UF 9 R.F., I.F. and A.F. pentode

This is a variable-mu R.F. or I.F. pentode for AC or DC receivers having series-connected 100 mA heater circuits. It can also be employed as R—C coupled A.F. amplifier, with or without control (A.G.C. system including A.F. stage). The UF. 9 is designed to work on a sliding screen grid voltage, giving a lower anode current with higher mutual conductance than a valve of which the screen grid voltage is fixed and which, as far as cross-modulation is concerned in the uncontrolled condition, has the same characteristics. When the valve is used on a supply voltage of 200 V, the screen grid is fed through a resistance of 60,000 Ohms, in which case the cathode resistance is 325 Ohms and the mutual conductance in the uncontrolled condition 2.2 mA/V. On 100 V supply voltage the resistance in series with the screen grid can with advantage be short-circuited, since the grid bias in the uncontrolled state then readjusts itself to —2.5 V, with the mutual conductance once more at 2.2 mA/V. If this resistance is not shorted, the resultant lower screen grid voltage, combined with the smaller anode and screen grid current, will result in a reduction of both mutual conductance and bias; the cross-modulation curve is then not so satisfactory and there is a possibility that grid current will flow when no control is applied. The very slight degree of mains hum produced by the UF9 when used as A.F. amplifier is an advantage. Very great care has been taken in the designing to reduce hum to a minimum, more especially with a view to the use of this valve in AC/DC receivers where its heater, counting from the chassis, comes second in the heater circuit and carries high alternating voltages.

The UF 9 excels by reasons of its exceptionally low inter-electrode capacitances, the anode-to-grid capacitance being less than 0.002 pF. It is therefore very suitable for short-wave reception.

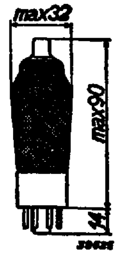

Fig. 1
Dimensions in mm.

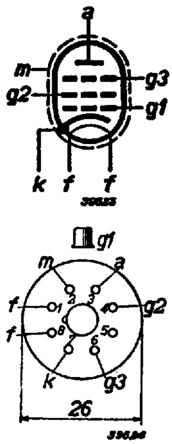

Fig. 2.
Arrangement of electrodes and contacts.

HEATER RATINGS

Heater feed: indirect by AC or DC; series supply.

Heater voltage . . . . V_f = 12.6 V

Heater current . . . . I_f = 0.100 A

CAPACITANCES

Anode-grid . . . . C_{ag1} < 0.002 pF.

Grid–all other electrodes . . . . C_{g1} = 4.9 pF.

Anode–all other electrodes . . . . C_a = 7.5 pF.

Grid-filament . . . . C_{g1f} < 0.005 pF.

OPERATING DATA: valve employed as R.F. or I.F. amplifier

a) With fixed screen grid voltage.

Anode voltage	V_a =	100 V			200 V			
Suppressor grid voltage	V_{g3} =	0 V			0 V			
Screen grid voltage	V_{g2} =	100 V			100 V			
Cathode resistance	R_k =	325 Ohms			325 Ohms			
Grid bias	V_{g1} =	—2.5¹)	—16.0²)	—19.5³)	—2.5¹)	—16.0²)	—19.5³)	V
Anode current	I_a =	6	—	—	6	—	—	mA
Screen grid current	I_{g2} =	1.7	—	—	1.7	—	—	mA
Mutual conductance	S =	2200	22	7	2200	22	7	μA/V
Internal resistance	R_i =	0.4	> 10	> 10	1.2	> 10	>10	MOhms

¹) Without control. ²) Mutual cond. controlled to 1/100. ³) Mutual conductance controlled to limit of range.

b) With sliding screen grid voltage.

		100 V			200 V			
Anode voltage	V_a =	100 V			200 V			
Suppressor grid voltage	V_{g3} =	0 V			0 V			
Screen grid resistance	R_{g2} =	60 000 Ohms			60,000 Ohms			
Cathode resistance	R_k =	325 Ohms			325 Ohms			
Grid bias	V_{g1} =	—1.3[1])	—16.5[2])	—20[3])	—2.5[1])	—32[2])	—39[3])	V
Screen grid voltage	V_{g2} =	50	—	100	100	—	200	V
Anode current	I_a =	3.2	—	—	6	—	—	mA
Screen grid current	I_{g2} =	0.85	—	—	1.7	—	—	mA
Mutual conductance	S =	2000	20	5	2200	22	5.5	µA/V
Internal resistance	R_i =	1	> 10	> 10	1.2	> 10	> 10	MOhms
Gain factor (with respect to screen grid)	μ_{g2g1} =	18	—	—	18	—	—	

[1]) Without control. [2]) Valve controlled to 1/100. [3]) Limit of control range.

OPERATING DATA: valve used as resistance-capacitance coupled A.F. amplifier with gain control on the control grid

Supply voltage	Anode coupling resistance	Screen grid resistance	Anode current	Screen grid current	Cathode resistance	Control voltage on grid 1	Gain	Required alternating grid voltage and total distortion for an output voltage of:					
								$V_{o\,eff} = 3$ V		$V_{o\,eff} = 5$ V		$V_{o\,eff} = 8$ V	
V_b (V)	R_a (MΩ)	R_{g2} (MΩ)	I_a (mA)	I_{g2} (mA)	R_k (ohms)	$-V_R$ (V)	$\frac{V_{o\,eff}}{V_{i\,eff}}$	$V_{i\,eff}$ (V)	d_{tot} (%)	$V_{i\,eff}$ (V)	d_{tot} (%)	$V_{i\,eff}$ (V)	d_{tot} %
200	0.2	0.8	0.65	0.17	2500	0	88	0.034	0.75	0.057	1.2	0.091	2.0
200	0.2	0.8	0.52	0.13	2500	5	32	0.095	1.3	0.160	2.2	0.255	3.5
200	0.2	0.8	0.42	0.10	2500	10	17	0.172	1.6	0.288	2.8	0.460	4.3
200	0.2	0.8	0.33	0.07	2500	15	12	0.260	1.8	0.430	3.0	0.690	4.8
200	0.2	0.8	0.25	0.05	2500	20	8	0.382	2.2	0.640	3.7	1.020	5.9
100	0.2	0.8	0.33	0.08	2500	0	82	0.037	0.83				
100	0.2	0.8	0.25	0.06	2500	2.5	31	0.090	2.6				
100	0.2	0.8	0.20	0.04	2500	5	16	0.190	3.9				
100	0.2	0.8	0.15	0.03	2500	7.5	10	0.300	4.2				
100	0.2	0.8	0.12	0.02	2500	10	7	0.450	5.1				
200	0.1	0.4	1.22	0.35	1300	0	78	0.039	0.75	0.064	1.3	0.103	2.0
200	0.1	0.4	0.91	0.26	1300	5	29	0.100	1.3	0.170	2.2	0.275	3.5
200	0.1	0.4	0.70	0.19	1300	10	16	0.190	1.9	0.310	3.1	0.500	5.0
200	0.1	0.4	0.51	0.13	1300	15	9	0.320	2.1	0.540	3.5	0.860	5.6
200	0.1	0.4	0.36	0.09	1300	20	6	0.500	3.4	0.840	5.6	1.340	9.0
100	0.1	0.4	0.61	0.15	1300	0	72	0.042	0.83				
100	0.1	0.4	0.44	0.12	1300	2.5	29	0.104	3.8				
100	0.1	0.4	0.33	0.09	1300	5	15	0.206	3.8				
100	0.1	0.4	0.24	0.06	1300	7.5	8	0.380	5				
100	0.1	0.4	0.17	0.04	1300	10	6	0.580	6.2				

MAXIMUM RATINGS

Anode voltage in cold condition	V_{ao}	= max. 550 V
Anode voltage	V_a	= max. 250 V
Anode dissipation	W_a	= max. 2 W
Screen grid voltage in cold condition	V_{g2o}	= max. 550 V
Screen grid voltage at I_a = 6 mA	V_{g2}	= max. 125 V
Screen grid voltage at $I_a < 3$ mA	V_{g2}	= max. 250 V
Screen grid dissipation	W_{g2}	= max. 0.3 W
Cathode current	I_k	= max. 10 mA
Grid current commences at (I_{g1} = + 0.3 μA)	V_{g1}	= max. —1.3 V
Max. external resistance between grid and cathode	R_{g1k}	= max. 3MΩ
Max. external resistance between filament and cathode	R_{fk}	= max. 20,000 Ohms
Max. voltage between filament and cathode (D.C. or effective value of A.C.)	V_{fk}	= max. 150 V

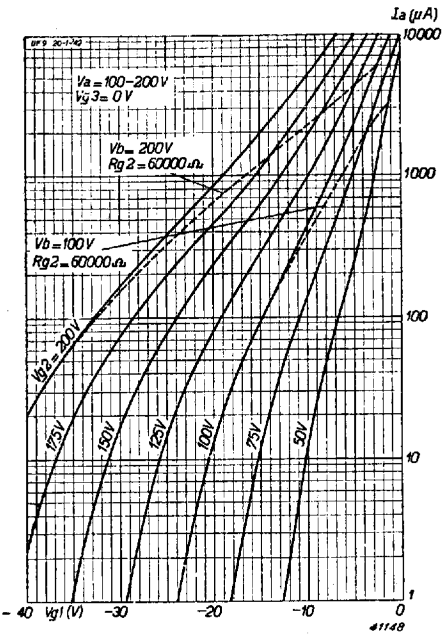

Fig. 3
Anode current as a function of grid bias at Va = 100—200 V and Vg_3 = 0 V, with screen grid voltage as parameter. The broken lines show the anode current of the controlled valve, with screen grid fed through a 60,000 ohm resistance from the 200 V or 100 V supply.

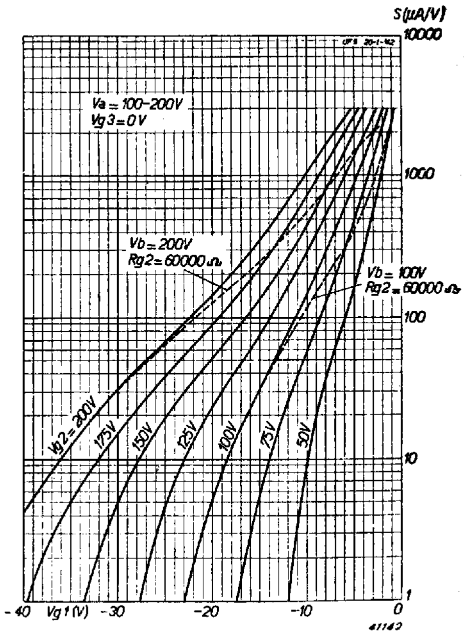

Fig. 4
Mutual conductance as a function of grid bias, with screen grid voltage as parameter. The broken lines show the course of the slope with control on the valve and the screen grid fed through a 60,000 Ohm resistance from the 200 V and 100 V supply.

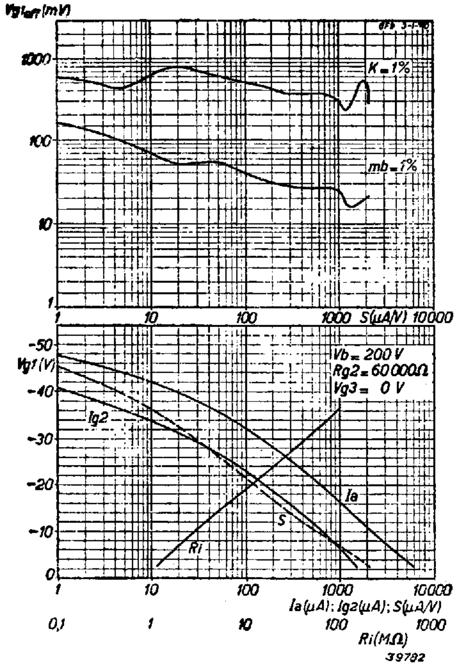

Fig. 5

At Vb = 200 V, Rg_2 = 60,000 Ohms (screen grid fed through a resistance) and Vg_3 = 0 V:
Upper diagram; Maximum permissible effective value of alternating grid voltage with 1 % cross modulation and 1 % modulation hum, as a function of mutual conductance.
Lower diagram; Mutual conductance, anode current, screen grid current and internal resistance as a function of grid bias.

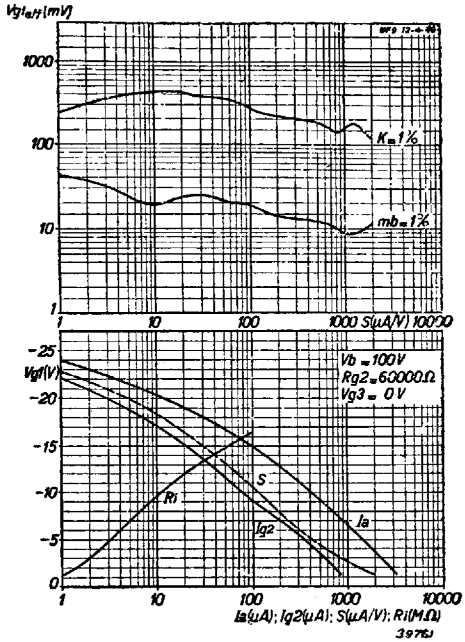

Fig. 6

At Vb = 100 V, Rg_2 = 60,000 ohms (resistance in series with the screen grid) and Vg_3 = 0 V:
Upper diagram; Maximum permissible effective value of alternating grid voltage with 1 % cross-modulation and 1 % modulation hum as a function of mutual conductance.
Lower diagram; Mutual conductance, anode current, screen grid current and internal resistance as a function of grid bias.

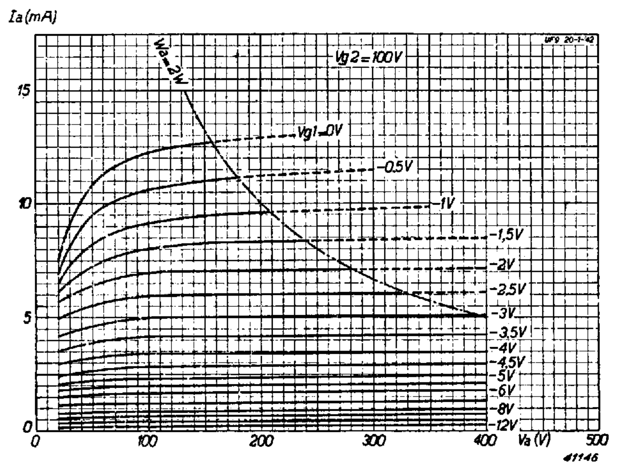

Fig. 7

Anode current as a function of anode voltage with a fixed screen grid voltage of 100 V: grid bias as parameter.

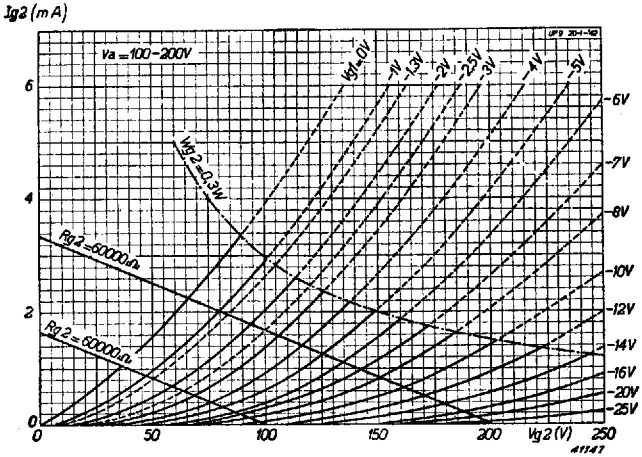

Fig. 8
Screen grid current as a function of screen grid voltage at Va = 100—200 V and Vg_3 = 0 V, with grid bias as parameter.