UCH 42 Triode-hexode frequency changer

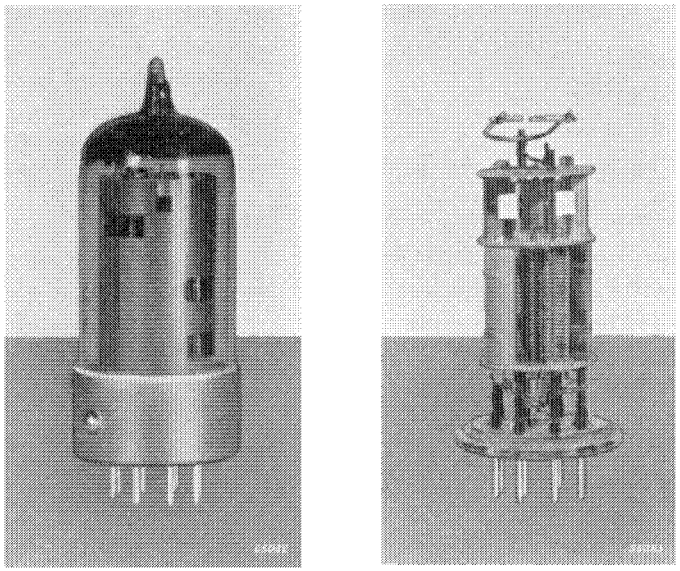

Fig. 1
The UCH 42, showing the electrode system (approximately actual size).

The triode-hexode UCH 42 is a frequency changer with a conversion conductance of 670 μA/V at an applied voltage of 170 V, or 530 μA/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			
Heater current	I_f	=	100 mA
Heater voltage	V_f	=	14 V

Capacitances (measured on cold valve)

Hexode section

Input capacitance	C_{g1}	=	4.0 pF
Output capacitance	C_a	=	9.4 pF
Anode - control grid	C_{ag_1}	<	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

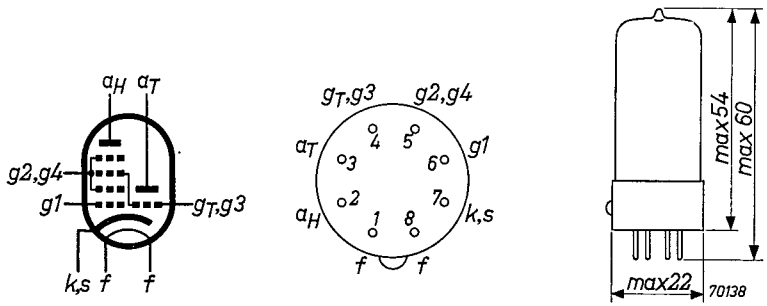

Fig. 2
Electrode arrangement, electrode connections and maximum dimensions in mm of the UCH 42.

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

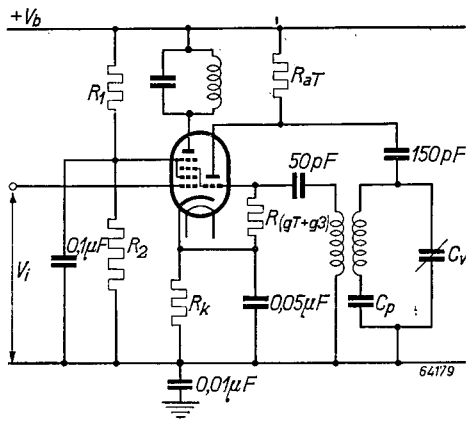

Fig. 3

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} =	—1.0	—13.5	—1.85	—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} =			—2	—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		kΩ
Oscillator voltage . .	V_{osc}	=	4		8		8		V_{RMS}
Oscillator grid leak .	R_{gT+g3}	=	22	47	22	47	22	47	kΩ
Oscillator grid current	I_{gT+g3}	=	175	100	350	200	350	200	μA
Anode current . . .	I_a	=	3.4	3.1	6.5	5.7	5.5	5.2	mA
Effective slope . .	S_{eff}	=	0.7	0.6	0.75	0.65	0.65	0.55	mA/V

Operating characteristics of the UCH 42 used as phase inverter

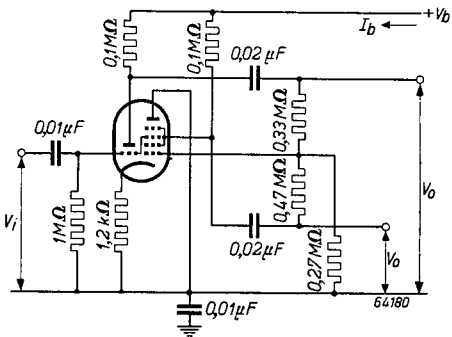

Fig. 4

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, with screen grids, together with that of the UAF 42, fed by means of a common potentiometer (see Figs. 23 to 25 incl.)

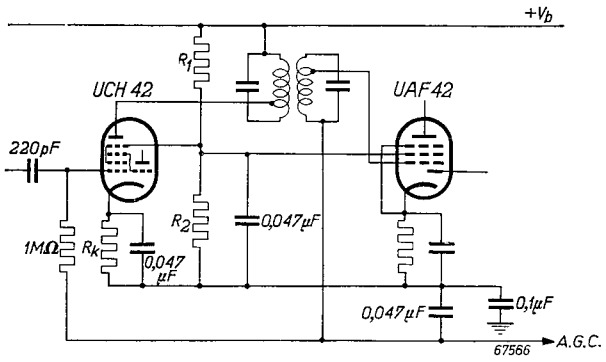

Fig. 5

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 controlled	$V_{g2+g4}(I_a<1\text{mA})$	= max.	250	V
Screen grid voltage, valve uncontrolled	$V_{g2+g4}(I_a=3\text{mA})$	= 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_o}	= 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	MΩ
External resistance between heater and cathode	R_{fk}	= max.	20	kΩ
Voltage between heater and cathode	V_{fk}	= max.	150	V

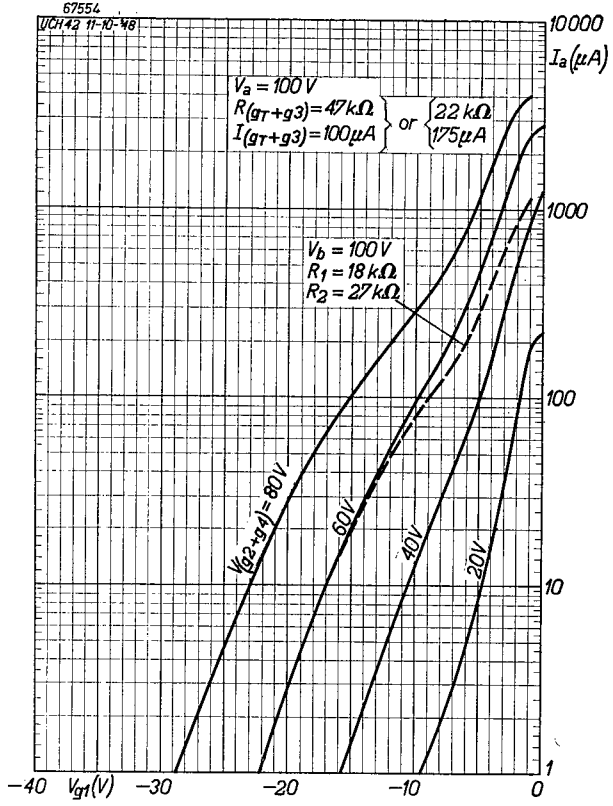


Fig. 6

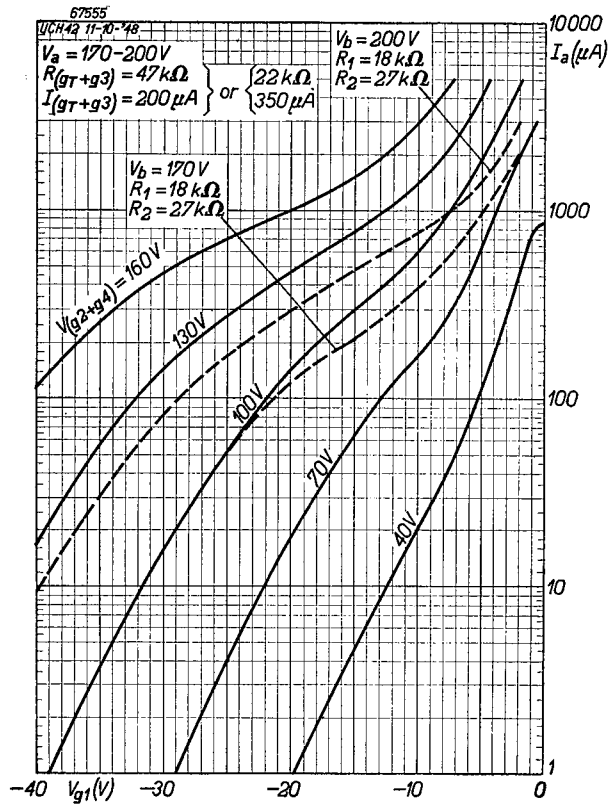


Fig. 7

Anode current (I_a) of the UCH 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 V; Fig. 7: V_b=170 - 200 V.

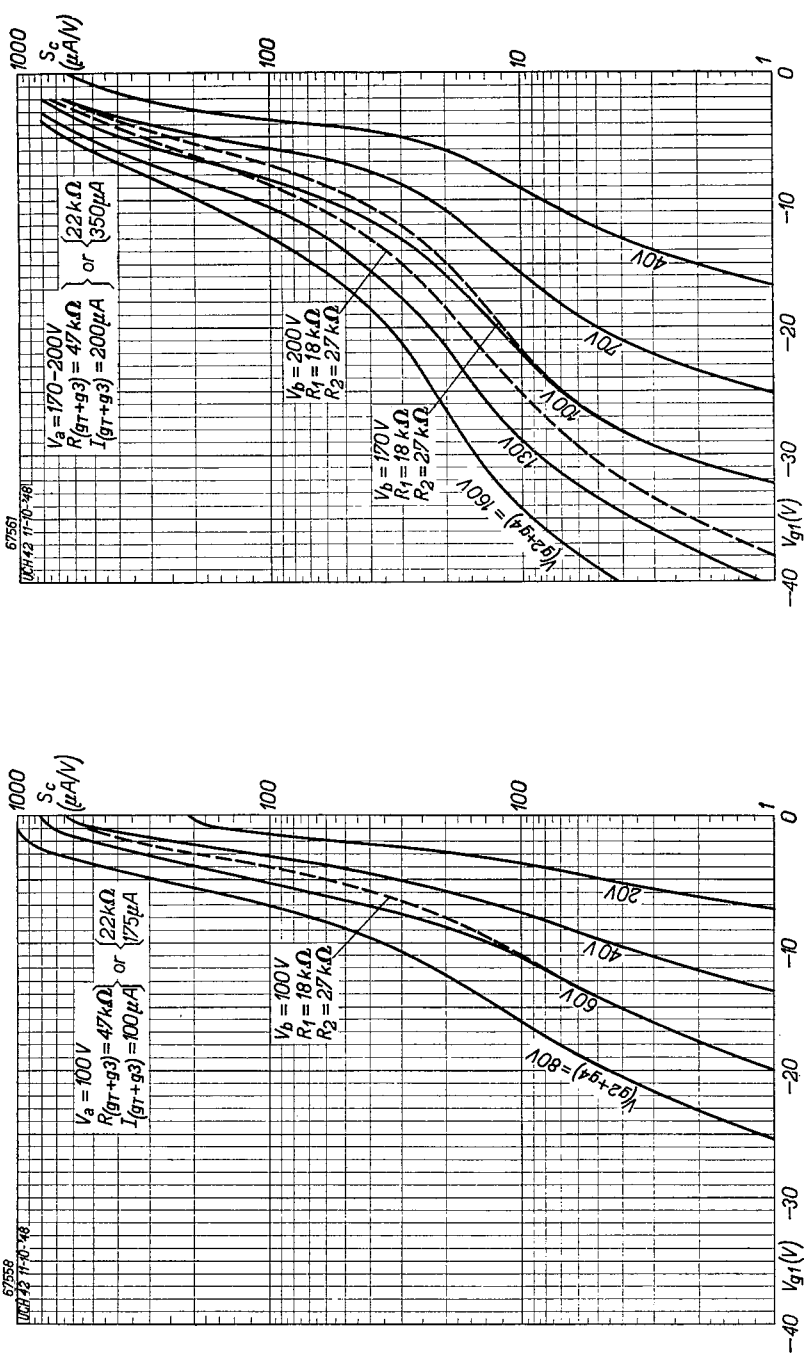


Fig. 8
Conversion conductance (S_c) of UCH 42 in oscillating condition, as a function of the grid bias (V_{g1}) with screen grid voltage (V_{g2+g4}) as parameter. The dotted lines indicate the conversion conductance when the screen grid voltage is derived from a potentiometer (R_1, R_2 in Fig. 3). Fig.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

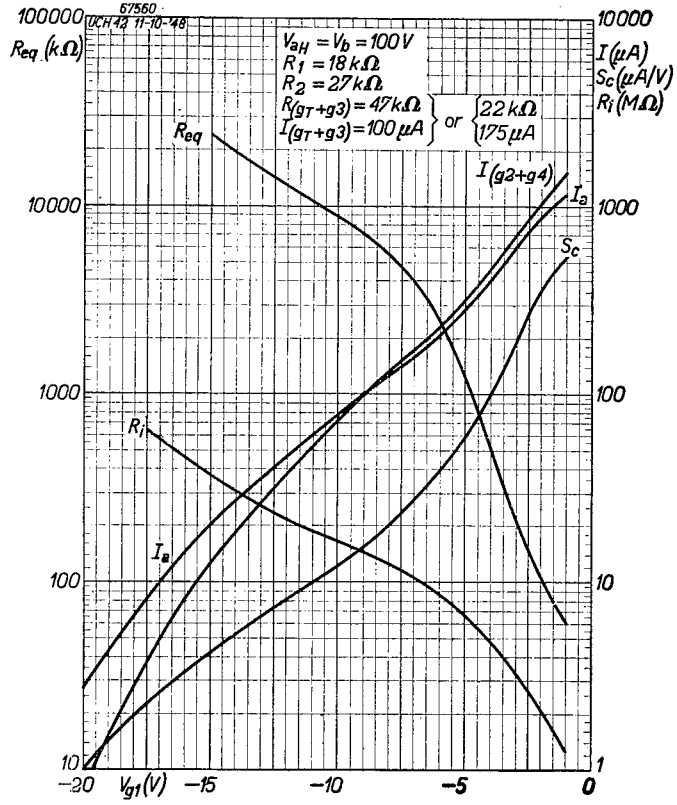


Fig. 10

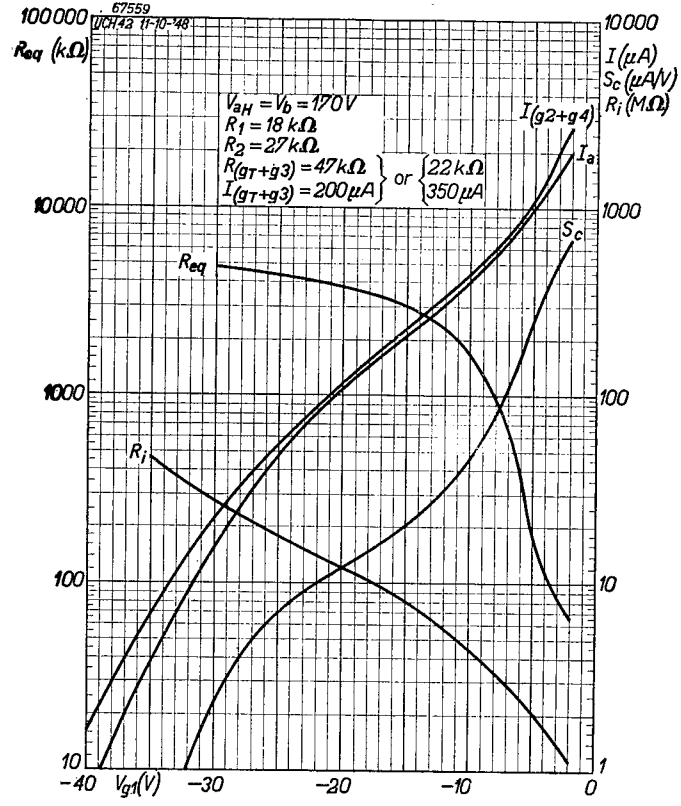


Fig. 11

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 42 in oscillating condition, as functions of the grid bias (V_{g1}). Measured in the circuit shown in Fig. 3. Fig. 10 : supply voltage $V_b = 100$ V Fig. 11 : $V_b = 170$ V.

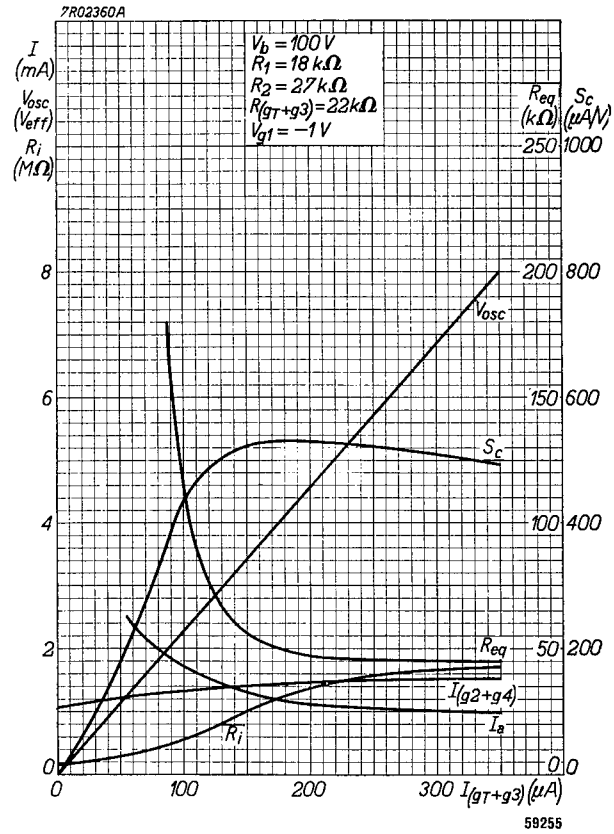


Fig. 12

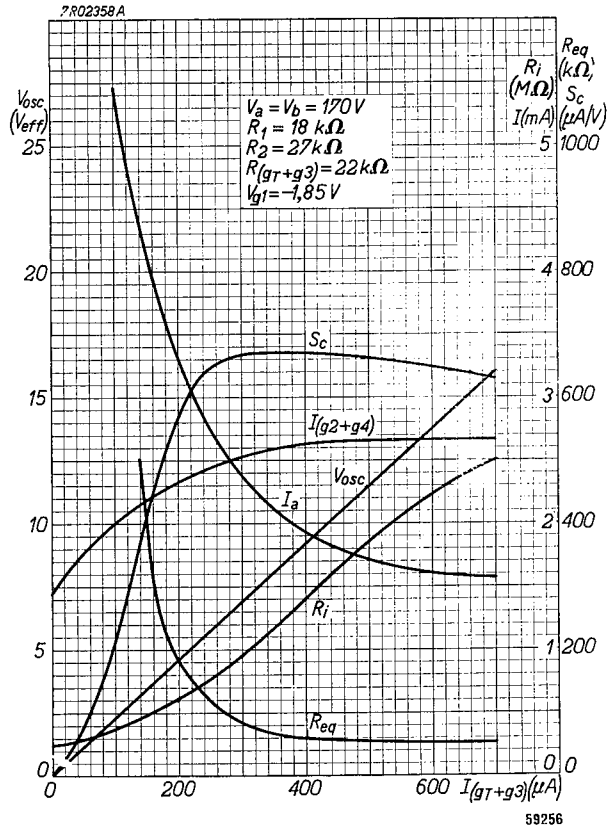


Fig. 13

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_{gT+g3}) for a grid leak R_{gT+g3} of 22 kΩ. Measured in the circuit shown in Fig. 3. Fig. 12 : supply voltage $V_b = 100$ V ; Fig. 13 : $V_b = 170$ V.

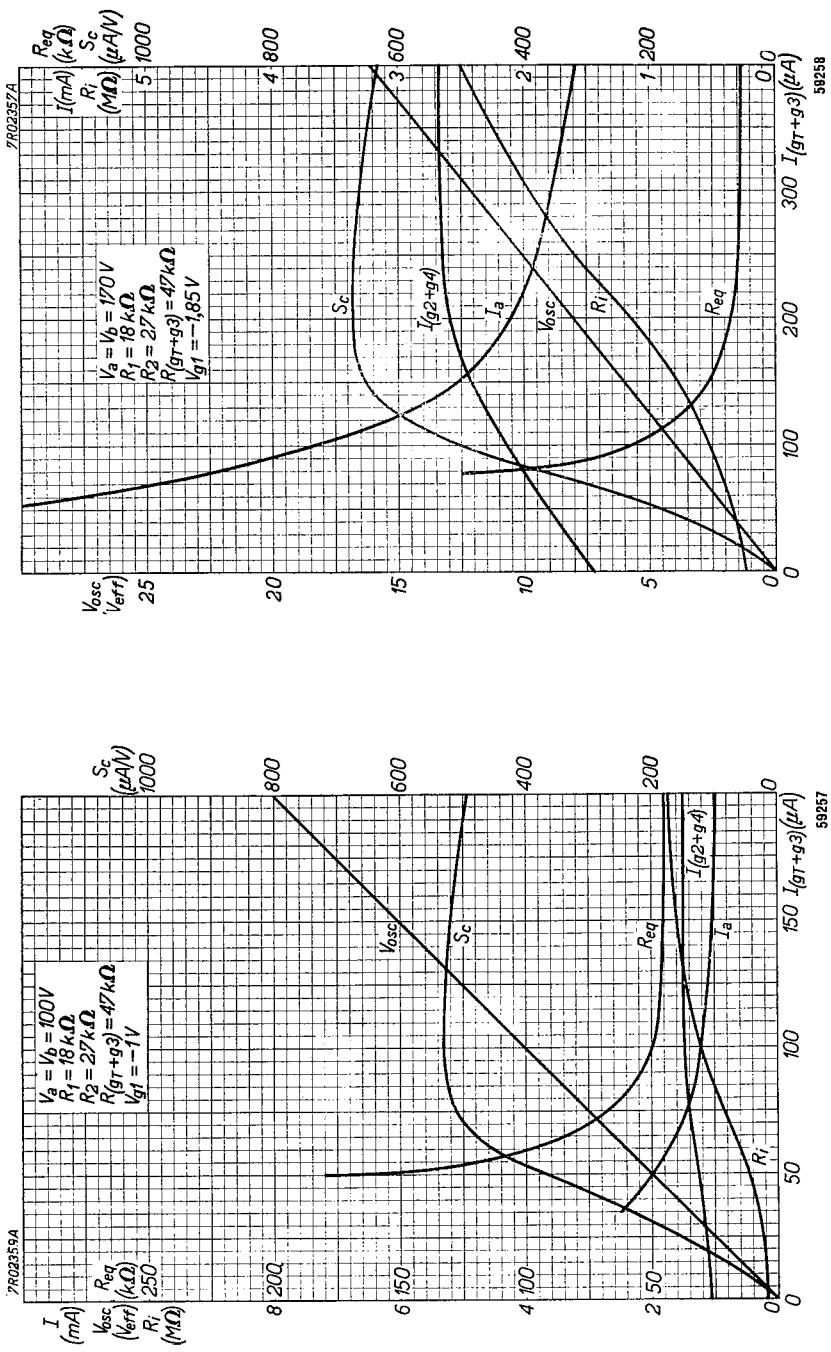


Fig. 14
As Figs. 12 and 13, but for grid leak R_{g1+g3} of 47 kΩ.

Fig. 15

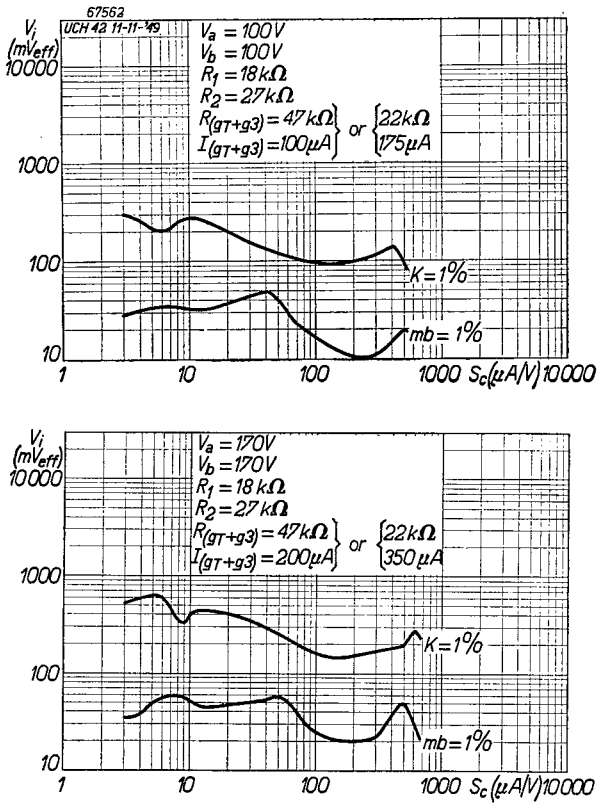


Fig. 16

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.

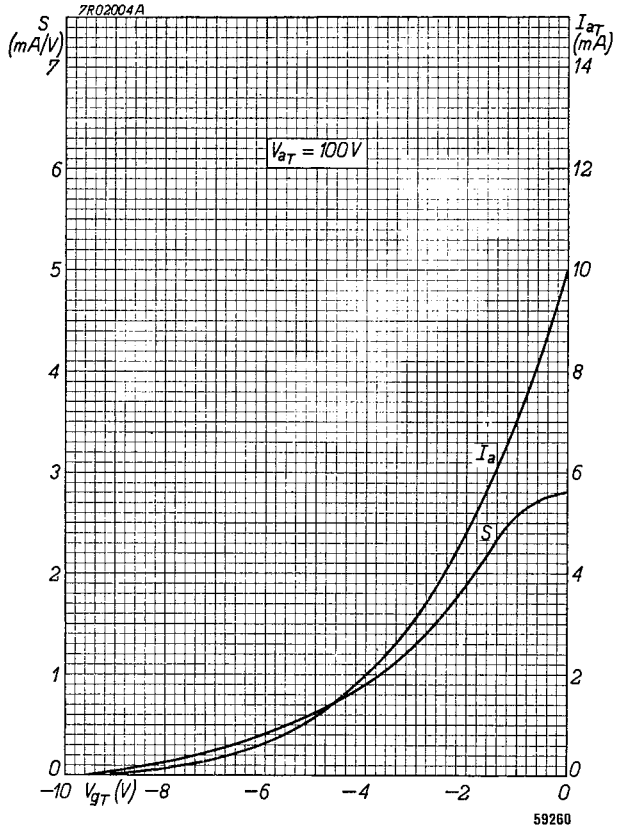
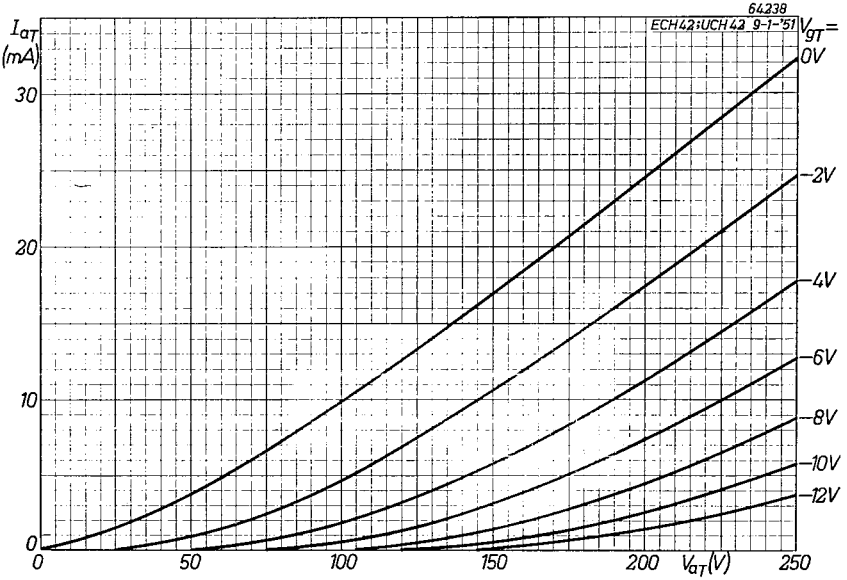


Fig. 17
I_a/V_g and S/V_g characteristics of the triode section of the UCH 42.

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



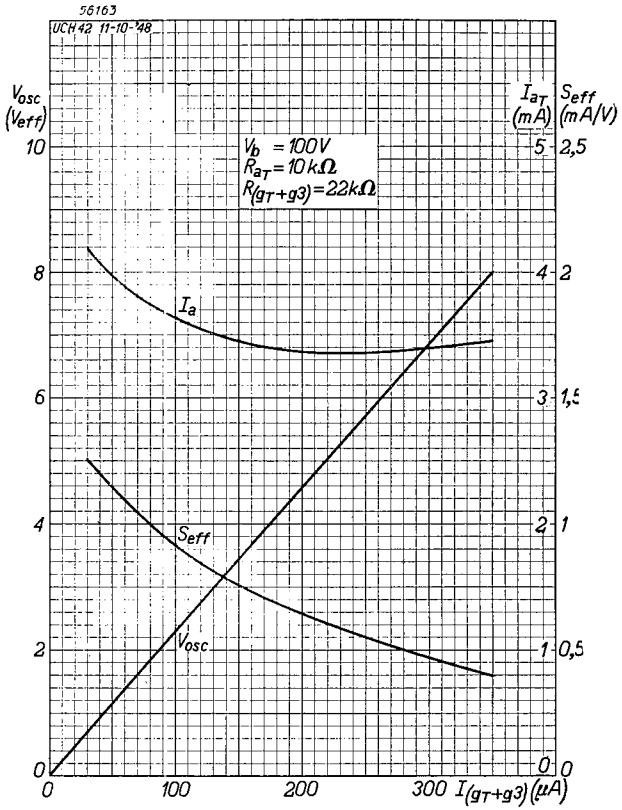


Fig. 19

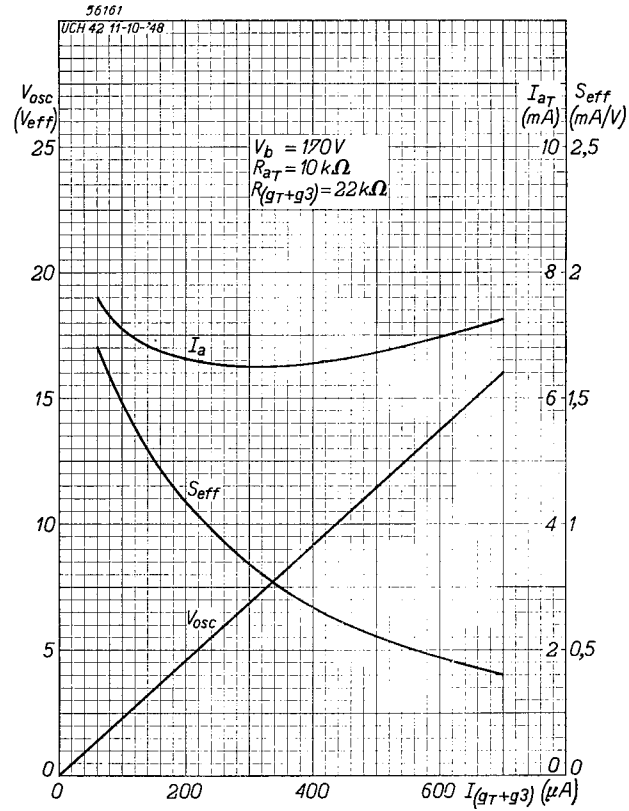


Fig. 20

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.

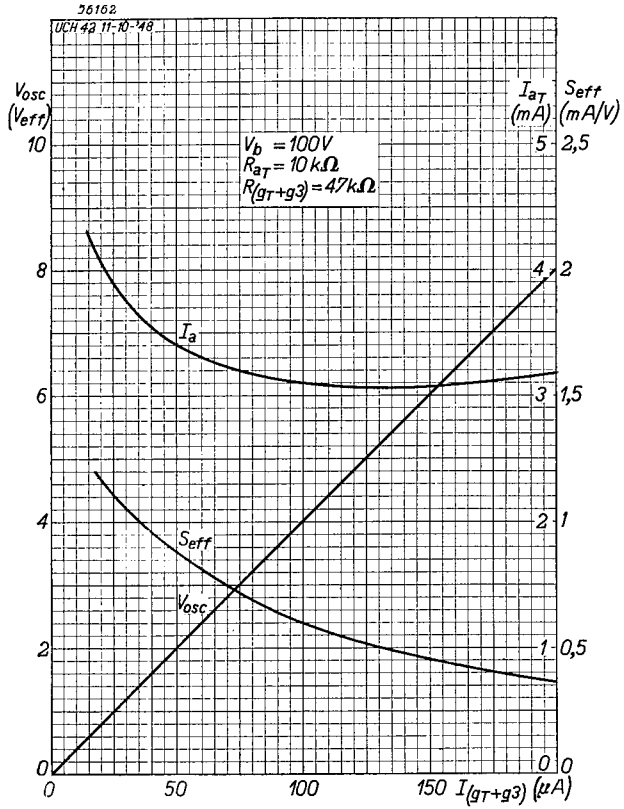


Fig. 21

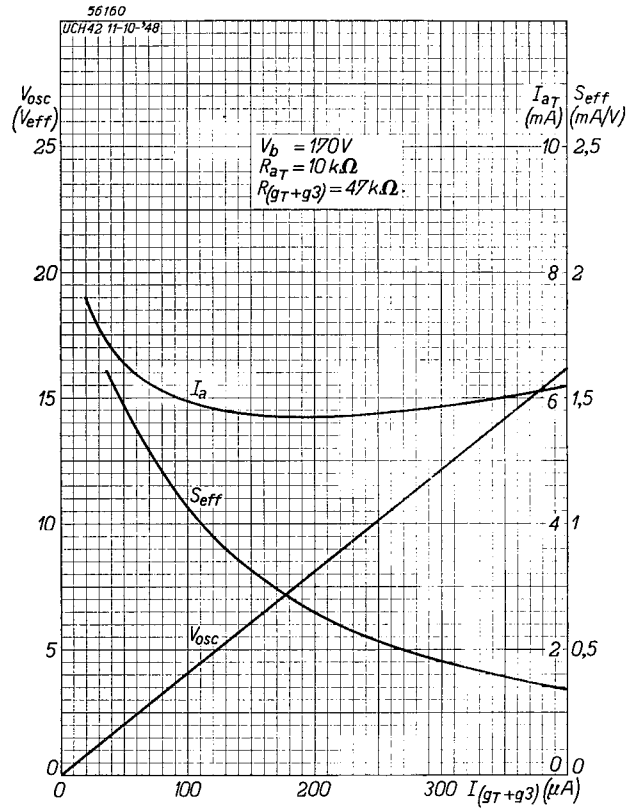


Fig. 22

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

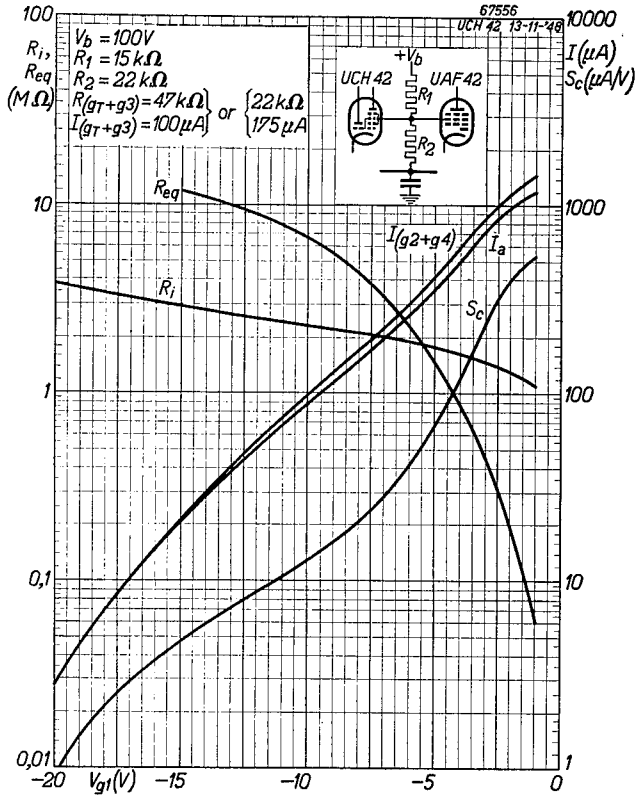


Fig. 23

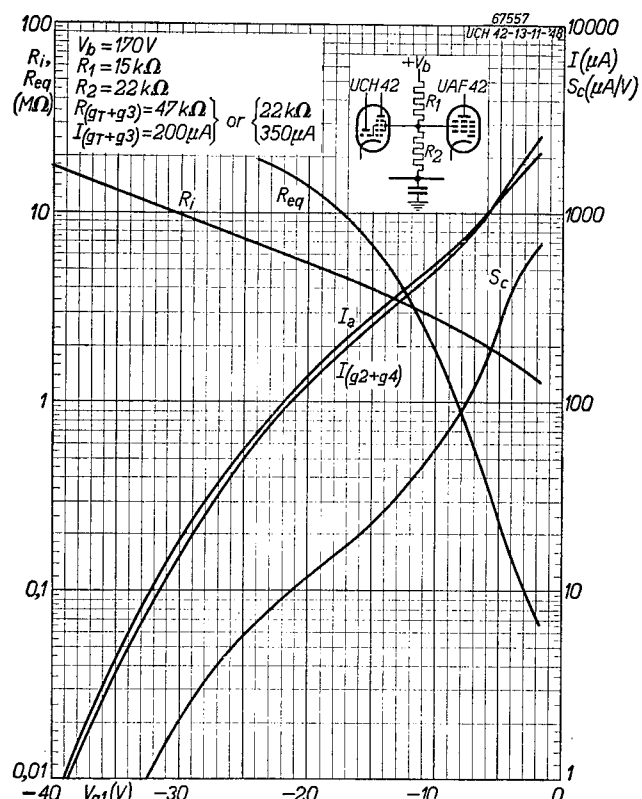


Fig. 24

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 = 100 V ; Fig. 24 : V_b = 170 V.

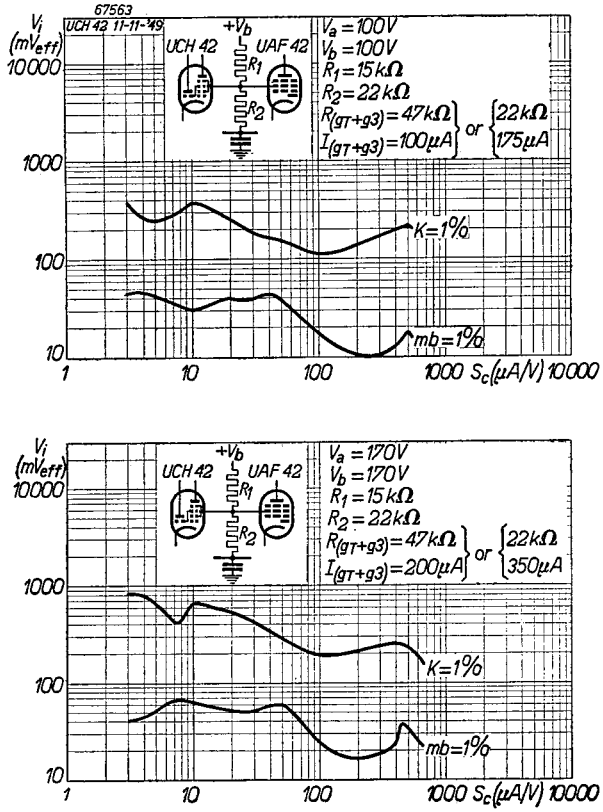


Fig. 25
As Fig. 16, but with the screen grids of the UAF 42 and UCH 42 fed by means of a common potentiometer.