UCH 41 Triode-hexode frequency changer

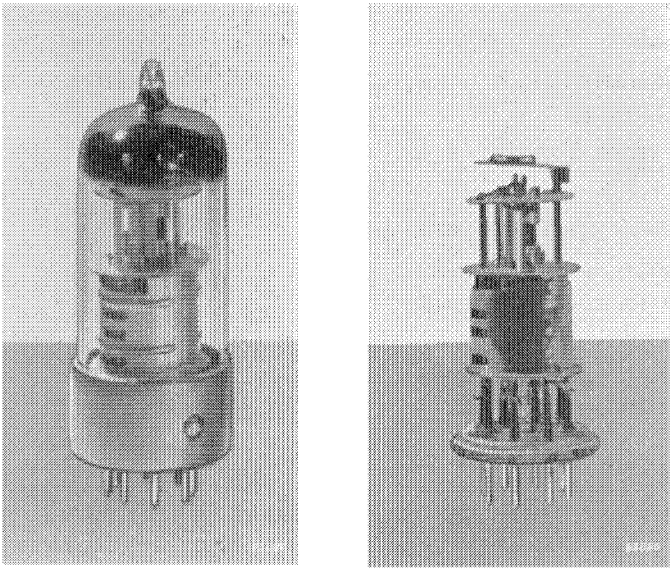


Fig. 1
The UCH 41, showing the electrode system (approximately actual size).

The triode-hexode UCH 41 is a frequency changer with a conversion conductance of 450 μA/V at an applied voltage of 170 V, or 320 μA/V at 100 V. Further particulars will be found in the description of the ECH 41, the corresponding E-type valve.

TECHNICAL DATA OF THE TRIODE-HEXODE UCH 41

Heater data

Heating : indirect, A.C. or D.C., series feed

Heater current	I_f	=	100 mA
Heater voltage	V_f	=	14 V

Capacitances (cold valve)

Hexode section

Input capacitance . . .	C_{g1}	=	3.4 pF
Output capacitance . . .	C_a	=	6.0 pF
Anode - control grid	C_{ag1}	<	0.1 pF
Heater - control grid	C_{g1f}	<	0.15 pF

Triode section

Input capacitance	C_{gT+g3}	=	4.9 pF
Output capacitance	C_a	=	1.5 pF
Anode - grid	$C_{(gT+g3)a}$	=	1.2 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

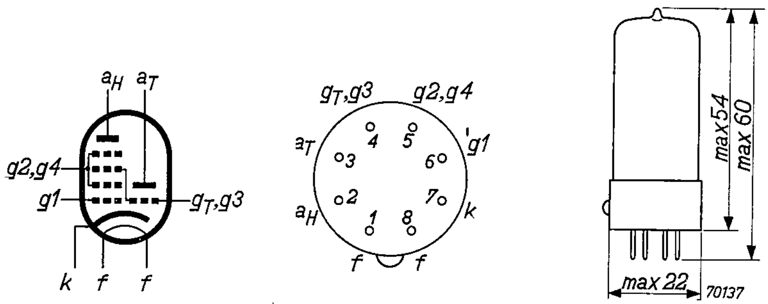


Fig. 2
Electrode arrangement, electrode connections and maximum dimensions in mm of the UCH 41.

Operating characteristics of the hexode section used as frequency changer
(screen grids fed by means of a potentiometer ; see Figs. 6—13 incl.)

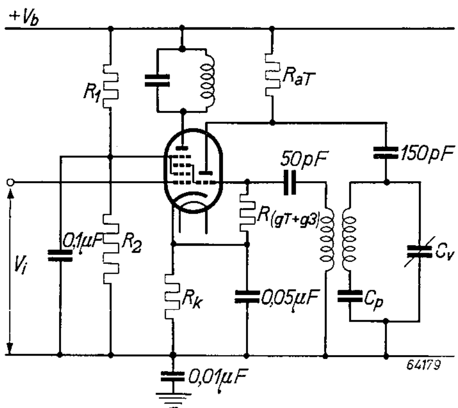


Fig. 3

UCH 41

Anode and supply voltage	$V_a = V_b$	=	100		170		V
Resistor between supply voltage and screen grids	R_1	=	22		22		kΩ
Resistor between screen grids and chassis	R_2	=	47		47		kΩ
Bias resistor	R_k	=	200		200		Ω
Oscillator grid leak	R_{gT+g3}	=	20		20		kΩ
Oscillator grid current	I_{gT+g3}	=	200		320		μA
Grid bias	V_{g1}	=	−1.0	−14	−1.8	−22	V
Screen grid voltage	V_{g2+g4}	=	52	68	87	116	V
Anode current	I_a	=	1.0	—	2.2	—	mA
Screen grid current	I_{g2+g4}	=	1.0	—	1.9	—	mA
Conversion conductance	S_c	=	320	3.2	450	4.5	μA/V
Internal resistance	R_i	=	1.4	>5	1.2	>5	MΩ
Equivalent noise resistance	R_{eq}	=	115	—	145	—	kΩ

Anode and supply voltage	$V_a = V_b$	=	200		V
Resistor between supply voltage and screen grids	R_1	=	22		kΩ
Resistor between screen grids and chassis	R_2	=	47		kΩ
Bias resistor	R_k	=	225		Ω
Oscillator grid leak	R_{gT+g3}	=	20		kΩ
Oscillator grid current	I_{gT+g3}	=	360		μA
Grid bias	V_{g1}	=	−2.2	−27	V
Screen grid voltage	V_{g2+g4}	=	105	136	V
Anode current	I_a	=	3.0	—	mA
Screen grid current	I_{g2+g4}	=	2.1	—	mA
Conversion conductance	S_c	=	500	5	μA/V
Internal resistance	R_i	=	1.0	>5	MΩ
Equivalent noise resistance	R_{eq}	=	220	—	kΩ

Typical characteristics of the triode section (see Figs. 15 and 16)

Anode voltage	V_a	=	100	V
Grid voltage	V_{gT+g3}	=	0	V
Anode current	I_a	=	8.5	mA
Mutual conductance	S	=	1.9	mA/V
Amplification factor	μ	=	19	

Operating characteristics of the triode section used as oscillator (see Figs. 17 and 18)

Supply voltage	V_b	=	100	170	200	V
Anode resistor	R_a	=	10	10	20	kΩ
Anode current	I_a	=	2.8	4.9	4.6	mA
Oscillator grid leak	R_{gT+g3}	=	20	20	20	kΩ
Oscillator grid current	I_{gT+g3}	=	200	320	360	μA
Oscillator voltage	V_{osc}	=	4	7	8	V_{RMS}
Effective slope	S_{eff}	=	0.56	0.6	0.5	mA/V

Operating characteristics of the UCH 41 used as phase inverter (see Fig. 4)

Supply voltage	Total current	Amplification	Distortion (%) at an output voltage of	
			5 V_{RMS}	10 V_{RMS}
100	1.2	10	1.5	—
170	2.0	10	1.0	1.8

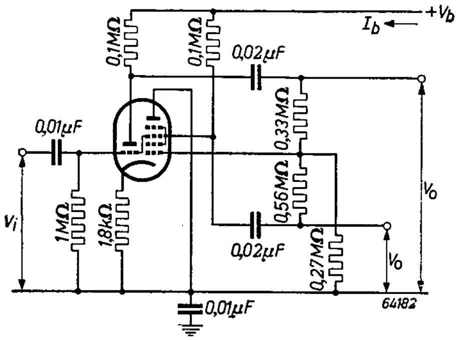


Fig. 4
The UCH 41 used as phase inverter.

Operating characteristics of the hexode section used as frequency changer with screen grids, fed, together with that of the UAF 42, by means of a common potentiometer (see Figs. 19—21)

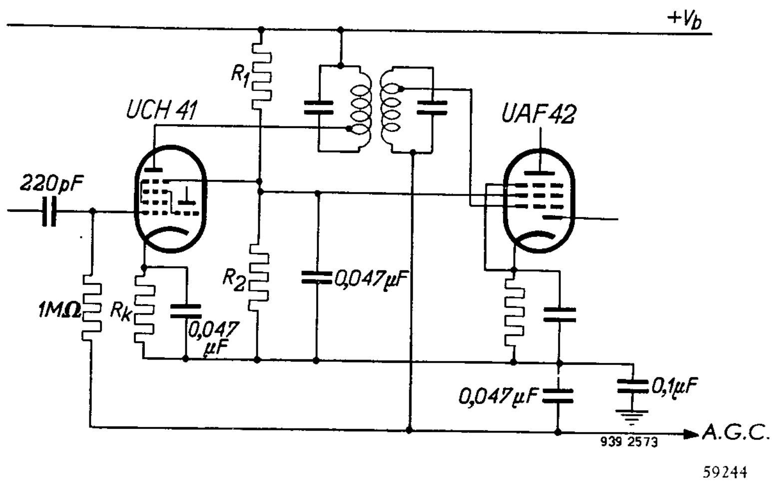


Fig. 5

Anode and supply voltage	$V_a = V_b =$	100		170		V
Resistor between supply voltage and screen grids	R_1 =	12		12		kΩ
Resistor between screen grids and chassis	R_2 =	27		27		kΩ
Bias resistor	R_k =	200		200		Ω
Oscillator grid leak	R_{gT+g3} =	20		20		kΩ
Oscillator grid current	I_{gT+g3} =	200		320		μA
Grid bias	V_{g1} =	−1.0	−10.5	−1.8	−18	V
Screen grid voltage	V_{g2+g4} =	53	69	87	117	V
Anode current	I_a =	1.0	—	2.2	—	mA
Screen grid current	I_{g2+g4} =	1.0	—	1.9	—	mA
Conversion conductance	S_c =	320	10	450	11	μA/V
Internal resistance	R_i =	1.4	—	1.2	—	MΩ
Equivalent noise resistance	R_{eq} =	115	—	145	—	kΩ

Operating characteristics of the hexode section of the UCH 41 used as frequency changer; screen grid voltage, together with that of the I.F. amplifier UF 41 derived from a common potentiometer (circuit corresponding to that shown in Fig. 5)

Anode and supply voltage	$V_a = V_b =$	100		170		V
Potentiometer for screen grid	R_1 =	12		12		kΩ
feed	R_2 =	27		27		kΩ
Bias resistor	R_k =	200		200		Ω
Oscillator grid leak	R_{gT+g3} =	20		20		kΩ
Oscillator grid current	I_{gT+g3} =	200		320		μA
Grid bias	V_{g1} =	−1.0	−12	−1.8	−20	V
Screen grid voltage	V_{g2+g4} =	53	69	87	117	V
Anode current	I_a =	1.0	—	2.2	—	mA
Screen grid current	I_{g2+g4} =	1.0	—	1.9	—	mA
Conversion conductance	S_c =	320	5.5	450	7	μA/V
Internal resistance	R_i =	1.4	>5	1.2	>5	MΩ
Equivalent noise resistance	R_{eq} =	115	—	145	—	kΩ

Limiting values of the hexode section

Anode voltage, valve biased to cut-off	V_{a_0}	= max.	550	V
Anode voltage	V_a	= max.	250	V
Anode dissipation	W_a	= max.	0.8	W
Screen grid voltage, valve biased to cut-off	$V_{(g2+g4)_0}$	= max.	550	V
Screen grid voltage	V_{g2+g4}	= max.	125	V
Screen grid dissipation	W_{g2+g4}	= max.	0.3	W
Grid current starting point	$V_{g1}(I_{g1} = +0.3\mu A)$	= max.	−1.3	V
Cathode current	I_k	= max.	7	mA
External resistance between grid 1 and cathode	R_{g1}	= max.	3	MΩ

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

Limiting values of the triode section

Anode voltage, valve biased to cut-off	V_{a_0}	= max. 550 V
Anode voltage	V_a	= max. 175 V
Anode dissipation	W_a	= max. 0.75 W
Grid current starting point . .	$V_g(I_g = +0.3\ \mu A)$	= max. —1.3 V
Cathode current	I_k	= max. 5.5 mA
External resistance between grid and cathode	R_g	= max. 3 MΩ
External resistance between heater and cathode	R_{fk}	= max. 20 kΩ
Voltage between heater and cathode	V_{fk}	= max. 150 V

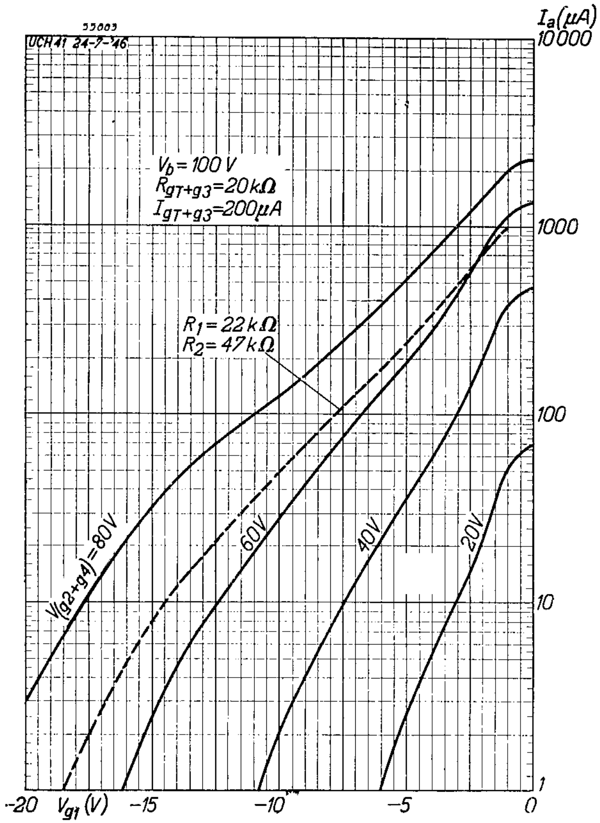


Fig. 6

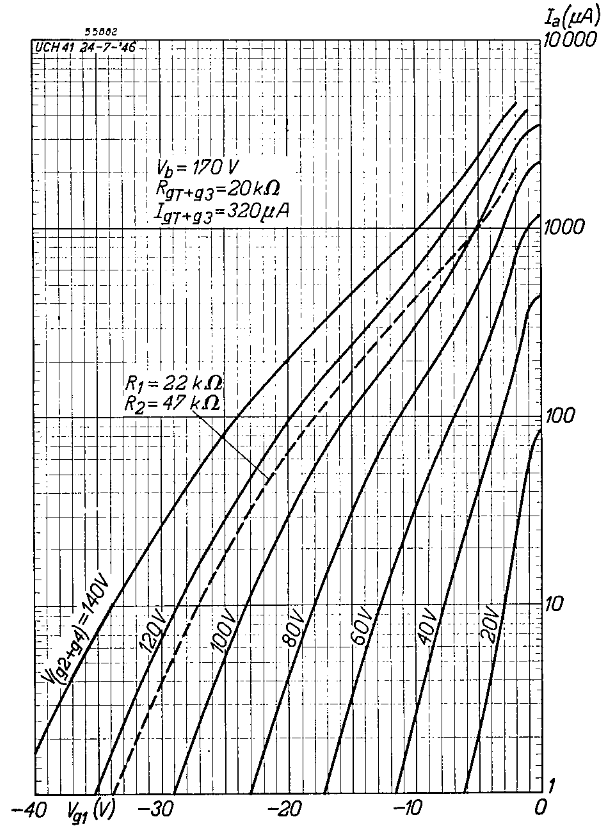


Fig. 7

Anode current (I_a) of the UCH 41, measured on oscillating valve, as a function of the grid bias (V_{g1}) with screen grid voltage (V_{g2+g4}) as parameter. The dotted curves represent the anode current when the screen grid voltage is derived from a potentiometer (R_1, R_2, see Fig. 3). Fig. 6 : supply voltage $V_b = 100$ V ; Fig. 7 : $V_b = 170$ V.

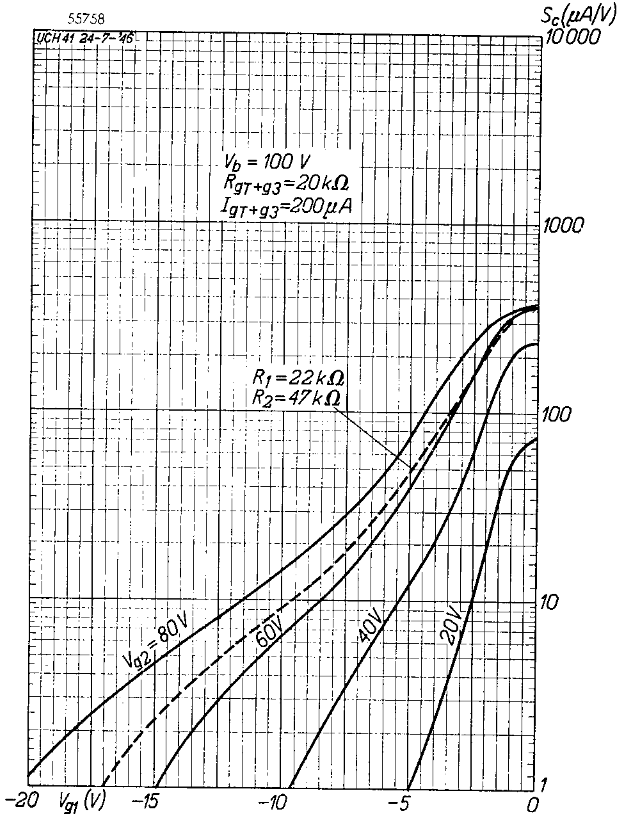


Fig. 8

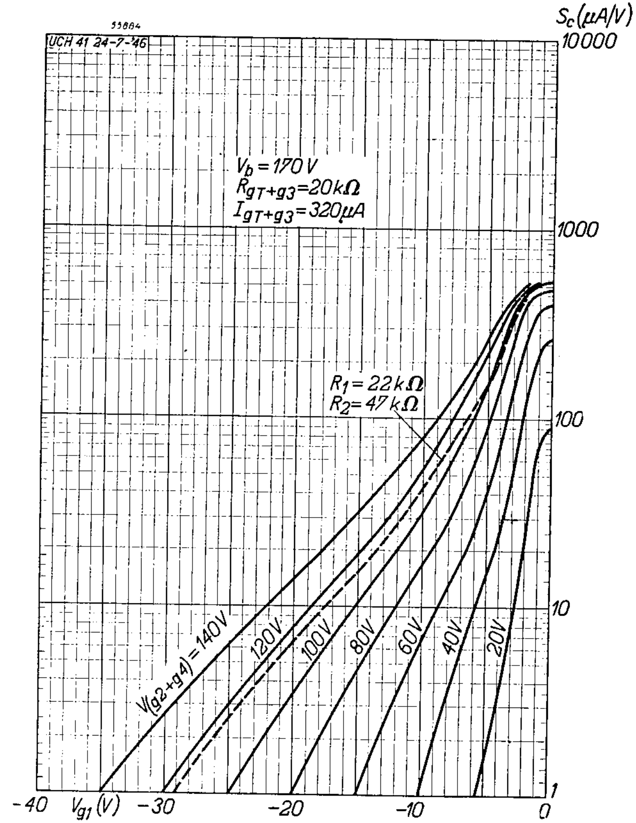
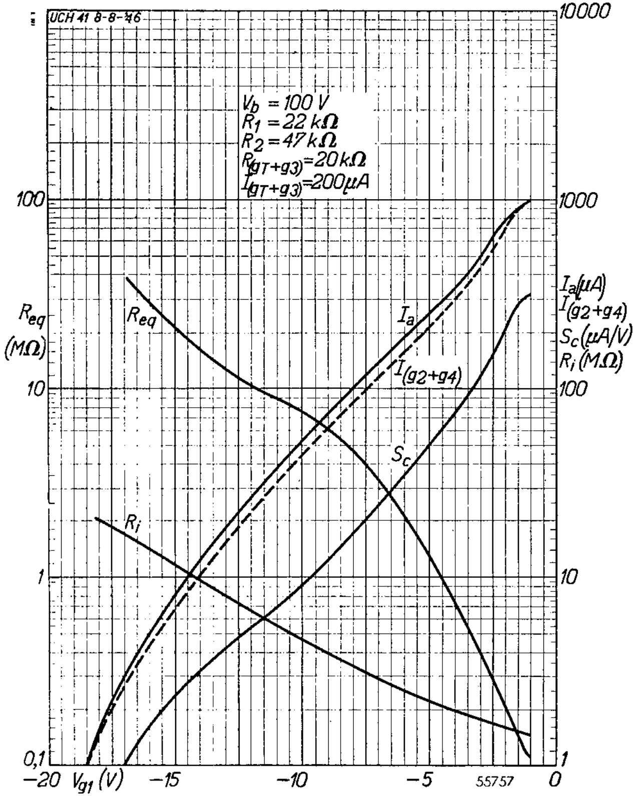


Fig. 9

Conversion conductance (S_c) of the UCH 41, measured on oscillating valve, as a function of the grid bias (V_{g1}), with screen grid voltage (V_{g2+g4}) as parameter. The dotted curves represent the conversion conductance when the screen grids are fed by means of a potentiometer (R_1, R_2, see Fig. 3). Fig. 8 : supply voltage V_b = 100 V; Fig. 9 : V_b=170 V.



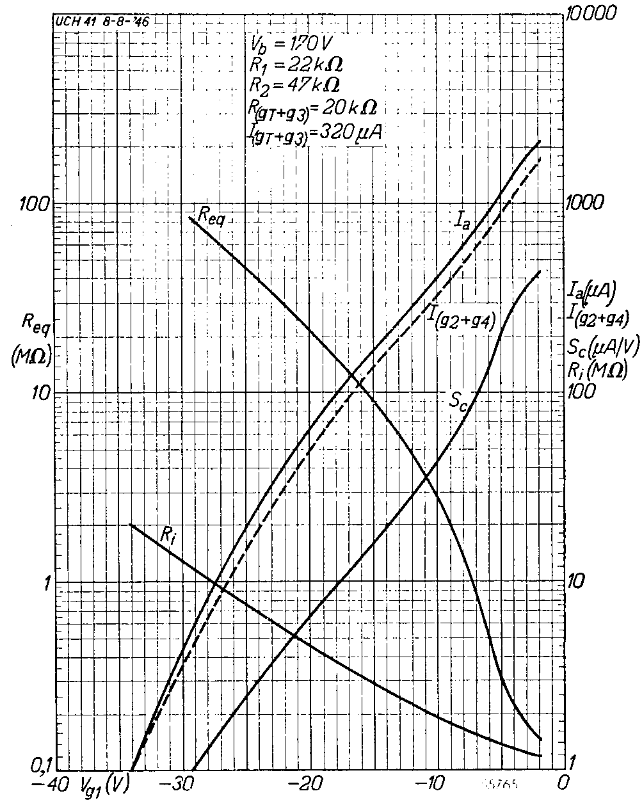
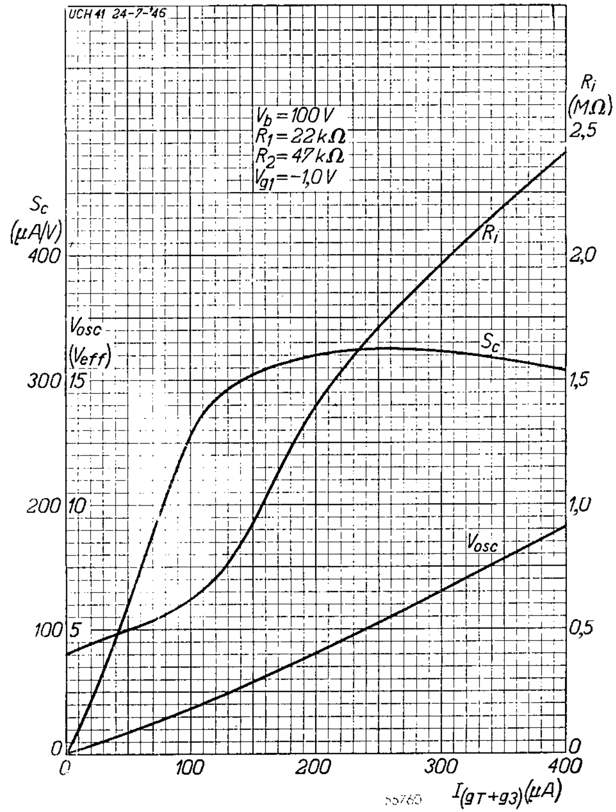


Fig. 10 Fig. 11

Anode current (I_a), screen grid current (I_{g2+g4}), conversion conductance (S_c), internal resistance (R_i) and equivalent noise resistance (R_{eq}) of the UCH 41, as functions of the grid bias (V_{g1}). Measurements taken from oscillating valve in circuit shown in Fig. 3. Fig. 10 : V_b=100 V ; Fig. 11 : V_b=170 V.



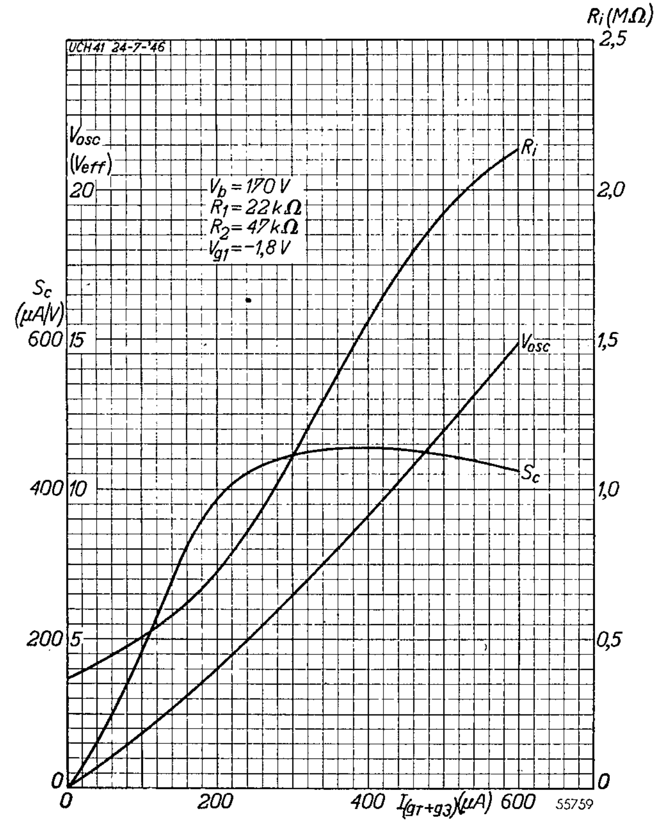


Fig. 12

Fig. 13

Conversion conductance (S_c), oscillator voltage (V_{osc}) and internal resistance (R_i) of the UCH 41, as functions of the oscillator grid current (I_{gT+g3}). Relative to the circuit depicted in Fig. 3. Fig. 12 : V_b=100 V ; Fig. 13 : V_b=170 V.

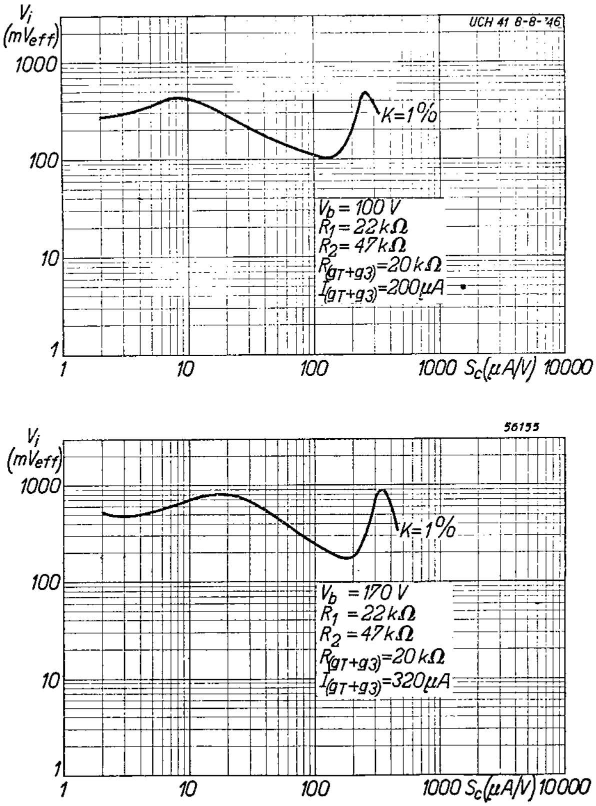


Fig. 14
The effective voltage (V_i) of an interfering signal at the control grid of the UCH 41, producing 1% cross modulation, as a function of the conversion conductance (S_c). Measurements taken in the circuit shown in Fig. 3. Upper figure: $V_b = 100$ V; lower figure: $V_b = 170$ V.

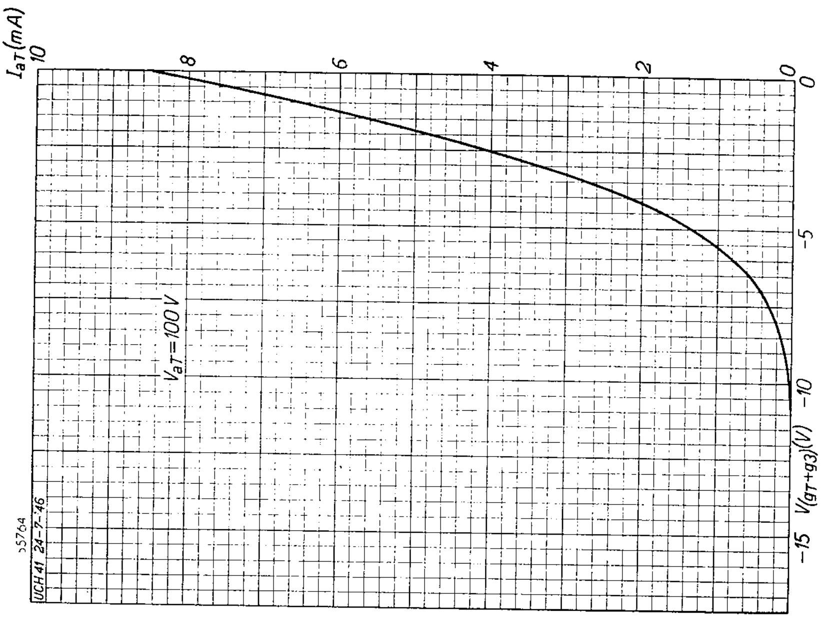


Fig. 15
I_a/V_g characteristic of the triode system of the UCH 41.

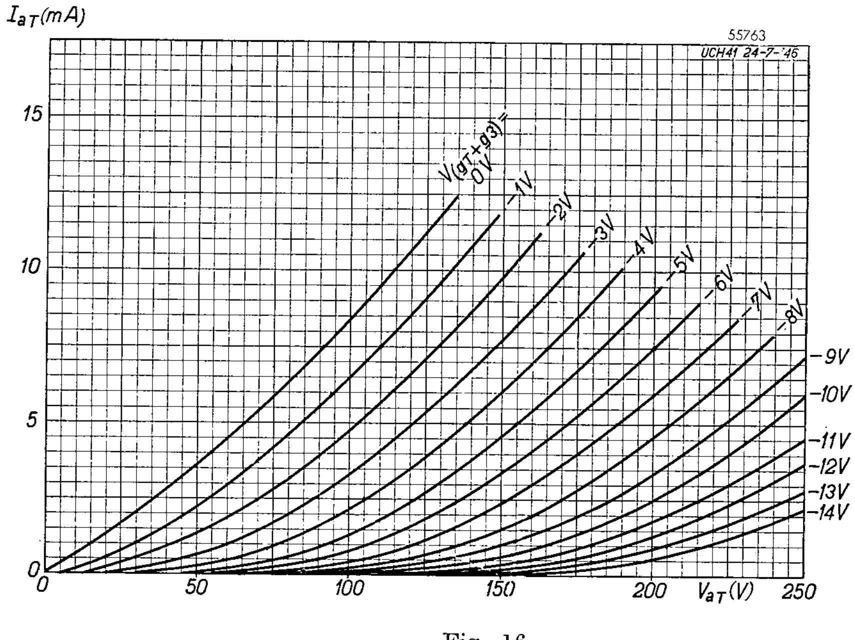


Fig. 16
I_a/V_a characteristics of the triode system of the UCH 41.

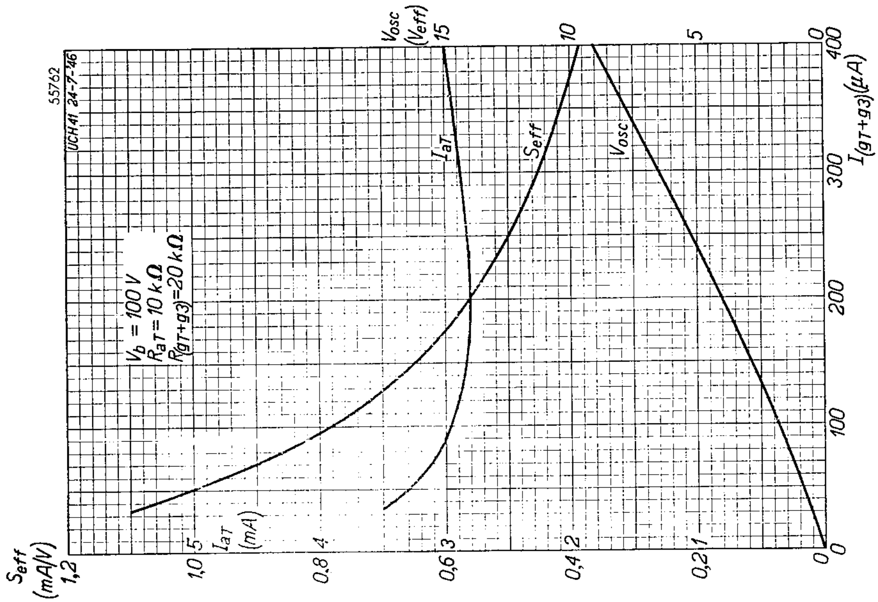


Fig. 17

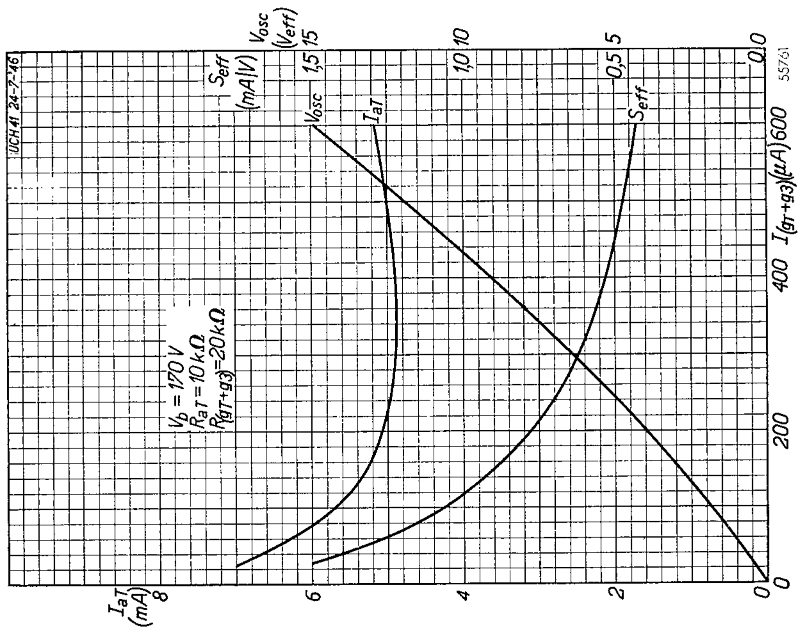
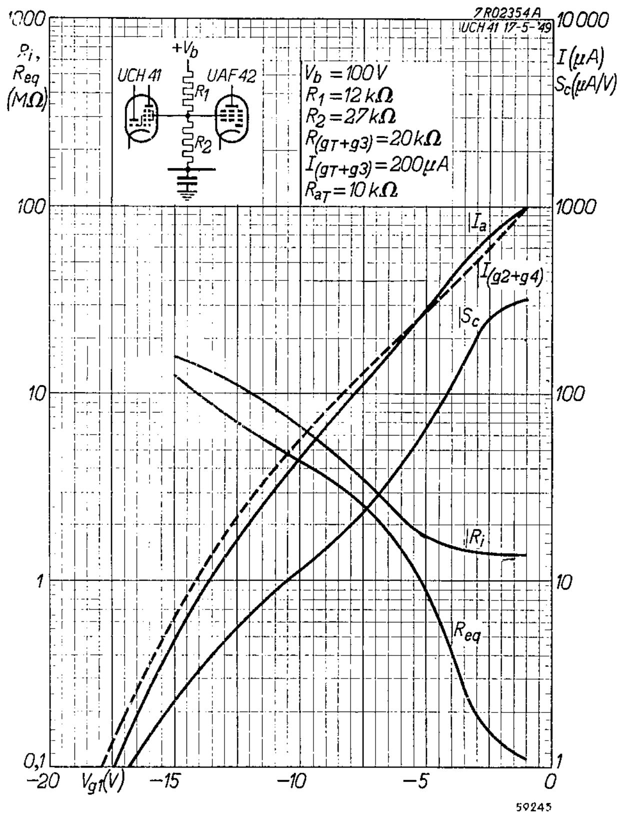


Fig. 18

Anode current (I_a), oscillator voltage (V_{osc}) and effective slope (S_{eff}) of the triode system of the UCH 41, as functions of the oscillator grid current (I_{gT+g3}). Fig. 17: supply voltage $V_b = 100$ V; Fig. 18: $V_b = 170$ V.



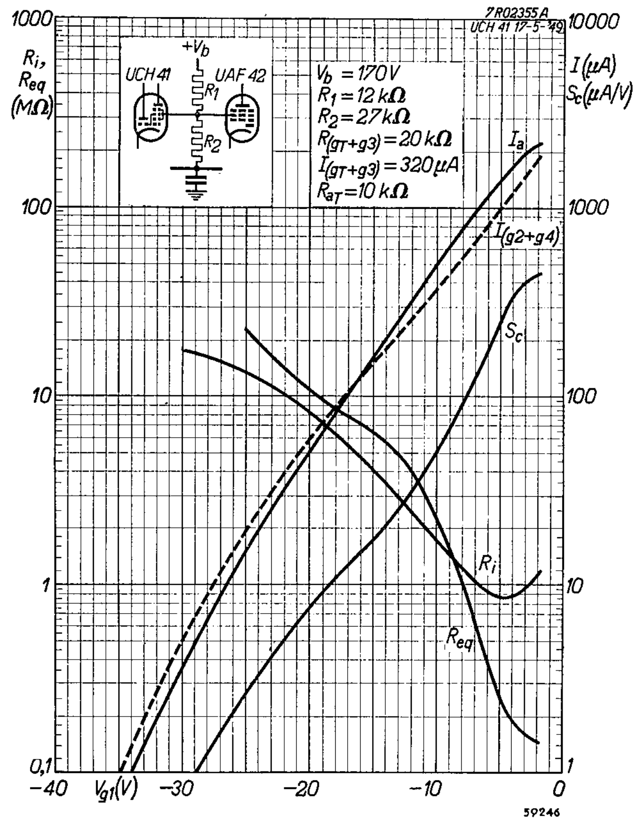


Fig. 19

Fig. 20

As Fig. 10 and Fig. 11, but with the screen grids of the UCH 41, together with that of the UAF 42, fed by means of a common potentiometer. Measurements taken in the circuit shown in Fig. 5. Fig. 19: supply voltage $V_b = 100$ V; Fig. 20: $V_b = 170$ V.

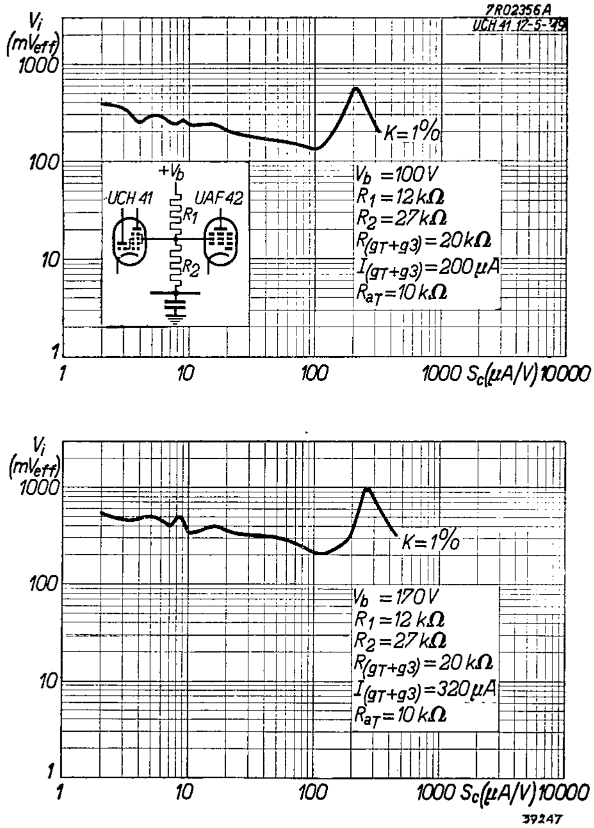


Fig. 21
As Fig. 14, but with screen grids of the UCH 41, together with that of the UAF 42, fed by means of a common potentiometer.