

# UCH 42 Triode-hexode frequency changer

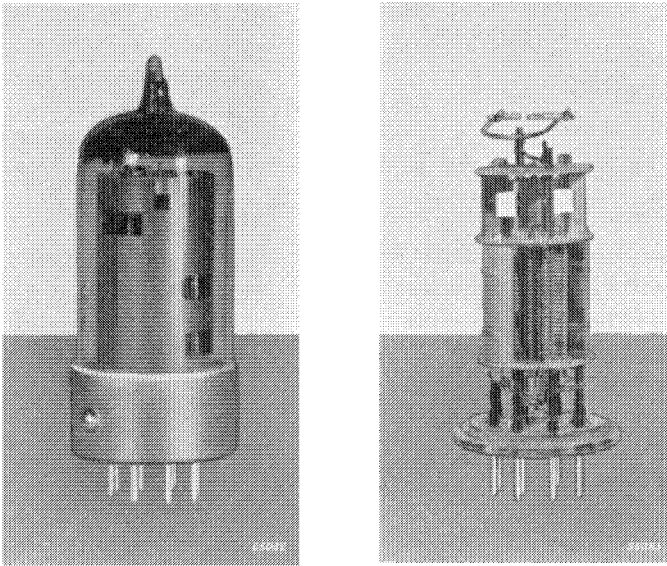


Fig. 1  
The UCH 42, showing the electrode system (approximately actual size).

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

|                          |       |   |        |
|--------------------------|-------|---|--------|
| 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 . . . . .  | $C_{ag1}$ | < | 0.1 pF  |
| Heater - control grid . . . . . | $C_{g1f}$ | < | 0.15 pF |

# UCH 42

## 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  |

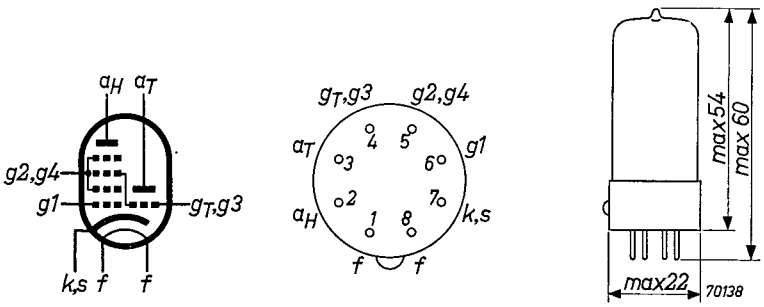


Fig. 2

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.)

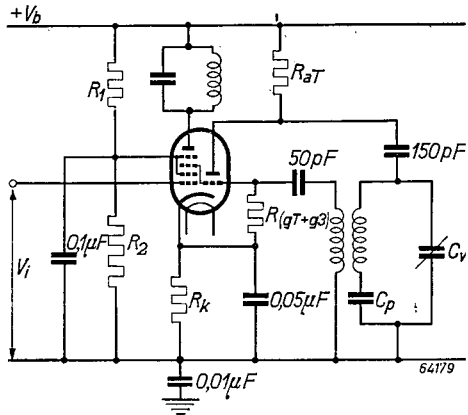


Fig. 3

|  |               |                   |                   |              |
|--|---------------|-------------------|-------------------|--------------|
| 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                                    | $R_b =$       | 180               | 180               | Ω            |
| Oscillator grid leak                             | $R_{gT+g3} =$ | 22                | 22                | kΩ           |
| Oscillator grid current                          | $I_{gT+g3} =$ | 175 <sup>1)</sup> | 350 <sup>1)</sup> | 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                                    | $R_b =$       |  | 180               | Ω        |
| Oscillator grid leak                             | $R_{gT+g3} =$ |  | 22                | kΩ       |
| Oscillator grid current                          | $I_{gT+g3} =$ |  | 350 <sup>1)</sup> | 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 | $\mu$       | = | 22       |

<sup>1)</sup> 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.

## UCH 42

### 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 $\Omega$ |            |      |      |
| Oscillator voltage . . .   | $V_{osc}$   | = | 4   | 8   | 8    | $V_{RMS}$  |            |      |      |
| Oscillator grid leak . . . | $R_{gT+g3}$ | = | 22  | 47  | 22   | 47         | k $\Omega$ |      |      |
| Oscillator grid current    | $I_{gT+g3}$ | = | 175 | 100 | 350  | 200        | $\mu$ A    |      |      |
| 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

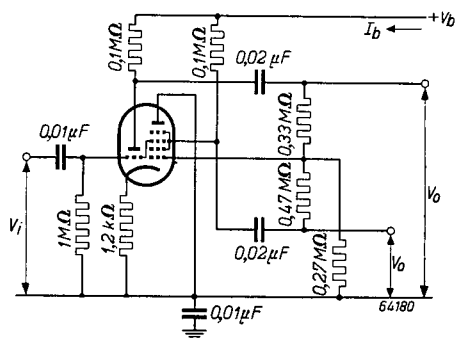


Fig. 4

| Supply voltage<br>$V_b$ (V) | Total current<br>$I_b$ (mA) | Amplification<br>$V_o/V_i$ | 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.)

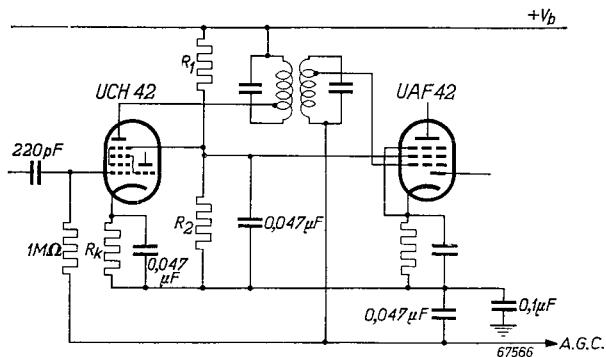


Fig. 5

|   |               |                        |                   |     |         |
|---|---------------|------------------------|-------------------|-----|---------|
| Anode and supply voltage . . . . .                            | $V_a = V_b =$ | 100                    | 170               | V   |         |
| Resistor between supply voltage<br>and screen grids . . . . . | $R_1 =$       | 15                     | 15                | kΩ  |         |
| Resistor between screen grids and<br>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 <sup>1)</sup>      | 350 <sup>1)</sup> | 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<br>condition . . . . .         | $V_{(g2+g4)_c}$                    | = max. | 550 V              |
| Screen grid voltage, valve con-<br>trolled . . . . .        | $V_{g2+g4}(I_a < 1\text{mA})$      | = max. | 250 V              |
| Screen grid voltage, valve un-<br>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<br>grid 1 and cathode . . . . . | $R_{g1}$                           | = max. | 3 MΩ <sup>2)</sup> |
| External resistance between<br>grid 3 and cathode . . . . . | $R_{g3}$                           | = max. | 3 MΩ               |
| External resistance between<br>heater and cathode . . . . . | $R_{fk}$                           | = max. | 20 kΩ              |
| Voltage between heater and<br>cathode . . . . .             | $V_{jk}$                           | = max. | 150 V              |

<sup>1)</sup> See note on page 213.

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

## UCH 42

### Limiting values of the triode section

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

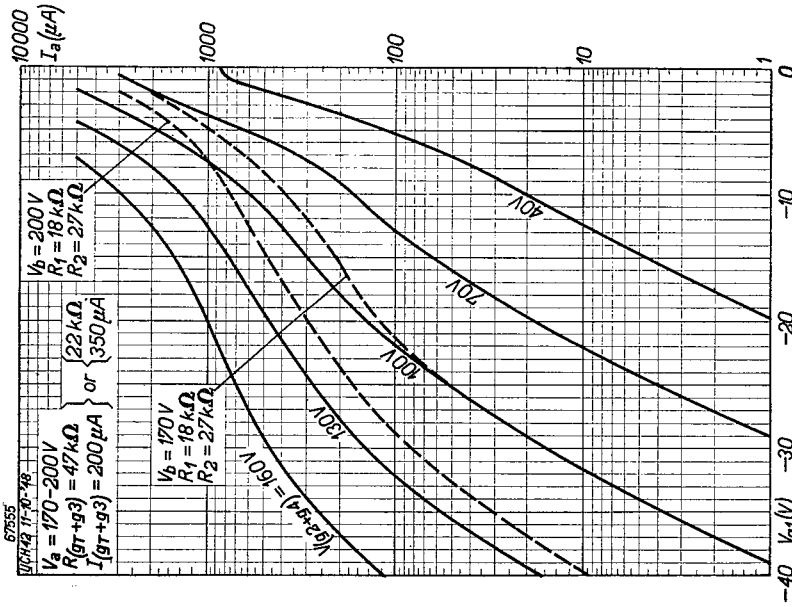


Fig. 7

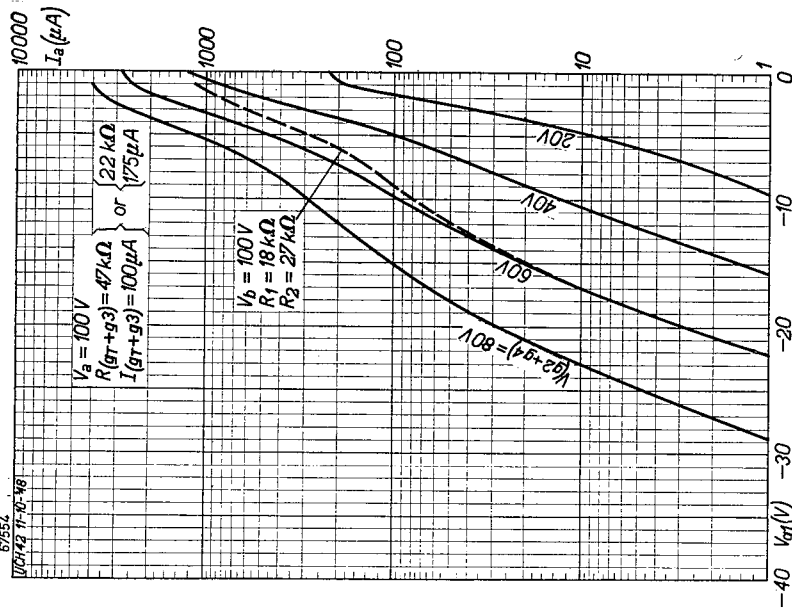


Fig. 6

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 at 0V. Fig. 6: supply voltage  $V_b = 100\text{ V}$ ; Fig. 7:  $V_b = 170 - 200\text{ V}$ .

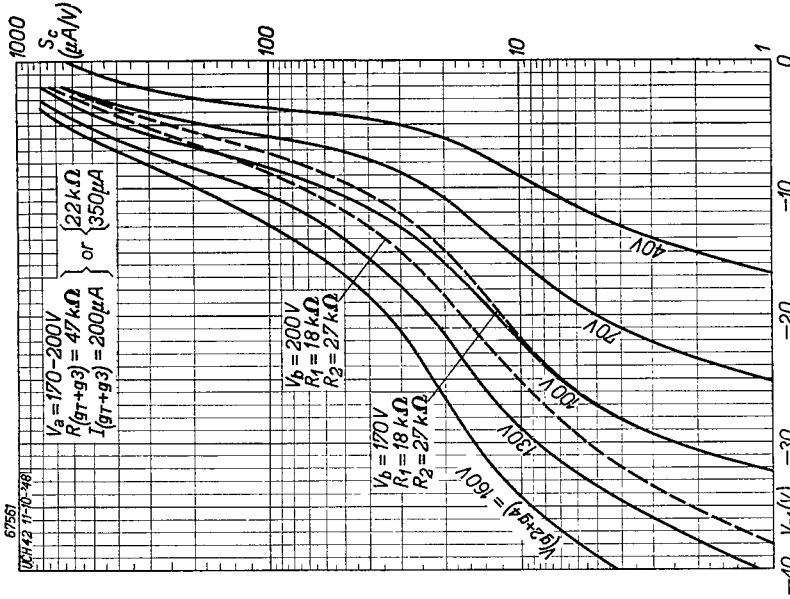


Fig. 9

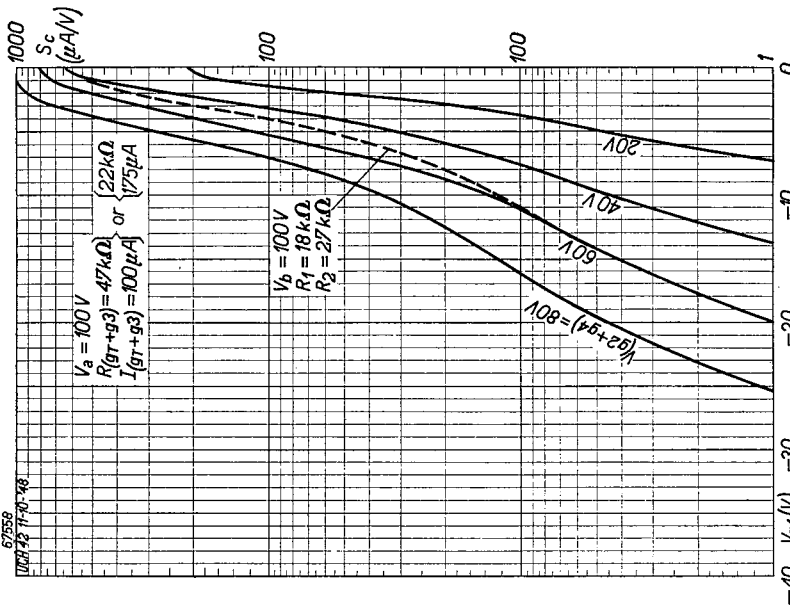


Fig. 8

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.



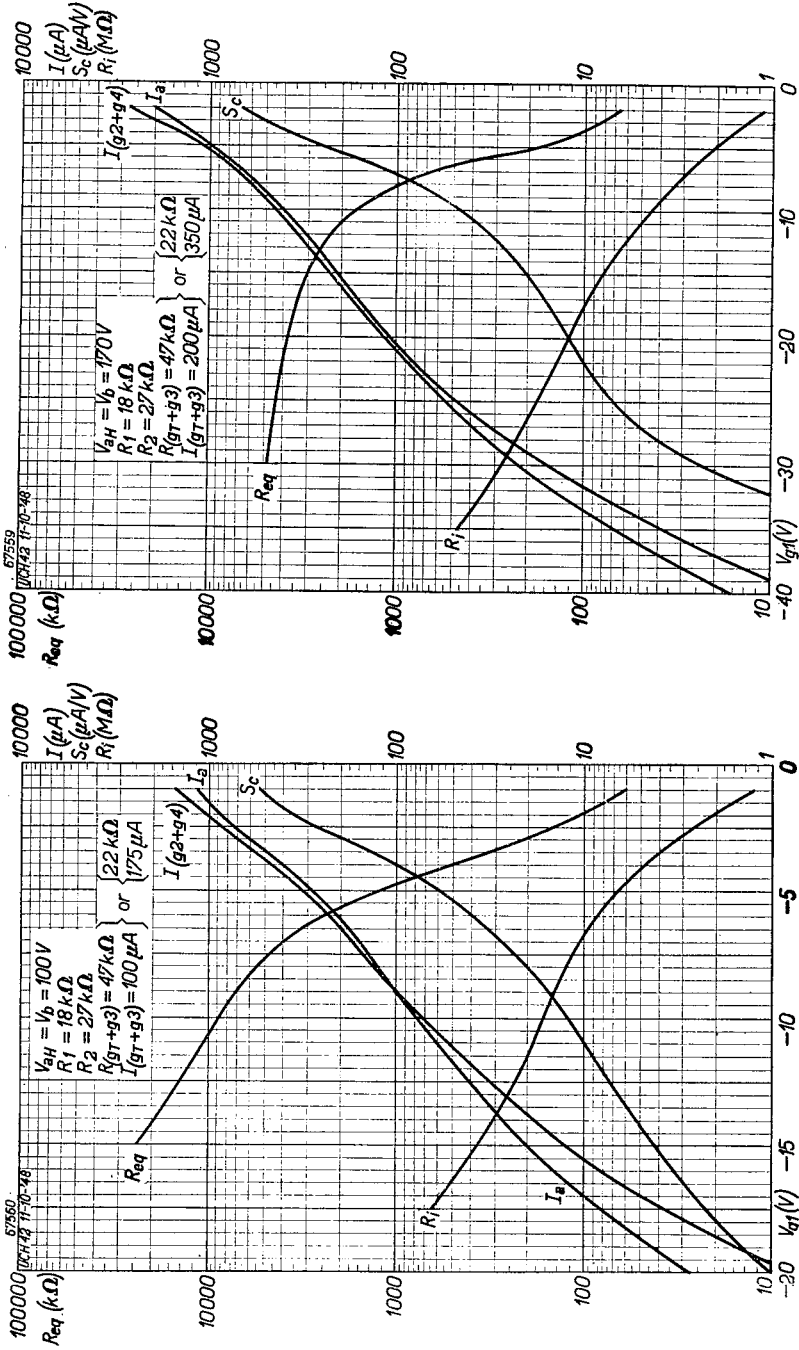


Fig. 10 Anode current ( $I_a$ ), screen grid current ( $I_{g2+g4}$ ), conversion conductance ( $S_c$ ), internal resistance ( $R_i$ ) and equivalent noise resistance ( $R_{eq}$ ) of the UCH 42 in oscillating condition, as functions of the grid bias ( $V_{g1}$ ). Measured in the circuit shown in Fig. 3. Fig. 10 : supply voltage  $V_b = 100V$ . Fig. 11 :  $V_b = 170V$ .

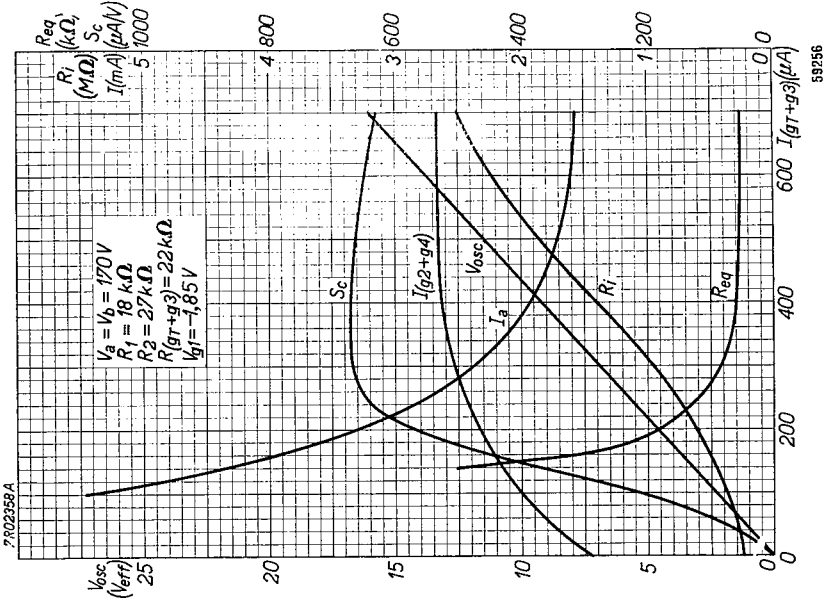


Fig. 13

Fig. 13: 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 ( $I_{g1+g3}$ ) for a grid leak  $R_{g1+g3}$  of 22 kΩ. Measured in the circuit shown in Fig. 3. Fig. 12: supply voltage  $V_b = 100\text{ V}$ ; Fig. 13:  $V_b = 170\text{ V}$ .

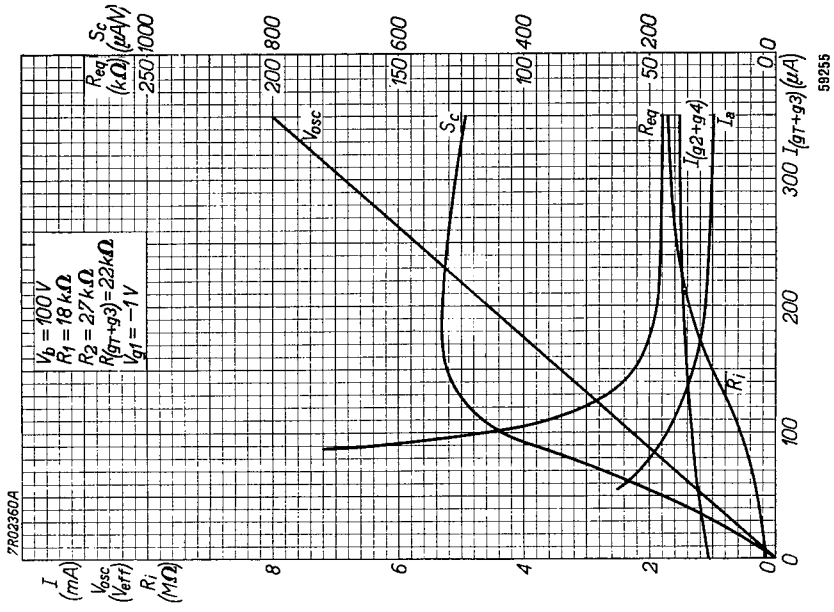


Fig. 12

Fig. 12: conversion conductance ( $S_c$ ), oscillator voltage ( $V_{osc}$ ), anode current ( $I_a$ ) and equivalent noise resistance ( $R_{eq}$ ) of the UCH 42 as functions of the oscillator grid current ( $I_{g1+g3}$ ) for a grid leak  $R_{g1+g3}$  of 22 kΩ. Measured in the circuit shown in Fig. 3. Fig. 12: supply voltage  $V_b = 100\text{ V}$ ; Fig. 13:  $V_b = 170\text{ V}$ .

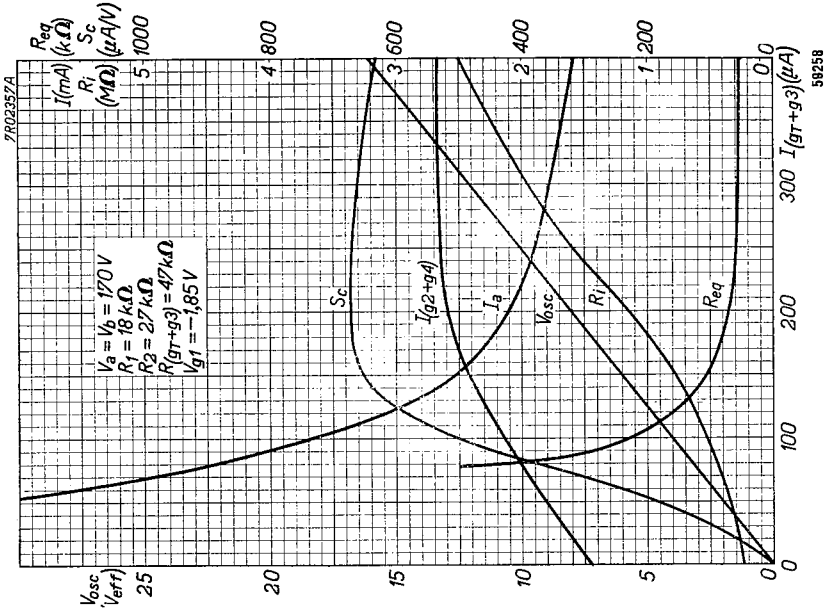


Fig. 15

As Figs. 12 and 13, but for grid leak  $R_{g1+g3}$  of 47 k $\Omega$ .

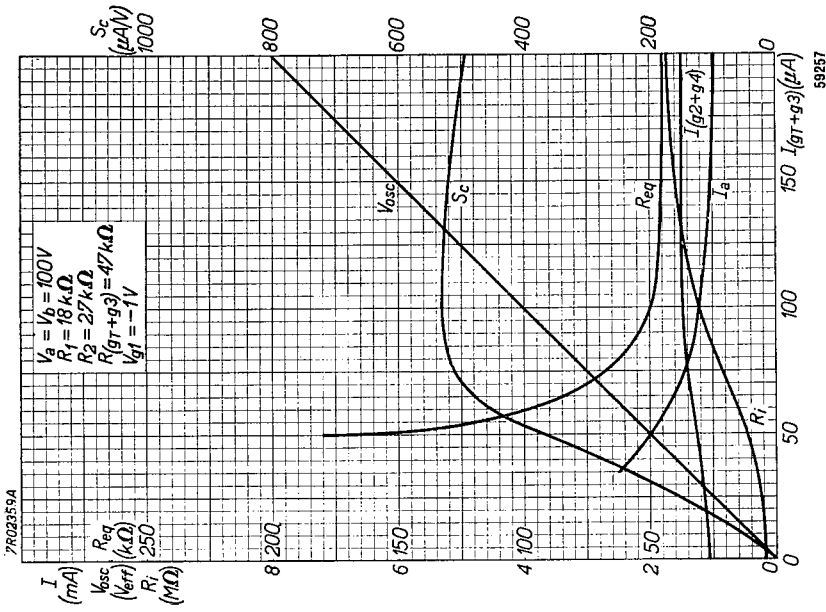


Fig. 14

As Figs. 12 and 13, but for grid leak  $R_{g1+g3}$  of 47 k $\Omega$ .

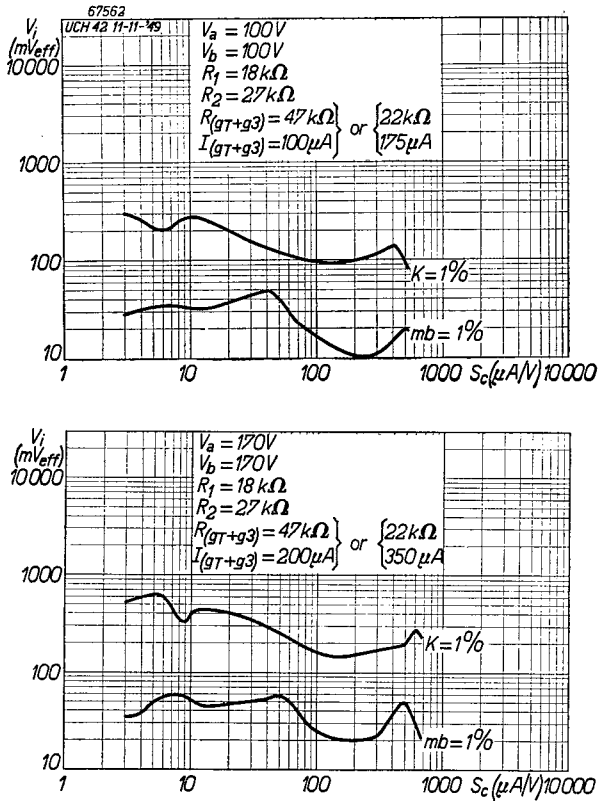


Fig. 16

- 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  $V_b=100V$ ; lower figure:  $V_b=170V$ .

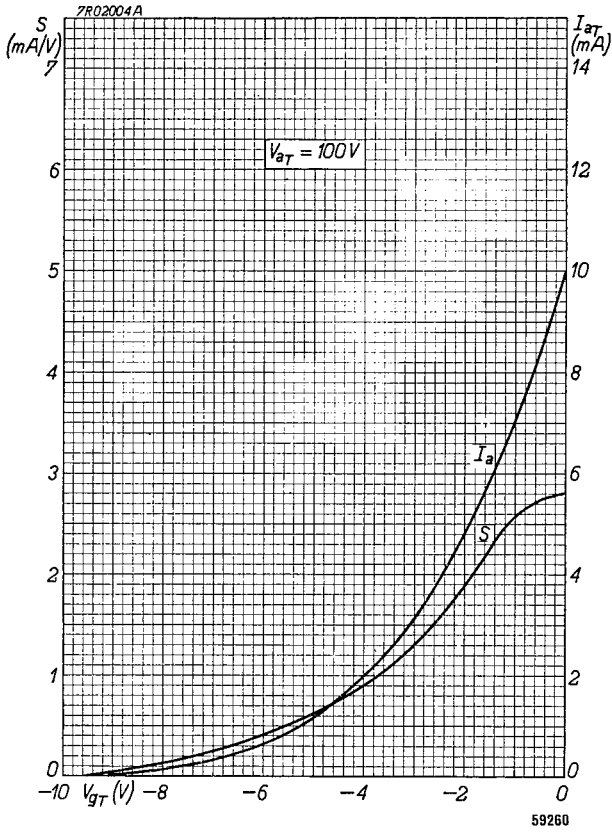
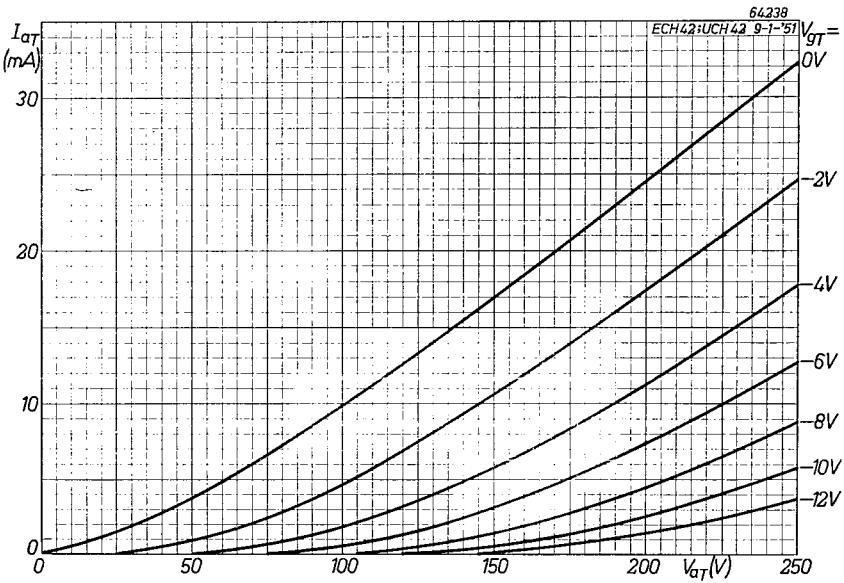


Fig. 17  
 $I_a/V_g$  and  $S/V_g$  characteristics of the triode section of the UCH 42.

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



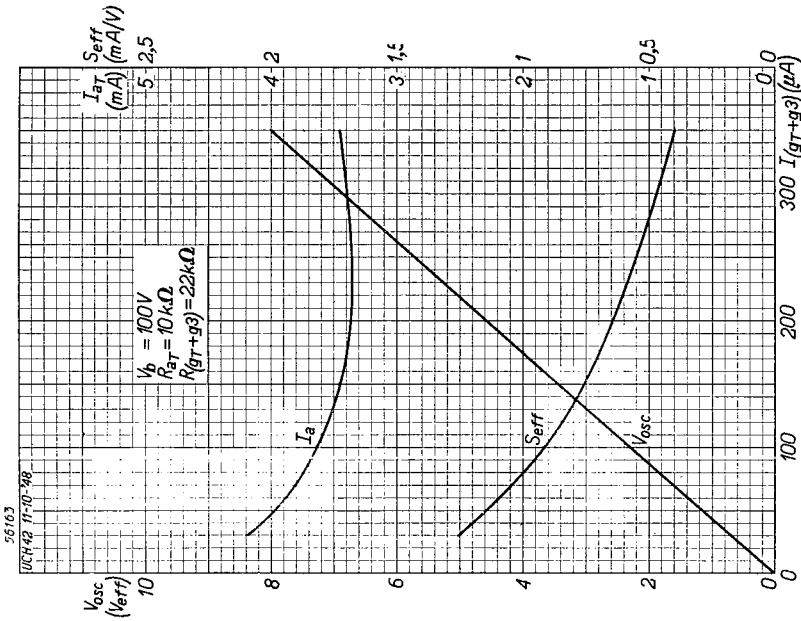


Fig. 19

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 ( $I_{gr+g3}$ ), with grid leak ( $R_{gr+g3}$ ) of 22 kΩ. Fig. 19: supply voltage  $V_b=100$  V; Fig. 20:  $V_b=170$  V.

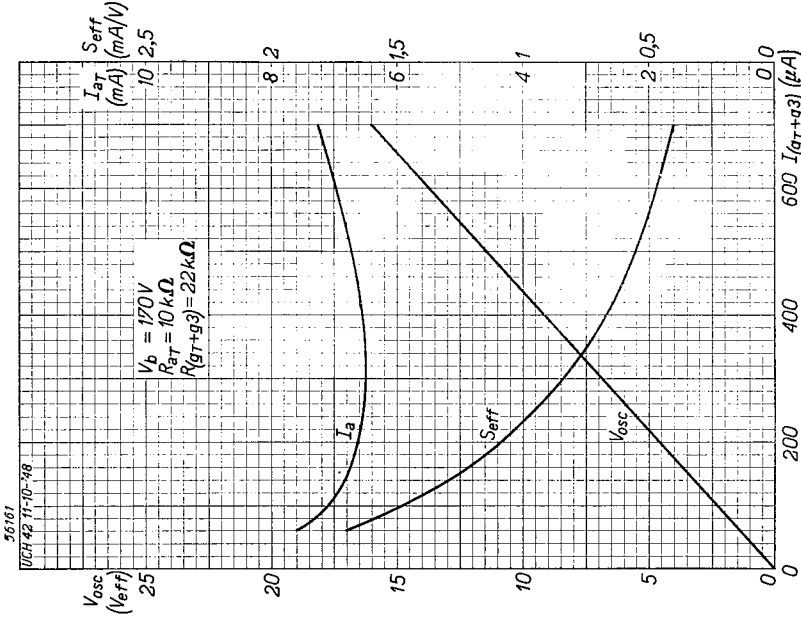


Fig. 20

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 ( $I_{gr+g3}$ ), with grid leak ( $R_{gr+g3}$ ) of 22 kΩ. Fig. 19: supply voltage  $V_b=100$  V; Fig. 20:  $V_b=170$  V.

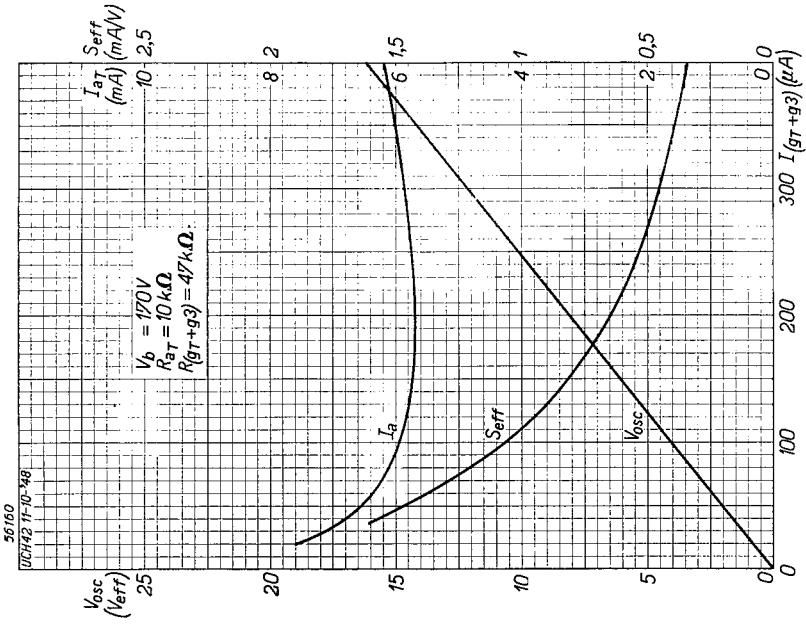


Fig. 22

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

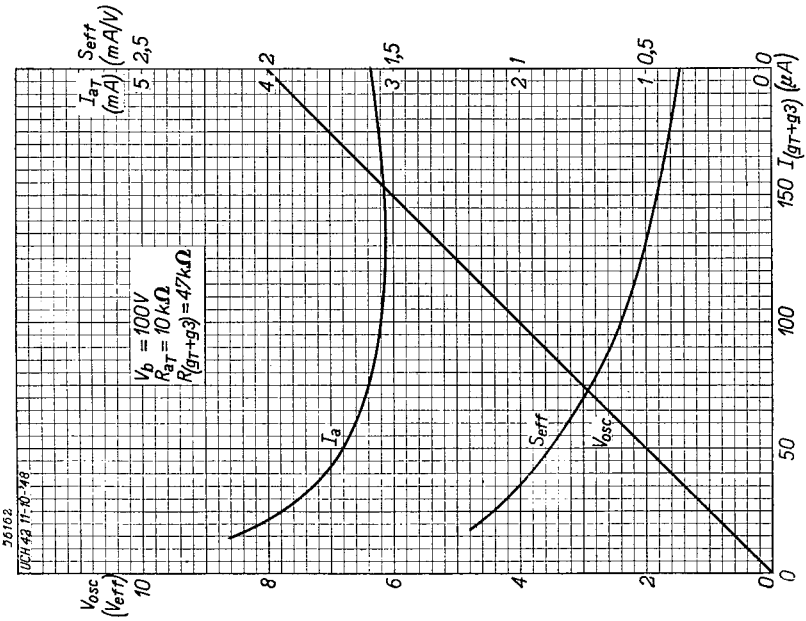


Fig. 21

As

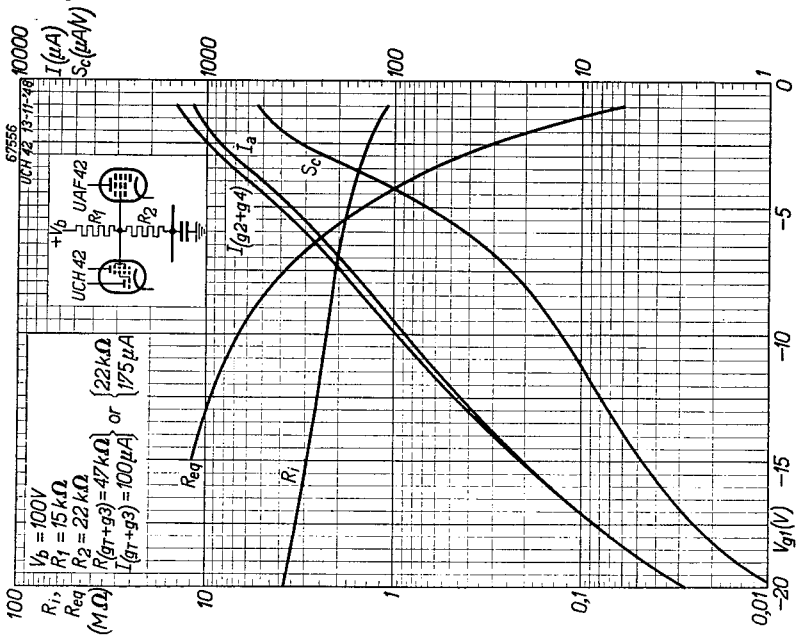
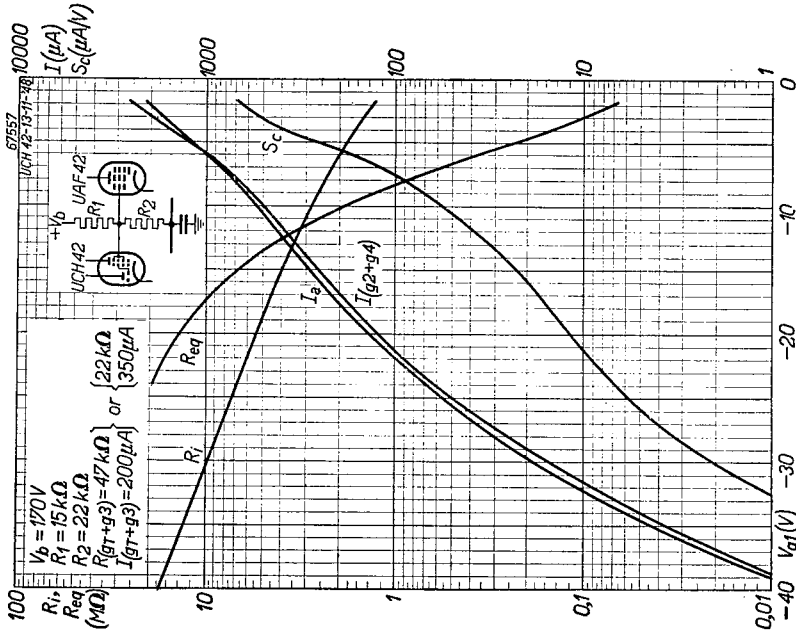


Fig. 23

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

Fig. 24





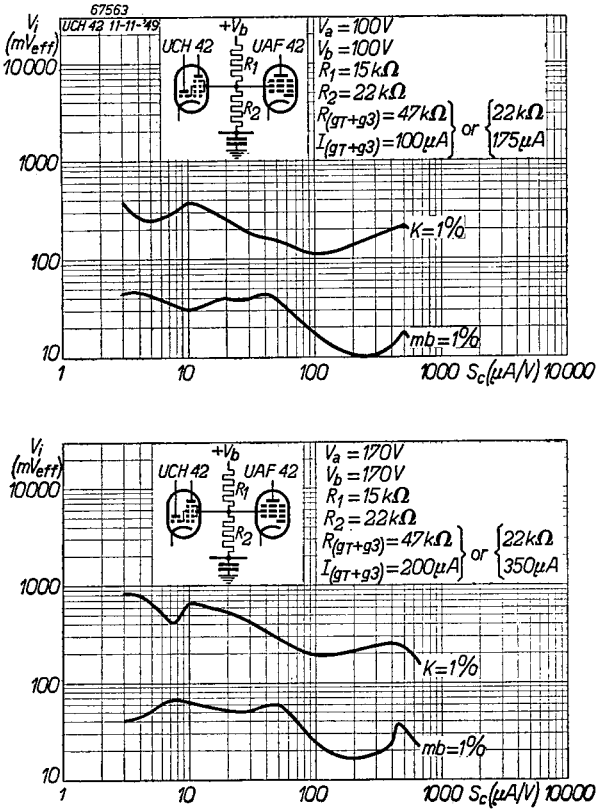


Fig. 25

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