UBF 80 Double diode - variable-mu pentode

The UBF 80, designed for A.C./D.C. receivers with 100 mA heater chains, contains two diodes and a variable-mu pentode. The pentode section is suitable for R.F., I.F. and A.F. amplification, the slope being about 2.2 mA/V for an anode current of 5 mA; the internal resistance is about 1 MΩ. The diodes can be used for detection and to provide the control voltage for A.G.C.
As the properties of this valve are identical with those of the EBF 80, reference may be made to the description of the latter for further details.

TECHNICAL DATA OF THE DOUBLE DIODE-PENTODE UBF 80

Heater data

Heating: indirect by A.C. or D.C.; series feed

Heater current	I_f	=	100 mA
Heater voltage . .	V_f	=	17 V

Capacitances (cold valve)

Pentode section

Input capacitance . . .	C_{g1}	=	4.2 pF
Output capacitance . . .	C_a	=	4.9 pF
Control grid - anode . . .	C_{ag1}	<	0.0025 pF
Control grid - heater . . .	C_{g1f}	<	0.07 pF

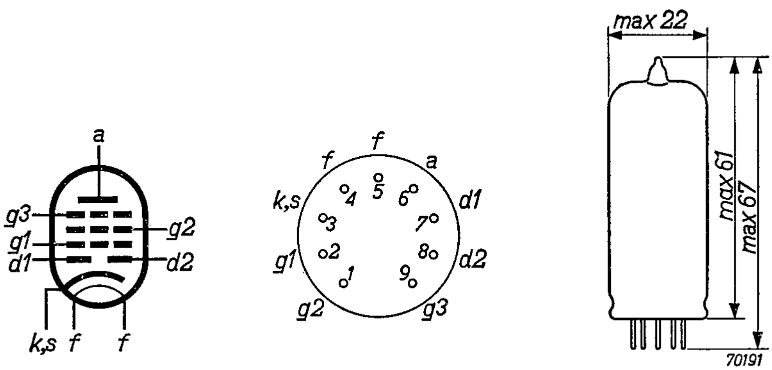

Fig. 1
Electrode arrangement, electrode connections and max. dimensions in mm of the UBF 80.

Diode section

Diode anode No. 1 - cathode	C_{d1}	=	2.2	pF
Diode anode No. 2 - cathode	C_{d2}	=	2.35	pF
Between diode anodes . . .	C_{d1d2}	<	0.35	pF
Diode anode No. 1 - heater	C_{d1f}	<	0.02	pF
Diode anode No. 2 - heater	C_{d2f}	<	0.005	pF

Between diodes and pentode

Diode anode No. 1 - control grid	C_{d1g1}	<	0.0008	pF
Diode anode No. 2 - control grid	C_{d2g1}	<	0.001	pF
Diode anode No. 1 - pentode anode	C_{d1a}	<	0.2	pF
Diode anode No. 2 - pentode anode	C_{d2a}	<	0.05	pF

Operating characteristics of the pentode section as R.F. or I.F. amplifier

Anode and supply voltage . .	$V_a = V_b$	=	100		170		V
Voltage on grid No. 3 . . .	V_{g3}	=	0		0		V
Screen grid resistor	R_{g2}	=	47		47		kΩ
Cathode resistor	R_k	=	295		295		Ω
Grid bias	V_{g1}	=	—1.15	—15.5	—2	—26.5	V
Anode current	I_a	=	2.8	—	5.0	—	mA
Screen grid current	I_{g2}	=	1.0	—	1.75	—	mA
Mutual conductance . .	S	=	1900	19	2200	22	µA/V
Internal resistance	R_i	=	0.9	>10	0.9	>10	MΩ
Amplification factor of grid 2 with respect to grid 1	μ_{g2g1}	=	18	—	18	—	
Equivalent noise resistance .	R_{eq}	=	4.6	—	6.2	—	kΩ

Anode and supply voltage	$V_a = V_b$	=	200		V
Voltage on grid No. 3 . . .	V_{g3}	=	0		V
Screen grid resistor	R_{g2}	=	68		kΩ
Cathode resistor	R_k	=	295		Ω
Grid bias	V_{g1}	=	—2	—31.5	V
Anode current . . .	I_a	=	5.0	—	mA
Screen grid current	I_{g2}	=	1.75	—	mA
Mutual conductance . . .	S	=	2200	22	µA/V
Internal resistance	R_i	=	1.0	>10	MΩ
Amplification factor of grid 2 with respect to grid 1	μ_{g2g1}	=	18	—	
Equivalent noise resistance .	R_{eq}	=	6.2	—	kΩ

Operating characteristics of the pentode section as a resistance-capacity coupled A.F. amplifier

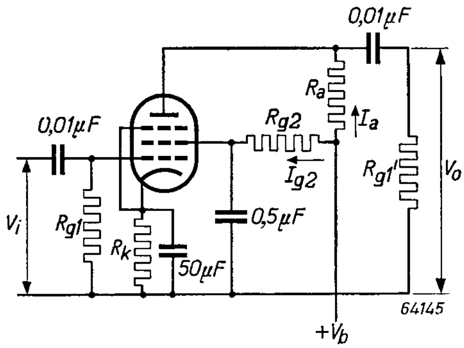

Fig. 2
The UBF 80 as an A.F. amplifier.

Supply voltage	V_b	=	170	170	170	170	V
Anode resistor	R_a	=	0.22	0.1	0.22	0.1	MΩ
Screen grid resistor	R_{g2}	=	0.68	0.27	0.82	0.33	MΩ
Grid leak	R_{g1}	=	1	1	10	10	MΩ
Cathode resistor	R_k	=	2700	1000	0	0	Ω
Grid leak of next valve	R_{g1}'	=	0.68	0.33	0.68	0.33	MΩ
Anode current	I_a	=	0.56	1.25	0.56	1.16	mA
Screen grid current	I_{g2}	=	0.20	0.50	0.19	0.46	mA
Amplification	V_o/V_i	=	85	70	140	100	
Distortion d_{tot} at an output voltage of	3 V_{RMS}	=	1.2	1.2	0.8	0.8	%
	5 V_{RMS}	=	1.5	1.6	1.0	1.4	%
	8 V_{RMS}	=	1.8	2.0	1.4	2.0	%

Supply voltage	V_b	=	100	100	100	100	V
Anode resistor	R_a	=	0.22	0.1	0.22	0.1	MΩ
Screen grid resistor	R_{g2}	=	0.68	0.27	0.82	0.33	MΩ
Grid leak	R_{g1}	=	1	1	10	10	MΩ
Cathode resistor	R_k	=	2700	1000	0	0	Ω
Grid leak of next valve	R_{g1}'	=	0.68	0.33	0.68	0.33	MΩ
Anode current	I_a	=	0.32	0.73	0.32	0.66	mA
Screen grid current	I_{g2}	=	0.12	0.29	0.11	0.25	mA
Amplification	V_o/V_i	=	82	67	100	70	
Distortion d_{tot} at an output voltage of	3 V_{RMS}	=	1.4	1.4	2.8	1.7	%
	5 V_{RMS}	=	1.9	1.8	3.0	3.2	%

Operating characteristics of the pentode section as a resistance-capacity coupled A.F. amplifier, triode-connected (screen grid connected to anode)

Supply voltage	V_b	=	170	170	170	170	V
Anode resistor	R_a	=	0.1	0.047	0.1	0.047	MΩ
Grid leak	R_{g1}	=	1	1	10	10	MΩ
Cathode resistor	R_k	=	1800	1000	0	0	Ω
Grid leak of next valve	R_{g1}'	=	0.33	0.15	0.33	0.15	MΩ
Anode current	I_a	=	1.25	2.4	1.4	2.8	mA
Amplification	V_o/V_i	=	11	11	14	14	
Distortion d_{tot} at an output voltage of	3 V_{RMS}	=	2.1	1.8	2.5	2.1	%
	5 V_{RMS}	=	3.5	3.1	3.8	3.4	%
	8 V_{RMS}	=	4.8	4.6	5.0	4.7	%

Supply voltage	V_b	=	100	100	100	100	V
Anode resistor	R_a	=	0.1	0.047	0.1	0.047	MΩ
Grid leak	R_{g1}	=	1	1	10	10	MΩ
Cathode resistor	R_k	=	1800	1000	0	0	Ω
Grid leak of next valve	R_{g1}'	=	0.33	0.15	0.33	0.15	MΩ
Anode current	I_a	=	0.74	1.4	0.8	1.5	mA
Amplification	V_o/V_i	=	11	11	12	12	
Distortion d_{tot} at an output voltage of	3 V_{RMS}	=	3.2	3.0	3.0	3.0	%
	5 V_{RMS}	=	4.9	4.8	4.7	4.8	%

Limiting values of the pentode section

Anode voltage, valve biased to cut-off	V_{a_0}	= max.	550	V
Anode voltage	V_a	= max.	250	V
Anode dissipation	W_a	= max.	1.5	W
Screen grid voltage, valve biased to cut-off	V_{g2_0}	= max.	550	V
Screen grid voltage, valve controlled	$V_{g2}(I_a<2\text{ mA})$	= max.	250	V
Screen grid voltage, valve uncontrolled	$V_{g2}(I_a=5\text{ mA})$	= max.	125	V
Screen grid dissipation	W_{g2}	= max.	0.3	W
Cathode current	I_k	= max.	10	mA
Grid current starting point	$V_{g1}(I_{g1}=+0.3\,\mu A)$	= max.	—1.3	V
External resistance between control grid and cathode (with cathode resistor)	$R_{g1}(R_k=295\Omega)$[1]	= 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]) If the grid bias is obtained only by means of the grid leak, the limiting value for R_{g1} is max. 22 MΩ.

Limiting values of the diode section

Peak inverse voltage on diode No. 1	$V_{d1inv\,p}$	= max. 350 V
Peak inverse voltage on diode No. 2	$V_{d2inv\,p}$	= max. 350 V
Diode No. 1 current	I_{d1}	= max. 0.8 mA
Diode No. 2 current	I_{d2}	= max. 0.8 mA
Diode No. 1 peak current . .	I_{d1p}	= max 5 mA
Diode No. 2 peak current . .	I_{d2p}	= max. 5 mA
External resistance between heater and cathode . . .	R_{fk}	= max 20 kΩ
Voltage between heater and cathode	V_{fk}	= max. 150 V

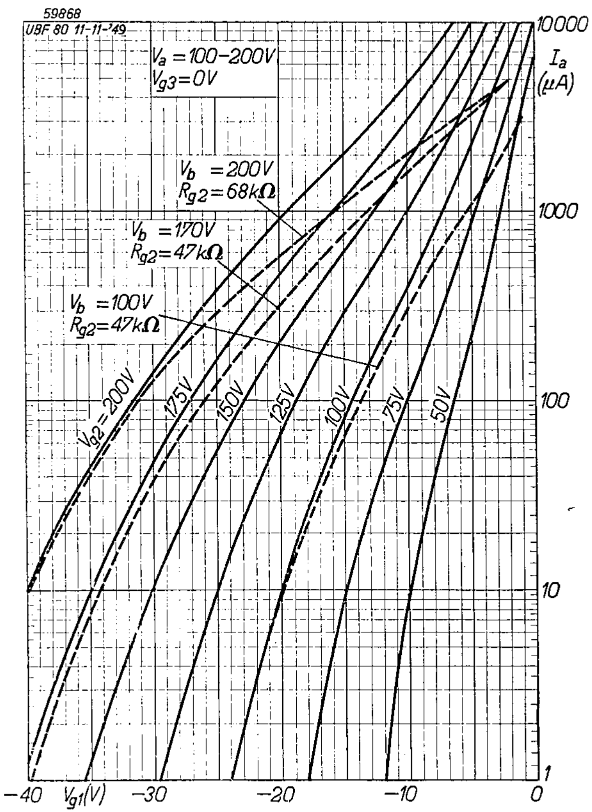

Fig. 3

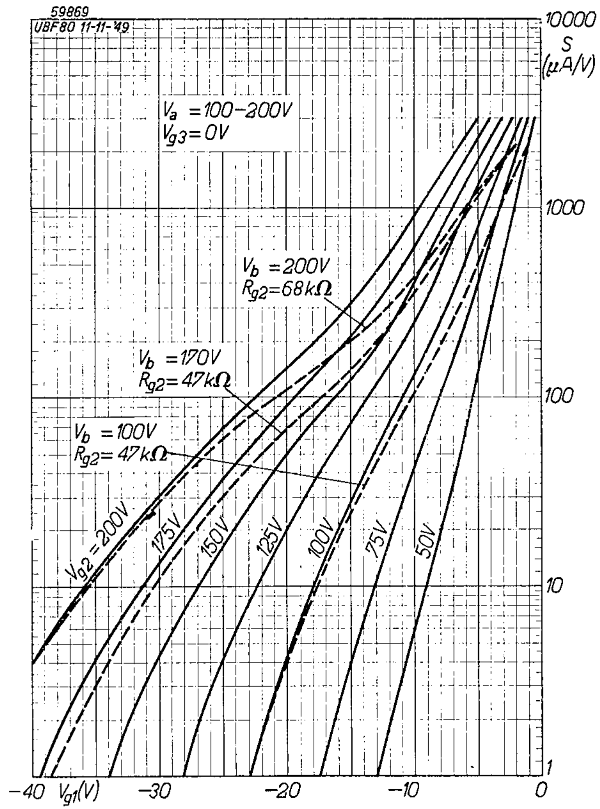

Fig. 4

Anode current (I_a, Fig. 3) and mutual conductance (S, Fig. 4) as functions of the grid bias (V_{g1}), with screen grid voltage (V_{g2}) as parameter. The broken lines indicate the anode current and mutual conductance at supply voltages of 200, 170 and 100 V, with screen grid resistors of 68, 47 and 47 kΩ, respectively.

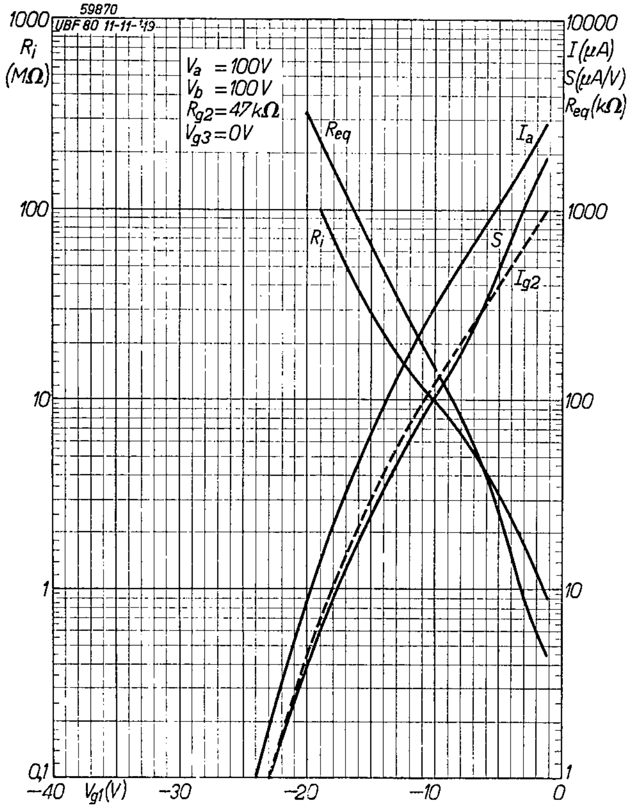

Fig. 5

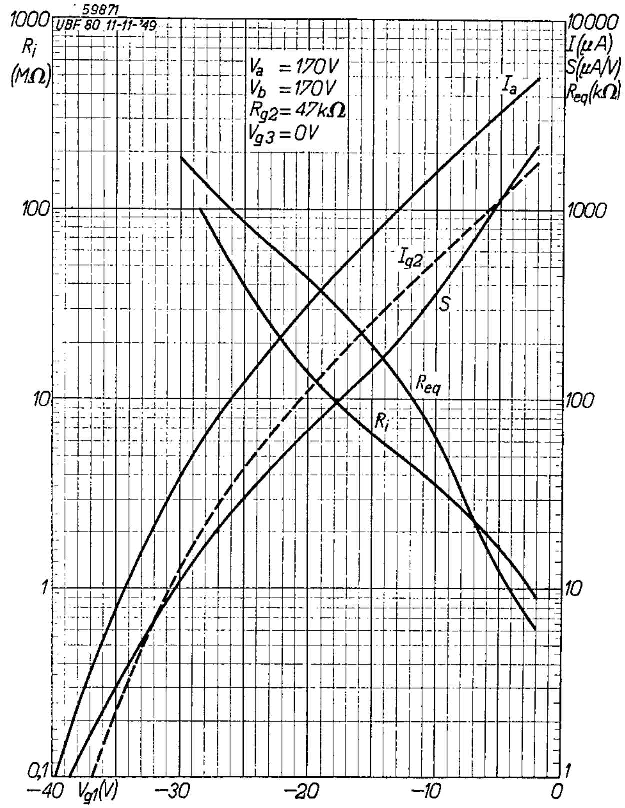

Fig. 6

Anode current (I_a), screen grid current (I_{g2}), mutual conductance (S), internal resistance (R_i) and equivalent noise resistance (R_{eq}) as functions of the grid bias (V_{g1}).

Fig. 5: Supply voltage $V_b = 100$ V, screen grid resistor $R_{g2} = 47$ kΩ.

Fig. 6: Supply voltage $V_b = 170$ V, screen grid resistor $R_{g2} = 47$ kΩ.

UBF 80

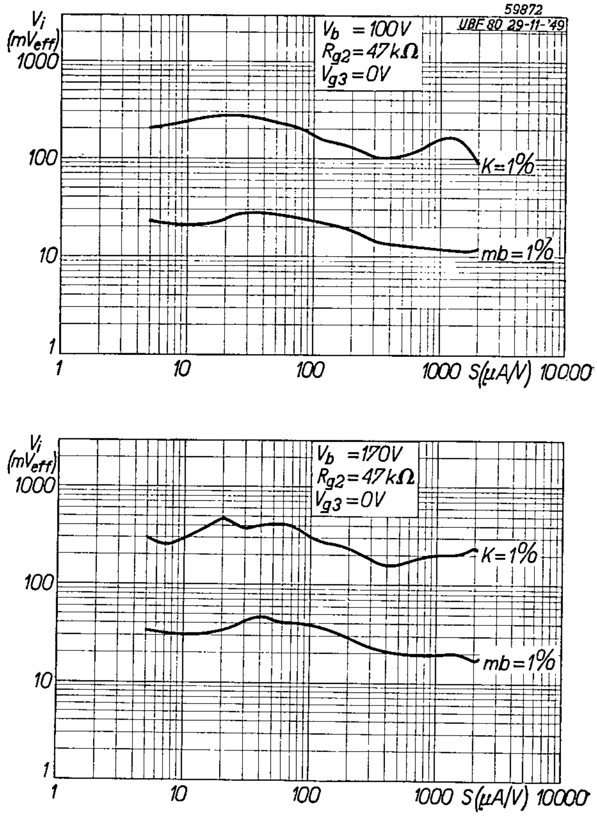

Fig. 7. 1) The strength of an interfering signal (V_i) at the control grid producing 1% cross-modulation (curve $K=1\%$) and
2) The strength of a ripple voltage (V_i) at the control grid producing 1% modulation hum (curve $m_b=1\%$), both as functions of the mutual conductance (S). Upper diagram: $V_b=100$ V. Lower diagram: $V_b=170$ V.

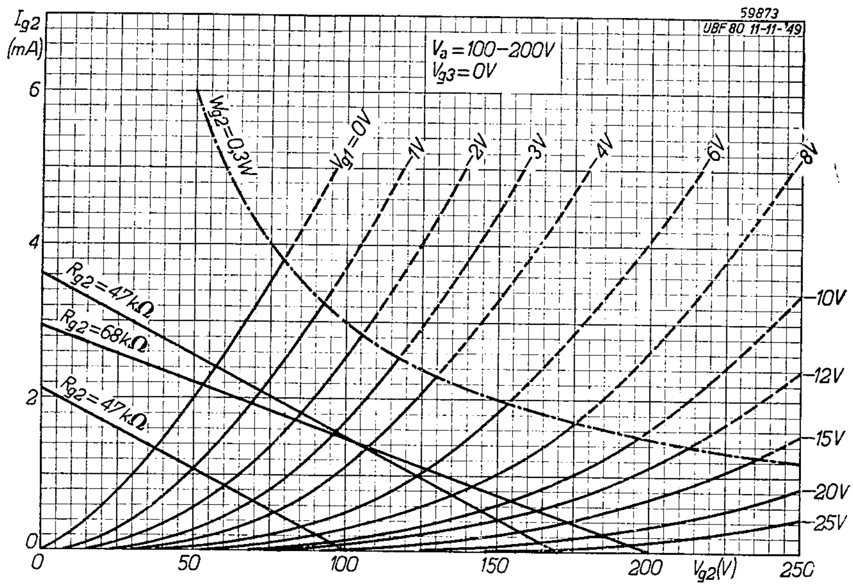

Fig. 8
Screen grid current (I_{g2}) as a function of the screen grid voltage (V_{g2}), with grid bias (V_{g1}) as parameter. The broken line indicates the maximum permissible screen grid dissipation ($W_{g2}=0.3$ W). The load lines for 68 kΩ at $V_b=200$ V, 47 kΩ at $V_b=170$ V and 47 kΩ at $V_b=100$ V are also shown.