CK 3 Octode

This is an octode of the 4-channel type; with the exception of the heater ratings it is similar to the EK 3, for A.C./D.C. receivers. With a view to its use on 100 V mains, the sixth grid has been modified slightly, but the data as given for the EK 3 also apply to this valve, which offers the same advantages with respect to frequency drift, induction effect, conversion conductance, cross-modulation, oscillator slope, etc.

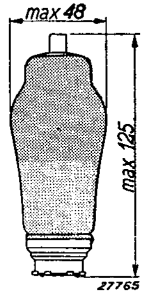

Fig. 1
Dimensions in mm

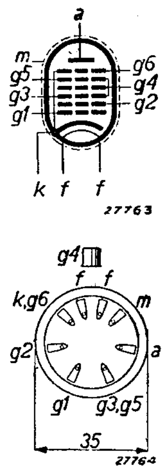

Fig. 2
Arrangement of electrodes and base connections.

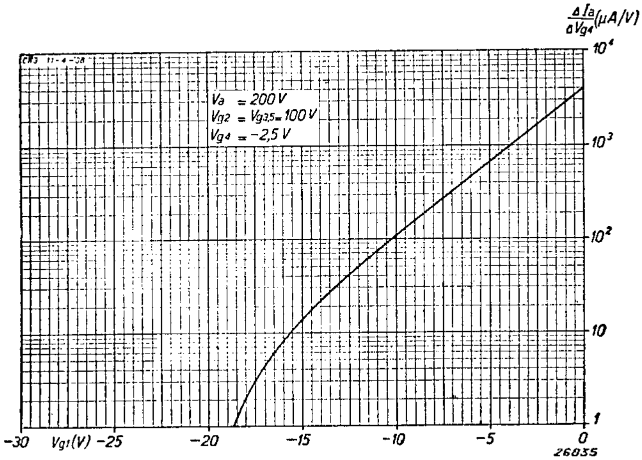

Fig. 3
Conductance of the 4th grid as a function of the direct voltage on grid 1.

HEATER RATINGS

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

Heater voltage . . . . $V_f = 19$ V

Heater current . . . . $I_f = 0.200$ A

CAPACITANCES

$C_{ag4} < 0.1\ \mu\mu F$	$C_{g1g4} = 1.1\ \mu\mu F$
$C_a = 16.5\ \mu\mu F$	$C_{g2} = 8.6\ \mu\mu F$
$C_{g1} = 14\ \mu\mu F$	$C_{g4} = 15.2\ \mu\mu F$

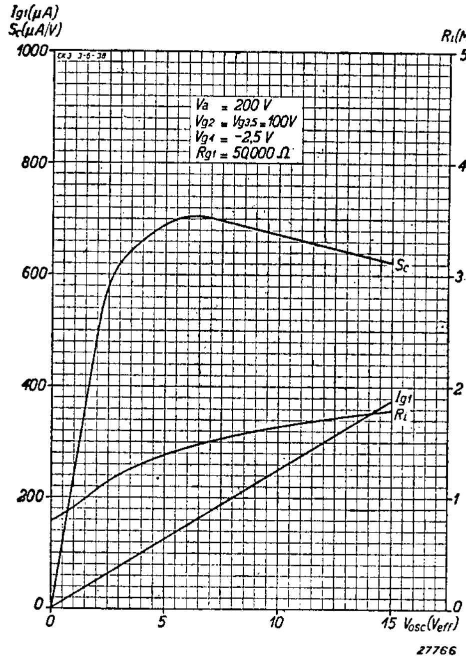

Fig. 4
Internal resistance, conversion conductance and oscillator-grid current as functions of the oscillator voltage, for a grid leak of 50,000 ohms, with $Va = 200$ V.

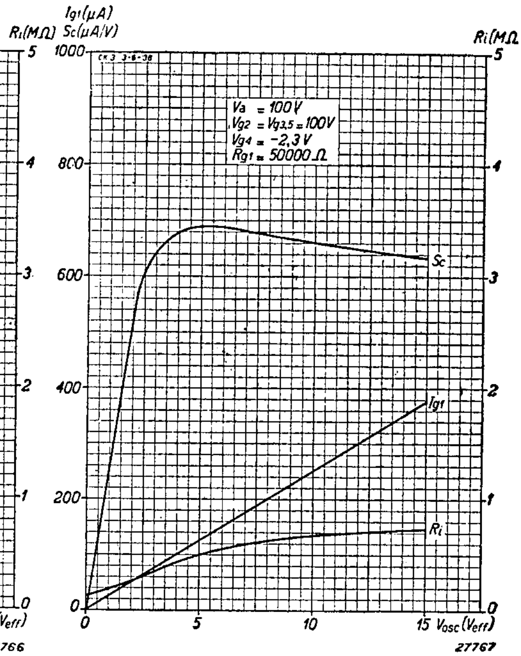

Fig. 5
Internal resistance, conversion conductance and oscillator-grid current as functions of the oscillator voltage, for a grid leak of 50,000 ohms, with $Va = 100$ V.

OPERATING DATA: CK 3 used as frequency-changer 200 V

Anode voltage	V_a	= 200 V		
Screen-grid voltage	$V_{g3,5}$	= 100 V		
Oscillator-anode voltage	V_{g2}	= 100 V		
Grid leak, oscillator	R_{g1}	= 50,000 ohms		
Alternating oscillator voltage, grid 1	$V_{g1(osc)}$	= 12 V_{eff}		
Oscillator-grid current	I_{g1}	= 300 μA		
Cathode resistor	R_k	= 190 ohms		
Bias, grid 4	V_{g4}	= —2.5 V [1]	—38 V [2]	—42 V [3]
Anode current	I_a	= 2.5 mA	—	—
Screen-grid current	$I_{g3} + I_{g5}$	= 5.5 mA	—	—
Oscillator-anode current	I_{g2}	= 5 mA	—	—
Conversion conductance	S_c	= 650	6.5	3 μA/V
Internal resistance	R_i	= 1.7	> 10	> 10 M ohms
Conductance: grid 1 with respect to grid 2 ($V_{osc} = 0$)	S_{g1g2}	= 4 mA/V	—	
Oscillator-anode current at threshold of oscillation ($V_{osc} = 0$)	I_{g2}	= 18 mA	—	

[1]) Without control.
[2]) Conductance reduced to one-hundredth of uncontrolled value.
[3]) Limit of control.

100 V

Anode voltage	V_a	= 100 V
Screen-grid voltage	$V_{g3,5}$	= 100 V
Oscillator-anode voltage	V_{g2}	= 100 V
Oscillator grid leak	R_{g1}	= 50,000 ohms
Alternating oscillator voltage, grid 1	$V_{g1(osc)}$	= 12 V_{eff}
Oscillator-grid current	I_{g1}	= 300 μA
Cathode resistor	R_k	= 175 ohms

Bias, grid 4	V_{g4}	= —2.3 V [1]	—38 V [2]	—42 V [3]
Anode current	I_a	= 2.5 mA	—	—
Screen-grid current	$I_{g3} + I_{g5}$	= 5.5 mA	—	—
Oscillator-anode current	I_{g2}	= 5 mA	—	—
Conversion conductance	S_c	= 650	6.5	3 μA/V
Internal resistance	R_i	= 0.7	> 10	> 10 M ohms
Conductance, grid 1 with respect to grid 2 ($V_{osc} = 0$)	S_{g1g2}	= 4 mA/V	—	—
Oscillator-anode current at threshold of oscillation ($V_{osc} = 0$)	I_{g2}	= 18 mA	—	—

[1]) Without control.
[2]) Conductance reduced to one-hundredth of uncontrolled value.
[3]) Limit of control.

MAXIMUM RATINGS

Anode voltage in cold condition	V_{a0}	= max. 550 V
Anode voltage	V_a	= max. 300 V
Anode dissipation	W_a	= max. 1 W
Screen voltage in cold condition	$V_{g3,50}$	= max. 550 V
Screen voltage	$V_{g3,5}$	= max. 150 V
Screen dissipation	$W_{g3,5}$	= max. 1 W
Oscillator-anode voltage, cold	V_{g20}	= max. 550 V
Oscillator-anode voltage	V_{g2}	= max. 150 V
Oscillator-anode dissipation	W_{g2}	= max. 1 W
Cathode current	I_k	= max. 23 mA
Grid voltage at grid current start ($I_{g4} = +0.3\,\mu$A)	V_{g4}	= max. —1.3 V
External resistance between grid 4 and cathode	R_{g4k}	= max. 3 M ohms
External resistance between grid 1 and cathode	R_{g1k}	= max. 100,000 ohms
External resistance between heater and cathode	R_{fk}	= max. 20,000 ohms
Voltage between heater and cathode (direct voltage or effective value of alternating voltage)	V_{fk}	= max. 100 V

The frequency drift in this octode will be at its minimum when the tuned oscillator circuit is coupled to the oscillator anode; the coupling coil is then connected to the control grid and Fig. 7 shows the method of arranging the feeds. The direct voltage is applied to the oscillator anode across a resistor of 30,000 ohms.

The direct voltage on the oscillator anode must be 100 V; on 110 V mains this is of the same order as the supply voltage and the series resistor should then actually be much less than 30,000 ohms, but this, again, is not feasible since the oscillator circuit is damped by this resistor and either the oscillator voltage in the short and medium ranges would then be too small, or it would not be possible to maintain it. An alternative method is to use the CK 3 in the other type of circuit, shown in Fig. 8, although a drawback to this arrangement is that extra contacts have to be provided in the wave-change switch for changing over the padding capacitor C_p. However, Fig. 9 offers a better solution that can be quite serviceable on a high intermediate frequency, provided that the padding capacitance is kept fairly small. In the long-wave range, for instance, this capacitance is of the order of 200 $\mu\mu$F, but this is insufficient for by-passing the feed resistor of 5,000 ohms and would produce too much damping of the oscillator circuit; in the other wave ranges, in which C_p is of a higher value, this does not apply to such an extent, so that the type of circuit shown in Fig. 7 may be used for the long-wave range and that of Fig. 9 for the other ranges; the combined circuit is shown in Fig. 10. On long waves, when switches S_1 and S_2 are open, the circuit closely resembles that of Fig. 7, although the feed is not applied at the extreme "top" of the circuit. The oscillator circuit is thus fairly heavily damped by the resistor of 5,000 ohms, but on long waves it is not a difficult matter to obtain a sufficiently tight coupling.

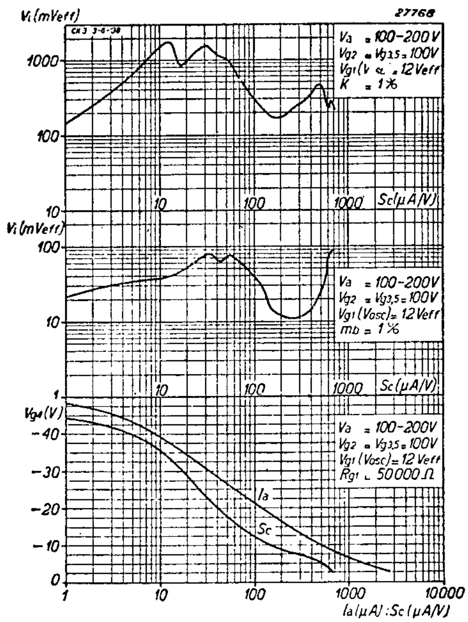

Fig. 6

Upper diagram. Input signal as a function of the conversion conductance as controlled by the bias on the 4th grid, with 1 % cross-modulation. (Conductance and voltage on logarithmic scale)

Centre diagram. Input signal as a function of the conversion conductance as controlled by the bias on the 4th grid, with 1 % modulation hum. (Conductance and voltage on logarithmic scale)

Lower diagram. Conversion conductance and anode current (logarithmic scale) as a function of the bias on grid 4 (on linear scale).

On the medium waves, with S_1 closed, the circuit is as shown in Fig. 9; the padding capacitor is large enough, as is also the case for the short waves.

If it is necessary to isolate the tuning capacitor from the D.C. supply of 100 V, a fixed capacitor of fairly high capacitance is placed in series with it, although this is superfluous if the tuned oscillator circuit is connected to the first grid. The frequency drift due to control of the voltage on the 4th grid is then somewhat more, but this must be accepted if control on the valve is essential.

It should be noted that no account has been taken of the 100 V D.C. occurring on the contacts of the wave-change switch and in many instances this will not be acceptable in view of prevailing safety precautions. High-capacitance isolating capacitors then have to be included, but if this is considered too costly the only alternative is to connect the tuned oscillator circuit to the first grid.

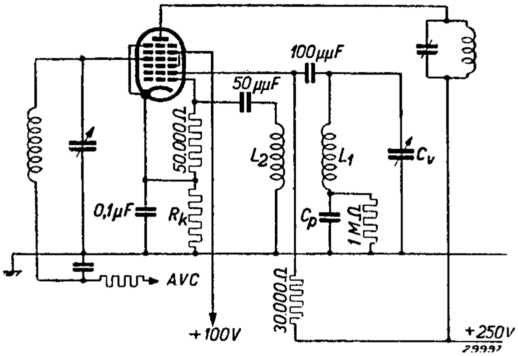

Fig. 7
Oscillator anode fed through a resistor of 30,000 ohms. This circuit is not suitable for the CK 3 when used on 100 V supply.

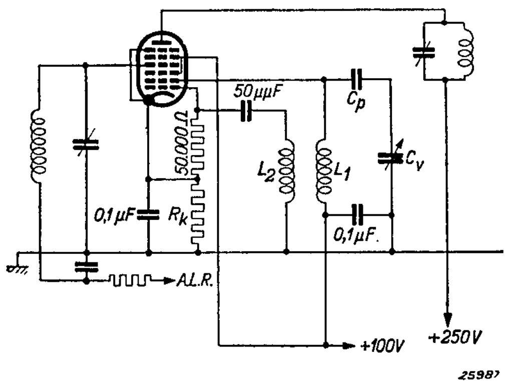

Fig. 8
Oscillator anode fed through the tuning coil. This arrangement is suitable for 100 V supply but has the disadvantage that the padding capacitors for the different wave ranges have to be switched.

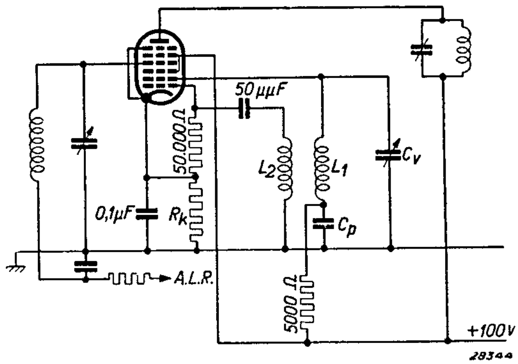

Fig. 9
Oscillator anode fed through the tuning coil using a series resistor of 5,000 ohms.

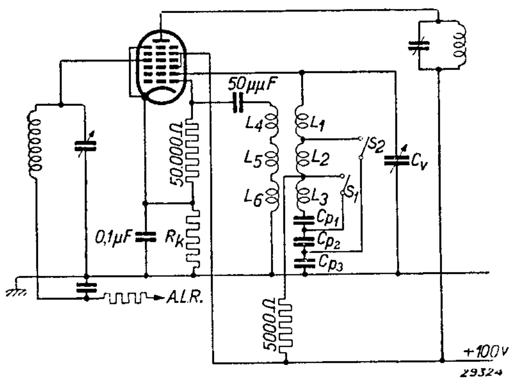

Fig. 10
Combination of circuits of Figs 7 and 9