

UCH 42 Triode-hexode frequency changer

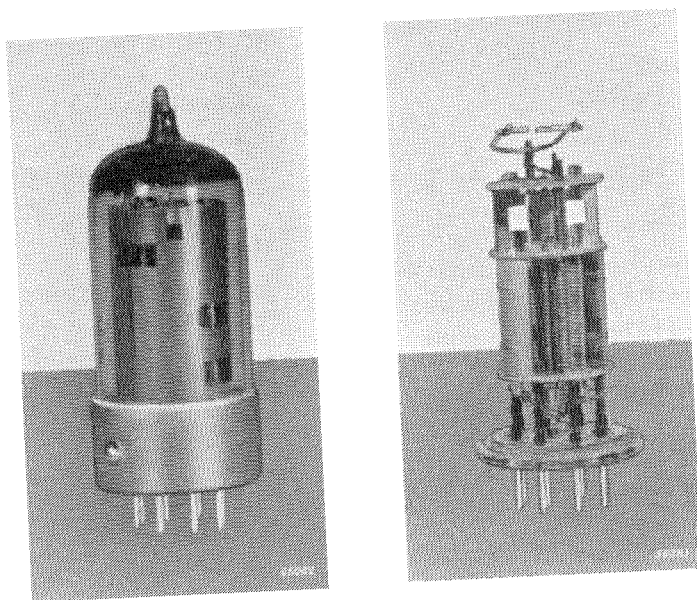


Fig. 1
The UCH 42, showing the electrode system (approximately actual size).

The triode-hexode UCH 42 is a frequency changer with a conversion conductance of $670 \mu\text{A/V}$ at an applied voltage of 170 V, or $530 \mu\text{A/V}$ at 100 V. It is designed for A.C./D.C. receivers in which the heaters, connected in series, take a current of 100 mA. Further particulars will be found in the description of the ECH 42, the corresponding E-type valve.

TECHNICAL DATA OF THE TRIODE-HEXODE UCH 42

Heater data

Heating : indirect, A.C. or D.C., series feed	=	100 mA
Heater current I_f	=	14 V
Heater voltage V_f		

Capacitances (measured on cold valve)

<i>Hexode section</i>		
Input capacitance C_{g1}	=	4.0 pF
Output capacitance C_a	=	9.4 pF
Anode - control grid C_{ag1}	<	0.1 pF
Heater - control grid C_{g1f}	<	0.15 pF

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Triode section

Input capacitance	C'_{gT+g3}	=	5.9 pF
Output capacitance	C'_a	=	2.4 pF
Anode - grid	$C'_{(gT+g3)a}$	=	1.3 pF

Between triode and hexode sections

Hexode control grid - triode			
grid	$C_{g1H-(gT+g3)}$	<	0.35 pF
Hexode anode - triode grid . .	$C_{aH-(gT+g3)}$	<	0.2 pF

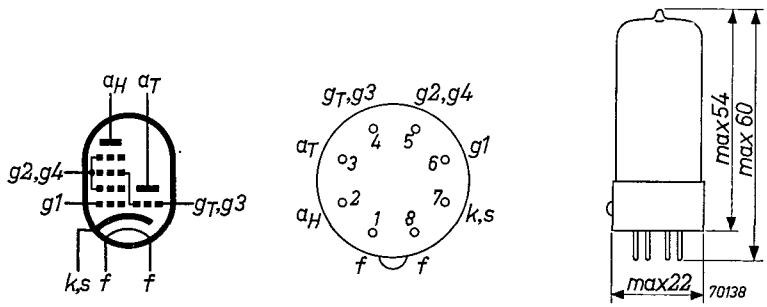


Fig. 2
Electrode arrangement, electrode connections and maximum dimensions in mm of the UCH 42.

Operating characteristics of the hexode section used as frequency changer (screen grids fed by means of a potentiometer, see Figs. 6 to 15 incl.)

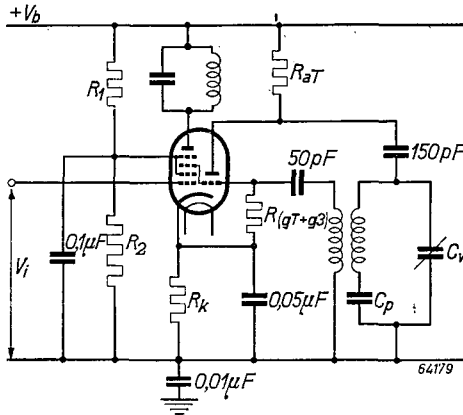


Fig. 3

Anode and supply voltage	$V_a = V_b =$	100	170	V
Resistor between supply voltage and screen grids	$R_1 =$	18	18	kΩ
Resistor between screen grids and chassis	$R_2 =$	27	27	kΩ
Bias resistor	$R_k =$	180	180	Ω
Oscillator grid leak	$R_{gT+g3} =$	22	22	kΩ
Oscillator grid current	$I_{gT+g3} =$	175 ¹⁾	350 ¹⁾	μA
Grid bias	$V_{g1} =$	$\overline{-1.0 \quad -13.5}$	$\overline{-1.85 \quad -25}$	V
Screen grid voltage	$V_{g2+g4} =$	43	57	70 100 V
Anode current	$I_a =$	1.2	—	2.1 — mA
Screen grid current	$I_{g2+g4} =$	1.46	—	2.6 — mA
Conversion conductance	$S_c =$	530	5.3	670 6.7 μA/V
Internal resistance	$R_i =$	>1	>5	>1 >5 MΩ
Equivalent noise resistance	$R_{eq} =$	50	—	85 — kΩ

Anode and supply voltage	$V_a = V_b =$		200	V
Resistor between supply voltage and screen grids	$R_1 =$		18	kΩ
Resistor between screen grids and chassis	$R_2 =$		27	kΩ
Bias resistor	$R_k =$		180	Ω
Oscillator grid leak	$R_{gT+g3} =$		22	kΩ
Oscillator grid current	$I_{gT+g3} =$		350 ¹⁾	μA
Grid bias	$V_{g1} =$		$\overline{-2 \quad -27.5}$	V
Screen grid voltage	$V_{g2+g4} =$		85	119 V
Anode current	$I_a =$		3.0	— mA
Screen grid current	$I_{g2+g4} =$		3.0	— mA
Conversion conductance	$S_c =$		750	7.5 μA/V
Internal resistance	$R_i =$		>1	>5 MΩ
Equivalent noise resistance	$R_{eq} =$		100	— kΩ

Typical characteristics of the triode section (see Figs. 17 and 18)

Anode voltage	V_a	=	100	V
Grid voltage	V_{gT+g3}	=	0	V
Anode current	I_a	=	10	mA
Mutual conductance	S	=	2.8	mA/V
Amplification factor	μ	=	22	

¹⁾ If the grid leak R_{gT+g3} equals 47 kΩ, the recommended value for I_{gT+g3} is 200 μA for supply voltages of 200 and 170 V, and 100 μA for a supply voltage of 100 V.

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Operating characteristics of the triode section used as oscillator
(see Figs. 19 to 22 incl.)

Supply voltage . . .	V_b	=	100	170	200	V
Anode resistor . . .	R_a	=	10	10	22	k Ω
Oscillator voltage . .	V_{osc}	=	4	8	8	V_{RMS}
Oscillator grid leak .	R_{gT+g3}	=	22	47	22	47 k Ω
Oscillator grid current	I_{gT+g3}	=	175	100	350	200 μ A
Anode current . . .	I_a	=	3.4	3.1	6.5	5.7 mA
Effective slope . . .	S_{eff}	=	0.7	0.6	0.75	0.65 mA/V

Operating characteristics of the UCH 42 used as phase inverter

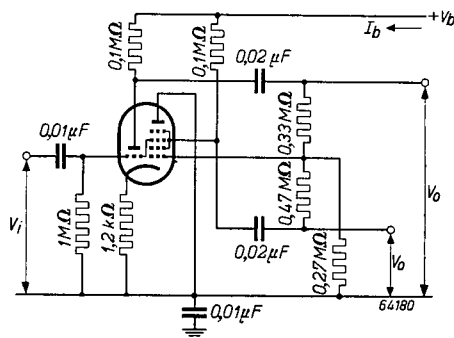


Fig. 4

Supply voltage V_b (V)	Total current I_b (mA)	Amplification V_o/V_i	Distortion (%) at an output voltage of	
			5 V_{RMS}	10 V_{RMS}
100	1.4	11	1.9	—
165	2.4	11	1.5	1.6

Operating characteristics of the hexode section used as frequency changer, together with that of the UAF 42, fed by means of a common potentiometer (see Figs. 23 to 25 incl.)

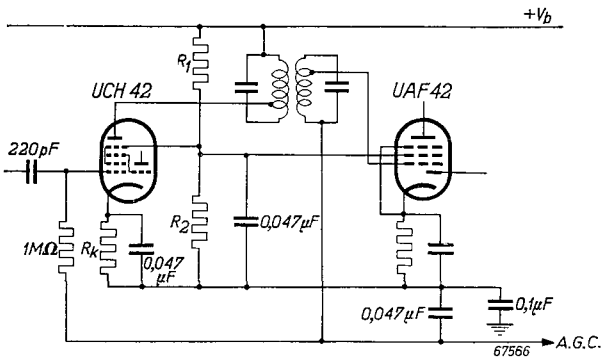


Fig. 5

Anode and supply voltage	$V_a = V_b =$	100	170	V		
Resistor between supply voltage and screen grids	$R_1 =$	15	15	kΩ		
Resistor between screen grids and chassis	$R_2 =$	22	22	kΩ		
Bias resistor	$R_k =$	180	180	Ω		
Oscillator grid leak	$R_{gT+g3} =$	22	22	kΩ		
Oscillator grid current	$I_{gT+g3} =$	175 ¹⁾	350 ¹⁾	μA		
Grid bias	$V_{g1} =$	—1.0 —9.6 —1.8 —15.5	V			
Screen grid voltage	$V_{g2} =$	43	58	70	99	V
Anode current	$I_a =$	1.2	—	2.1	—	mA
Screen grid current	$I_{g2+g4} =$	1.46	—	2.6	—	mA
Conversion conductance	$S_c =$	530	14	670	20	μA/V
Internal resistance	$R_i =$	>1	>2	>1	>4	MΩ
Equivalent noise resistance	$R_{eq} =$	60	—	66	—	kΩ

Limiting values of the hexode section

Anode voltage, cut-off condition	V_{a_o}	= max.	550	V
Anode voltage	V_a	= max.	250	V
Anode dissipation	W_a	= max.	1.5	W
Screen grid voltage, cut-off condition	$V_{(g2+g4)_c}$	= max.	550	V
Screen grid voltage, valve con- trolled	$V_{g2+g4}(I_a < 1\text{mA})$	= max.	250	V
Screen grid voltage, valve un- controlled	$V_{g2+g4}(I_a = 3\text{mA})$	= max.	125	V
Screen grid dissipation	W_{g2+g4}	= max.	0.3	W
Grid current starting point	$V_{g1}(I_{g1} = +0.3\mu\text{A})$	= max.	-1.3	V
Cathode current	I_k	= max.	10	mA
External resistance between grid 1 and cathode	R_{g1}	= max.	3	MΩ ²⁾
External resistance between grid 3 and cathode	R_{g3}	= max.	3	MΩ
External resistance between heater and cathode	R_{fk}	= max.	20	kΩ
Voltage between heater and cathode	V_{fk}	= max.	150	V

¹⁾ See note on page 213.

²⁾ This value is applicable where the grid bias is derived from a cathode resistor.

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Limiting values of the triode section

Anode voltage, cut-off condition	V_{a_0}	= max.	550 V
Anode voltage	V_a	= max.	175 V
Anode dissipation	W_a	= max.	0.8 W
Grid current starting point . .	$V_g(I_g = +0.3\mu A)$	= max.	-1.3 V
Cathode current	I_k	= max.	6 mA
External resistance between grid and cathode	R_g	= max.	3 M Ω
External resistance between heater and cathode	R_{fk}	= max.	20 k Ω
Voltage between heater and cathode	V_{fk}	= max.	150 V

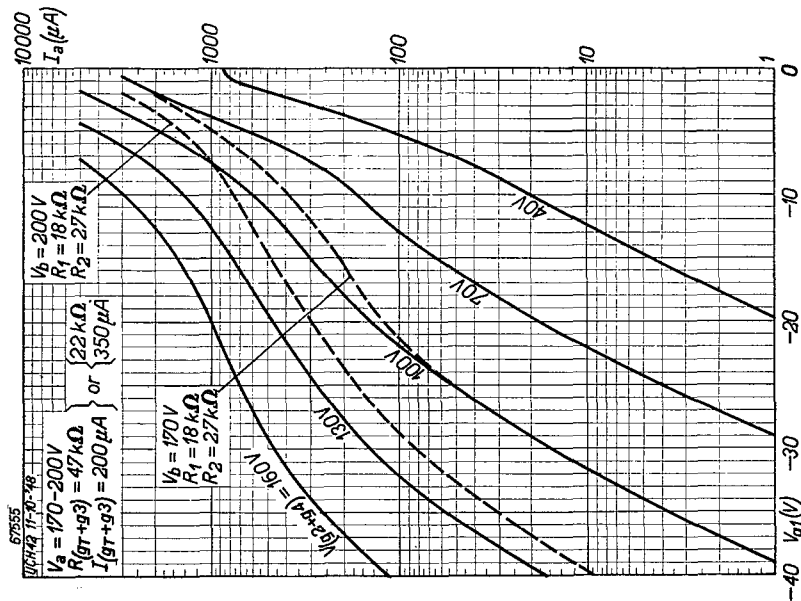


Fig. 7

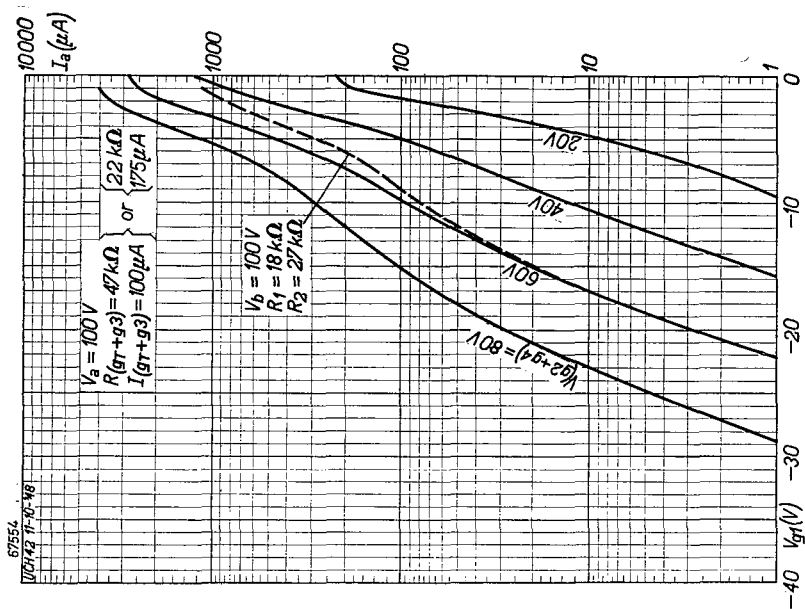


Fig. 6

Anode current (I_a) of the UCH 42 as a function of the grid bias (V_{g1}), measured on oscillating valve, with screen grid voltage (V_{g2+g4}) as parameter. The dotted lines represent the anode current when the screen grids are fed by means of a potentiometer (R_1 , R_2 , see Fig. 3). Fig. 6: supply voltage $V_b = 100\text{ V}$; Fig. 7: $V_b = 170 - 200\text{ V}$.

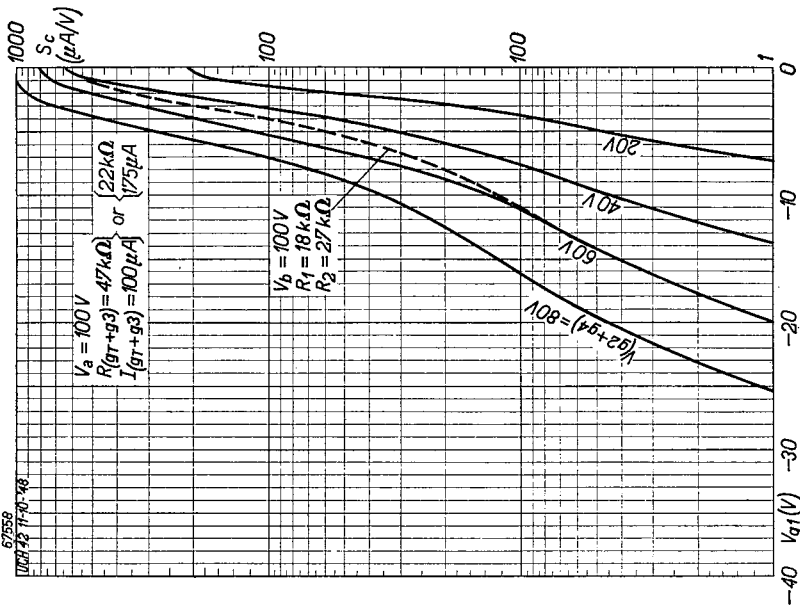


Fig. 8

Conversion conductance (S_c) of UCH 42 in oscillating condition, as a function of the grid bias (V_{g1}) with screen grid voltage (V_{g2+g4}) as parameter. The dotted lines indicate the conversion conductance when the screen grid voltage is derived from a potentiometer (R_1, R_2 in Fig. 3). Fig. 8 : supply voltage $V_b = 100V$; Fig. 9 : $V_b = 170 - 200V$.

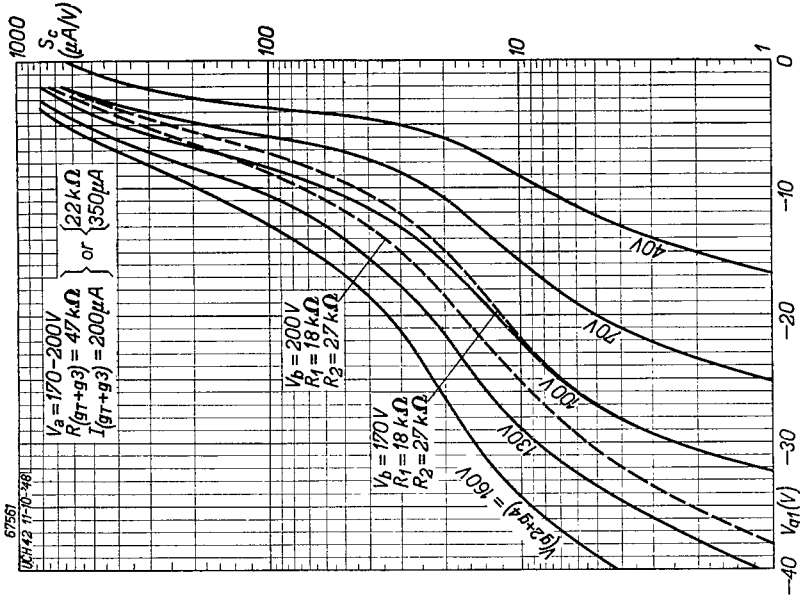


Fig. 9

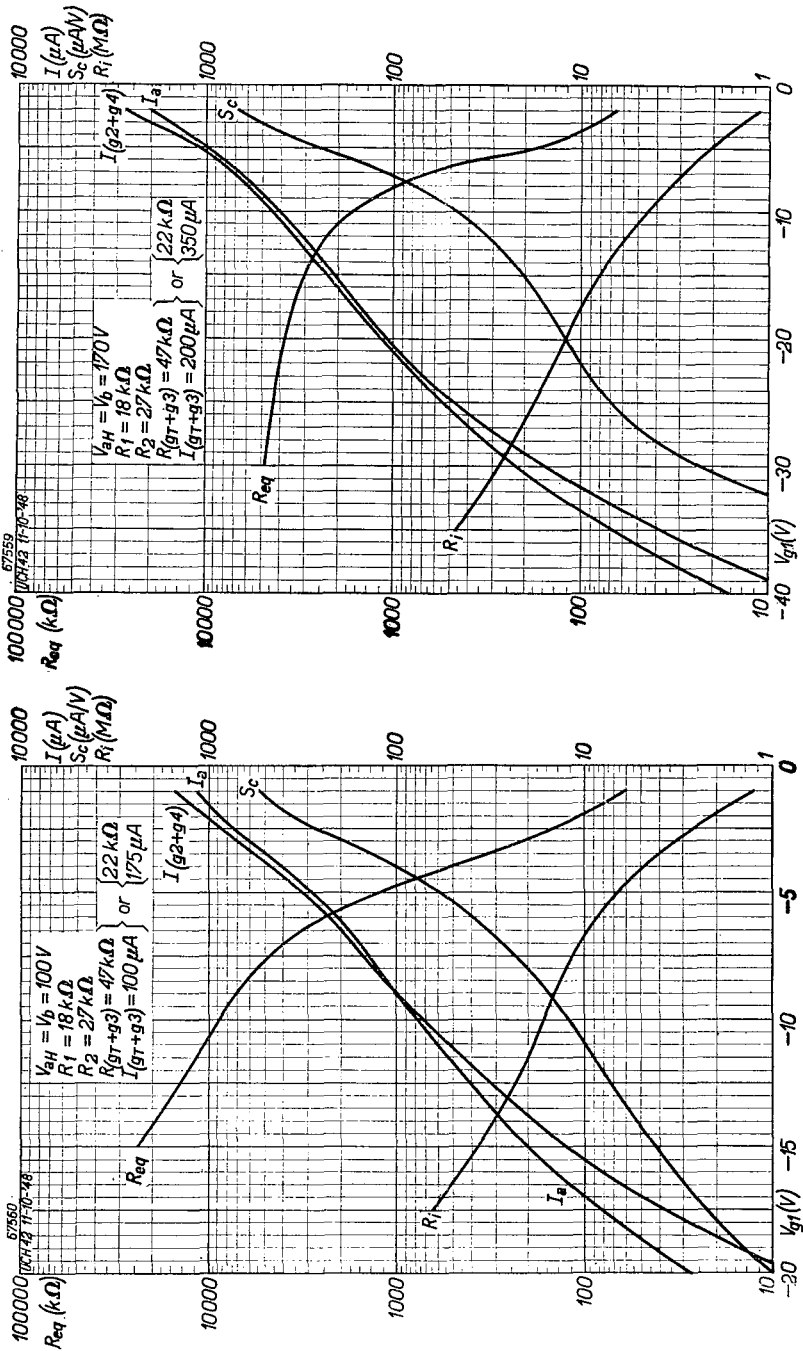


Fig. 10 Anode current (I_a), screen grid current ($I_{g_1+g_2}$), conversion conductance (S_c), internal resistance (R_i) and equivalent noise resistance (R_{eq}) of the UCH 42 in oscillating condition, as functions of the grid bias (V_{gr}). Measured in the circuit shown in Fig. 3. Fig. 10 : supply voltage $V_b = 100V$ Fig. 11 : $V_b = 170V$.

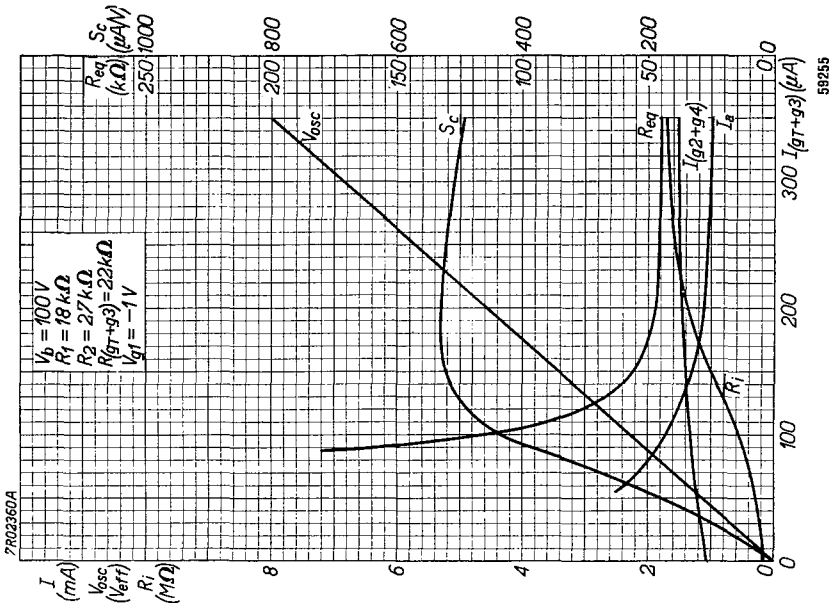


Fig. 12

Anode current (I_a), conversion conductance (S_c), oscillator voltage (V_{osc}), internal resistance (R_i) and equivalent noise resistance (R_{eq}) of the UCH 42 as functions of the oscillator grid current ($I_{g_1+g_3}$) for a grid leak $R_{g_1+g_3}$ of 22 k Ω . Measured in the circuit shown in Fig. 3. Fig. 12 : supply voltage $V_b = 100\text{ V}$; Fig. 13 : $V_b = 170\text{ V}$.

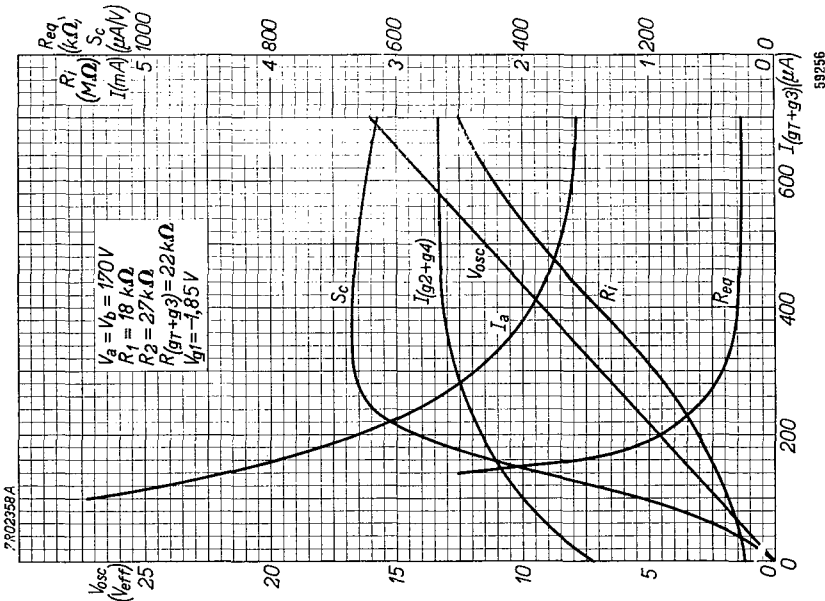


Fig. 13

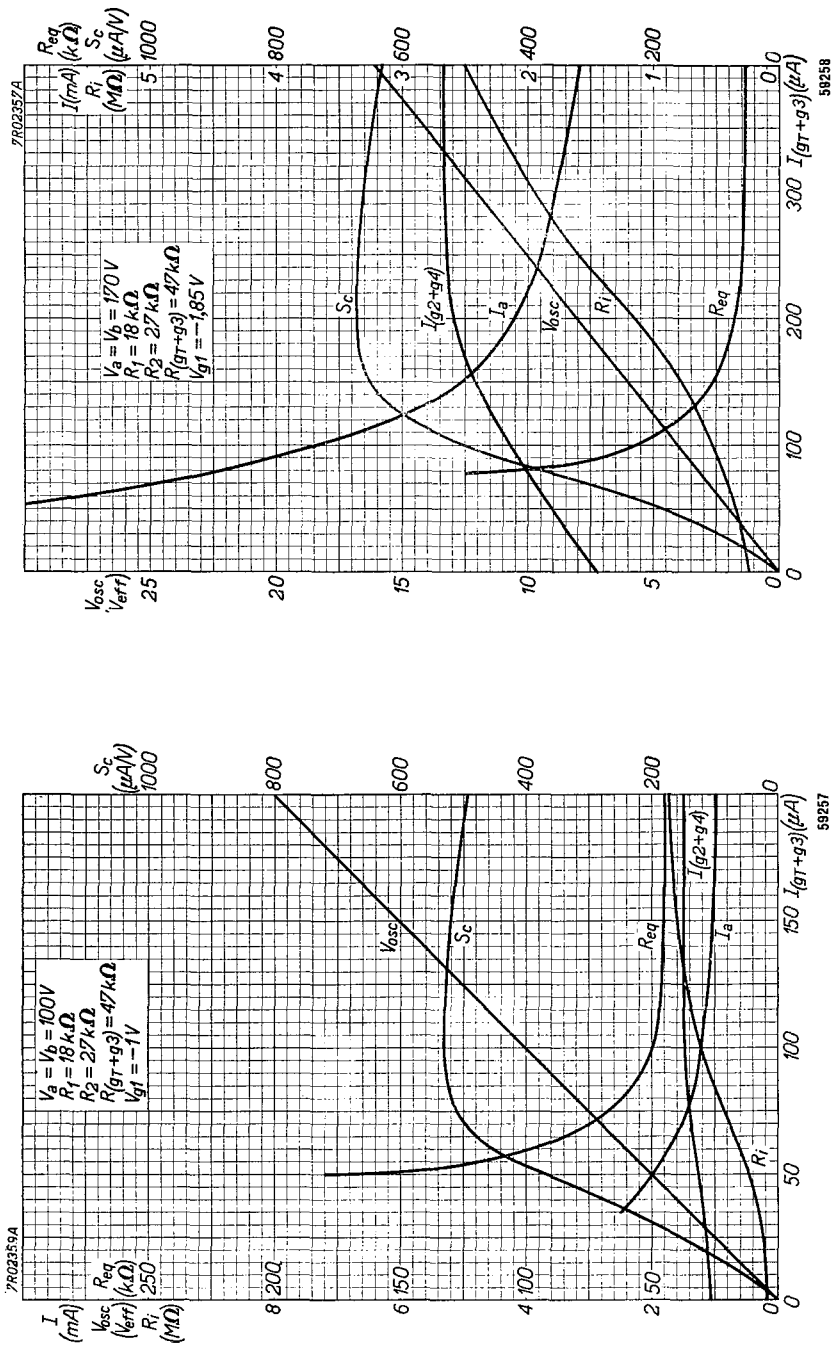


Fig. 14 As Figs. 12 and 13, but for grid leak R_{g1+g3} of 47 k Ω .

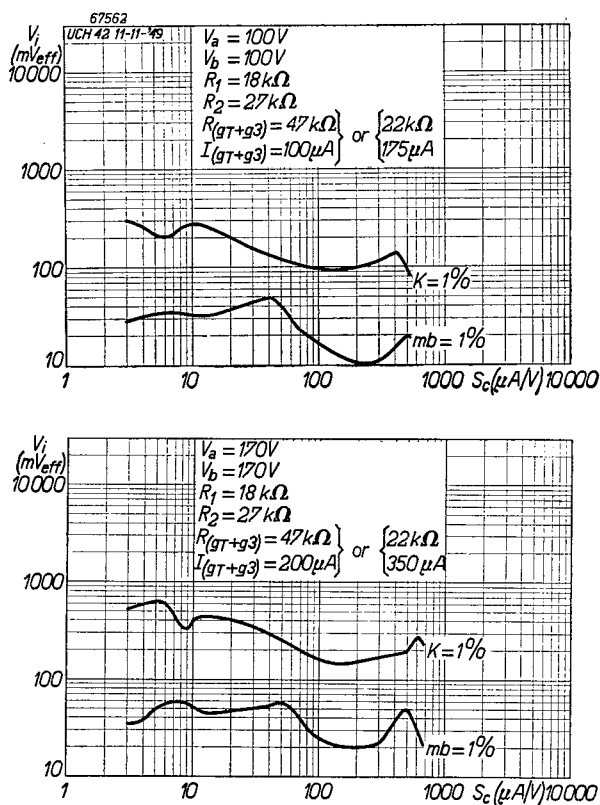


Fig. 16

- 1) The effective voltage (V_i) of an interfering signal at the control grid of the UCH 42 producing 1% cross modulation (curve $K=1\%$) and
- 2) the effective voltage (V_i) of a ripple signal at the control grid producing 1% modulation hum (curve $m_b=1\%$), both as function of the conversion conductance S_c and measured in the circuit shown in Fig. 3. Upper figure: supply voltage $V_b=100$ V; lower figure: $V_b=170$ V.

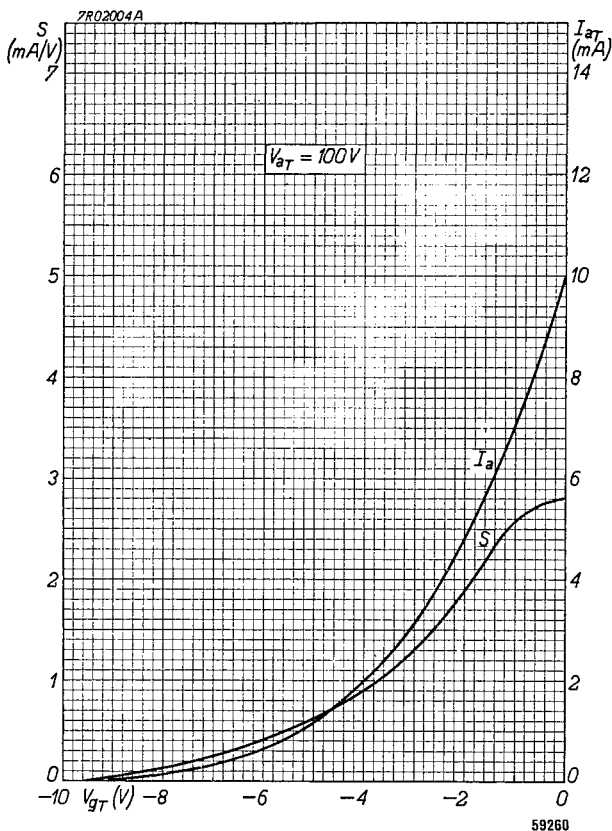
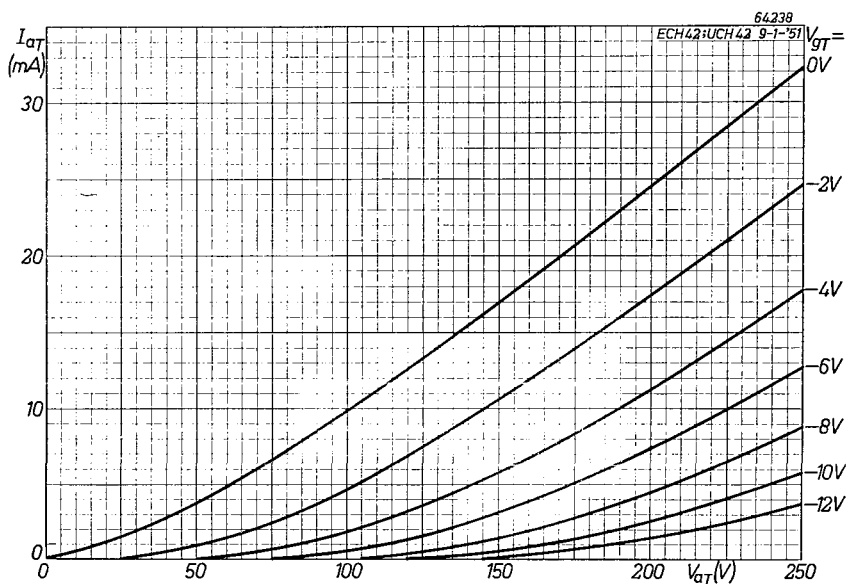


Fig. 17
 I_a/V_g and S/V_g characteristics of the triode section of the UCH 42.

Fig. 18
 I_a/V_a characteristics relative to the triode section of the UCH 42.



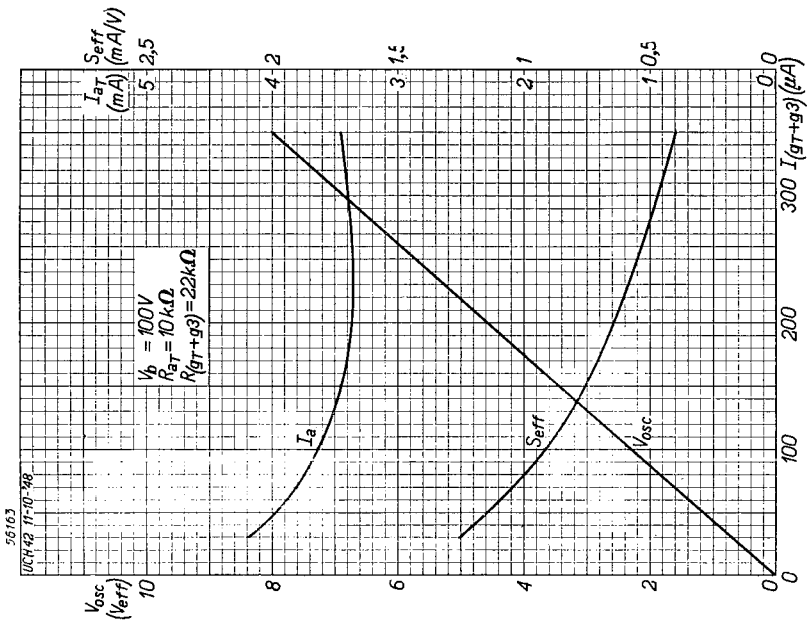


Fig. 19

Anode current (I_a), oscillator voltage (V_{osc}) and effective slope (S_{eff}) of the triode section of the UCH 42 as functions of the oscillator grid current (I_{gT+g3}), with grid leak (R_{gT+g3}) of 22 kΩ. Fig. 19: supply voltage $V_b=100$ V; Fig. 20: $V_b=170$ V.

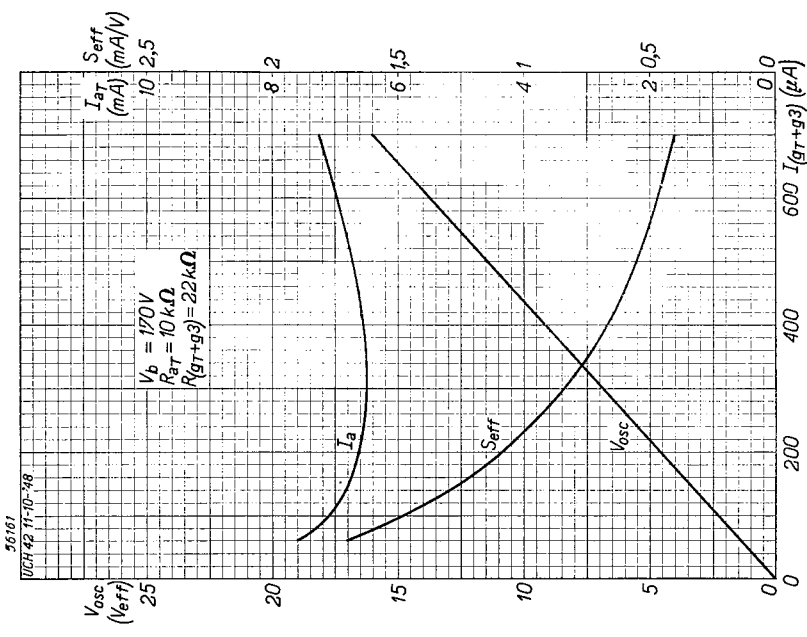


Fig. 20

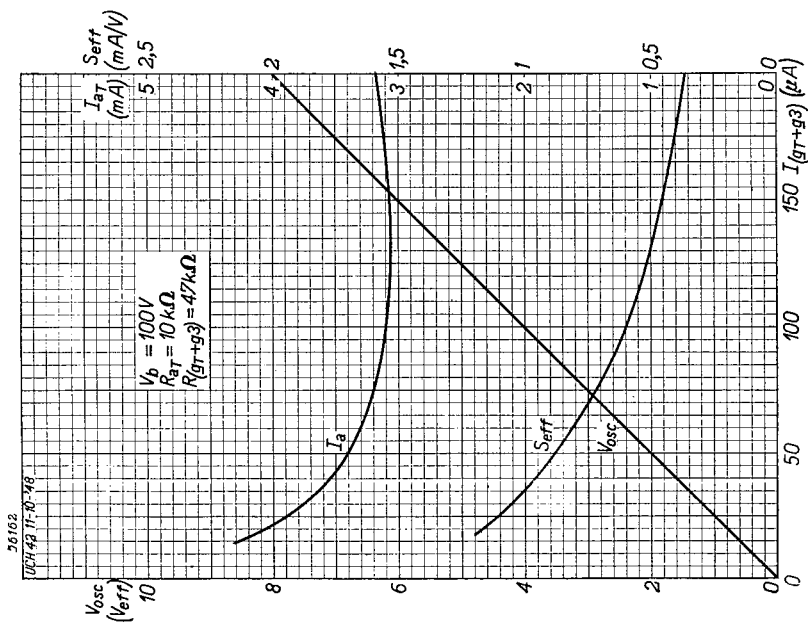


Fig. 21

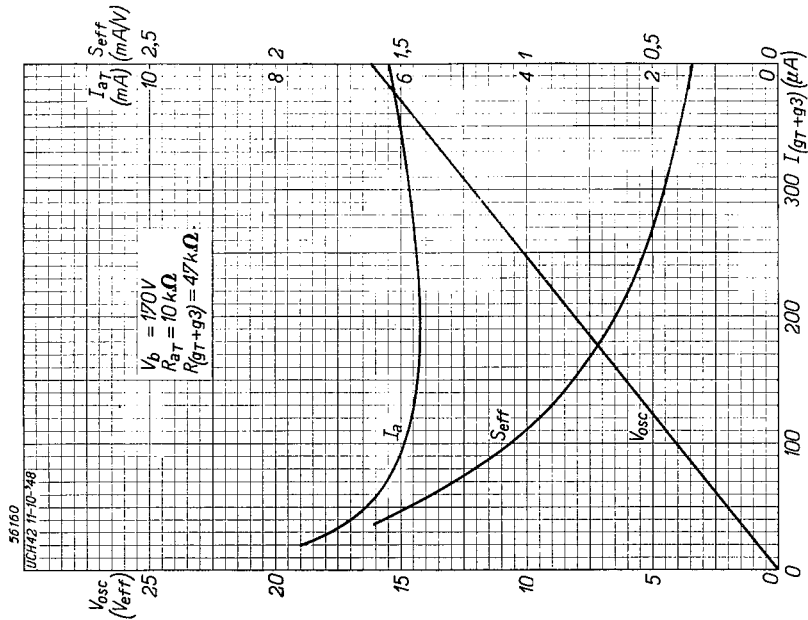


Fig. 22

As Figs. 19 and 20, but with a grid leak $R_{(gT+g3)}$ of 47 k Ω .

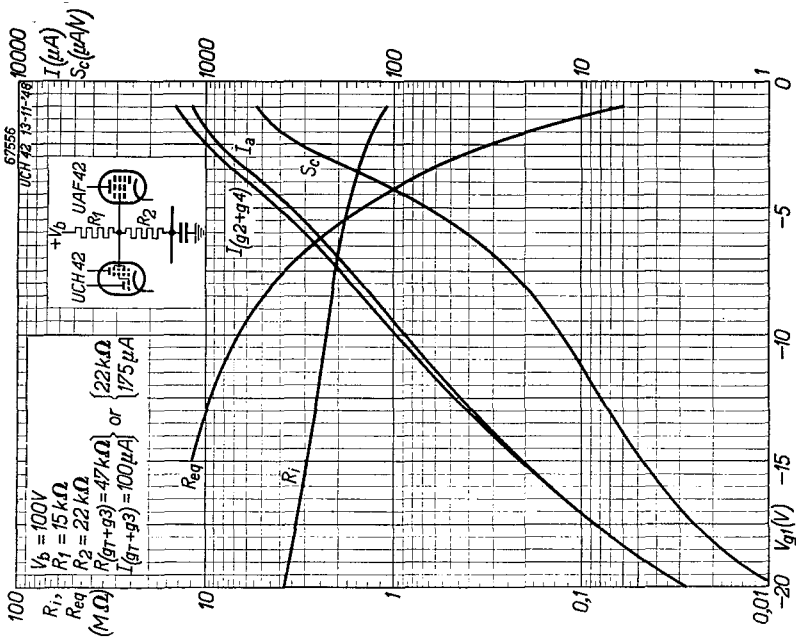
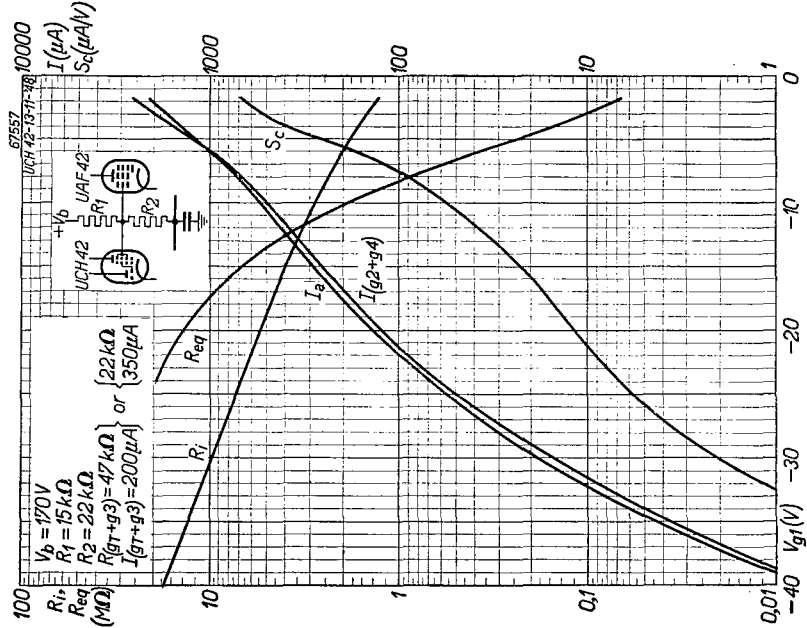


Fig. 23

As Figs. 10 and 11, but with the screen grid voltage of the UCH 42 together with that of the UAF 42 fed by means of a common potentiometer. Measured in the circuit shown in Fig. 5. Fig. 23 : supply voltage $V_b = 100V$; Fig. 24 : $V_b = 170V$.

Fig. 24



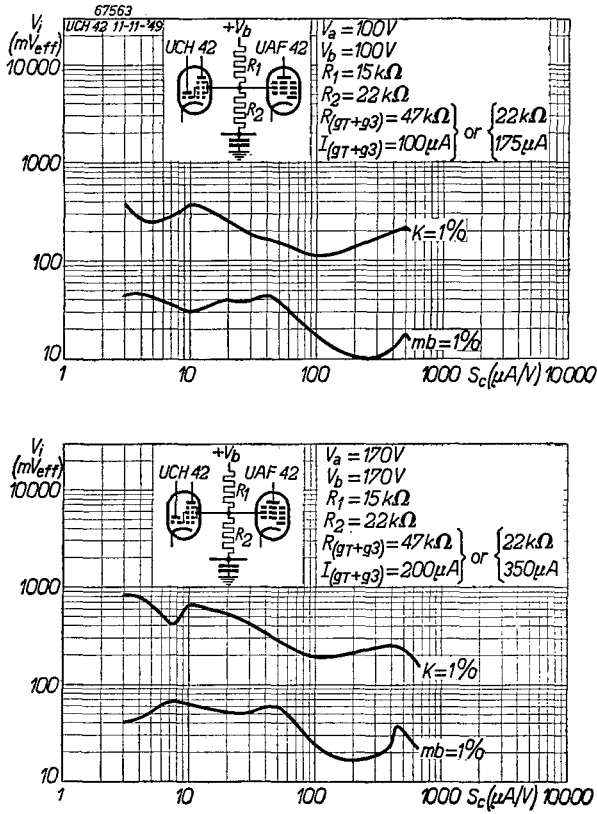


Fig. 25

As Fig. 16, but with the screen grids of the UAF 42 and UCH 42 fed by means of a common potentiometer.