286	0,857
7	DA 1346	45000-120000	1,5	6	0,200	0,800
8	DA 1346	120000-190000	0,5	3,5	0,071	0,500
9	DA 1346	190000-255000	1	4	0,154	0,615
10	DA 1368	65000-210000	2	2,5	0,138	0,172
11	DHC-508	20000-81000	2	4,5	0,228	0,738
12	DHC-508	81000-130000	1,5	5,5	0,306	1,122
13	EC-117	15000-150000	2	2,5	0,148	0,185
14	41-0092-1	100000-240000	2	4	0,143	0,286
15	41-0092-1	230000-350000	2	4	0,286	0,571
16	40-0230-9	10000-135000	2,5	2,5	0,200	0,200
17	40-0230-9	135000-208000	1	3,5	0,141	0,483