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GRUNDARTANGI

GEOPHYSICAL SURVEYS

By Halina Guðmundsson

OS-ROD-7527 June 1975

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Raforkudeild

G R U N D A R T A N G I

Geophysical surveys

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INTRODUCTION

This investigation has been done for Jarðkönnunardeild (J.K.D.), which requested ROD to handle the geophysical measurements in order to find out the thickness and velocity of the layers up to the bedrock in Hvalfjörður-area.

The result of these measurements were supposed to answer the question whether it is likely to find groundwater in this area and where it is most likely to look for it.

GEOLOGY

The area around Lake Eiðisvatn down to the shore at Grundartangi is covered by overburden (peat), underneath there is silt ranging in thickness. From the boreholes which were drilled at Grundartangi is known that the lower part of the silt is consolidated and hard (tillite), but the upper part is looser. The bedrock is Tertiary basalt (the approximately age is 3.3 million years). The rock seems to be quite watertight, as all holes and fractures in basalt are filled with secondary minerals.

GEOPHYSICS SURVEY

In the end of June 1975 a seismic refraction survey was carried out at the approximately south-south-west of the Eiðisvatn Lake (see location map), mainly for detecting the thickness of the secons layer, its velocity and depth to the basaltic bedrock. There were taken several profiles on two main lines, I and II (approximately parallel to each other) both in direction SW-NE ; on line I were taken 8 profiles (No. 1, 2, 3, 4, 5, 6, 7, 11) and on line II 3 profiles (No. 8, 9, 10), each about 100 m long. All of them were shot from both ends of the profile (see time-distance graphs, figures ...

The final result after calculating the field refraction materials is shown on the figure no. 1. Profile no. 1 from NE-SW gives information that the basaltic bedrock is not constant in its shape, but has step like form. Therefore, in same places (profile 1,2) the bedrock lies straight under overburden, what appeares on time distance graphs as two layers case.

While moving along profile I south-westwards the layer between bedrock and overburden appears with variety thickness with the tendency of getting deeper to SW direction (see figure no. ...

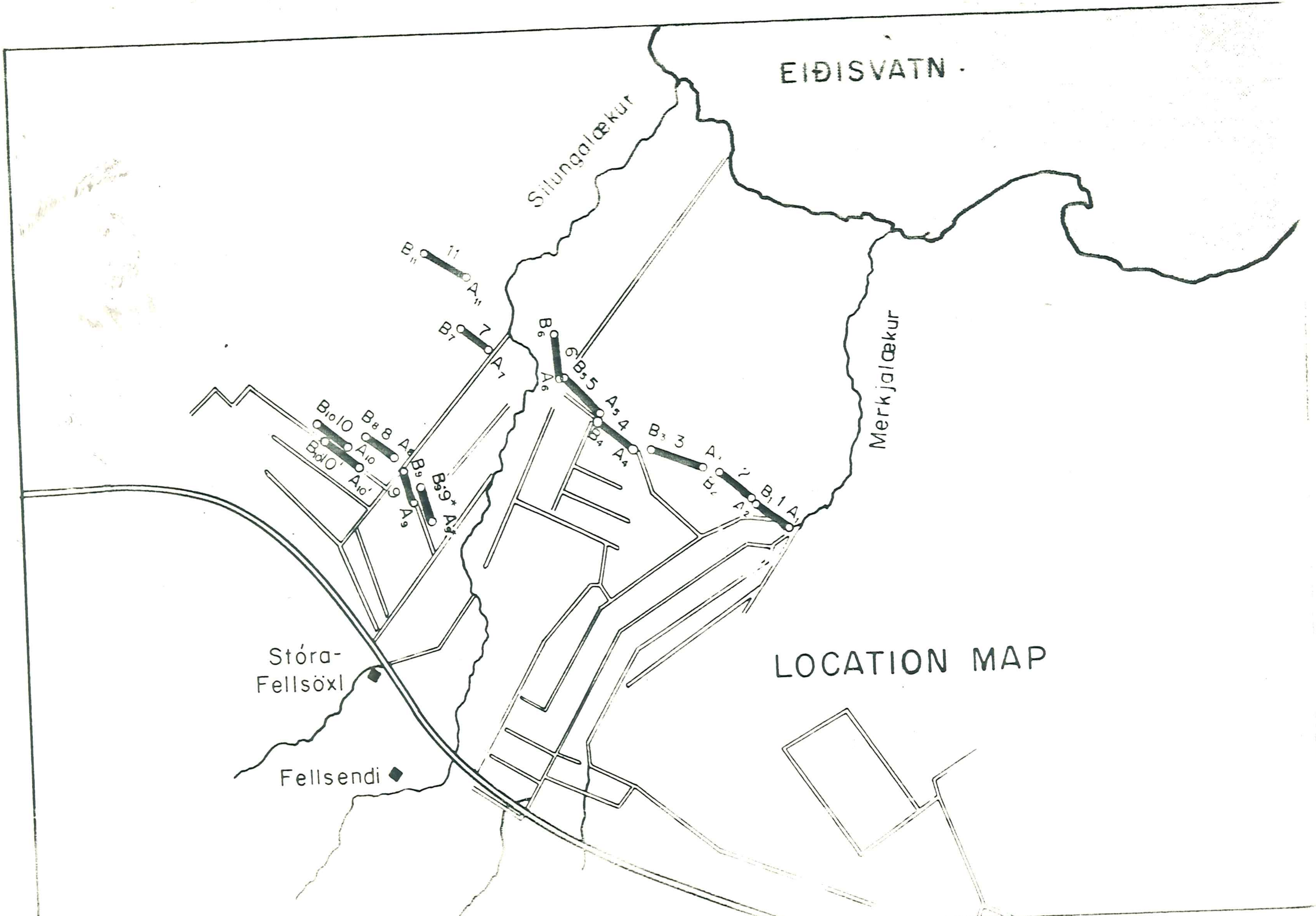
On profile number 1-2 there are only overburden and bedrock under it
" " " 3 the second layer appears (silt) about 6 m thick
" " " 4-7 gets deeper up to 10 m
and gets deeper towards SW up to approximately 20-24 cm
on profile number 11 - 11 *

These differences in thickness of the second layer between following profiles can be explained by step-like structure of the bedrock which the second layer repeats.

This second layer was expected to be a collector of groundwater. Refraction seismic shows that the velocity of this layer is approx. 20-30 km/s. which is typical for hard silt and therefore rather unlikely to be a collection of water. It is possible that there is a gravel in the lowest part of silt layer which could be filled with water, but refraction seismic cannot give so detailed an answer.

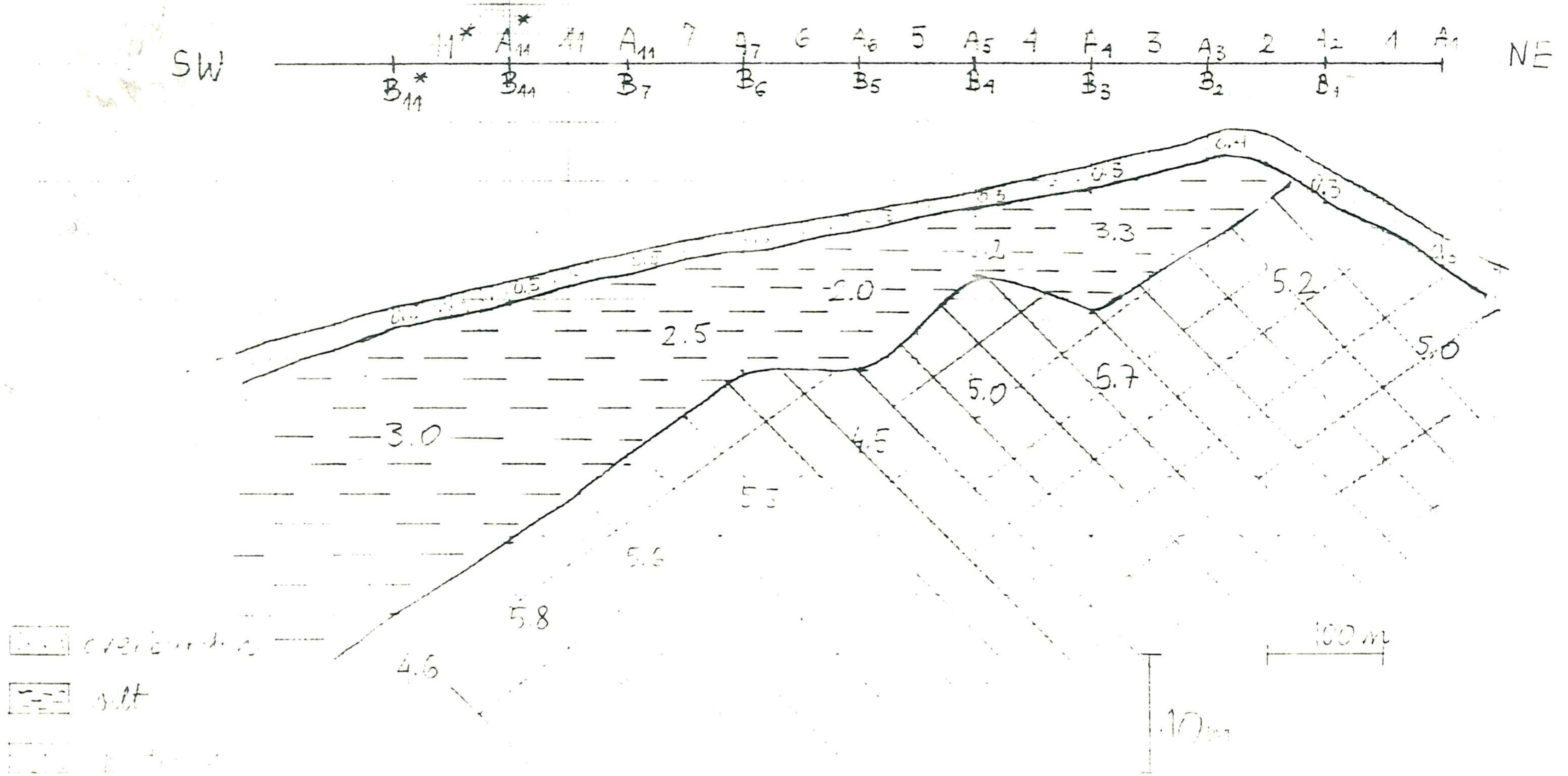
Calculated velocities and depths to bedrock in the geological sections I and II

		V_1 m/ms	V_2	V_3	h_1	h_2 m
I	A_1	0,3	5,0		2,1	
	B_1	0,3	5,2		4,2	
	A_2	0,3	4,4		1,4	
	B_2	0,6	4,3		1,3	
	A_3	0,3	3,2		1,6	
	B_3	0,3	3,2		1,0	
	A_4	0,4	3,3	5,7	2,0	12,6
	B_4	0,3	2,2	4,2	1,1	7,2
	A_5	0,4	2,1	5,6	1,4	6,3
	B_5	0,3	1,8	4,4	1,3	6,6
	A_6	0,4	2,3	4,5	1,0	18,8
	B_6	0,7	2,3	5,5	5,1	12,0
	A_7	0,4	2,7		1,3	
	B_7	0,3	2,4	6,0	2,0	8,7
	B7'	0,8	5,0		6,0	
	B7''	0,5	4,5		3,6	
	A11	0,6	2,6	5,5	1,2	2,8
	B11	0,4	2,5	4,0	1,3	10,7
	A11*	0,6	3,4	5,5	1,3	3,3
	B11*	0,6	3,0	4,6	1,3	2,4
II	Ag	0,6	3,1	6,6	1,2	7,4
	Bg	1,6	2,9	5,1	2,4	12,0
	Ag*	1,3	2,7	5,5	4,5	22,8
	Bg*	1,5	3,0	4,3	4,3	7,2
	Ag**	1,2	2,9	4,7	4,2	16,4
	Bg**	1,3	3,0	4,6	3,7	17,0
	A_8	0,4	2,9		2,8	
	B_8	0,3	3,3		2,3	
	B_{10}		3,2			
	A_{10}	0,3	1,7	3,1	1,0	7,2
	A'_{10}	0,6	3,0		3,2	
	A''_{10}	0,3	2,3	5,5	2,2	9,0



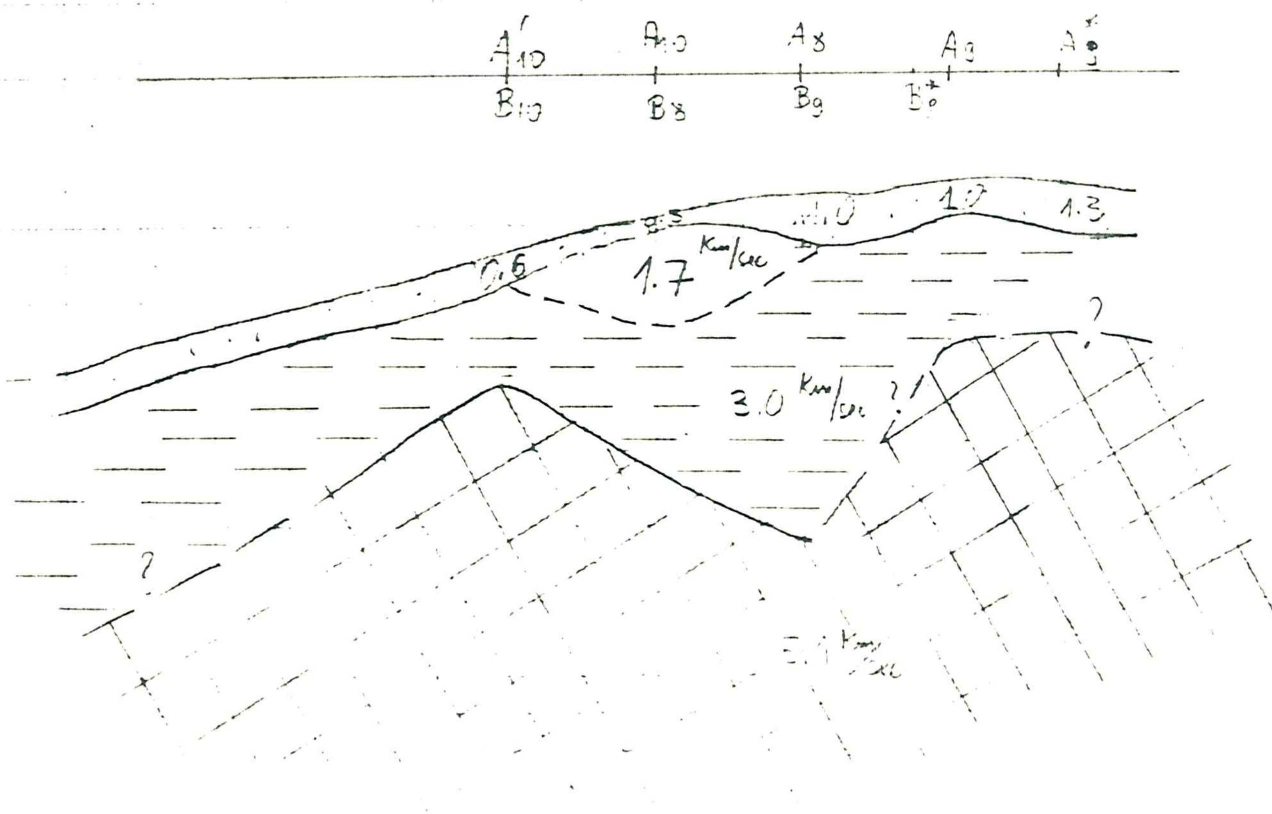
LOCATION MAP

profile I



SW
NE
A₁ 1 A₂ 2 A₃ 3 A₄ 4 A₅ 5 A₆ 6 A₇ 7 A₁₁ 11 A₁₁* 11*
B₁ B₂ B₃ B₄ B₅ B₆ B₇ B₁₁ B₁₁*
0.4
0.5
3.3
2.0
2.5
3.0
5.2
5.0
5.7
4.5
5.8
4.6
100 m
10 m
silt

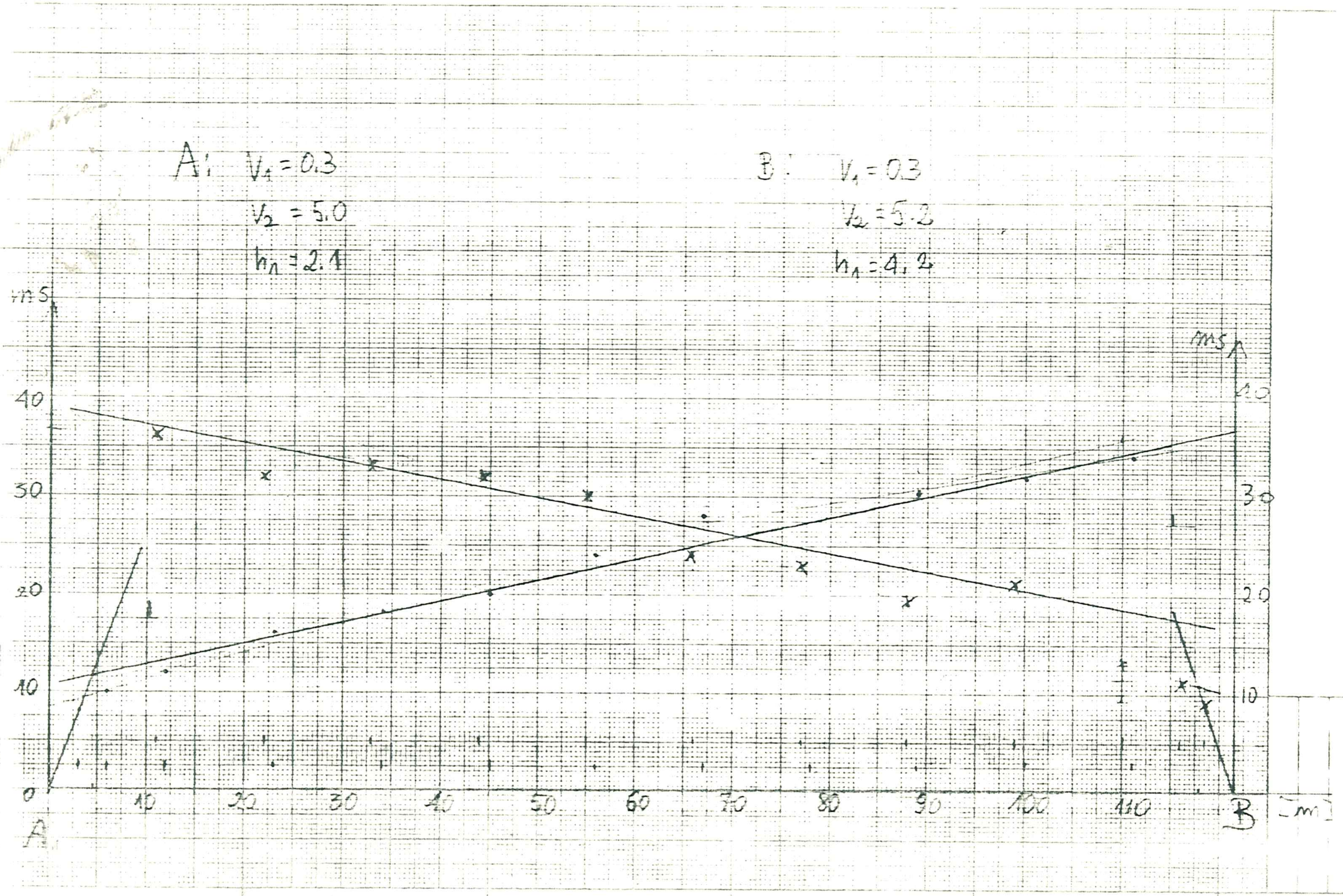
II



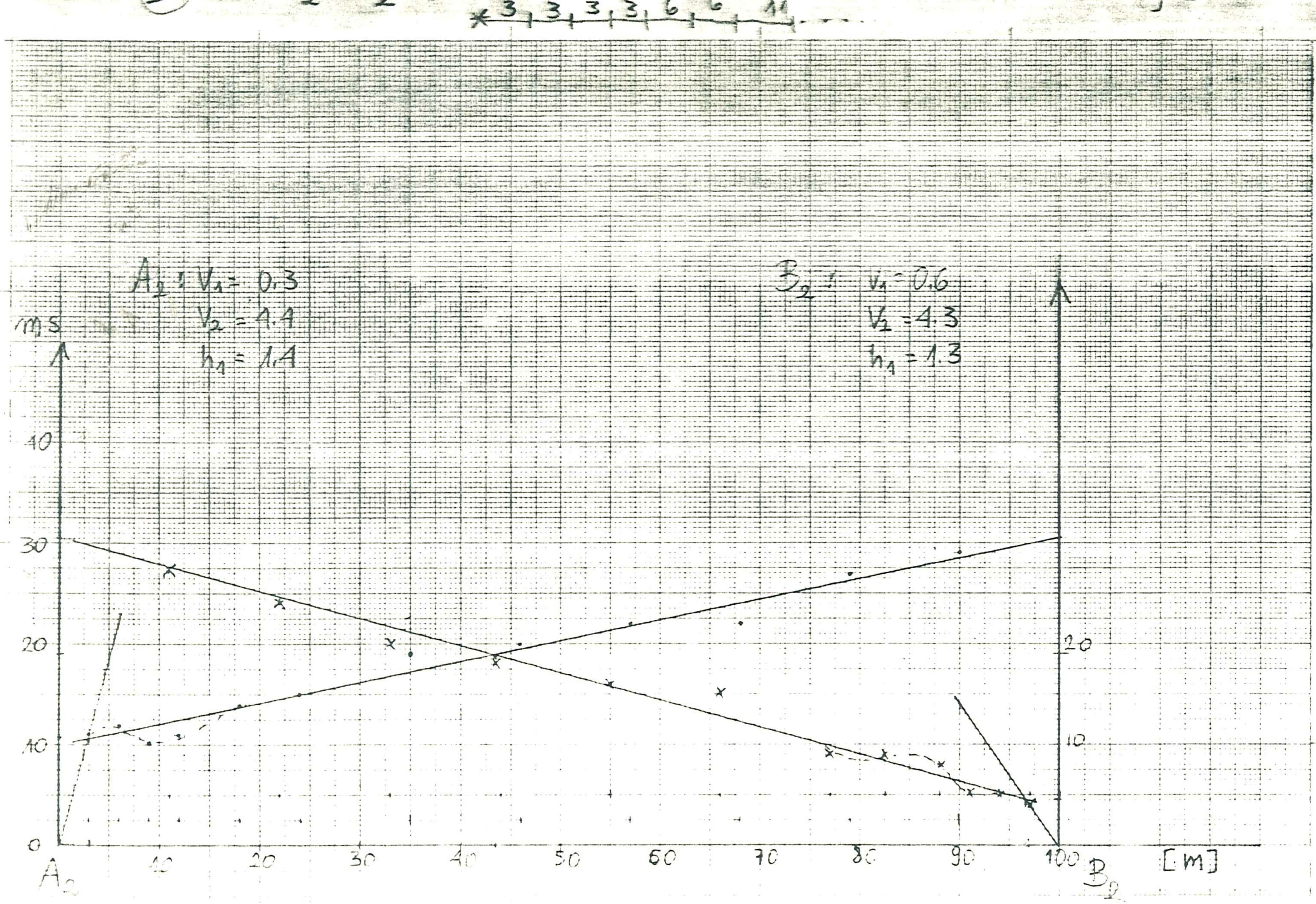
overburden
silt

I 1 A_1-B_1

Fig. 4


A: $V_1 = 0.3$
$V_2 = 5.0$
$h_1 = 2.1$
B: $V_1 = 0.3$
$V_2 = 5.2$
$h_1 = 4.2$
ms
0
10
20
30
40
50
60
70
80
90
100
110
A
B
[m]

(I) 2 A_2-B_2 Fig. 5



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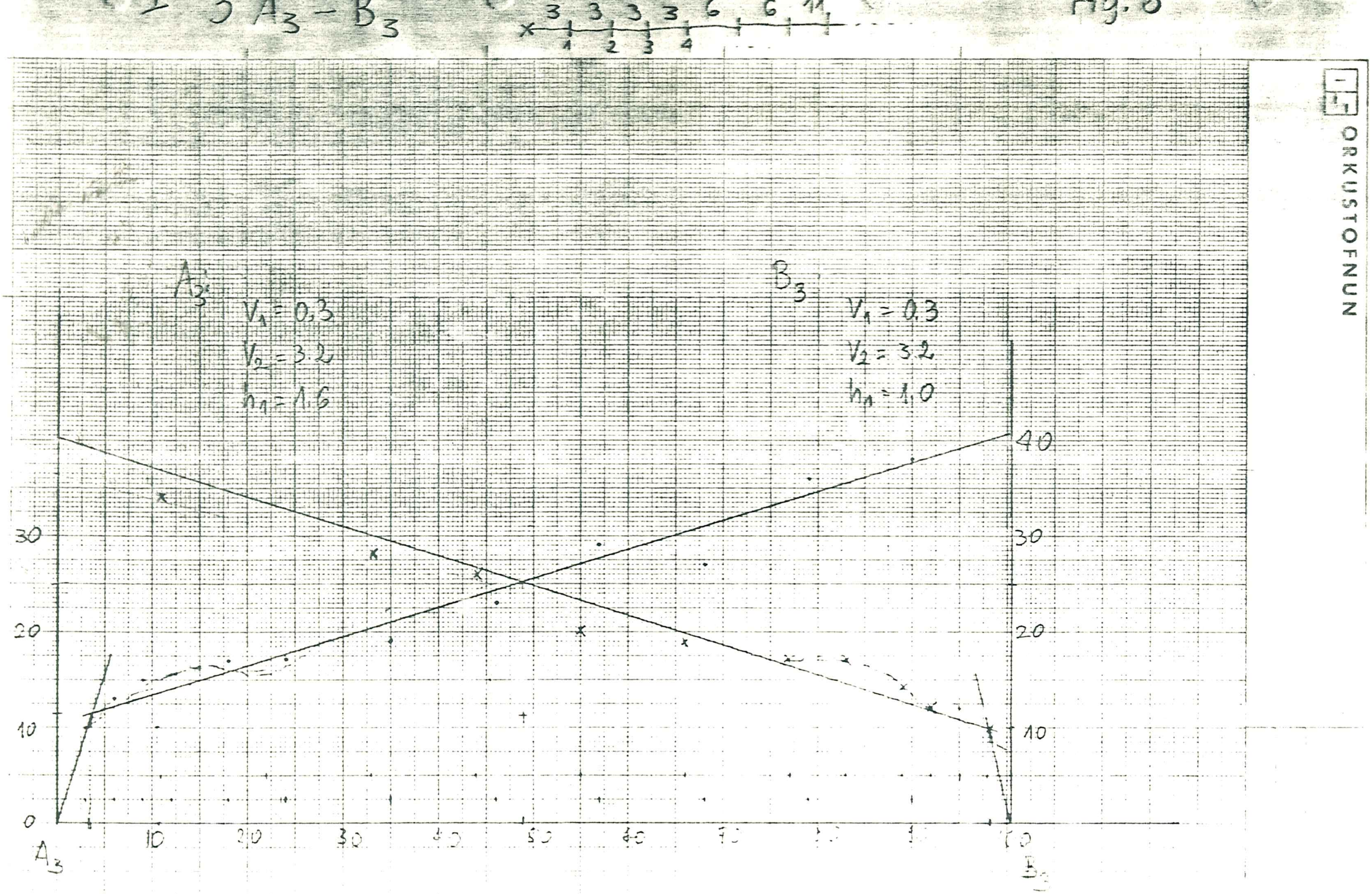
I 3 $A_3 - B_3$

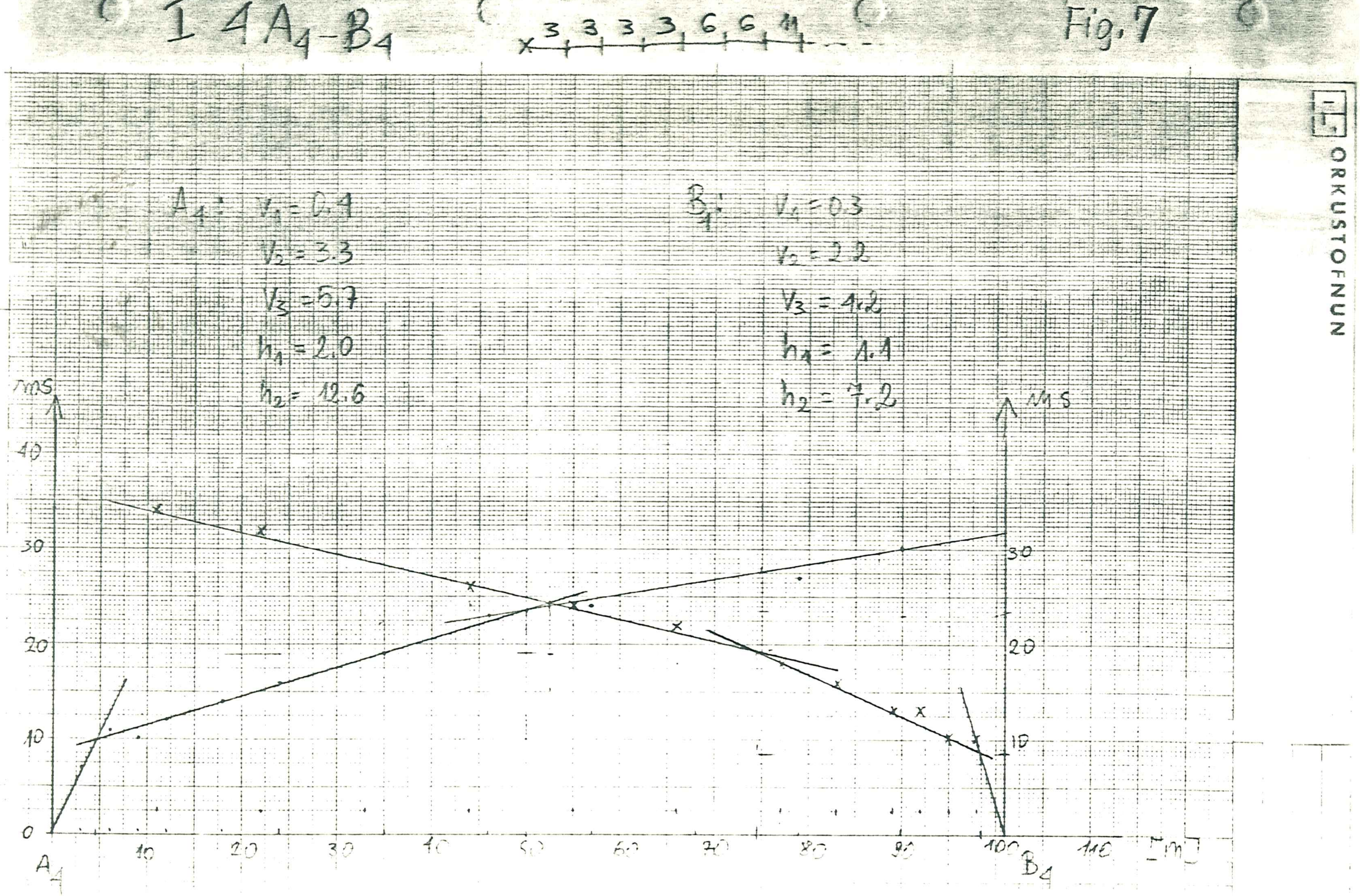
Fig. 6



3 3 3 3 6 6 11
1 2 3 4
ORKUSTOFNUN
A_3
$V_1 = 0.3$
$V_2 = 3.2$
$h_1 = 1.6$
B_3
$V_1 = 0.3$
$V_2 = 3.2$
$h_1 = 1.0$
40
30
20
10
0
10
20
30
50
A_3
B_3

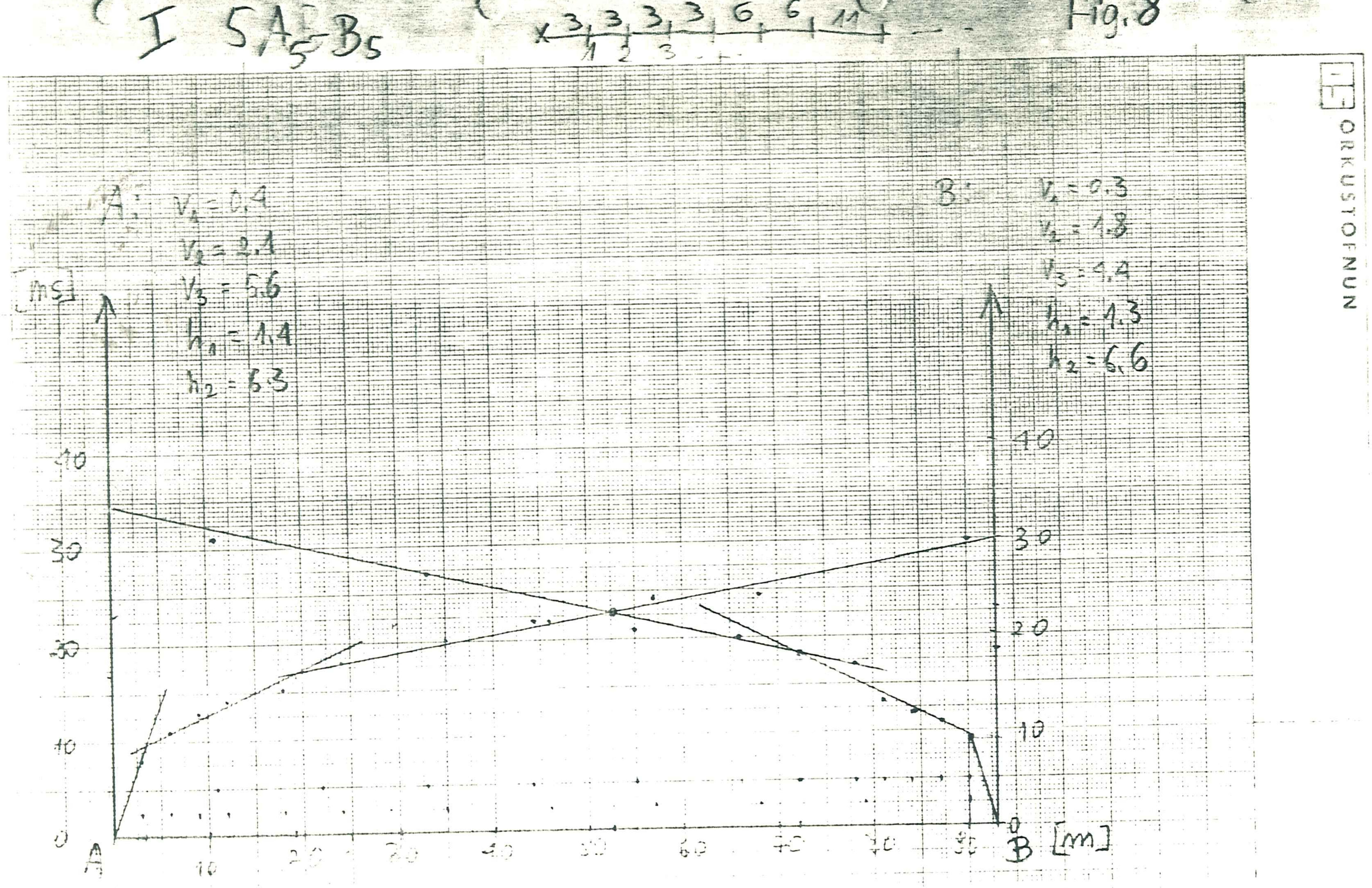
I 4 A_4 - B_4

Fig. 7


x 3 3 3 3 6 6 11
A_1: V_1 = 0.4
V_2 = 3.3
V_3 = 5.7
h_1 = 2.0
h_2 = 12.6
B_1: V_1 = 0.3
V_2 = 2.2
V_3 = 4.2
h_1 = 1.1
h_2 = 7.2
ms
0
10
20
30
40
A_4
B_4
100
110
[m]
ORKUSTOFNUN

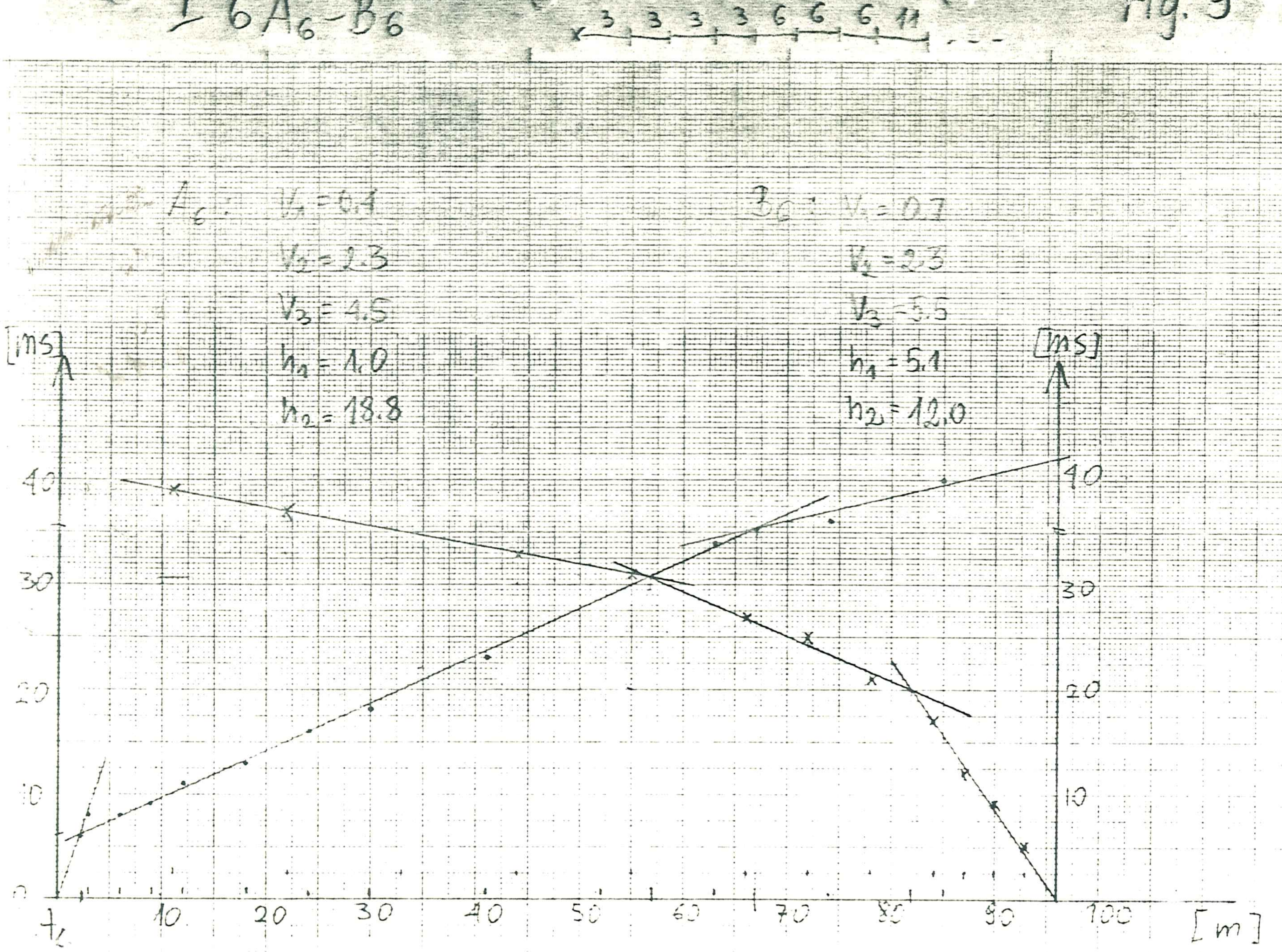
I 5 A5–B5

Fig. 8


x 3 3 3 3 6 6 11
1 2 3
ORKUSTOFNUN
A: v_1 = 0.4
v_2 = 2.1
v_3 = 5.6
h_1 = 1.4
h_2 = 6.3
B: v_1 = 0.3
v_2 = 1.8
v_3 = 4.4
h_1 = 1.3
h_2 = 6.6
[ms]
0
10
20
30
40
A
B
[m]

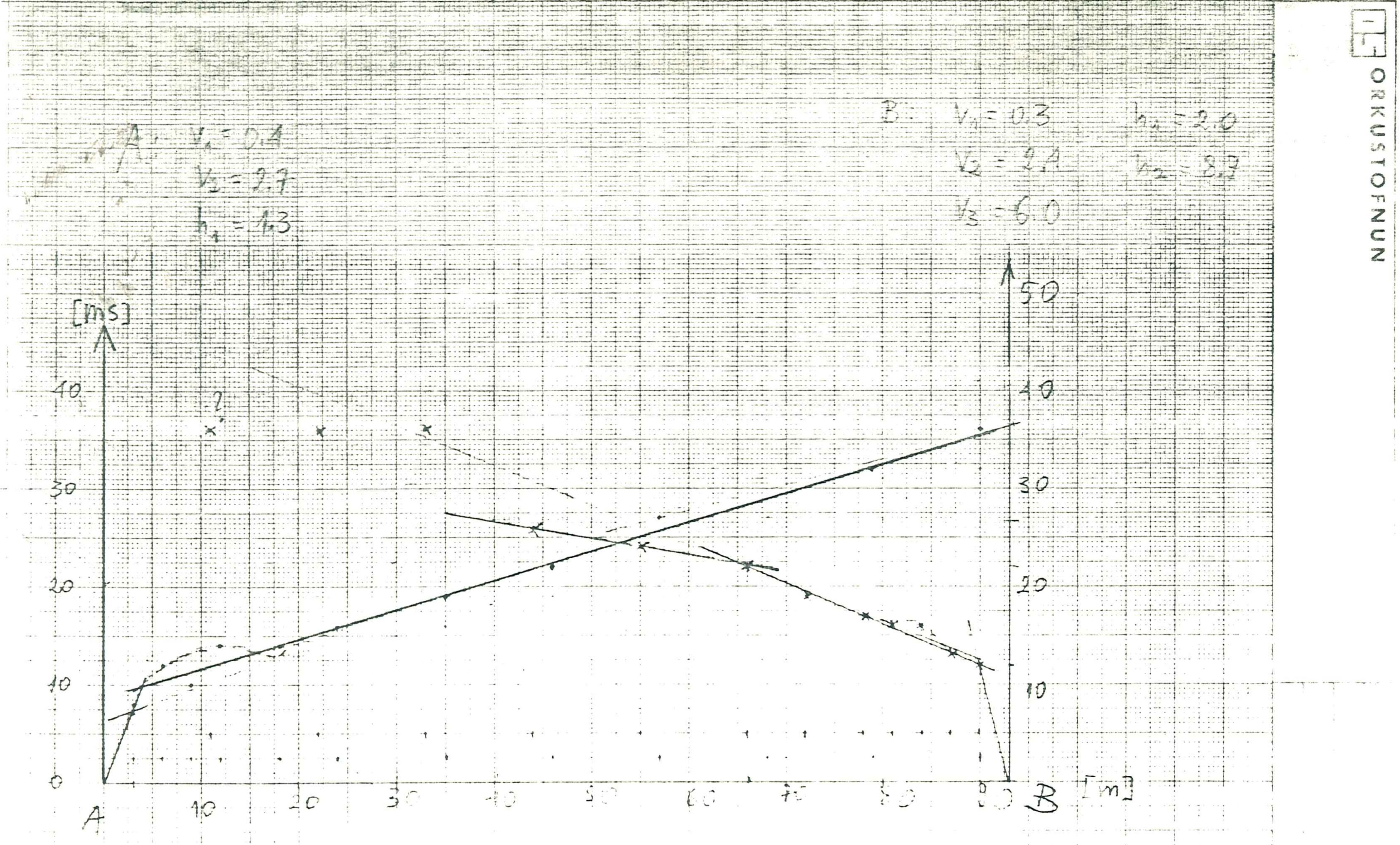
I 6A₆-B₆

Fig. 9



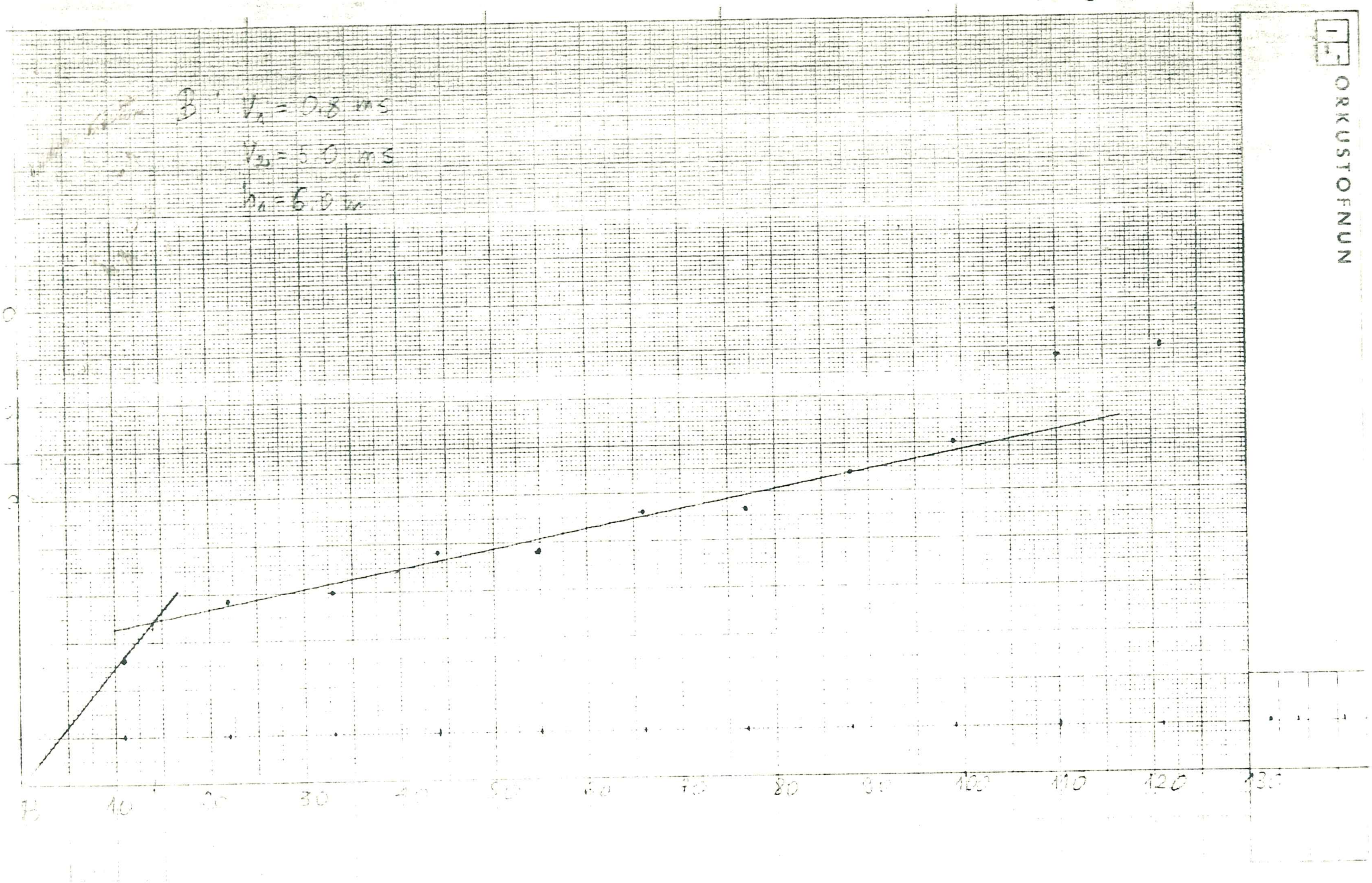
x 3 3 3 3 6 6 6 11
A6 : V1 = 0.1
V2 = 2.3
V3 = 4.5
h1 = 1.0
h2 = 18.8
B6 : V1 = 0.7
V2 = 2.3
V3 = 3.5
h1 = 5.1
h2 = 12.0
[ms]
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
[m]

I 7 A_7-B_7 x 3 3 3 3 6 6 11 Fig. 10

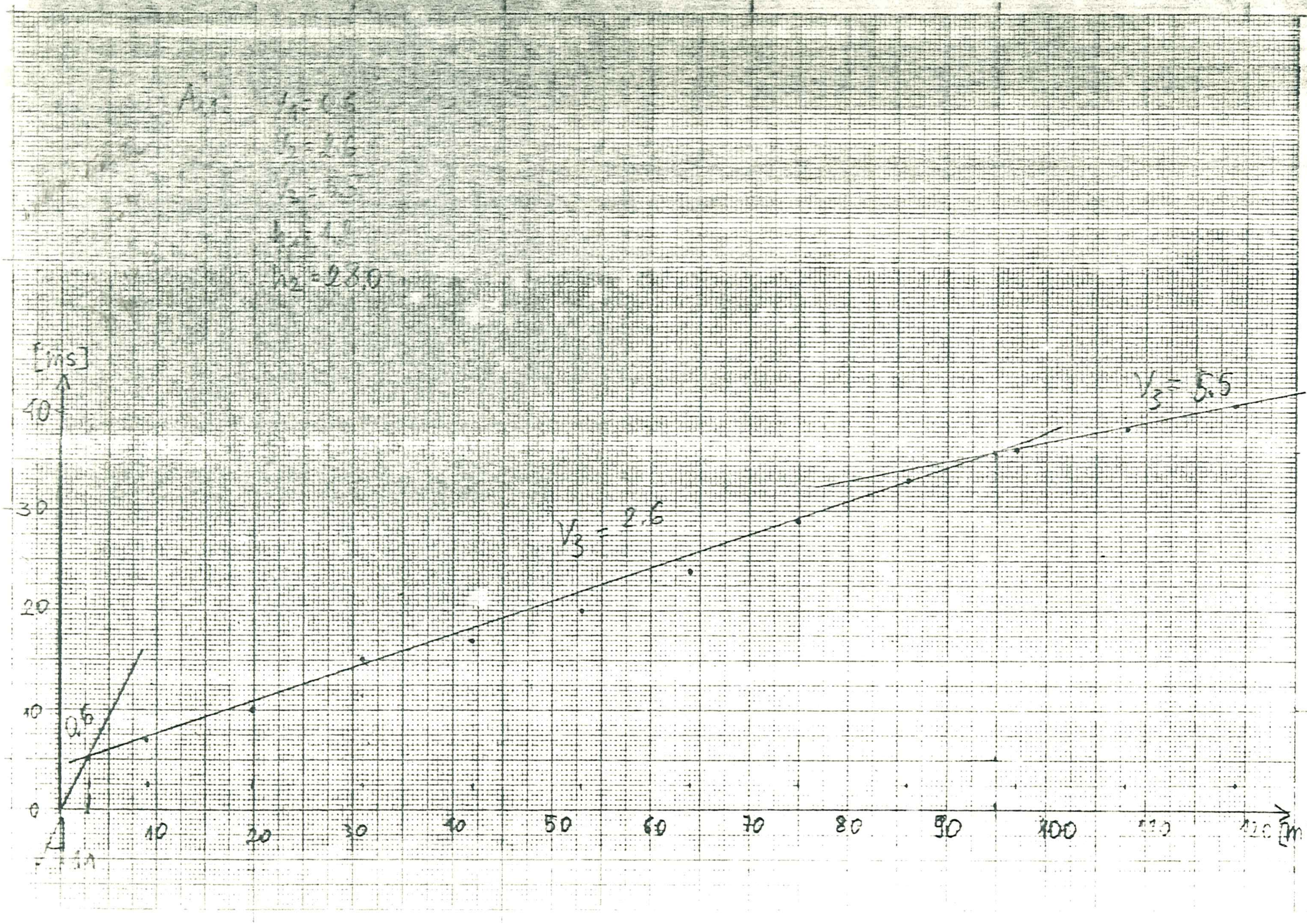


7' B

Fig. 11



I 11 A   × 3 6 11 ...   Fig. 13



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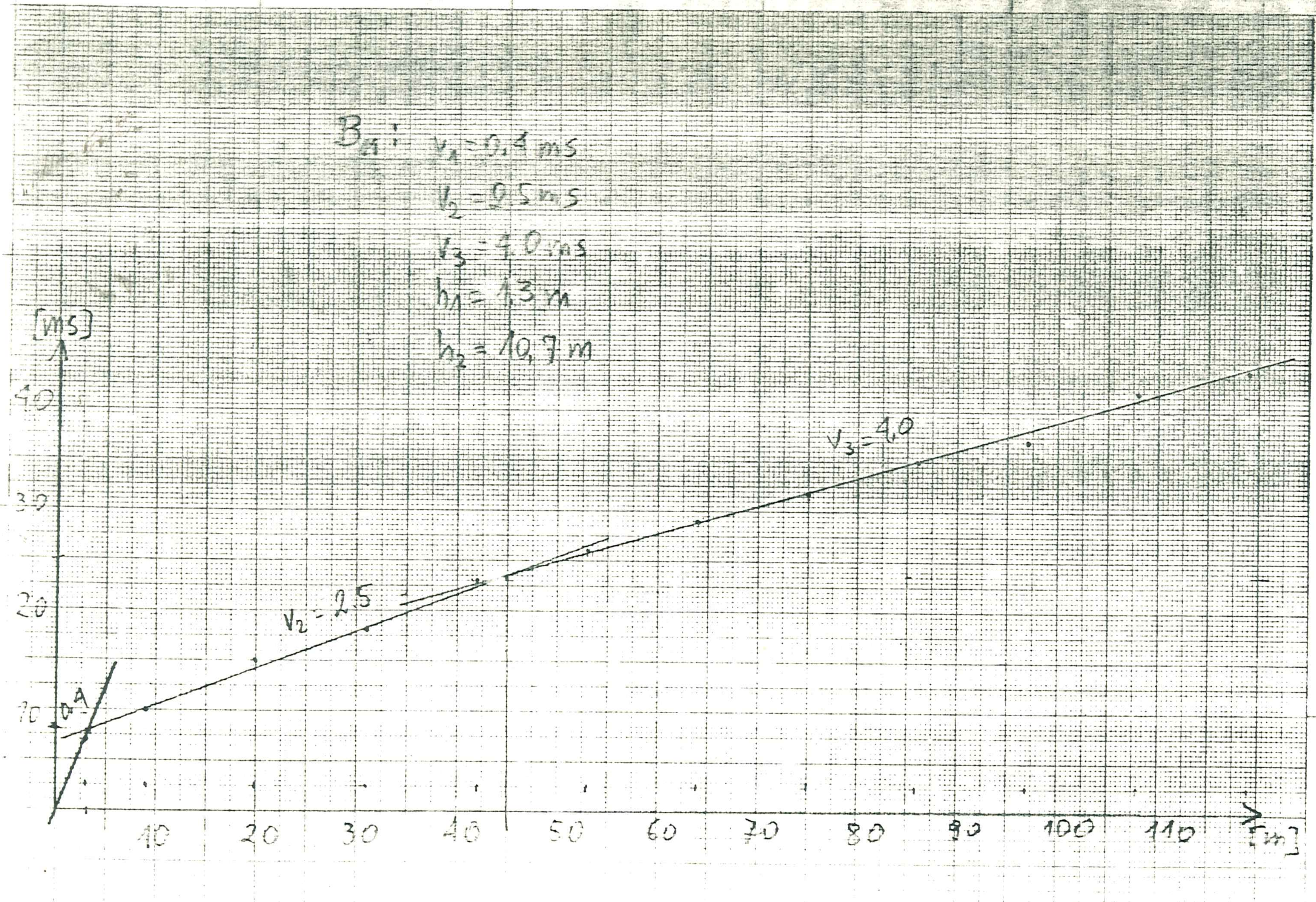
I 11B

Fig. 14



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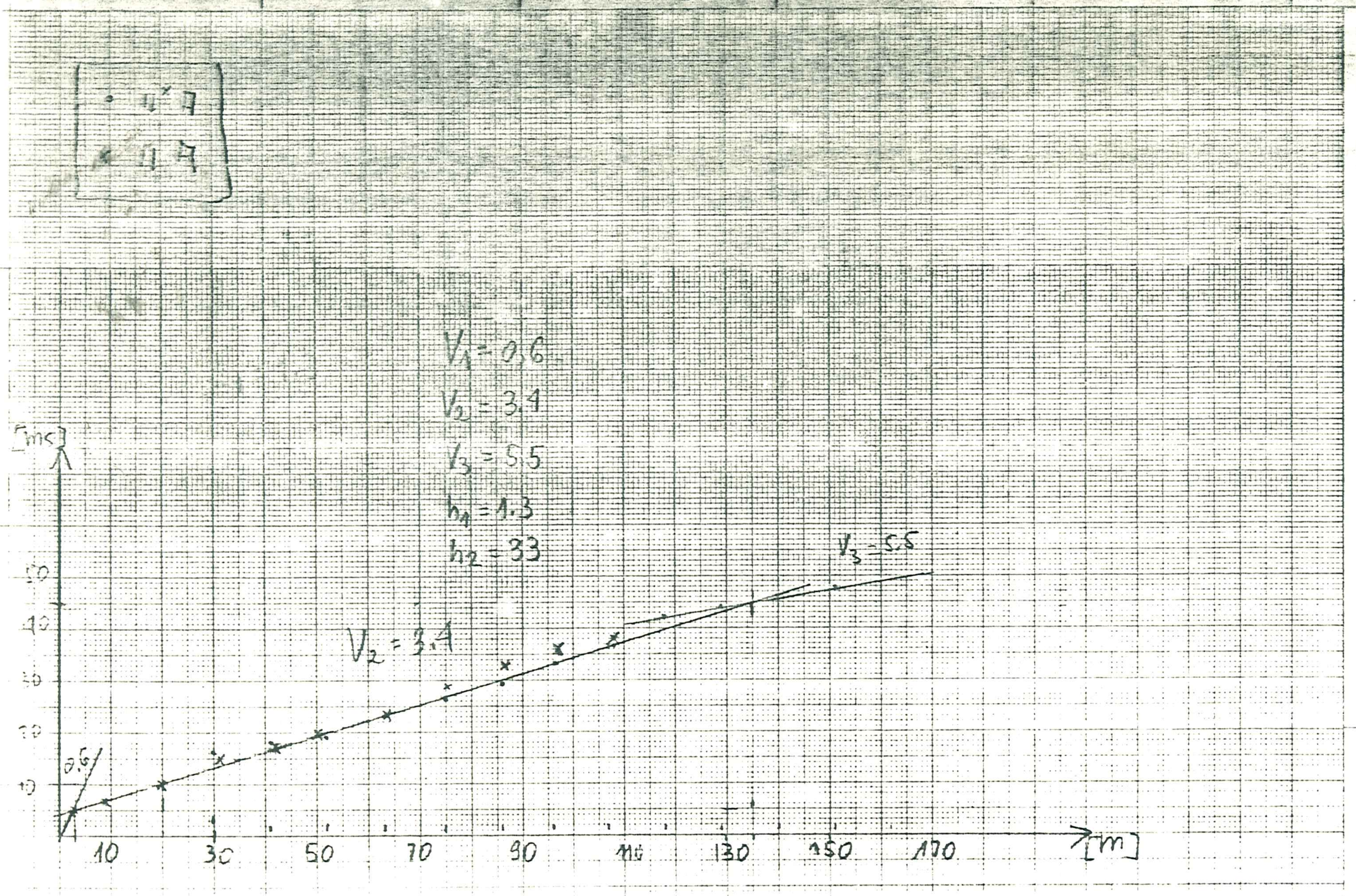
I 11* A

Fig. 15



x 30 1 11 2 11 3
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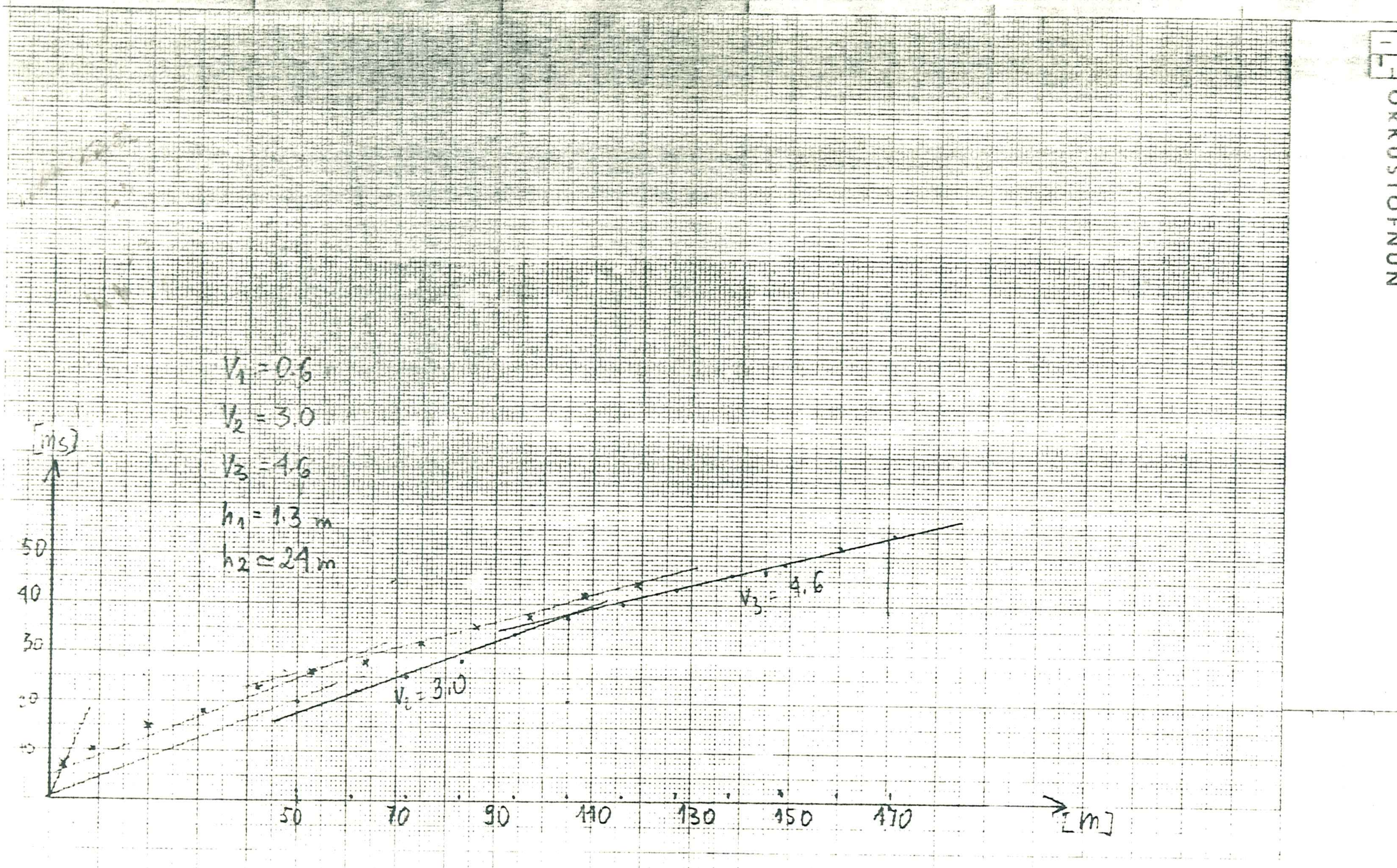
• 11* A
x 11 A
$V_1 = 0.6$
$V_2 = 3.4$
$V_3 = 5.5$
$h_1 = 1.3$
$h_2 = 33$
$V_2 = 3.4$
$V_3 = 5.5$
0.6
[ms]
[m]
10
30
50
70
90
110
130
150
170

I 11*B x 50 m Fig. 16

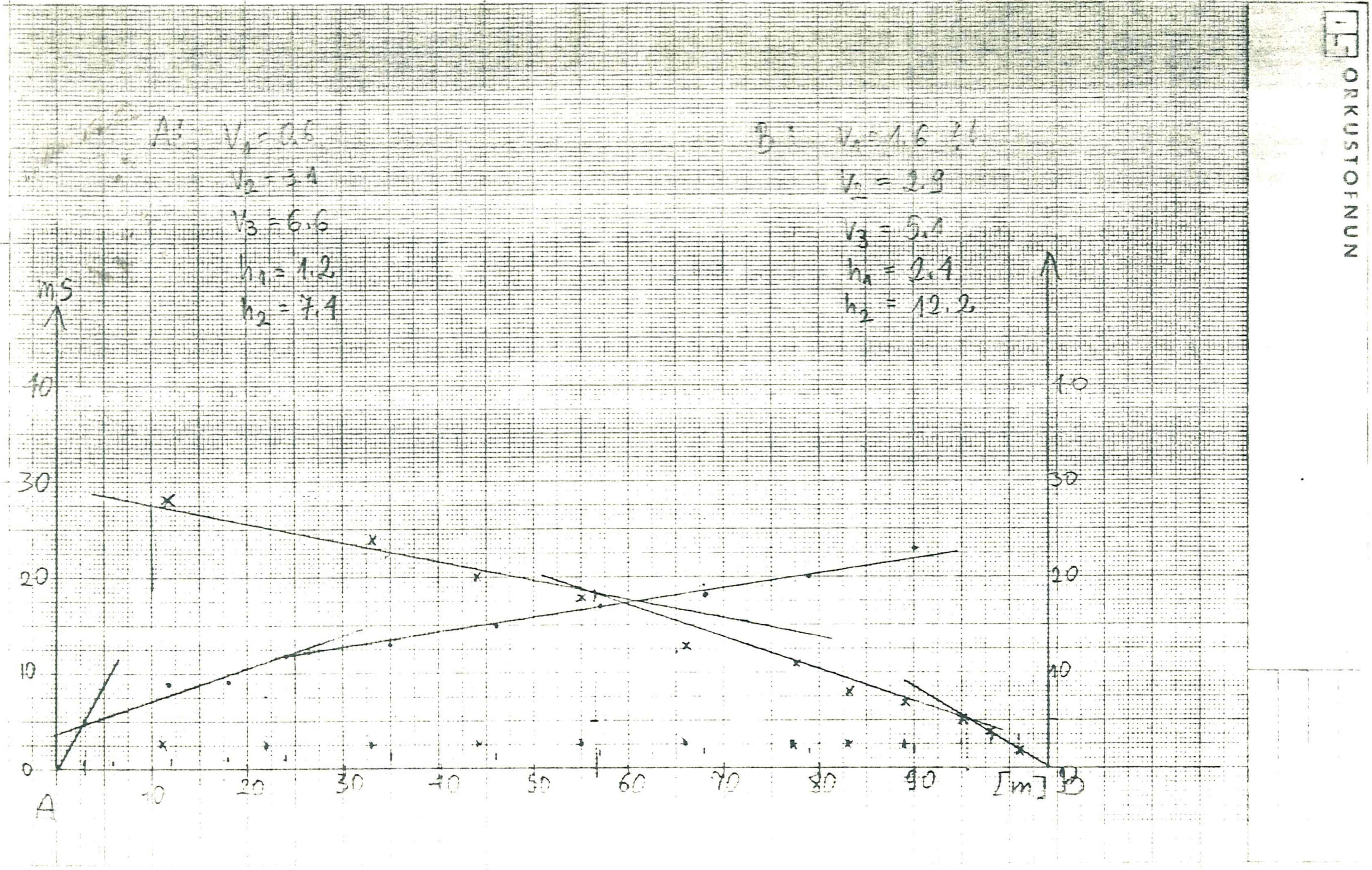


II 9 $A_g - B_g$

A × 3, 3, 6, 6, 6, 11, 11 ... geophones are in ditch

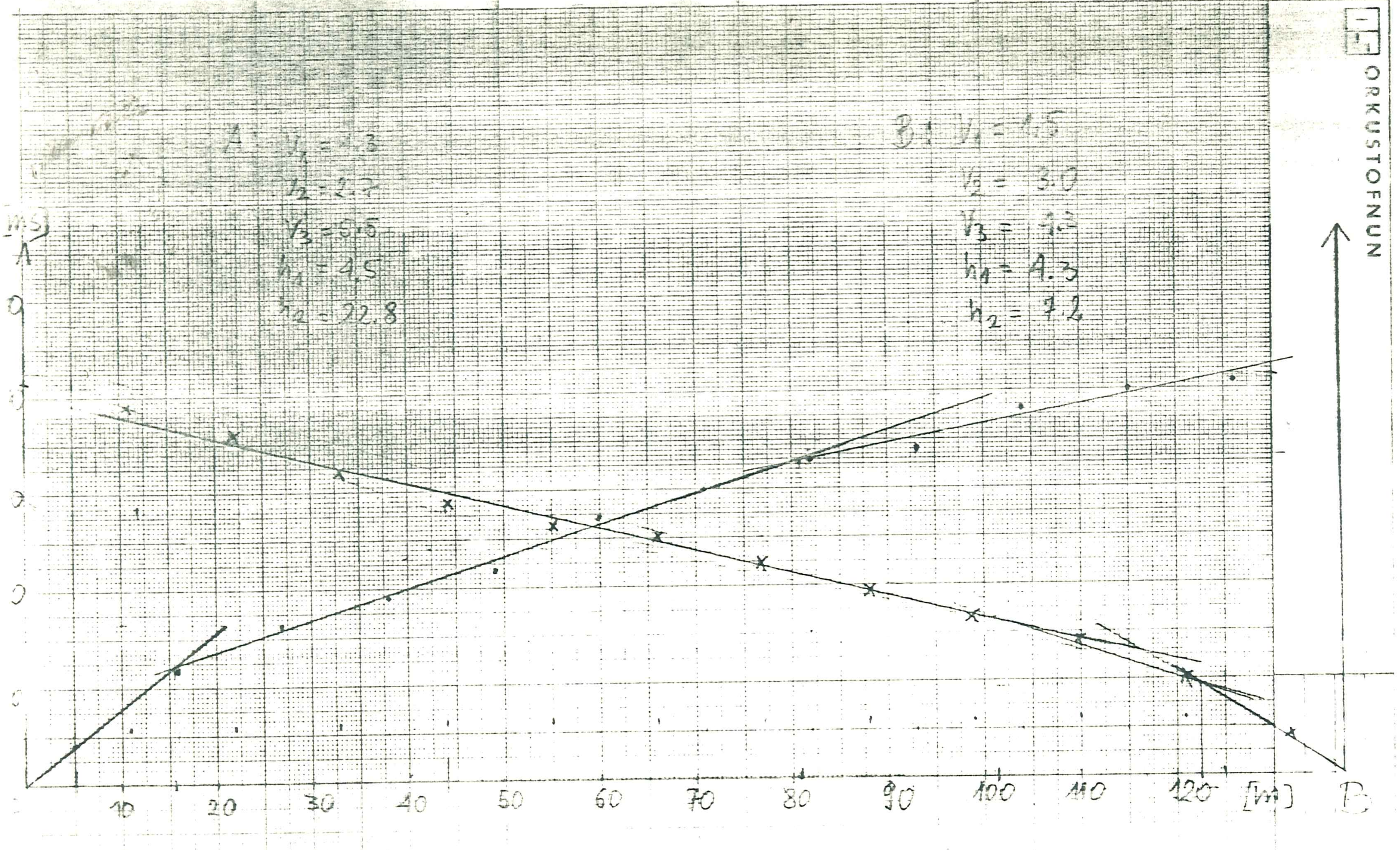
B ... 11, 6, 6, 6, 3, 3, 3 ×

Fig. 17



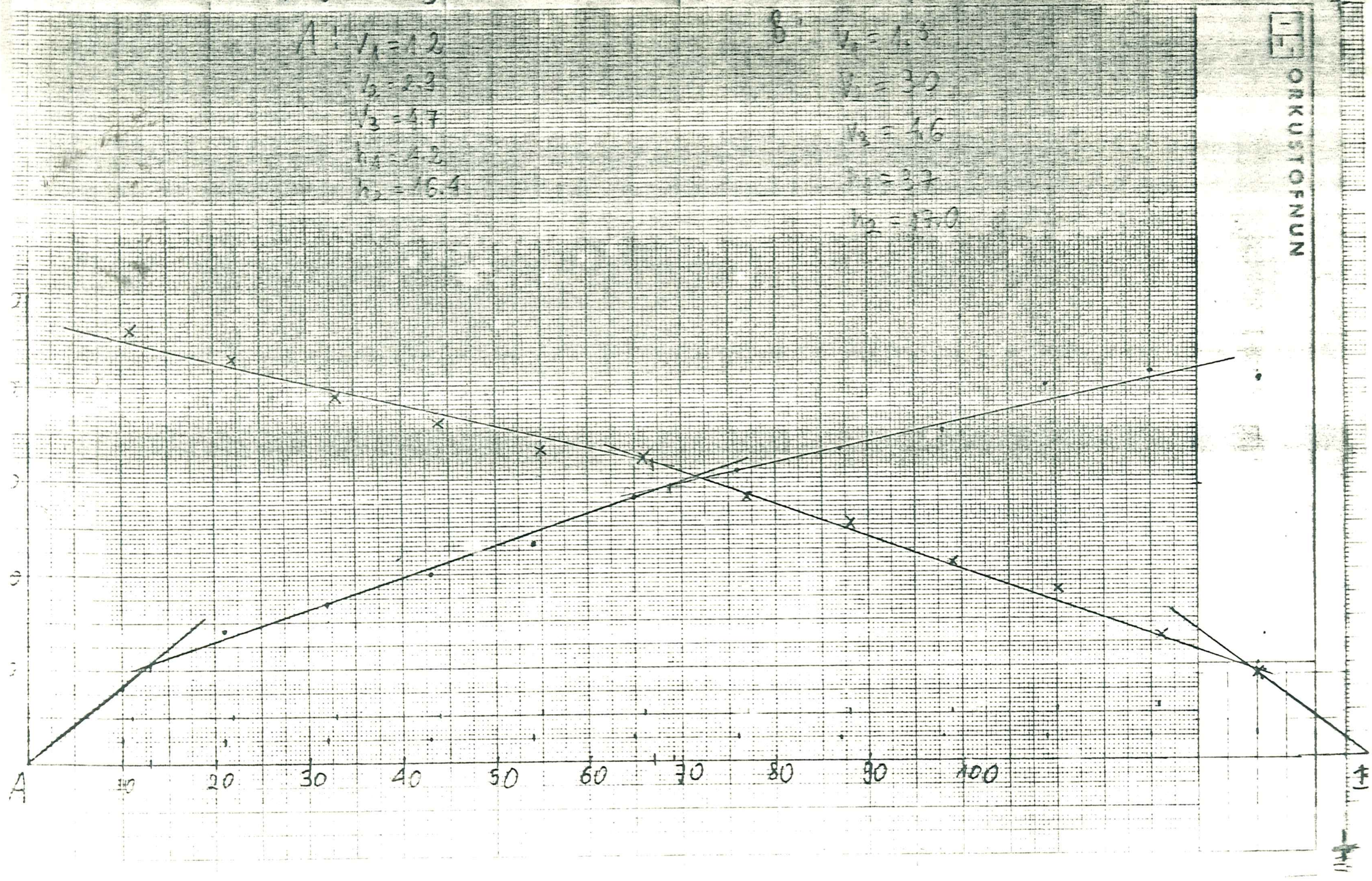
II* g* A_9^* - B_9^* ×5 11 11

Fig. 18

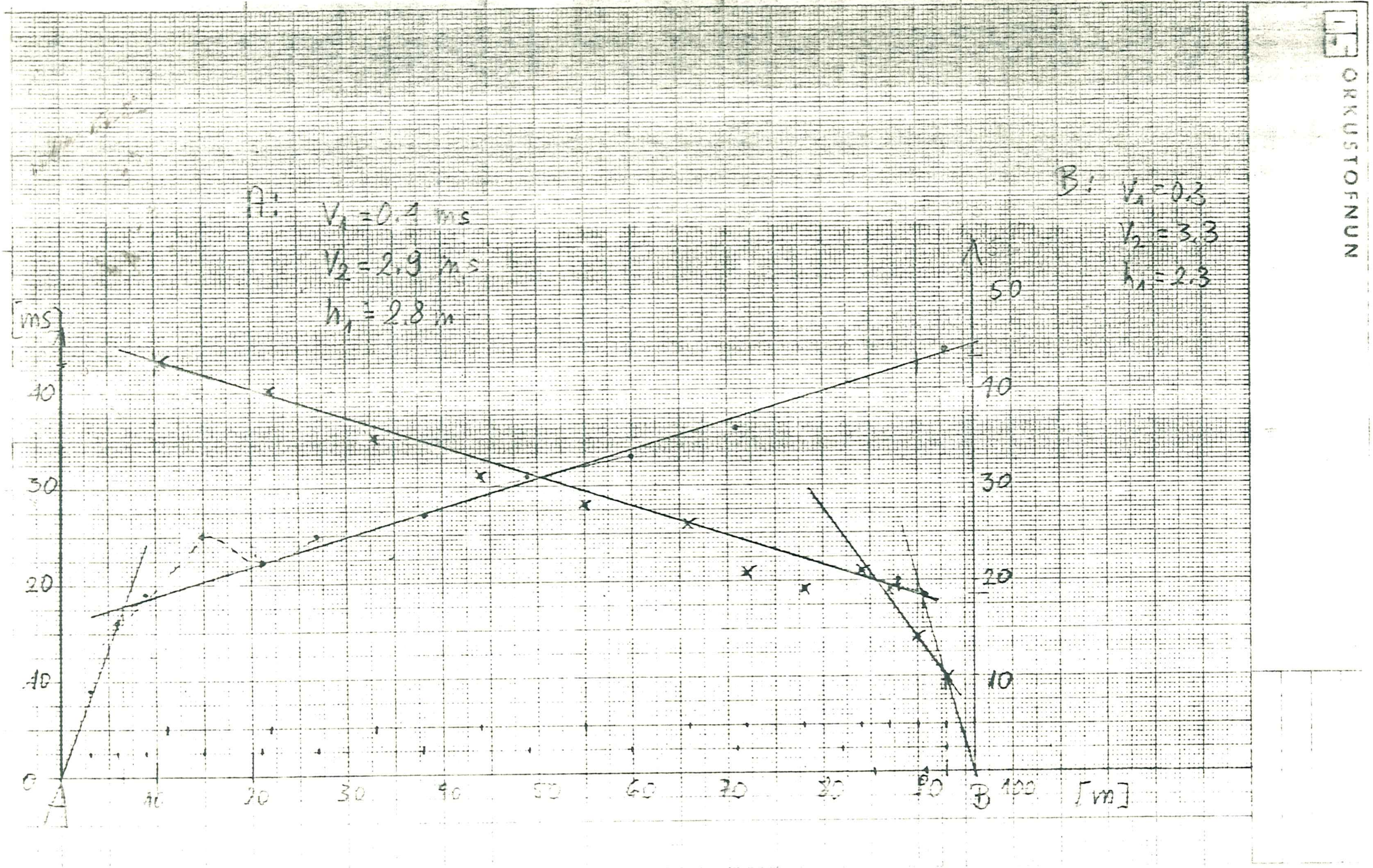


II g^{**} $A_g^{xx} - B_g^{x2}$ A x 10, 11, 11, ... B x 12, 11, 11, ...

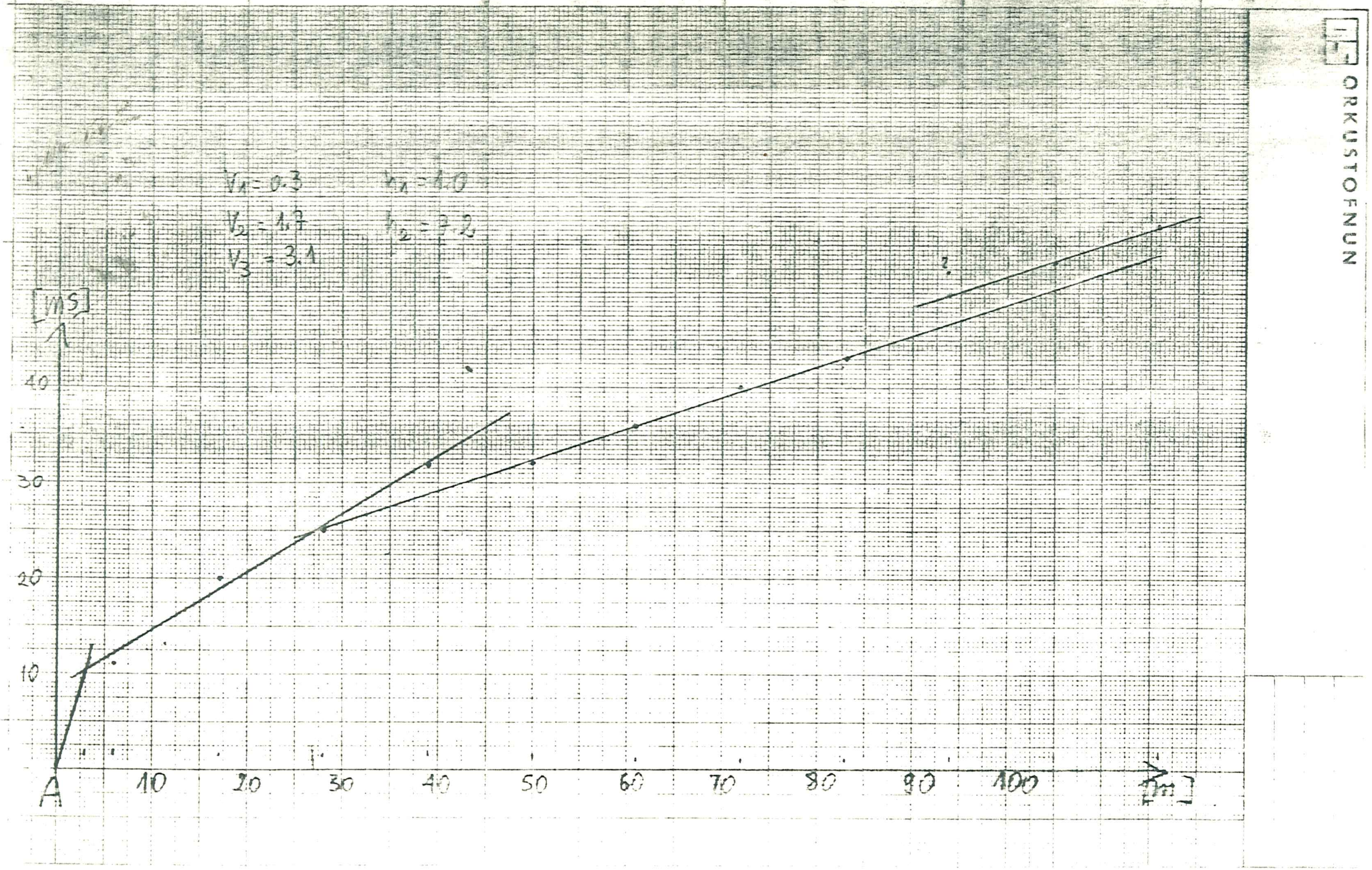
Fig. 19



II 8 A_8–B_8 Fig. 20

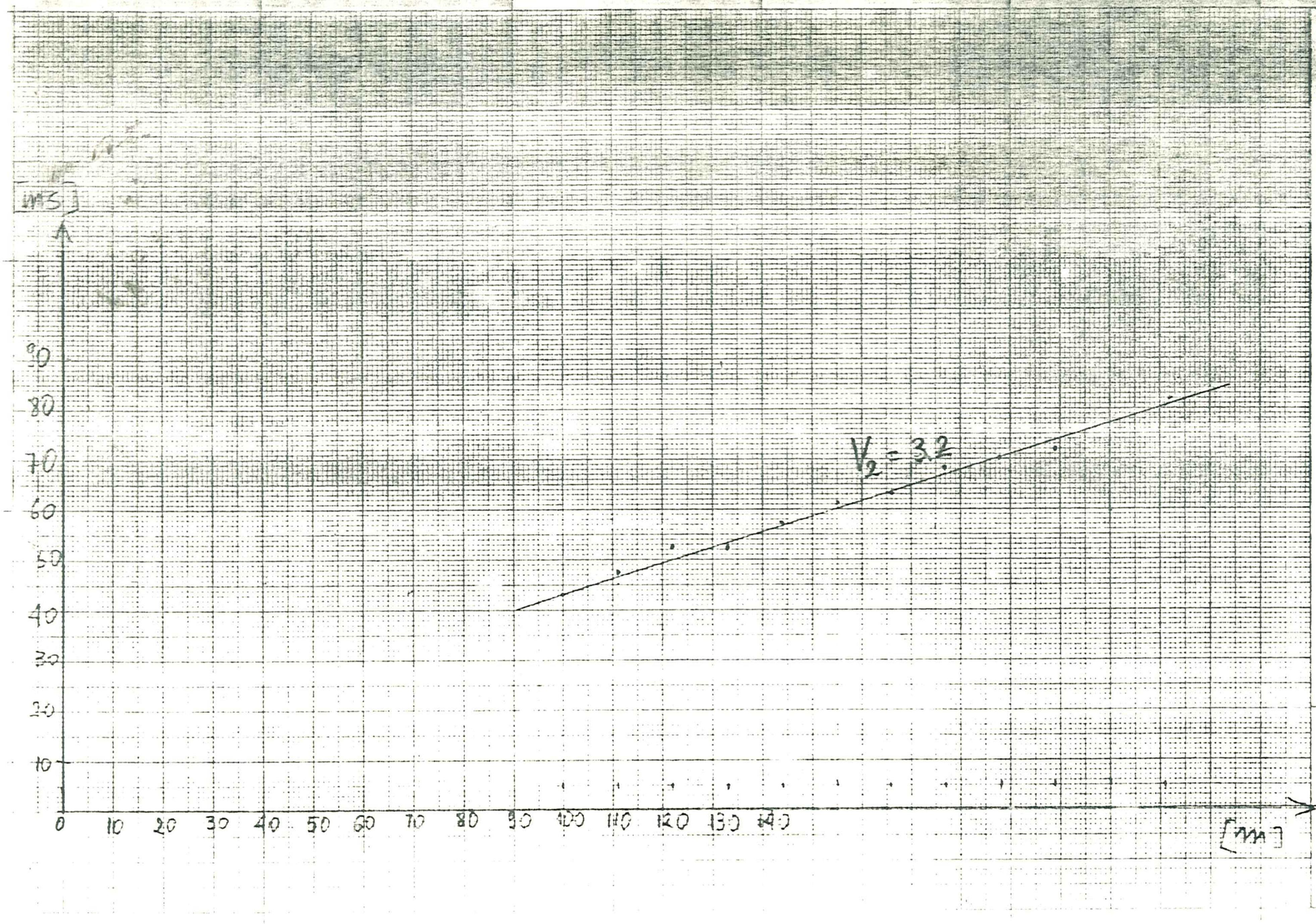


II 10 A A Fig. 21



II 10B

Fig. 22



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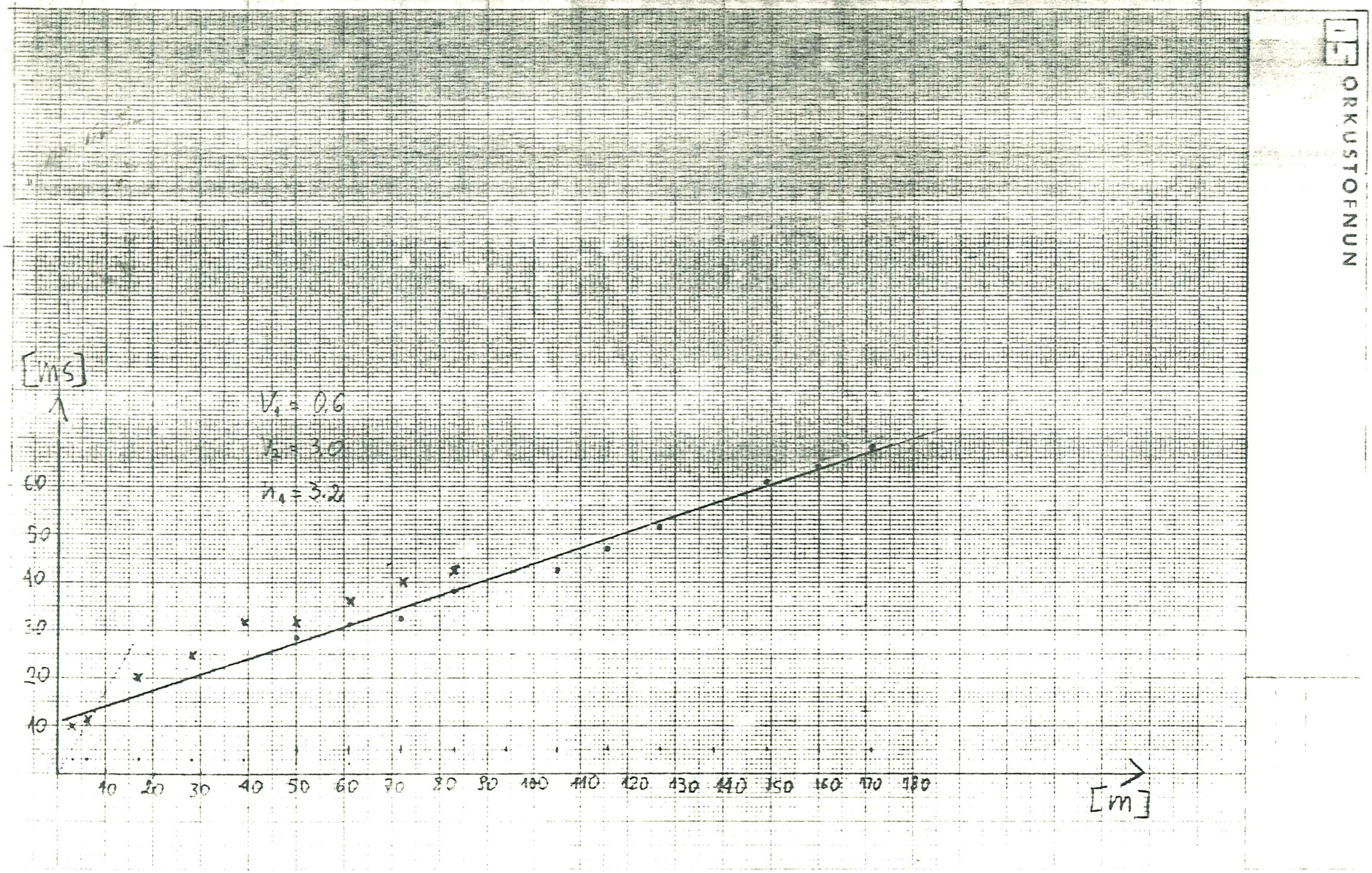
II 10 A'

Fig. 23



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[ms]
$V_1 = 0.6$
$V_2 = 3.0$
$h_1 = 3.2$
10
20
30
40
50
60
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
[m]

II 10A"

Fig. 24

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