CHAPTER III

EXPERIMENTAL WORK

3.1 Introduction

From the basic circuits of Chapter II, compressor and expander are composed of variable loss devices, rectifiers and amplifiers. In this chapter various parts of the compressor and the expander are constructed and tested by experiments.

Many problems have been arised in construction of the transistor compandor; i.e.

1) Inadequate of measuring instruments at the beginning,
2) Lacking of materials for construction of transformers,
3) Lacking of techniques in designing a.f. transformers,
4) There are many types of transistors to be selected, we must make decision on them for the most suitable.
5) Lacking of experience in transistor works, etc.

Therefore this compandor is not as perfect as it has been expected to be. It needs further improvements.

3.2 Compressor Variable-loss Circuits

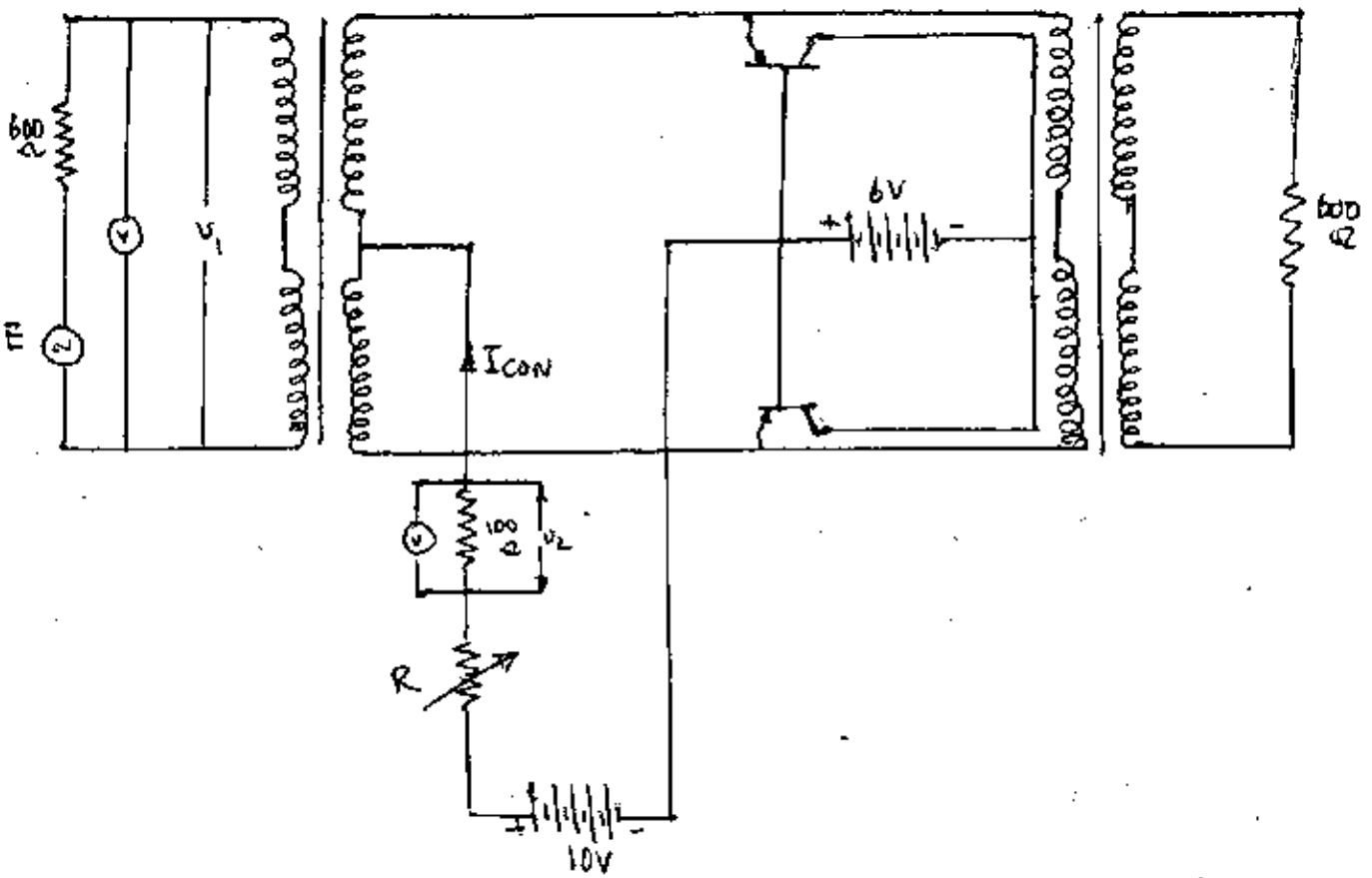


Fig 31 — Compressor Variable-loss Circuit

By varying R to obtain the required value of v_2 and read the corresponding value v_1, I_{con} and R_1 can be computed as follows:

$$R_1 = \frac{600\ v_1}{775 - v_1} \qquad \text{——(3.1)}$$

$$I_{con} = 10\ v_2 \qquad \text{——(3.2)}$$

DATA NO 1

V_2 mv	I_{con} μa	V_1 mv	R_i ohm	Note
1	10	460	875	Input 0 db
2	20	430	748	Transformer
4	40	400	640	Turn ratio 1:10
8	80	355	500	Transistor OC70
11	110	320	420	
16	160	260	300	
25	250	170	170	
50	500	100	90	

DATA NO 2

V_2 mv	I_{con} μa	V_1 mv	R_i ohm	Note
1	10	460	875	Input 0 db
2	20	440	788	Transformer
4	40	410	675	turn ratio 1:10
7	70	370	545	Transistor OC71
12	120	300	379	
25	250	170	168	
60	600	100	89	

DATA NO 3

V_2 mv	I_{con} ua	V_1 mv	R_i ohm	Note
1	10	470	975	Input 0 db
2	20	460	875	Transformer
4	40	415	690	turn ratio 1:10
8	80	375	560	Transistor OC72
12	120	325	430	
22	220	205	216	
40	400	110	100	
60	600	100	90	

DATA NO 4

V_2 mv	I_{con} ua	V_1 mv	R_i ohm	Note
1	10	485	1000	Input 0 db.
2	20	465	900	Transformer
4	40	430	748	turn ratio 1:10
8	80	375	560	Transistor OC74
13	130	305	390	
27	270	165	160	
40	400	110	100	
60	600	100	90	

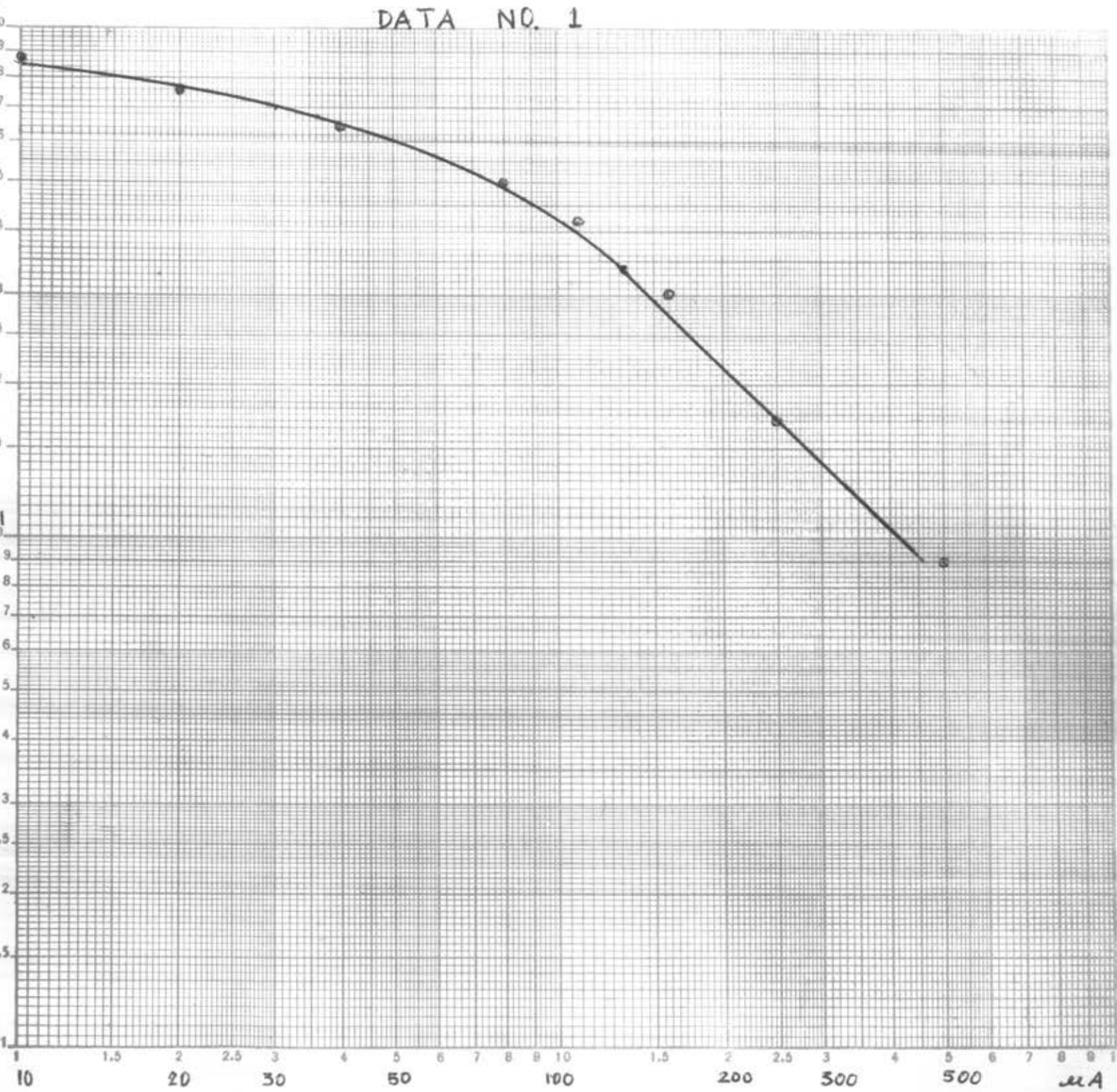


Fig. 32 A.C resistance/control Current characteristic

DATA NO 2

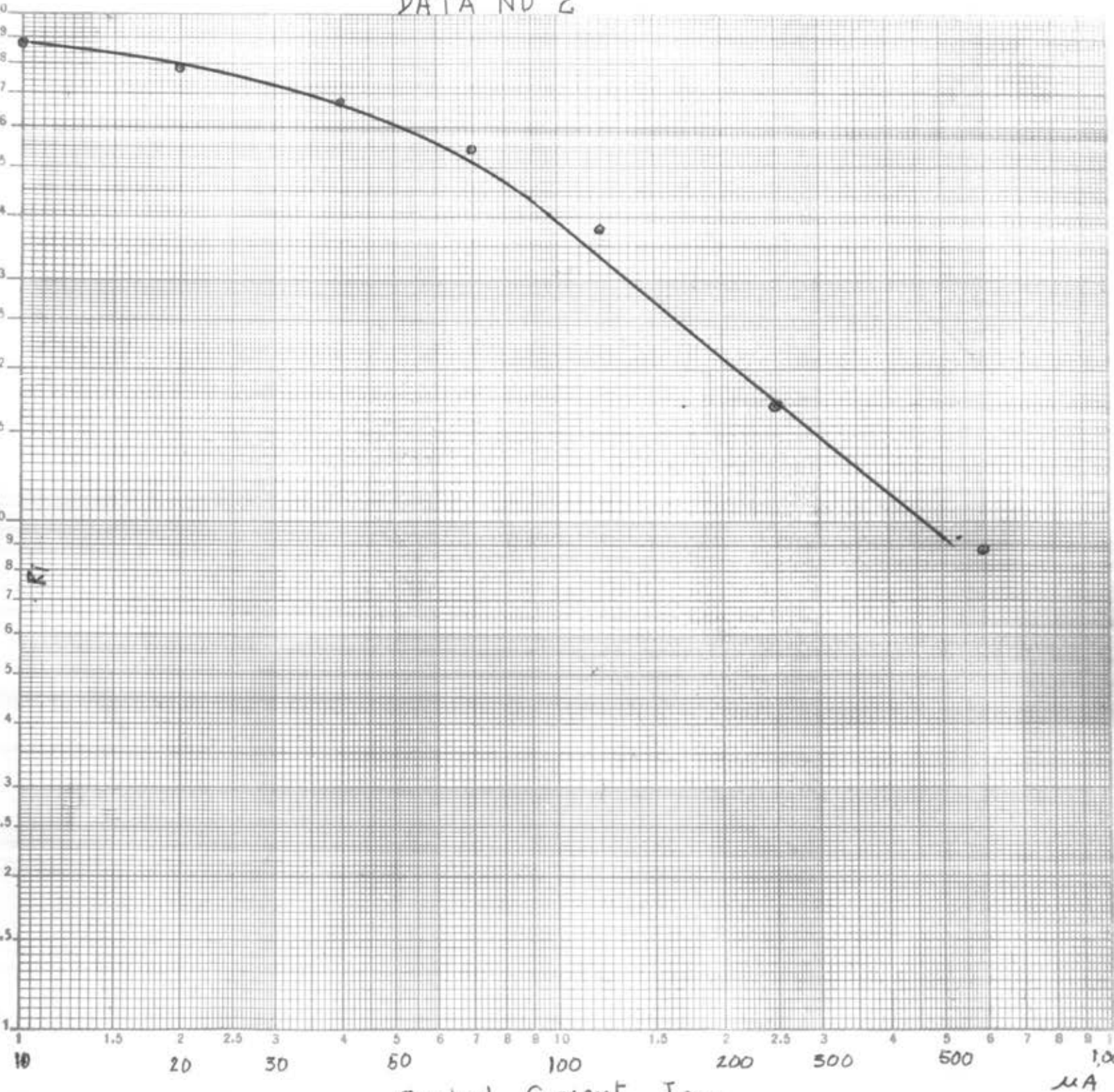


Fig 33 A.C resistance/control Current characteristic

DATA NO 3

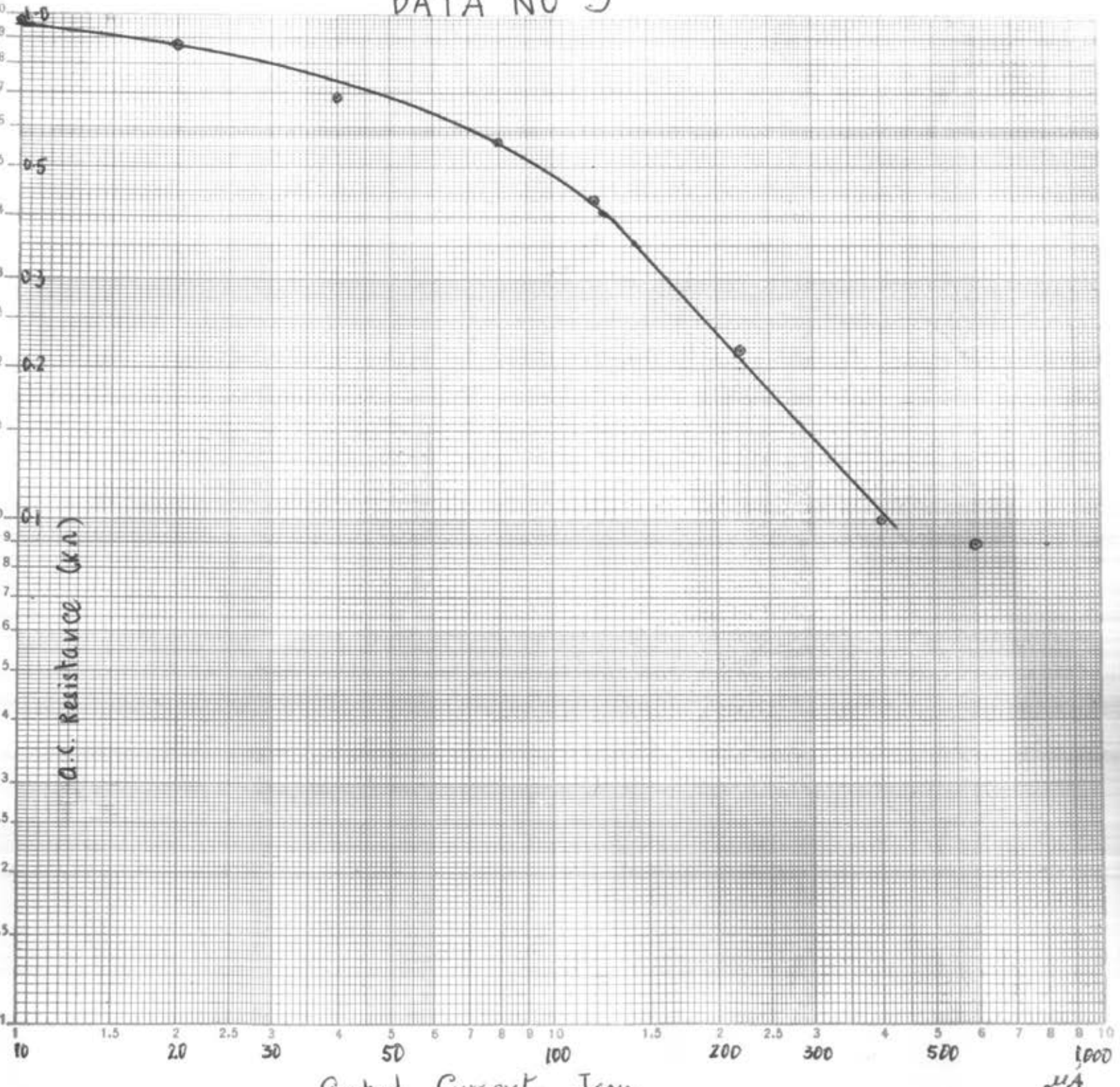


Fig 34 A.C. resistance / control Current characteristic

DATA NO 4

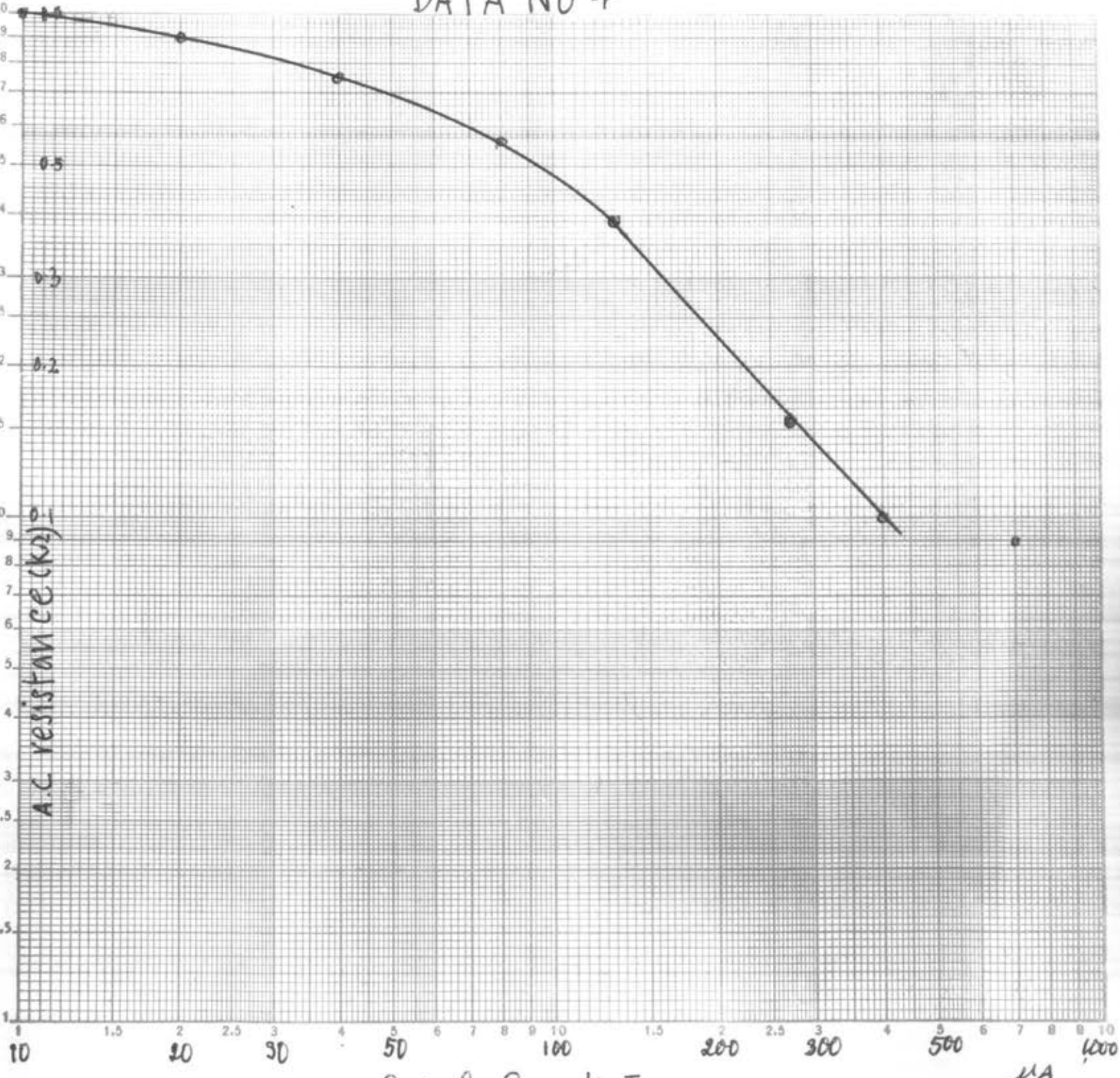


Fig 35 A.C. resistance / control current characteristic

3.3 Expander Variable Loss Device

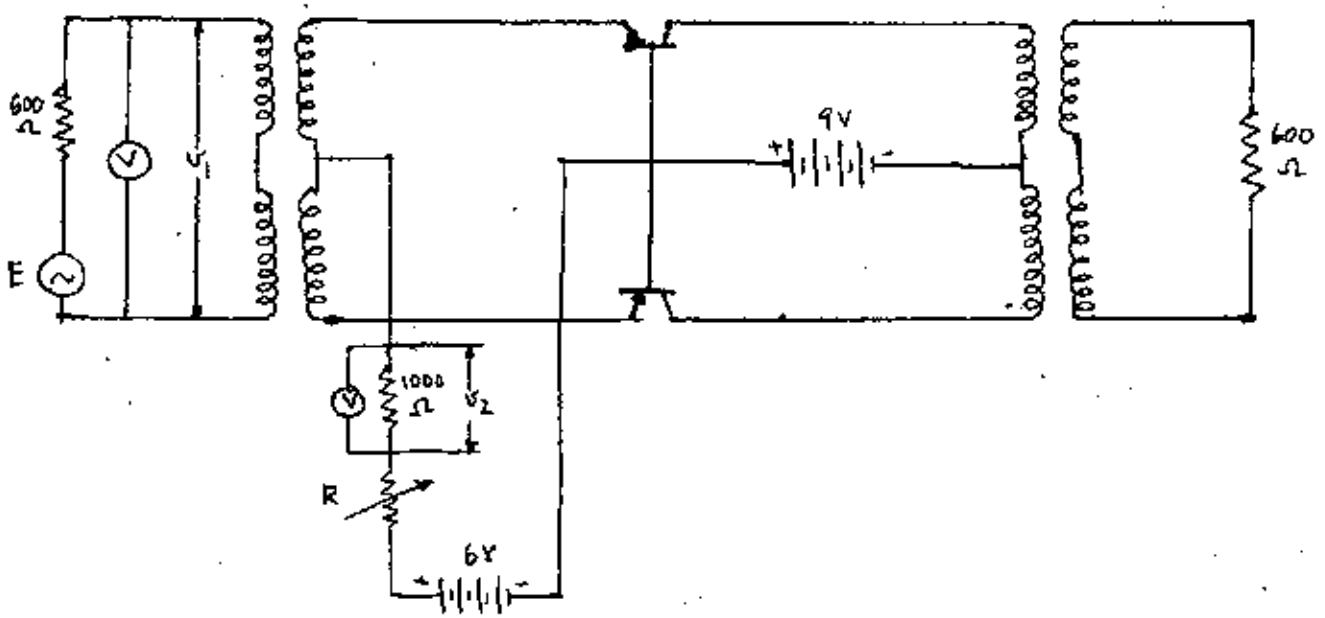


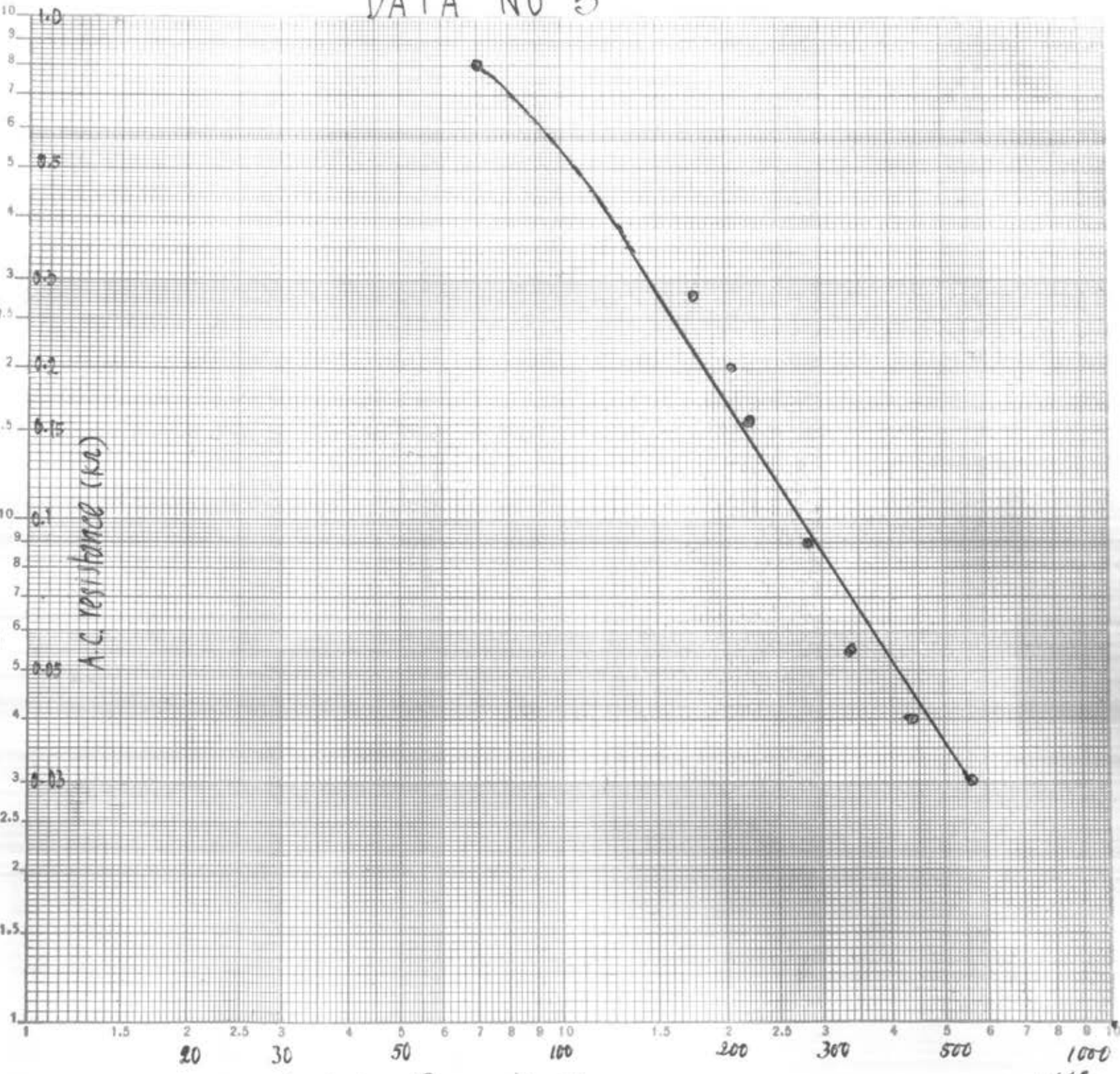
Fig 36 Expander Variable loss device

Vary R to the desire value of v_2, then record the corresponding value of v_1, from the value of v_1 and v_2, I_{con} and R_i can be computed.

DATA NO 5

v_2 mv	I_{con} μa	v_1 mv	R_i ohm	Note
70	70	140	800	Input -10 db
175	175	77.5	280	Transformer
205	205	62	200	turn ratio 1:6
220	220	50	155	Transistor OC71
280	280	32	90	
340	340	19.5	55	
440	440	15	40	
560	560	12	30	

DATA NO 5



Control Current, Icon.

Fig. 37 A.C. resistance / control current characteristic

3.4 Control Current Rectifier

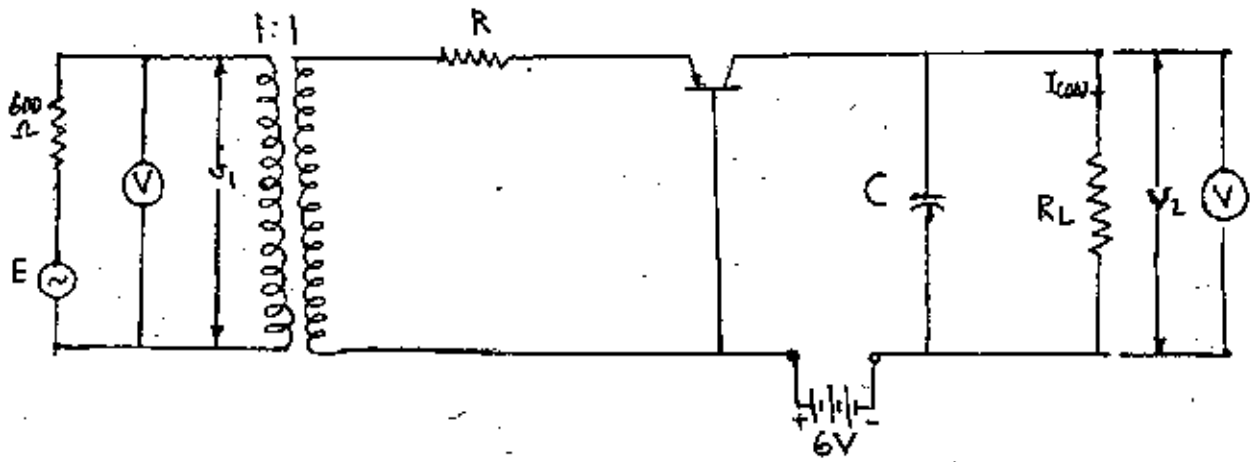


Fig 38 — Control Current Rectifier

For a given input v_1, record the corresponding value of v_2, then I_{con} can be computed.

DATA NO 6

v_1 db	v_2 mv	I_{con} μa	Note
5	2200	4400	R = 0
0	1100	2200	R_L= 500 ohms
−5	540	1080	Transistor 0C70
−10	225	450	
−15	54	108	
−20	19.5	39	
−25	7	14	
−30	4.5	9	
−37	3.5	7	

DATA NO 7

V_1 db	V_2 mv	I_{con} ua	Note
5	2400	4800	R = 0
0	1250	2500	R_1 = 500 ohms
-5	560	1120	Transistor 0C72
-10	215	430	
-15	64	128	
-20	18	36	
-25	8	16	
-30	5	10	
-37	4	8	

DATA NO 8

V_1 db	V_2 mv	I_{con} μa	Note
5	2200	4400	R = 0
0	1100	2200	R_1 = 500 ohms
-5	500	1000	Transistor 0C71
-10	200	400	
-15	46	92	
-20	13	26	
-24.5	6	12	
-30	4	8	
-37	2	4	

DATA NO 9

V_1 db	V_2 mv	I_{con} μa	Note
5	2650	5300	R = 0
0	1300	2600	R_1 = 500 ohms
-5	660	1320	Transistor OC74
-10	290	580	
-15	89	198	
-20	40	80	
-25	21	42	
-30	16	32	
-37	14	28	

DATA NO 10

V_1 db	V_2 mv	I_{con} μa	Note
0	2200	2200	R = 0
-5	1100	1100	R_I = 1000 ohms
-10	200	200	Transistor OC70
-15	84	84	
-20	28	28	
-24	14	14	
-30	8	8	
-40	6	6	

DATA NO 11

V_1 db	V_2 mv	I_{con} µa	Note
0	2000	2000	R = 0
-5	1000	1000	R_1 = 1000 ohms
-10	180	180	Transistor OC71
-15	76	76	
-20	25	25	
-25	10	10	
-35	6	6	
-40	4	4	

DATA NO 12

V_1 db	V_2 mv	I_{con} µa	Note
0	2500	2500	R = 0
-5	1150	1150	R_1 = 1000
-10	400	400	Transistor OC72
-15	84	84	
-20	34	34	
-25	12	12	
-30	8	8	
-40	6	6	

DATA NO 13

V_1 db	V_2 mv	I_{con} μa	Note
5	3000	3000	R = 0
0	1300	1300	R_1 = 1000 Ω
-5	805	805	Transistor OC74
-10	256	256	
-15	90	90	
-20	48	48	
-25	16	16	
-29	10	10	
-40	6.5	6.5	

DATA NO 14

V_1 db	V_2 mv	I_{con} μa	Note
.5	.140	280	R = 2000 Ω
0	56	112	R_1 = 500 Ω
-5	29.5	59	Transistor OC70
-10	14.5	29	
-15	8	16	
-20	4.5	9	
-30	2.5	5	
-40	2	4	

DATA NO 15

V_1 db	V_2 mv	I_{con} μa	Note
5	140	280	R = 2000 Ω
0	56	112	R_l = 500 Ω
-5	28	56	Transistor 0C71
-10	15.5	31	
-15	7	14	
-20	4	8	
-24	3	6	
-30	2	4	
-40	2	4	

DATA NO 16

V_1 db	V_2 mv	I_{con} μa	Note
5	140	280	R = 2000 Ω
0	52	104	R_l = 500 Ω
-5	28	56	Transistor 0C72
-10	14.5	29	
-15	8	16	
-20	5	10	
-24.5	3.5	7	
-29	3	6	
-46	3	6	

DATA NO 17

V_1 db	V_2 mv	I_{con} μa	Note
5	210	420	R = 2000 ohms
0	57	114	R_1 = 500 ohms
-5	32	64	Transistor 0C74
-10	18.5	37	
-15	12	24	
-20	8	16	
-25	6.5	13	
-30	6.5	13	
-34	6	12	
-39	6	12	

DATA NO 18

V_1 db	V_2 mv	I_{con} μa	Note
5	150	150	R = 2000 ohms
0	82	82	R_1 = 1000 ohms
-5	44.5	44.5	Transistor 0C70
-10	26	26	
-15	13	13	
-20	8	8	
-25	6	6	
-30	5	5	
-40	4	4	

DATA NO 19

V_1 db	V_2 mv	I_{con} μa	Note
5	160	160	R = 2000 ohms
0	88	88	R_1 = 1000 ohms
-5	43.5	43.5	Transistor OC71
-10	22	22	
-15	11.5	11.5	
-20	6.5	6.5	
-25	4.5	4.5	
-30	4	4	
-40	3	3	

DATA 20

V_1 db	V_2 mv	I_{con} μa	Note
5	160	160	R = 2000 ohms
0	93	93	R_1 = 1000 ohms
-5	44.5	44.5	Transistor OC72
-10	24	24	
-15	17.5	17.5	
-19	8.5	8.5	
-24	6	6	
-30	4.5	4.5	
-40	4	4	

DATA NO 21

V_1 db	V_2 mv	I_{con} μa	Note
5	180	180	R = 2000 ohms
0	100	100	R_1 = 1000 ohms
−5	52	52	Transistor 0C74
−10	32	32	
−15	18.5	18.5	
−20	14	14	
−25	11	11	
−30	10	10	
−40	10	10	

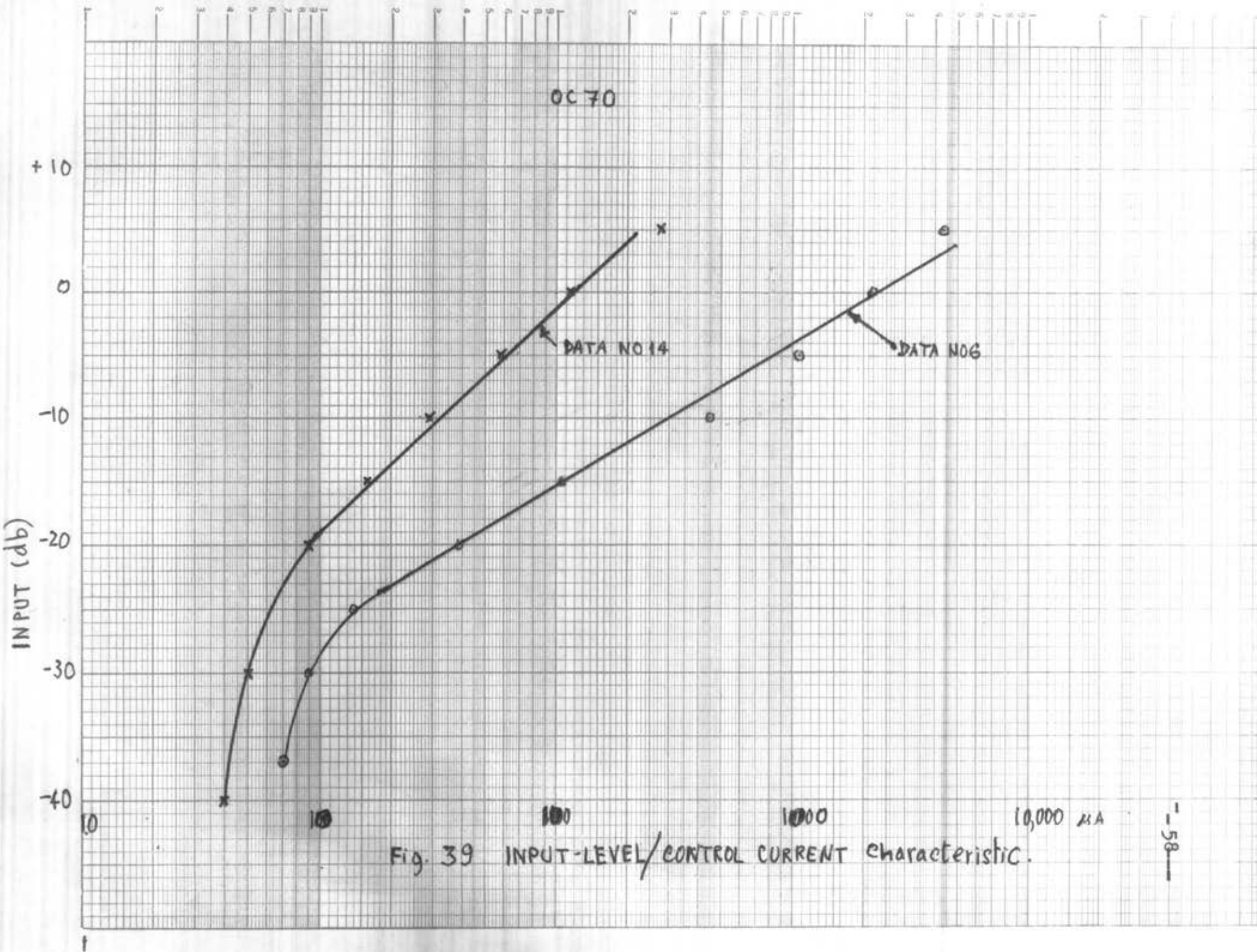


Fig. 39 INPUT-LEVEL/CONTROL CURRENT characteristic.

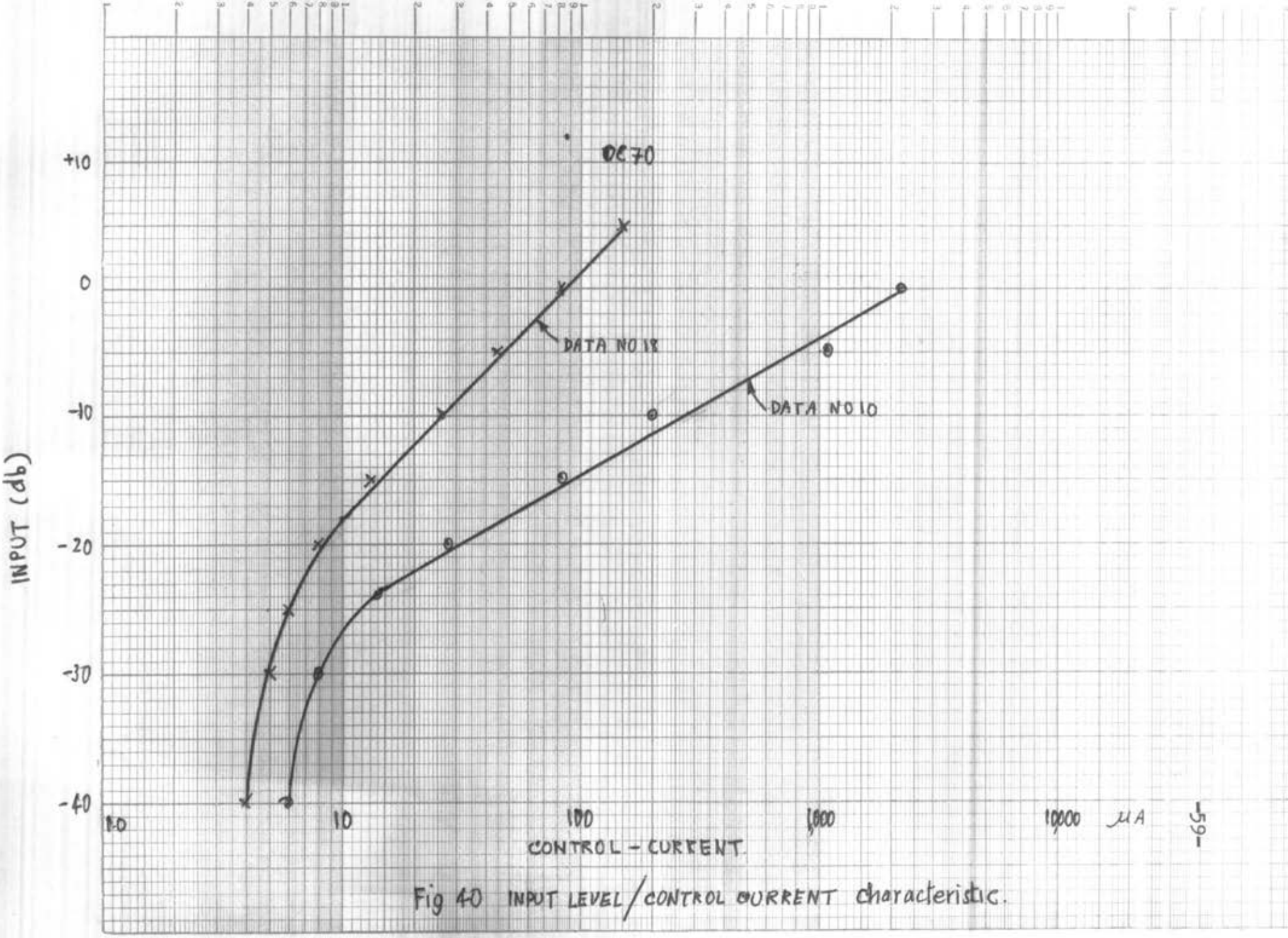


Fig 40 INPUT LEVEL / CONTROL CURRENT characteristic.

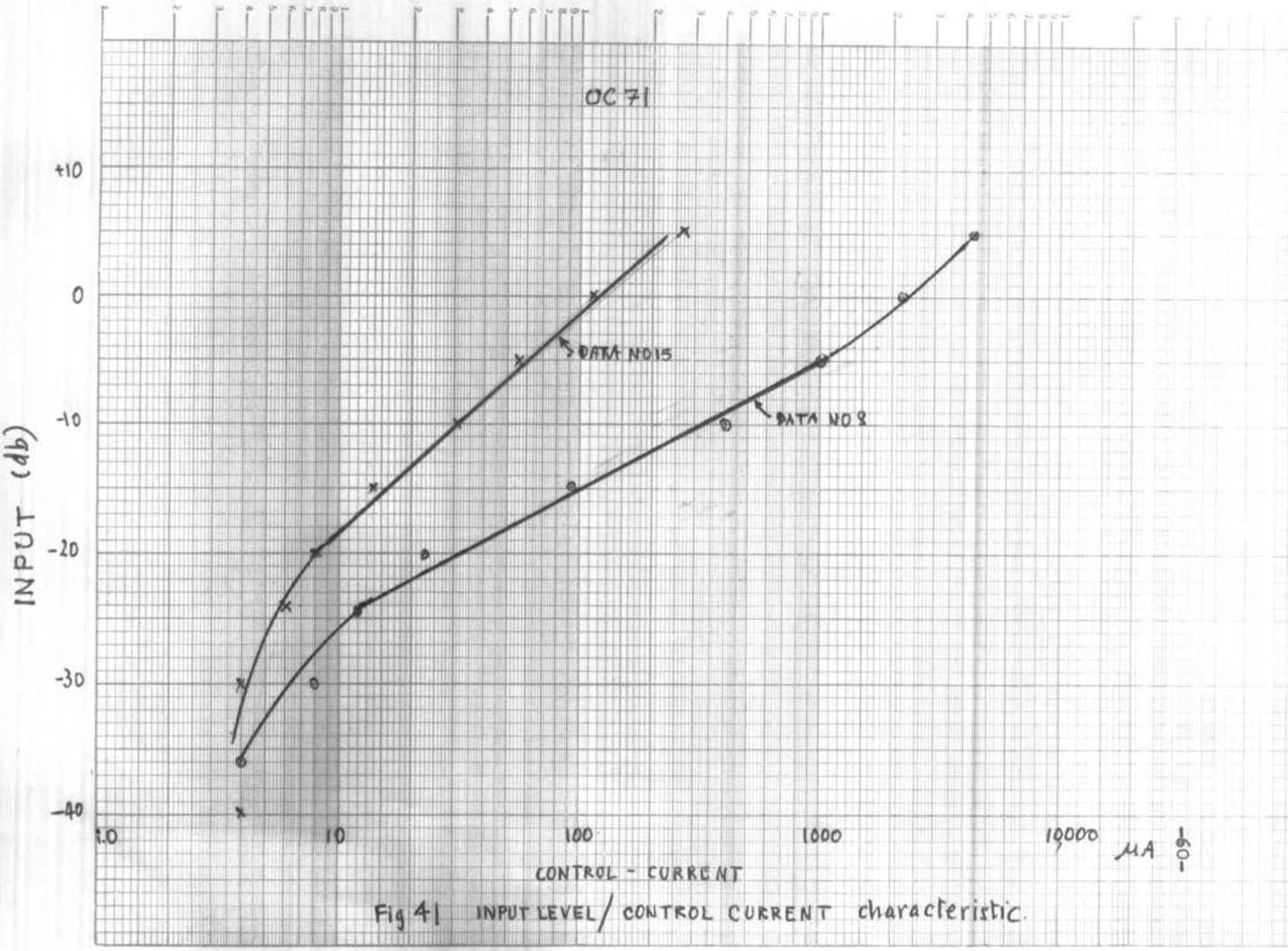


Fig 41 INPUT LEVEL / CONTROL CURRENT characteristic.

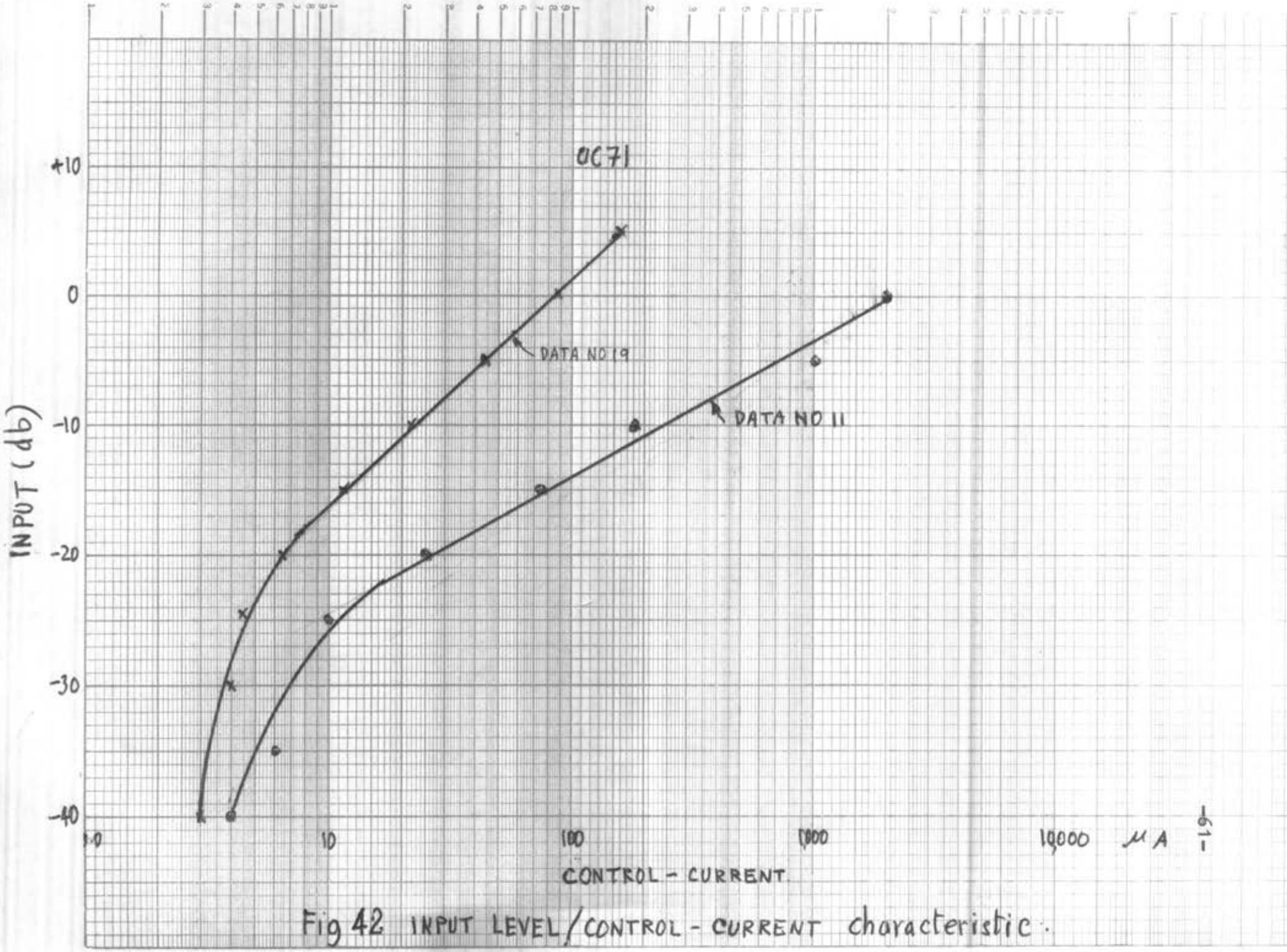


Fig 42 INPUT LEVEL/CONTROL - CURRENT characteristic.

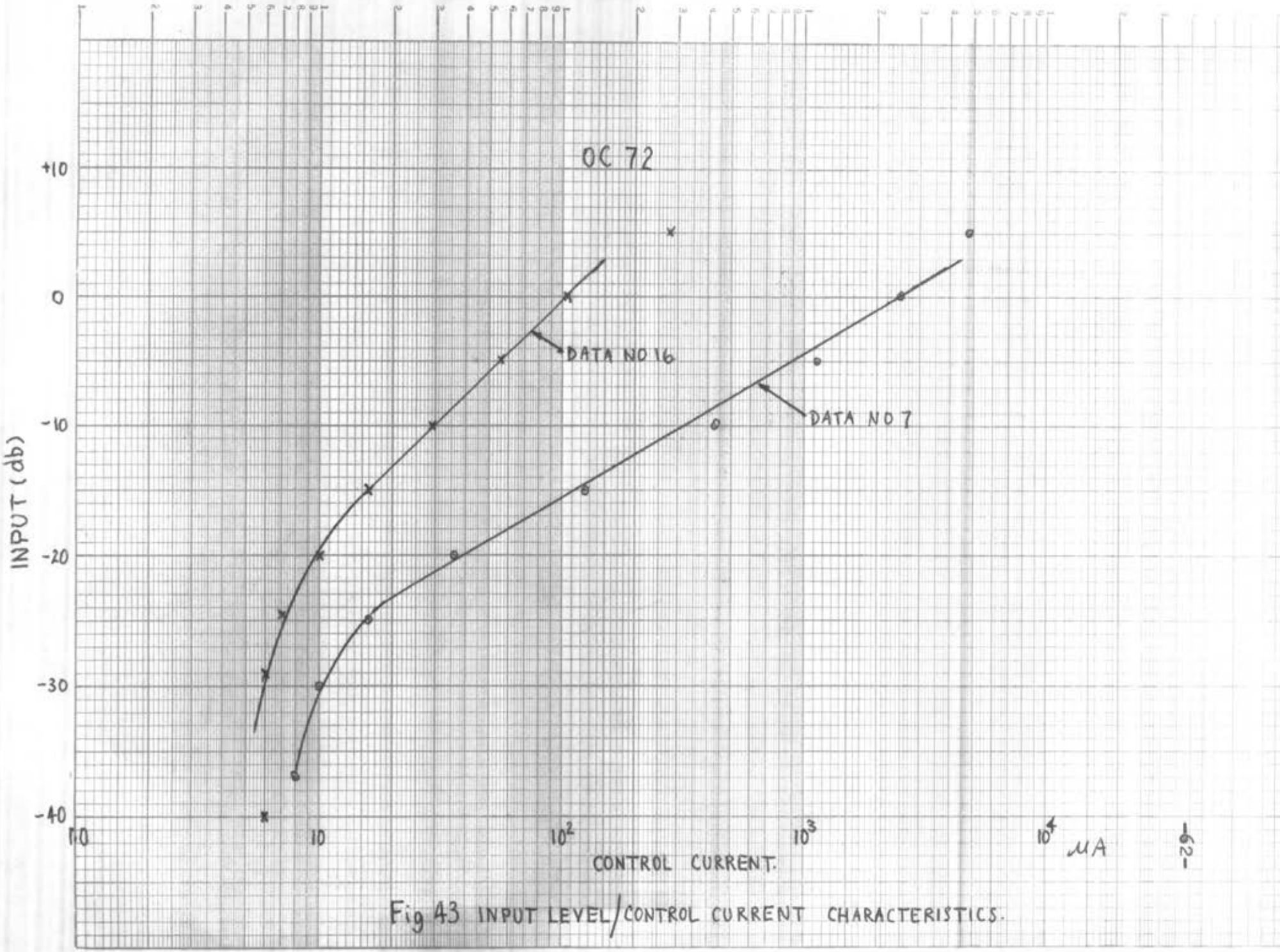


Fig 43 INPUT LEVEL/CONTROL CURRENT CHARACTERISTICS.

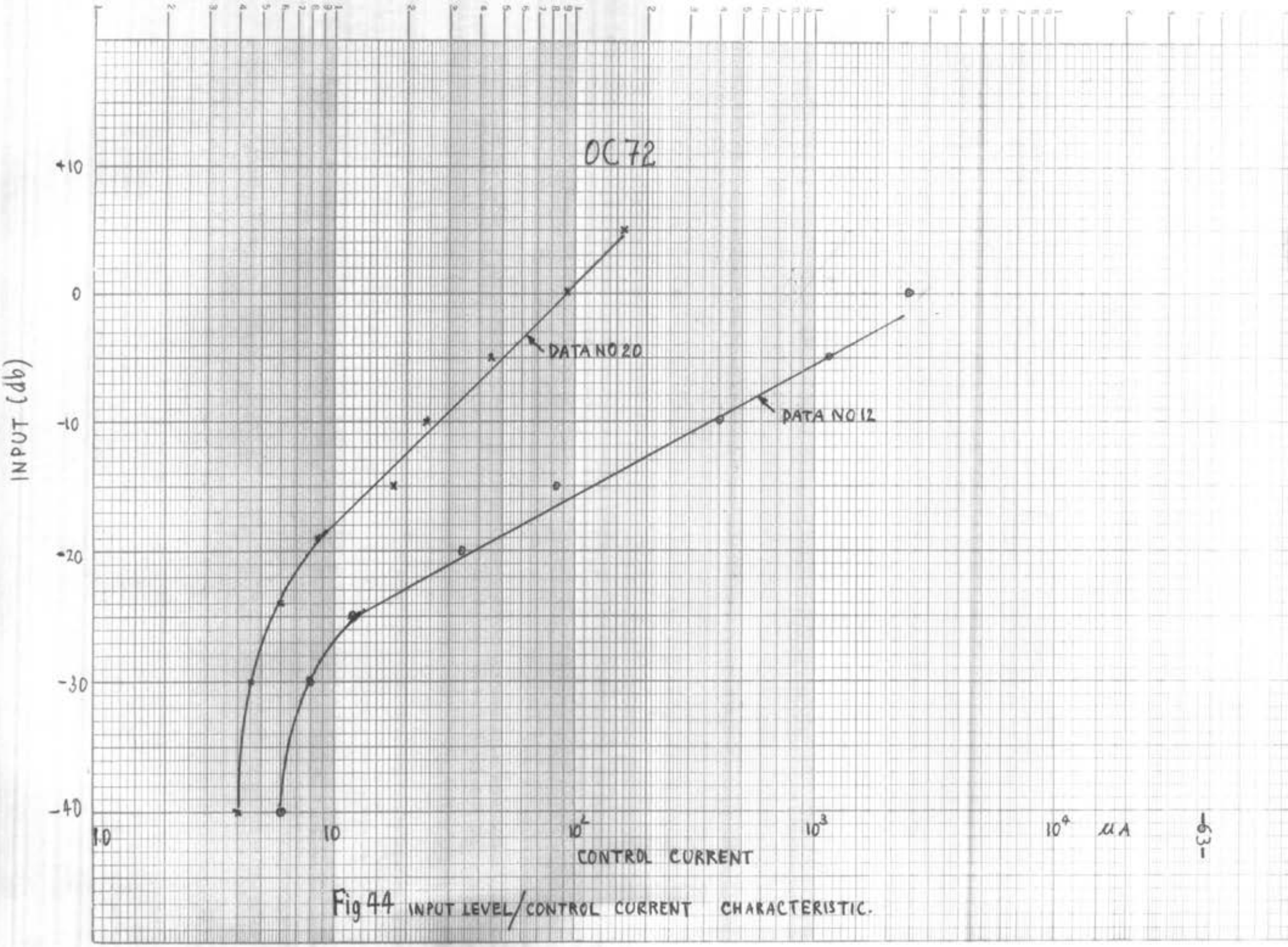


Fig 44 INPUT LEVEL/CONTROL CURRENT CHARACTERISTIC.

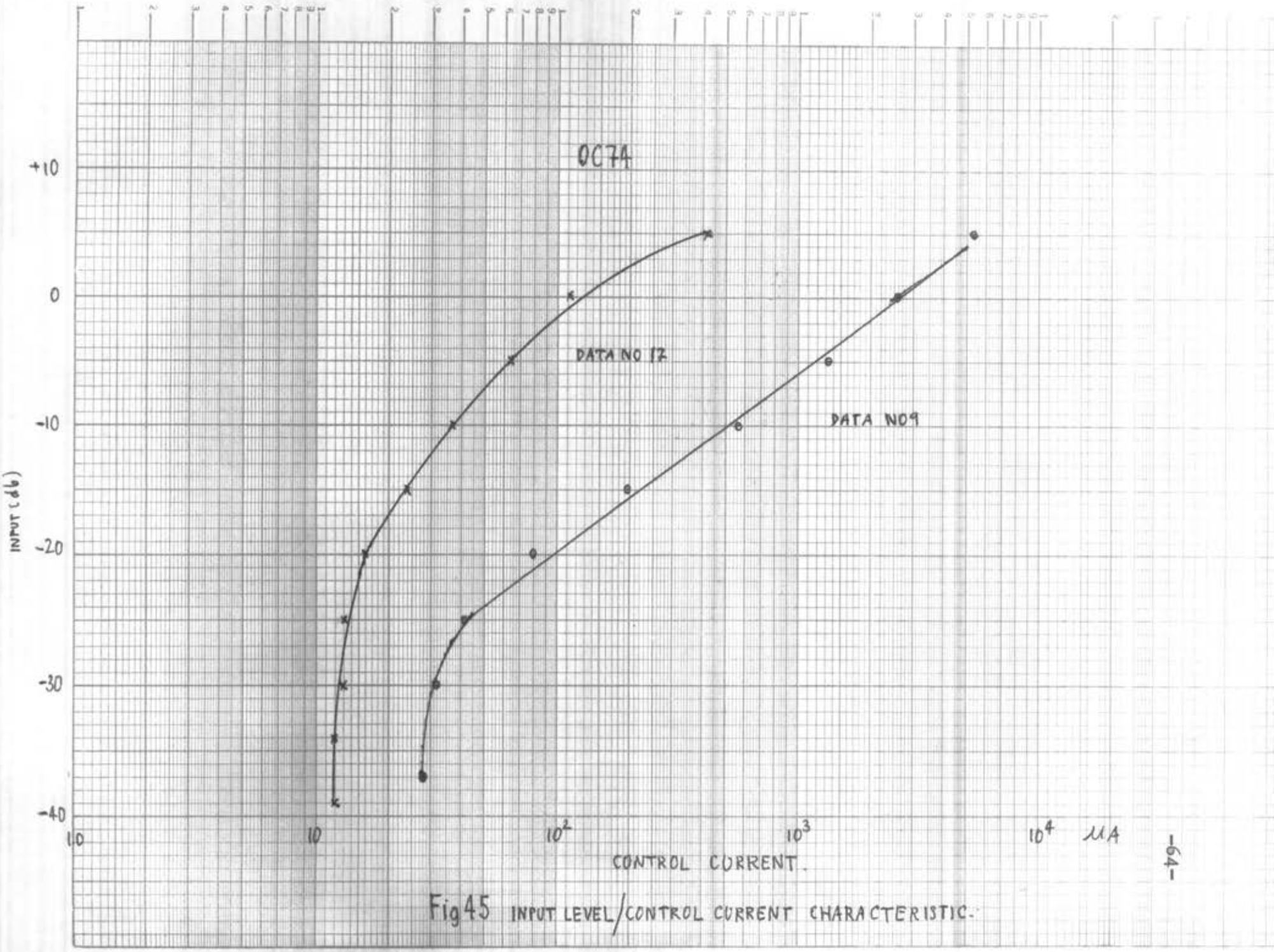


Fig 45 INPUT LEVEL/CONTROL CURRENT CHARACTERISTIC.

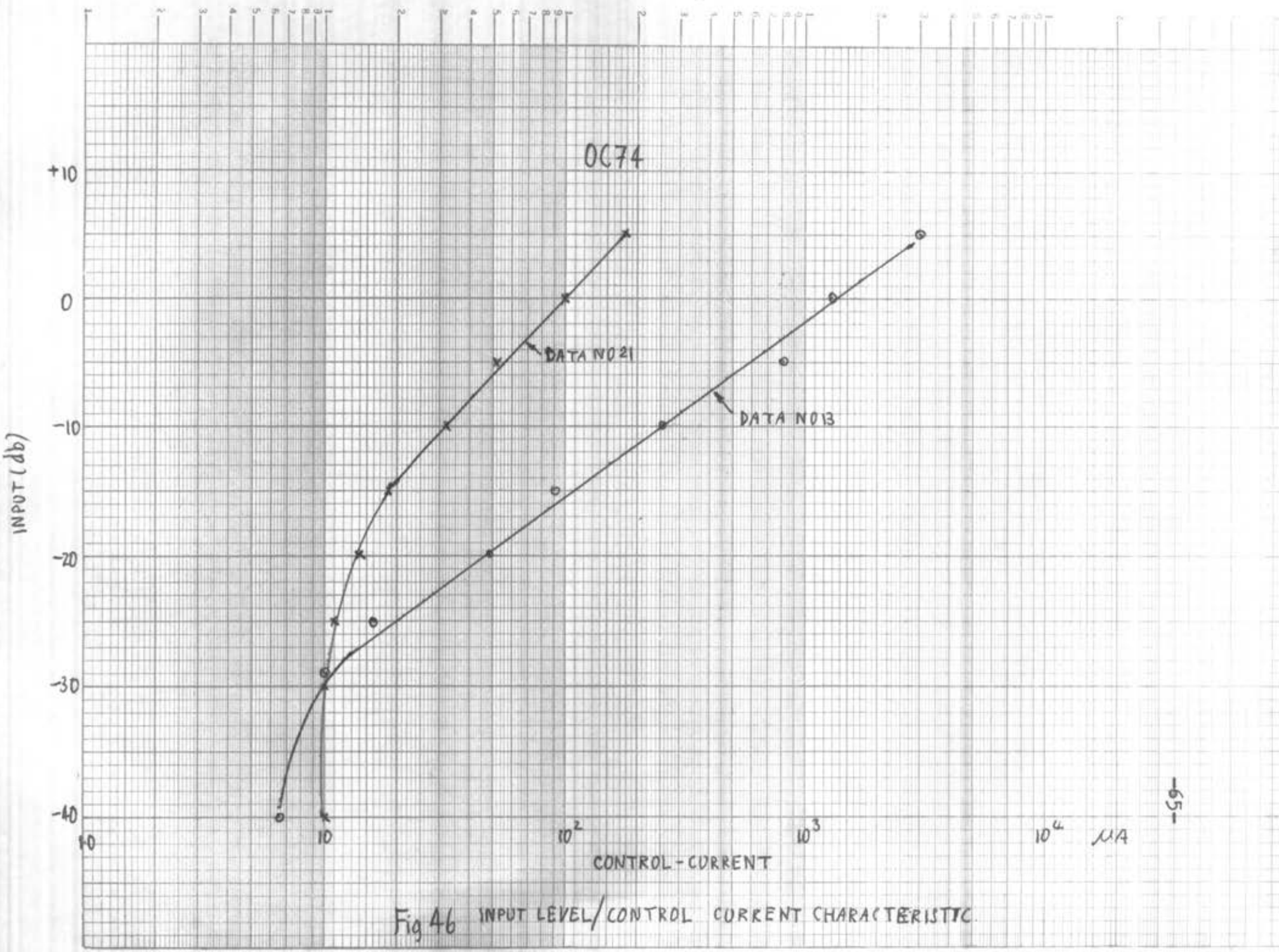


Fig 46 INPUT LEVEL/CONTROL CURRENT CHARACTERISTIC

3.5 Amplifiers

(Fig 47, 48, 49)

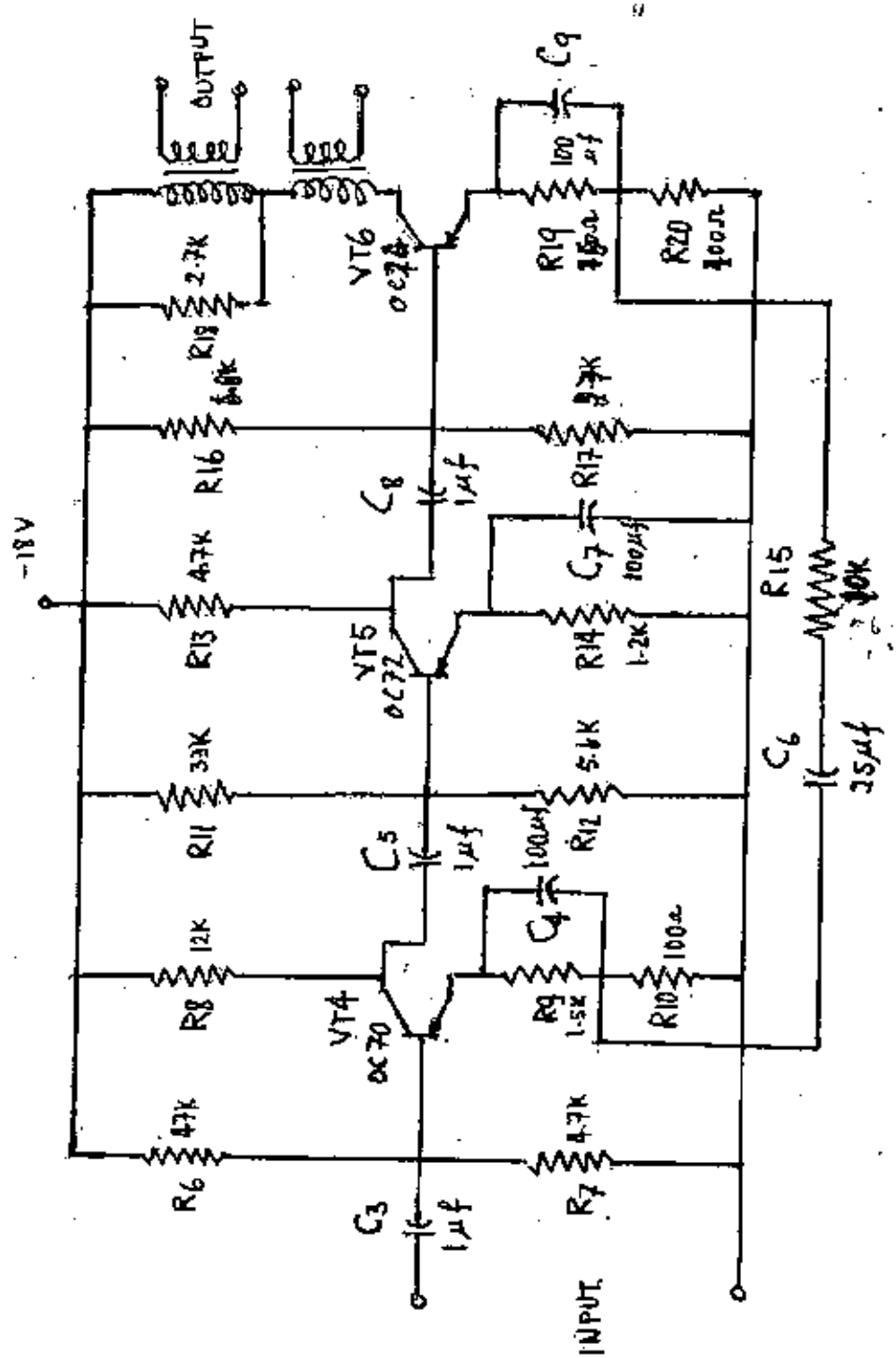


Fig 47 — High gain amplifier using with compressor

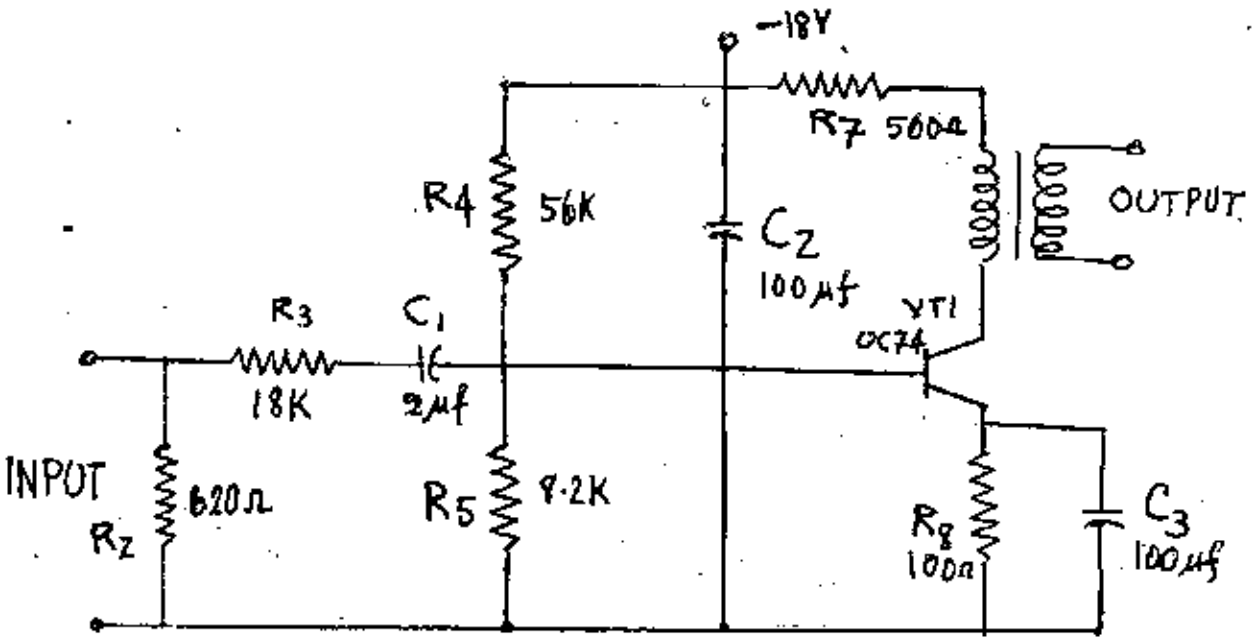


Fig 48 — Pre-amplifier using with expander

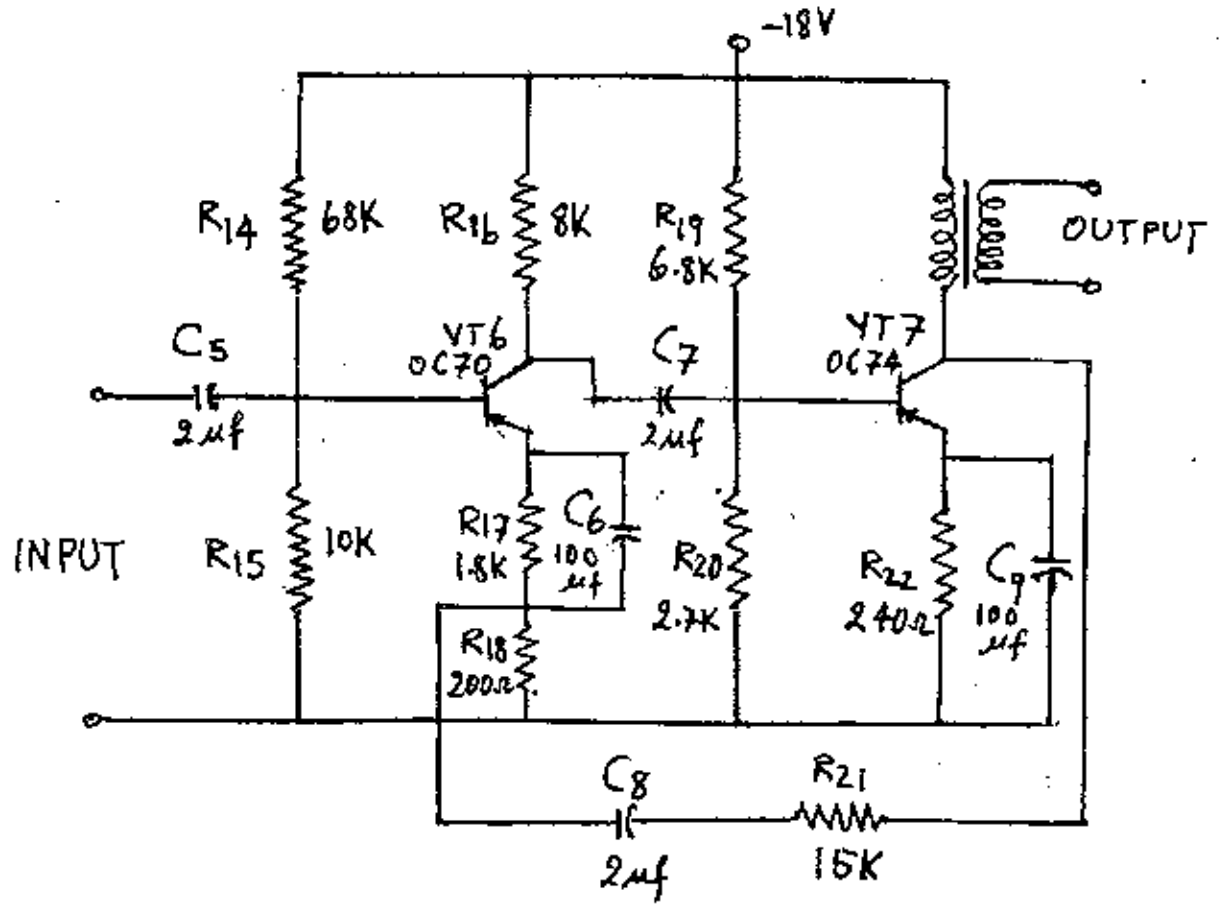


Fig 49 -- Amplifier using with expander

3.6 Compressor

Refer to Fig. 27

R_1 = -

R_2 = 300 ohms

R_3 = 680 ohms

R_4 = 6.8 kilohms = R_{16}

R_5 = 12 " = R_8

R_6 = 47 "

R_7 = 4.7 " = R_{13}

R_9 = 1.5 "

R_{10} = 100 ohms = R_{20}

R_{11} = 33 kilohms

R_{12} = 5.6 "

R_{14} = 1.2 "

R_{15} = 10 Kilohms.

R_{17} = 2.7 kilohms

R_{18} = 2.7 "

R_{19} = 150 ohms

R_{21} = 150 "

$C_1 = C_6 = 25$ µf

$C_2 = C_4 = C_7 = C_9 = 100$ µf

$C_3 = C_5 = C_8 = 2$ µf

$VT_1 = VT_2 = VT_3 = VT_7$ = OC71

VT_4 = OC70

VT_5 = OC72

VT_6 = OC74

DATA NO 22

INPUT (db)	OUTPUT (db)			
	Theory (db)	Measure (db)	Error (db)	Distortion %
0	0	0	0	2.0
-5	-2.5	-2.7	0.2	
-10	-5.0	-5.2	0.2	1.4
-15	-7.5	-8.0	0.5	
-20	-10.0	-10.2	0.2	1.4
-25	-12.5	-12.8	0.3	
-30	-15.0	-15.0	0	2.2
-35	-17.5	-17.3	-0.2	
-40	-20.0	-19.6	-0.4	2.7

DATA NO 22.

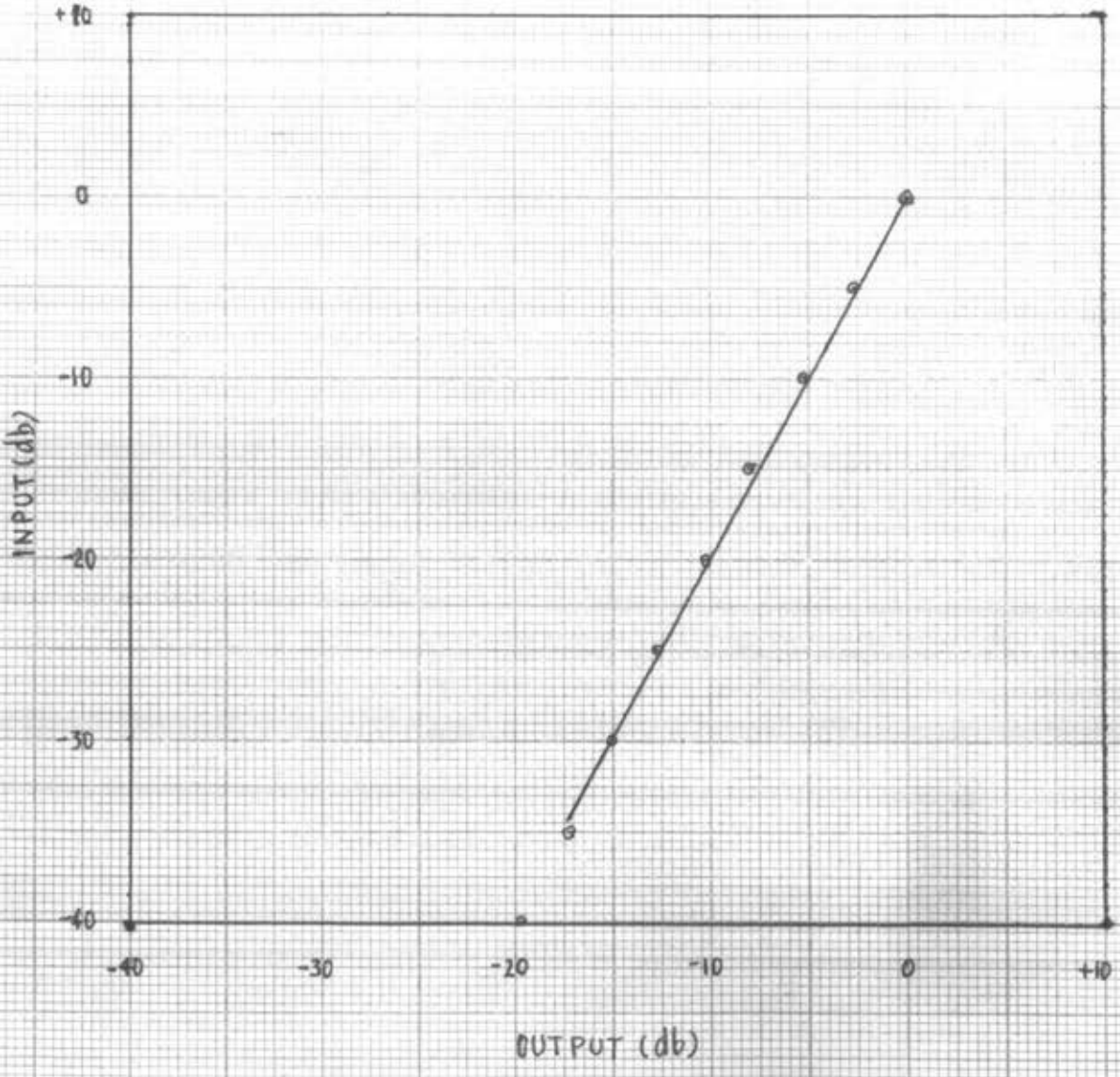


Fig 50 INPUT/OUTPUT characteristic of compressor

DATA NO 22A

INPUT (db)	OUTPUT (db)	GAIN (db)
0	0	0
-5	-2.7	2.3
-10	-5.2	4.8
-15	-8.0	7.0
-20	-10.2	9.8
-25	-12.8	12.2
-30	-15.0	15.0
-35	-17.3	17.7
-40	-19.6	20.4

DATA NO 22 A

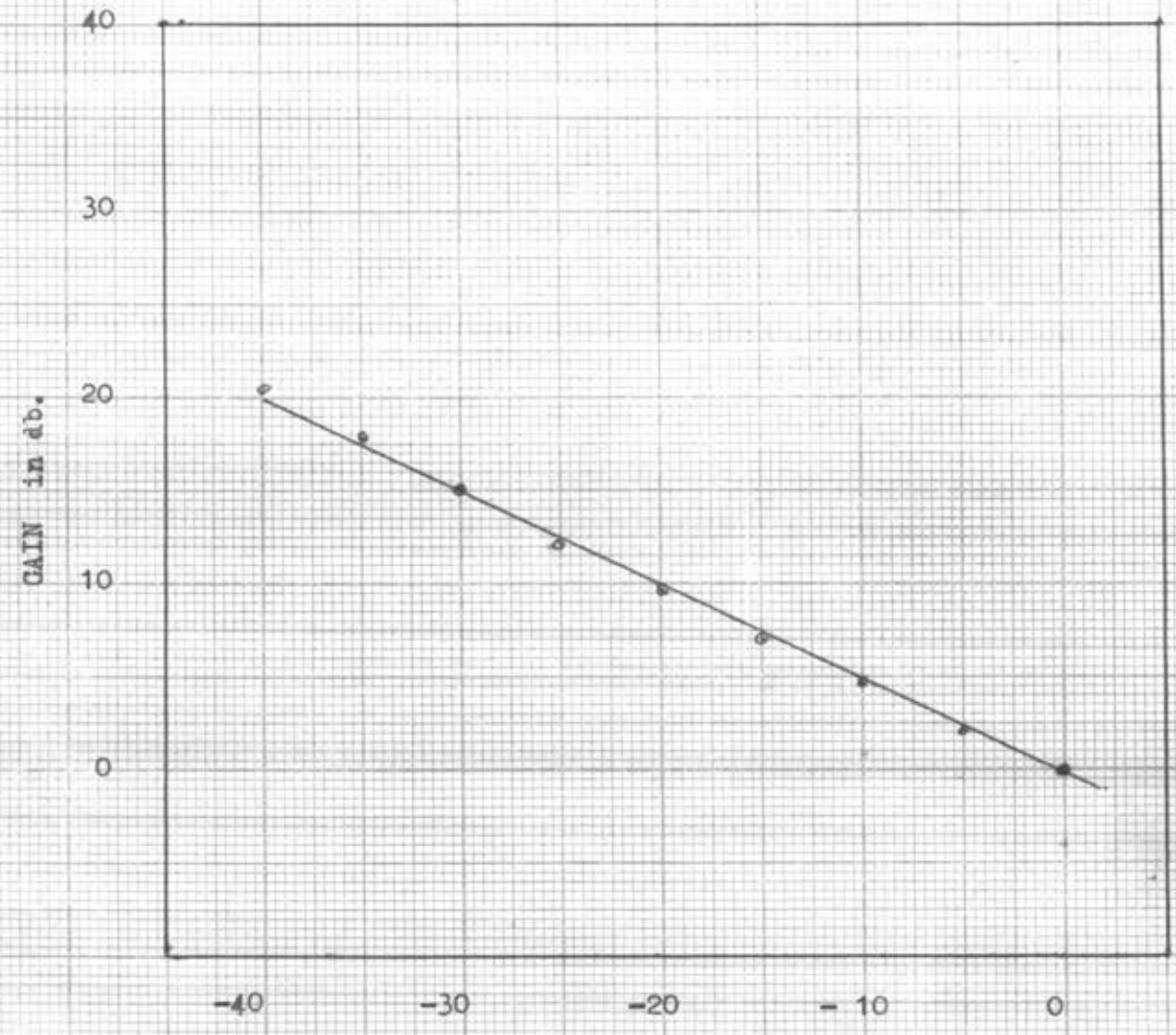


Fig. 50A GAIN/INPUT characteristic of compresser.

3.7 Expander

Refer to Fig. 28

R_1	=	5.1	Kilohms	
R_2	=	680	ohms	
R_3	=	18	Kilohms	
R_4	=	56	"	
R_5	=	8.2	"	$= R_{16}$
R_6	=	10	ohms	$= R_{23}$
R_7	=	560	"	$= R_{10}$
R_8	=	100	"	
R_9	=	300	"	
R_{11}	=	200	"	
R_{12}	=	3.3	Kilohms	$= R_{13}$
R_{14}	=	68	"	
R_{15}	=	10	"	
R_{17}	=	1.8	"	
R_{18}	=	200	ohms	
R_{19}	=	6.8	Kilohms	
R_{20}	=	2.7	"	
R_{21}	=	15	"	
R_{22}	=	240	ohms	

$C_1 = C_3 = C_4 = C_5 = C_7 = 2$ uf

$C_2 = C_6 = C_8 = 100$ uf

$VT_1 = VT_7 = OC74$

$VT_2 = VT_3 = VT_4 = VT_5 = OC71$

$VT_6 = OC70$

DATA NO 23

INPUT (db)	OUTPUT (db)			
	Theory (db)	Measure (db)	Error (db)	Distortion %
0	0	0	0	5.6
-1	-2	-1.9	-0.1	4.5
-2	-4	-3.7	-0.3	3.7
-3	-6	-5.5	-0.5	2.8
-4	-8	-7.2	-0.8	2.2
-5	-10	-9.2	- 0.8	1.7
-6	-12	-10.8	-1.2	1.35
-7	-14	-12.7	-1.3	1.1
-8	-16	-14.7	-1.3	0.8
-9	-18	-16.9	-1.1	0.6
-10	-20	-19.0	-1.0	0.45
-11	-22	-20.3	-1.7	0.35
-12	-24	-22.2	-1.8	0.24
-13	-26	-24.0	-2.0	0.17
-14	-28	-25.9	-2.1	0.13
-15	-30	-27.4	-2.6	0.13

DATA NO 23.

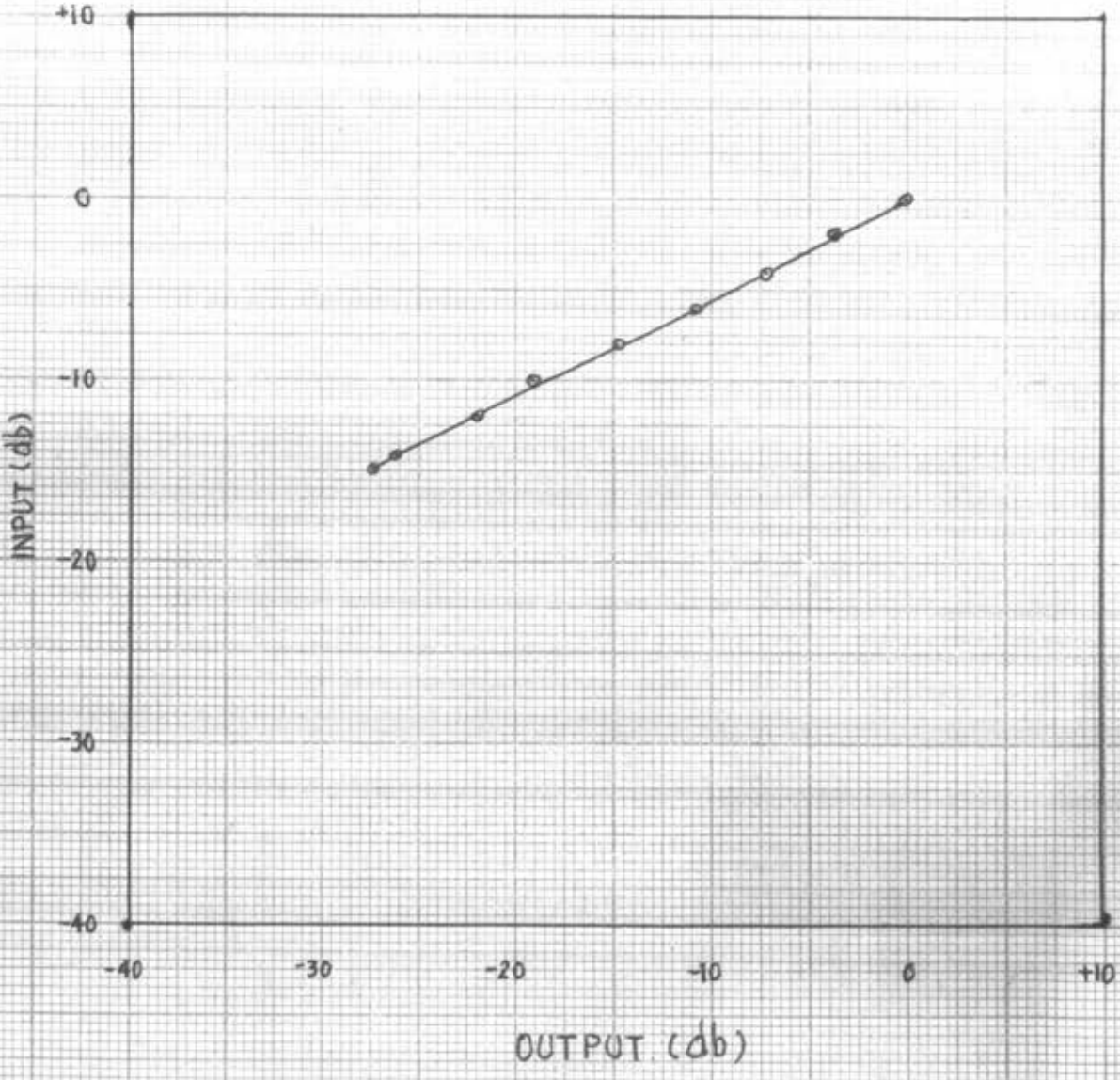


Fig. 51 INPUT/OUTPUT characteristic of EXPANDER

DATA NO 23A

INPUT (db)	OUTPUT (db)	GAIN (db)
0	0	0
-1	-1.9	-0.9
-2	-3.7	-1.7
-3	-5.5	-2.5
-4	-7.2	-3.2
-5	-9.2	-4.2
-6	-10.8	-4.8
-7	-12.7	-5.7
-8	-14.7	-6.7
-9	-16.9	-7.9
-10	-19.0	-9.0
-11	-20.3	-9.3
-12	-22.2	-10.2
-13	-24.0	-11.0
-14	-25.9	-11.9
-15	-27.4	-12.4

DATA NO 23A

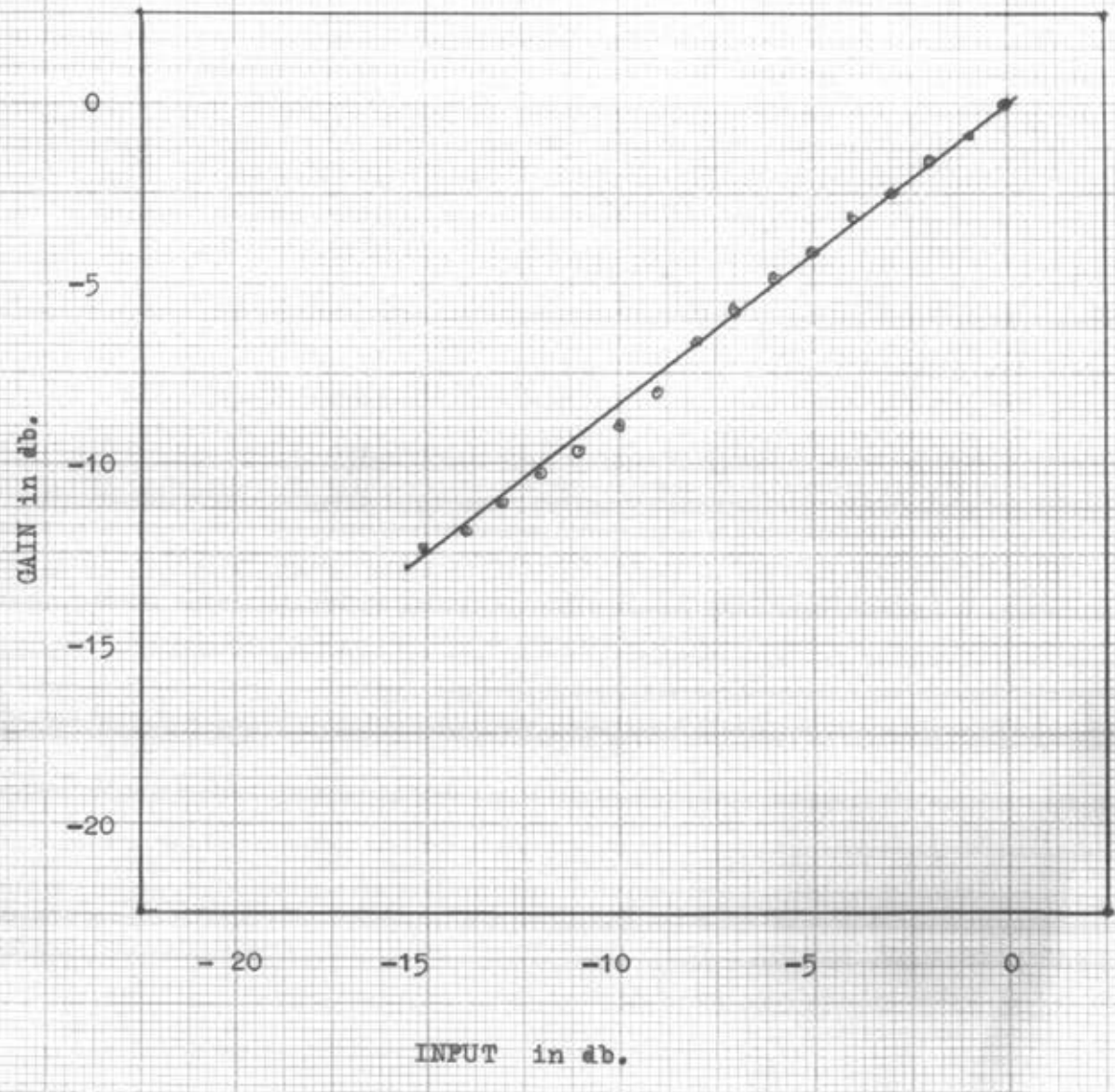


Fig. 51A GAIN/INPUT characteristic of expander.

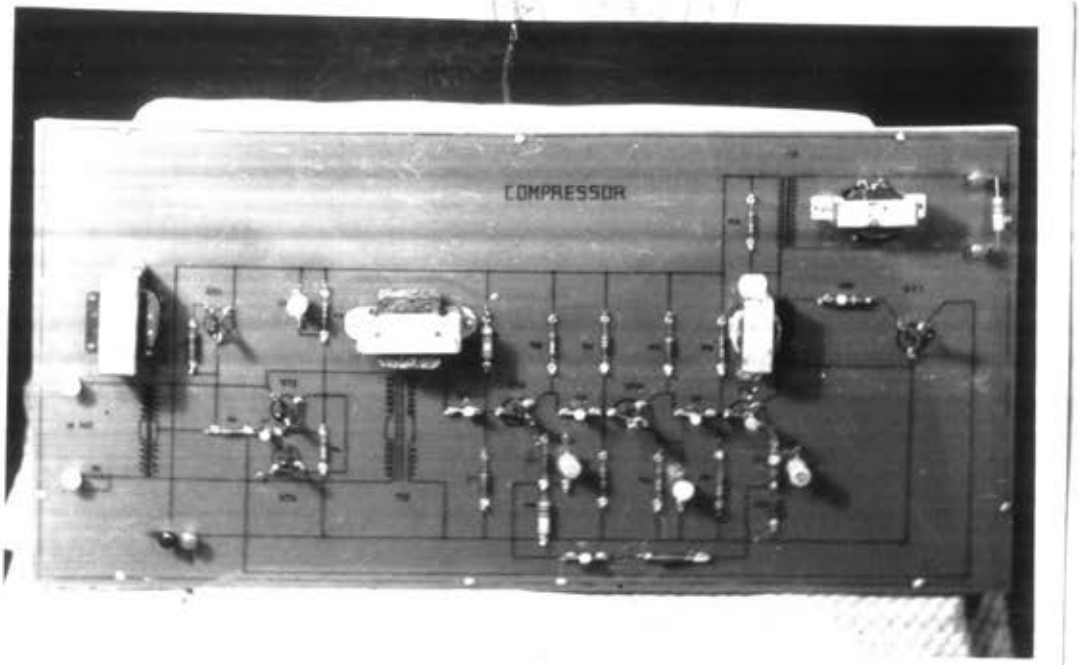


Fig. 52 — Compressor

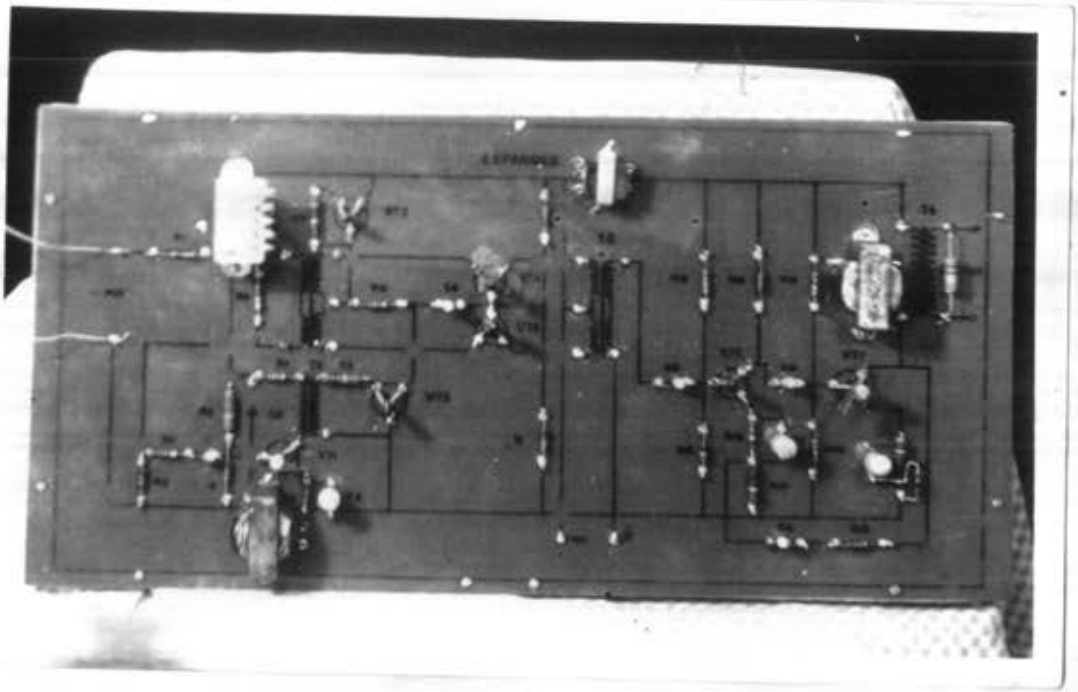


Fig. 53 — Expander