KH 1 Hexode

This battery hexode can be utilized for three different purposes, viz:
1) As a frequency-changer with a separate oscillator valve, such as the KC 4 which was specially designed for the purpose. The R.F. signal is applied to the first grid and the oscillator signal to the third grid. The screens, grids two and four, are given a positive potential of 60 V. The pitch of the first grid is such that A.G.C. can be employed, with excellent cross-modulation characteristics; the conversion conductance, for a battery valve, is very high, being 450 μA/V.
2) As an R.F. vari-mu pentode in R.F. and I.F. amplifiers. The second and third grids are again given a potential of 60 V, whilst the fourth grid serves as suppressor and is accordingly earthed, this arrangement giving high mutual conductance (1.4 mA/V) with a low battery current (2.95 mA).
3) As a variable-mu R.F. tetrode in R.F. or I.F. amplifiers. The second and fourth grids are joined and supplied with 60 V and the third grid is earthed. In this case the mutual conductance is slightly higher than when the valve is used as a pentode (1.5 mA/V), and the anode current somewhat lower (2.8 mA); the control, however, is less rapid and the internal resistance is lower.

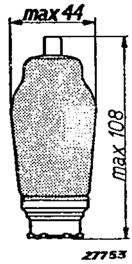

Fig. 1
Dimensions in mm.

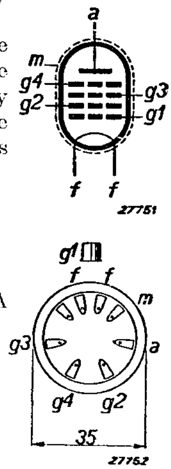

Fig. 2
Arrangement of electrodes and base connections.

FILAMENT RATINGS

Heating: direct by battery; parallel supply.
Filament voltage . . . . $V_f = 2.0$ V
Filament current . . . . $I_f = 0.135$ A

CAPACITANCES

$C_{g1} = 7.8\ \mu\mu$F $\qquad C_{g1g3} = 0.17\ \mu\mu$F
$C_{g3} = 12.5\ \mu\mu$F $\qquad C_{ag1} = < 0.002\ \mu\mu$F
$C_a = 16.3\ \mu\mu$F

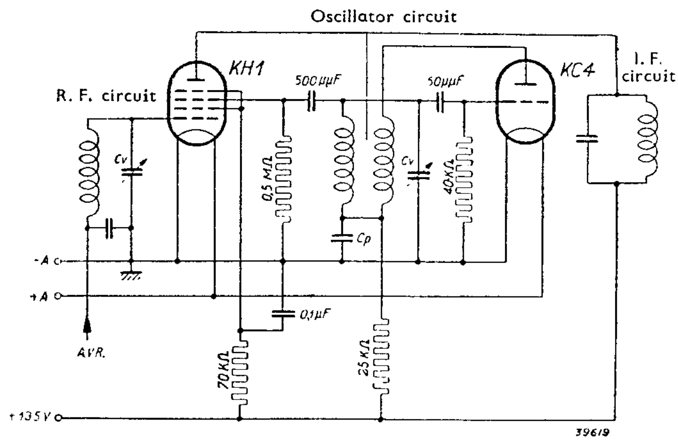

Fig. 3
Circuit diagram showing the KH 1 used as a frequency-changer.

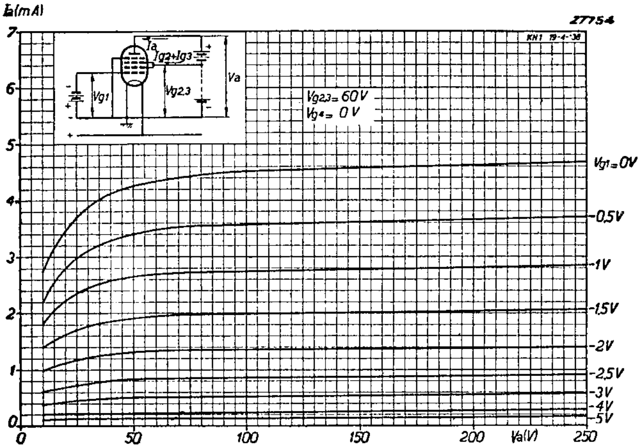

Fig. 4
Ia/Va characteristics of the KH 1 used as a pentode.

OPERATING DATA: KH 1 employed as a frequency-changer

Anode voltage	V_a	= 135 V		
Voltage on grid 2	V_{g2}	= 60 V		
Voltage on grid 4	V_{g4}	= 60 V		
Grid leak, grid 3	R_{g3}	= 0.5 M ohm		
Oscillator voltage, grid 3	V_{osc}	= 10 V_{eff}		
Grid bias	V_{g1}	= —1.5 V [1]	—8 V [2]	—9.5 V [3]
Anode current	I_a	= 1 mA	—	—
Screen-grid current	$I_{g2} + I_{g4}$	= 1.1 mA	—	—
Conversion conductance	S_c	= 450 μA/V	4.5 μA/V	1 μA/V
Internal resistance	R_i	= 1 M ohm	> 10 M ohms	> 10 M ohms

[1]) Without control. [2]) Conductance controlled to 1 : 100. [3]) Limit of control.

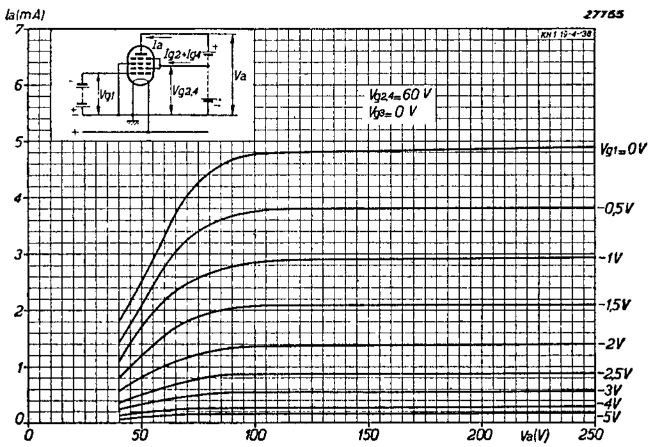

Fig. 5
Ia/Va characteristics of the KH 1 used as tetrode.

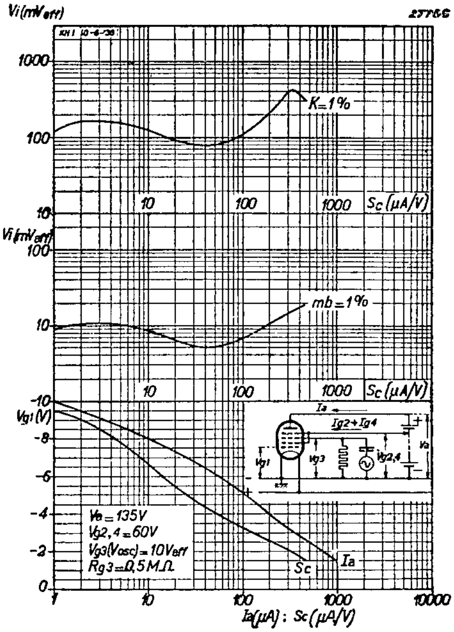

Fig.6
KH 1 as a frequency-changer.
Upper diagram. Effective value of the alternating grid voltage as a function of the conversion conductance, with 1 % cross-modulation.
Centre diagram. Effective value of the alternating grid voltage as a function of the conversion conductance, with 1 % modulation hum.
Lower diagram. Conversion conductance *Sc* and anode current *Ia* as funcitons of the grid bias.

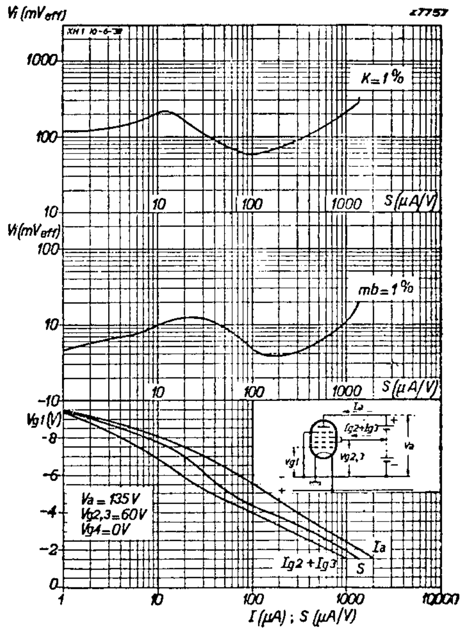

Fig. 7
KH 1 as a pentode.
Upper diagram. Effective value of the alternating grid voltage as a function of the mutual conductance, with 1 % cross-modulation.
Centre diagram. Effective value of the alternating grid voltage as a function of the mutual conductance, with 1 % modulation hum.
Lower diagram. Mutual conductance *S*, screen-grid current $Ig_2 + Ig_3$, and anode current as functions of the grid bias.

OPERATING DATA: KH 1 connected as a pentode (R.F. or I.F. amplifier)

Anode voltage	V_a	= 135 V		
Voltage on grid 2	V_{g2}	= 60 V		
Voltage on grid 3	V_{g3}	= 60 V		
Voltage on grid 4	V_{g4}	= 0 V		
Grid bias	V_{g1}	= —1.5 V [1]	—7.5 V [2]	—9.3 V [3]
Anode current	I_a	= 2 mA	—	—
Screen-grid current	$I_{g2} + I_{g3}$	= 0.95 mA	—	—
Mutual conductance	S	= 1,400 μA/V	14 μA/V	1 μA/V
Internal resistance	R_i	= 1.3 M ohms	> 10 M ohms	> 10 M ohms

OPERATING DATA: KH 1 connected as a tetrode (R.F. of I.F. amplifier)

Anode voltage	V_a	= 135 V		
Voltage on grid 2	V_{g2}	= 60 V		
Voltage on grid 3	V_{g3}	= 0 V		
Voltage on grid 4	V_{g4}	= 60 V		
Grid bias	V_{g1}	= —1.5 V [1]	—8.5 V [2]	—11 V [3]
Anode current	I_a	= 2.1 mA	—	—
Screen-grid current	$I_{g2} + I_{g4}$	= 0.7 mA	—	—
Mutual conductance	S	= 1,500 μA/V	15 μA/V	1 μA/V
Internal resistance	R_i	= 0.7 M ohm	> 10 M ohms	> 10 M ohms

[1]) Without control. [2]) Conductance controlled to 1 : 100. [3]) Limit of control.

MAXIMUM RATINGS

Anode voltage	V_a	= max. 150 V
Anode dissipation	W_a	= max. 0.4 W
Voltage, grid 2	V_{g2}	= max. 60 V
Dissipation, grid 2	W_{g2}	= max. 0.1 W
Voltage, grid 3	V_{g3}	= max. 60 V
Dissipation, grid 3	W_{g3}	= max. 0.1 W
Voltage, grid 4	V_{g4}	= max. 60 V
Dissipation, grid 4	W_{g4}	= max. 0.1 W
Grid voltage at grid current start . . (I_{g1} = + 0.3 μA)	V_{g1}	= max. —0.2 V
(I_{g3} = + 0.3 μA)	V_{g3}	= max. —0.2 V
Cathode current	I_k	= max. 10 mA
External resistance between grid 1 and cathode	R_{g1k}	= max. 1 M ohm
External resistance between grid 3 and cathode	R_{g3k}	= max. 1 M ohm

TOLERANCES ON SCREEN-GRID CURRENT

a) valve used as a frequency-changer (V_a = 135 V, V_{g2} = V_{g4} = 60 V, V_{g3} = 10 V_{eff}, V_{g1} = —1.5 V).
   $I_{g2} + I_{g4}$ = max. 1.45 mA
   $I_{g2} + I_{g4}$ = min. 0.75 mA

b) valve used as a pentode (V_a = 135 V, V_{g2} = V_{g3} = 60 V, V_{g4} = 0, V_{g1} = —1.5 V).
   $I_{g2} + I_{g3}$ = max. 1.3 mA
   $I_{g2} + I_{g3}$ = min. 0.7 mA

c) valve used as a tetrode (V_a = 135 V, V_{g2} = V_{g4} = 60 V, V_{g3} = 0 V, V_{g1} = —1.5 V)
   $I_{g2} + I_{g4}$ = max. 0.9 mA
   $I_{g2} + I_{g4}$ = min. 0.5 mA

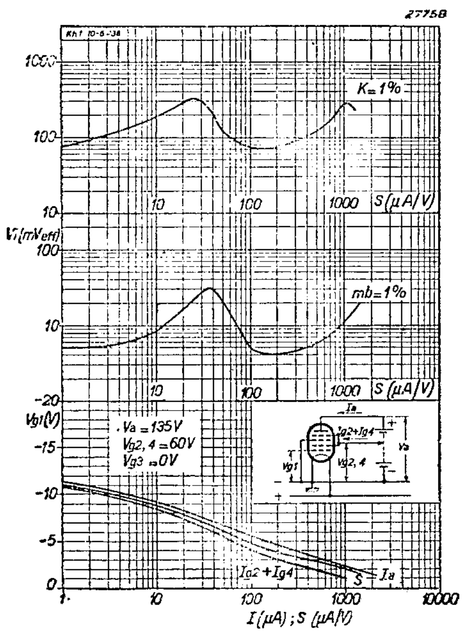

Fig. 8
KH 1 used as a tetrode:
Upper diagram. Effective value of the alternating grid voltage as a function of the mutual conductance, with 1 % cross-modulation.
Centre diagram. Effective value of the alternating grid voltage as a function of the mutual conductance, with 1 % modulalation hum.
Lower diagram. Mutual conductance S, screen-grid current $Ig_2 + Ig_4$, and anode current Ia as functions of the grid bias.