Osram Valve GUIDE

and Book of Circuits

EVERY RADIO-MAN'S POCKET REFERENCE

Osram Valves

are

LEADERS IN EVERY REAL ADVANCE OF TECHNICAL IMPORTANCE

First Dull Emitter—OSRAM—1921
First Screen Grid Valve—OSRAM—1926
First Indirectly Heated Valve—OSRAM—1926
The "Wembley" Filament—OSRAM—1931
The "CATKIN"—OSRAM—1933

BE UP-TO-DATE—USE OSRAM VALVES IN YOUR SET.

OSRAM VALVE GUIDE

Foreword

Since its introduction in 1926, the OSRAM VALVE GUIDE has proved its popularity and utility by an increasing circulation year by year amongst wireless enthusiasts.

The rapidly multiplying number of valve types on the market to meet modern circuit developments has set its own problem, which is to compile a reference booklet providing complete technical information and working data for each type, and yet retaining a handy pocket size.

The 1934 OSRAM VALVE GUIDE solves the problem for the technical reader by giving full tabulated data of all the OSRAM Ranges of Valves, and on pages 4 to 23 and 60 and 61 a clear guide to the non-technical user as to which valve to select.

By this means it becomes a matter of a few moments to refer to any type of OSRAM Valve.

In addition to the data charts, the 1934 OSRAM VALVE GUIDE contains much helpful information, circuit diagrams, and useful description of the application of modern valves.

Full characteristic curves of any type are available on request to the General Electric Company Ltd., Magnet House, Kingsway, London, W.C. 2, or to any Branch of the Company.

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SECTION I

CHOOSING YOUR

Osram Valves

In the following pages will be found tables giving the characteristics and working voltages for the complete range of OSRAM Broadcast Receiving Valves. Accurate average characteristic curves for any type are available on request.

OSRAM VALVES FOR

Type.	Purpose.	Filament Volts.	Filament Current.	Amplification Factor.	Impedance at Grid Volts 0 (Ohms).	Mutual Conductance m.a./v.	Max. Anode Volts.	Max. Screen Volts.
S23	Screen-	2.0	0.1	—	300,000	1.1	150	70
S24	grid	2.0	0.15	—	300,000	1.4	150	70
VS24 / **VS24/K**	Vari-mu. Screen-grid	2.0	0.15	—	250,000	1.5 to 0.016	150	75
VP21	H.F. Pen.	2.0	0.1	—	1,000,000	1.1 to 0.008	150	60
HL2 / **HL2/K**	Triode Det and L.F.	2.0	0.1	27	18,000	1.5	150	—
HD22	D-D-Triode	2.0	0.2	27	18,000	1.5	150	—
L21	L.F.	2.0	0.1	16	8,900	1.8	150	—
LP2	Power	2.0	0.2	15	3,900	3.85	150	—
P2	Super Power	2.0	0.2	7.5	2,150	3.5	150	—
PT2 / **PT2/K**	Output Pentode	2.0	0.2	—	50,000	2.5	150	150

2-VOLT BATTERY SETS

Average Anode Current (m.a.) at Max. Screen Volts. Anode Volts. 100	120	150	As Amplifier Average Screen Current (m.a.) at Max. Screen Volts	Approximate Grid Bias Volts at Max. Screen Volts. Anode Volts. 100	120	150	Optimum Load (Ohms.)	Type of Base.	Price.
1.3 to 2.8			0.8	0 to −1.5			—	4 pin	12/6
1.4 to 3.2			1.0	0 to −1.5			—	4 pin	12/6
4.5 to 2.3			0.5 to 0.2	0 to −1.5			—	4 pin	12/6
Negligible			Negligible	−9.0					12/6
2.8 to 1.4			0.7 to 0.4	0 to −1.5			—	7 pin†	13/6
Negligible			Negligible	−9.0					
1.2	2.3	1.8	—	−1.5	−1.5	−3.0	—	4 pin	5/6 5/6
1.4	2.5	2.0	—	−1.5	−1.5	−3.0	—	5 pin†	9/-
1.8	1.7	2.2	—	−3.0	−4.5	−6.0	—	4 pin	5/6
5.2	6.0	11.5	—	−3.0	−4.5	−4.5	7,000	4 pin	7/-
12.0	14.0	19.0	—	−6.0	−9.0	−10.5	4,500	4 pin	12/-
4.3*	4.5*	9.5	2.0	−3	−3	−4.5	20,000	5 pin	13/6 13/6

*100-v. Screen.

† See pp. 24, 25.

OSRAM VALVES FOR

Type.	Purpose.	Filament Volts.	Filament Current (Amps).	Max. Anode Volts.	Max Screen Volts.	Max. Oscillator Anode Volts.	As frequency changer under conditions of max. Anode Volts, Screen Volts 40. Oscillator Anode Volts 40. Average Anode Current (m.a.)	Average Screen Current (m.a.)	Oscillator Anode Current (m.a.)	Grid Bias Volts.
X.21	Heptode Frequency Changer	2.0	0.1	150	70	70	0.45 0.01	0.6 0.68	0.6 0.78	0 −9

"CLASS B" AND

Type.	Description.	Filament Volts.	Filament Current (Amps)	Max. Anode Volts.	Max. Screen Volts.	Total Quiescent Anode and Screen Current. (m.a.) H.T. Volts		Average Anode and Screen Current (m.a.)	Grid Bias.
B.21	Double Triode	2.0	0.2	150	—	150 120	2.2 1.65	7.5 6.0	−6 −4.5
QP.21	Double Pentode	2.0	0.4	150	150	150 120	4.3—7.5 5.0	7.0—9.0 7.0	−10.5 to −9 −7.5

2-VOLT BATTERY SETS

Conversion Conductance Micromhos. (Approx.)			Type of Base. (See pp. 24, 25).	Price.
At Grid Volts	0	200	7 pin.	**18/6**
,,	−9	2		

"QPP" VALVES

Optimum Load Resistance. (Plate to Plate) Ohms.	Recommended Driver Valve.	Recommended Input Transformer Ratio.		Type of Base. (See pp. 24, 25).	Price.
		H.T. Volts			
12,000	L.21	150	1.5—1*	7 pin	**14/-**
12,000		120	1.25—1*		
24,000 28,000	—	1—10 Max.*		7 pin	**22/6**

* Primary to total Secondary.

REPLACEMENT TABLE—2-VOLT BATTERY VALVES.

In addition to the 2-volt valves described fully on pages 4 to 7, which are suitable for receivers of recent design, the following types of 2-volt OSRAM Valves are still available for replacement purposes when re-valving an older type set.

Type.	Purpose.	Type of set.	Filament Volts.	Filament Current.	Amplification Factor	Impedance Ohms.	Mutual Conductance ma/volt.	Price.
H.L.210	Moderate Amplification Triode	Portable with aperiodic H.F. For H.F. and Det. stages	2.0	0.1	24	20,000	1.2	**5/6**
P.215	Small Power	Output stage in Portables	2.0	0.15	7	5,000	1.4	**7/-**
H.210	High Amplification Triode	Detector in OSRAM "Music MAGNET" Four and OSRAM "Four" Kit Sets	2.0	0.1	35	50,000	0.7	**5/6**
D.G.2	Double Grid Valve	Frequency Changer in certain Superhet sets.	2.0	0.2	4.5	3,750	1.2	**20/-**
V.S.2	Vari-mu Screen Grid	H.F. in certain receivers designed for V.S.2	2.0	0.1	—	At Grid Volts 0...1.25 At Grid Volts—12...0.03		**12/6**

REPLACEMENT TABLE—2-VOLT BATTERY VALVES

The following types of 2-volt OSRAM Valves are available only on special demand, but equivalent types of generally similar characteristic may in the majority of cases be used to replace them.

In a few receiving sets it is essential that the types of valves originally fitted should be employed, but in many sets the replacement types specified may be substituted with improved results.

Type	Purpose	Replace with OSRAM	Special Remarks
S.215	Low conductance screen grid	**S.23**	Metallised **S23** in OSRAM "MUSIC MAGNET 4" and "OSRAM FOUR" Sets.
S.21	Moderate conductance screen grid	**S.23**	Not in OSRAM "THIRTY-THREE" Set, where metallised **S21** must be used.
S.22	High conductance screen grid	**S.24**	Reduction in H.T. and L.T. current consumption.
H.2	High amplification factor triode	**H.L.2** or **H.L.2/K.**	—
L.210	Low frequency amplifier	**L.21**	Requires about 1½ volt less negative grid bias

OSRAM VALVES FOR A.C. MAINS SETS

Type.	Purpose.	Heater Volts.	Heater Current (Amps.)	Amplification Factor.	Impedance At Grid volts −1 (Ohms).	Mutual Conductance m.a./v.	Max. Anode Volts.	Max. Screen Volts.
MS.4	Screen grid	4.0	1.0	—	500,000	1.1	200	70
MS.4B / **Catkin MS.4B**	,,	4.0	1.0	—	350,000	3.2	200	80
VMS.4 / **Catkin VMS.4**	Vari-Mu Screen grid	4.0	1.0	—	250,000	2.6 to 0.03	200	80
VMS.4B	,,	4.0	1.0	—	250,000	2.9 to 0.04	200	80
VMP.4	Vari-Mu HF. Pen.	4.0	1.0	—	1,000,000	3.5 to 0.004	200	100
Catkin VMP.4K	,,	4.0	1.0	—	1,000,000	2.9 to 0.004	250	100
MSP.4	HF. Pen.	4.0	1.0	—	1,000,000	4.0	200	100
MH.41	Triode	4.0	1.0	80	13,300	6.0	200	—
MH.4 / **Catkin MH.4**	,,	4.0	1.0	40	11,000	3.6	200	—

(INDIRECTLY HEATED CATHODE)

As Amplifier under Conditions of Max. Anode Volts and Max. Screen Volts.			Bias Resistance (Ohms).		Optimum Load (Ohms).			
Average Anode Current (m.a.)	Average Screen Current (m.a.)	Approximate Grid Bias Volts.	In Amplifier.	As Anode Bend Detector	As Grid Leak Detector & in Amplifier.	As Anode Bend Detector.	Type of Base.	Price.
2.4	0.3	−1.5	550	—	20,000	—	5 pin	17/6
3.4	1.2	−1.0	250	15,000	30,000	400,000	5 pin	17/6 17/6
10.0 0.14	2.1 negligible	−0.5 −30.0	50 *	—	30,000	—	5 pin	17/6 17/6
6.7 0.2	1.3 negligible	−0.5 −15.0	50 *	—	30,000	—	5 pin	17/6
5.5 0.1	1.6 negligible	−1.0 −30.0	150 *	—	25,000	—	5 or 7 pin†	17/6
8.0 0.2	4.0 negligible	−0.5 −30.0	150 *	—	25,000	—	7 pin†	17/6
3.0	1.0	−1.75	400	1,500	25,000	100,000	5 or 7 pin†	17/6
5.2	—	−1.5	400	20,000	30,000	100,000	5 pin	13/6
4.5	—	−3	600	30,000	50,000	100,000	5 pin	13/6 13/6

*See diagrams, pages 29, 35

† See pp. 24, 25.

OSRAM VALVES FOR A.C. MAINS SETS

Type.	Purpose.	Heater Volts.	Heater Current (Amps.)	Amplification Factor.	Impedance (Ohms.)	Mutual Conductance. m.a./v.
MHL.4	Triode	4.0	1.0	20	8,000	2.5
ML.4	,,	4.0	1.0	12	2,860	4.2
MPT.4	Output Pentode	4.0	1.0	—	33,000	3.0
Catkin MPT4	,, ,,	4.0	1.0	—	40,000	3.0
MHD.4	D-D-Triode	4.0	1.0	40	18,200	2.2

Type.	Purpose.	Filament Volts.	Filament Current (Amps.)	Max. Anode Volts.	Max. Screen Volts.	Max. Oscillator Anode Volts.	As frequency changer under conditions of Max Anode Volts, Screen Volts 80 and Max. Oscillator Anode Volts. Average Anode Current (m.a.)	Average Screen Current (m.a.)	Oscillator Anode Current (m.a.)	Grid Bias Volts
MX.40	Heptode Frequency Changer	4.0	1.0	250	100	150	2.75	1.0	2.1	—3
							0.003	2.2	3.2	—30

(INDIRECTLY HEATED CATHODE)

Max. Anode Volts.	Max. Screen Volts.	As Amplifier under conditions of Max. Anode Volts and Max. Screen Volts. Average Anode Current (m.a.)	Average Screen Current (m.a.)	Approximate Grid Bias Volts.	Bias Resistance (Ohms.)	Optimum Load (Ohms.)	Type of Base.	Price.
200	—	7.0	—	−6.0	850	20,000	5 pin	**13/6**
200	—	19—25	—	−10−8.5	350−500	7,000	5 pin	**14/-**
250	200	32.0	5.0	−11	300	8,000	5 or 7 pin†	**18/6**
250	250	32.0	6.0	−13	340	8,500	5 or 7 pin†	**18/6**
200	—	3.0	—	−3.0	1,000	30,000	7 pin †	**15/6**

Fixed Bias Resistance. Ohms.	Conversion Conductance Micromhos. (Approx.)		Type of Base.	Price.
500	At grid volts−3 At grid volts−30	500 2.5	7 pin †	**20/-**

† See pp. 24, 25.

OSRAM VALVES FOR POWER

Type.	Description.	Filament Volts.	Filament Current (Amps).	Amplification Factor.	Impedance under working conditions (Ohms.)	Mutual Conductance (m.a./v) (measured under working conditions).	Max. Anode Volts.
PX.4	Triode 12 watt	4.0	1.0	5	830	6.0	250
PX.25	,, 25 watt	4.0	2.0	9.5	1,265	7.5	400
PX.25A	,, 25 watt	4.0	2.0	4	580	6.9	400
DA.60	,, 60 watt	6.0	4.0	2.5	835	3.0	500
DA.100	,, 100 watt	6.0	2.7	5.5	1,410	3.9	1,000
PT.4	Pentode 8 watt	4.0	1.0	120	42,000	2.85	250
PT.25	,, 25 watt	4.0	2.0	100	25,000	4.0	400
PT.25H	,, 25 watt	4.0	2.0	180	28,000	6.5	400

AMPLIFICATION. (DIRECTLY HEATED)

Max. Screen Volts.	As Power Amplifier under conditions of Max. Anode Volts and Max. Screen Volts. Average Anode Current (m.a.)	Average Screen Current (m.a.)	Approximate Grid Bias Volts.	Bias Resistance (Ohms.) A.C. Filament Heating.	Max. Anode Dissipation (Watts).	Optimum Load (Ohms.).	Type of Base.	Price
—	48	—	−34	750	12	3,200	4 pin	**16/6**
—	62.5	—	−31	530	25	3,200	4 pin	**25/-**
—	62.5	—	−100	1600	25	4,800	4 pin	**25/-**
—	120	—	−135	1150	60	3,000	Special	**110/-**
—	100	—	−146	1490	100	6,700	Special	**210/-**
250	32 0	8.0	−16.0	420	8.0	7,500	5 pin	**18/6**
200	62.5	10.6	−22.0	330	25.0	6,000	5 pin	**45/-**
400	62.5	12.5	−16.0	250	25.0	5,000	5 pin	**45/-**

OSRAM VALVES FOR D.C. MAINS SETS

Type.	Purpose.	Heater Volts.	Heater Current (Amps.)	Amplification Factor.	Impedance (Ohms.)	Mutual Conductance m.a./v.	Max. Anode Volts.
D.S	Screen grid	16.0	0.25	550	500,000	1.1	200
D.SB	,,	16.0	0.25	1120	350,000	3.2	200
VD.S	Vari-mu Screen Grid	16.0	0.25	—	250,000	2.4 to 0.013	200
VD.SB	Vari-mu Screen Grid	16.0	0.25	—	250,000	3.0 to 0.001	200
DH	Triode	16.0	0.25	40	10,800	3.7	200
DHD	D-D-Triode	16.0	0.25	40	18,200	2.2	200
DL	LF Triode	16.0	0.25	12	2,660	4.5	200
DPT	Output Pentode ...	16.0	0.25	90	30,000	3.0	200

(INDIRECTLY HEATED CATHODE) 0.25 Ampere Types

Max. Screen Volts.	As Amplifier under Conditions of Max. Anode Volts and Max. Screen Volts.			Bias Resistance (Ohms.)		Optimum Load (Ohms.)		Type of Base.	Price.
	Average Anode Current (m.a.)	Average Screen Current (m.a.)	Approximate Grid Bias Volts.	In Amplifier.	As Anode Bend Detector.	In Amplifier.	As Anode Bend Detector.		
70	2.4	0.3	−1.5	600—800	—	20,000	—	5 pin	**17/6**
80	3.4	1.2	−1.0	220	10,000	20,000	400,000	5 pin	**17/6**
80	11.0	1.2	−0.5	50	—	25,000	—	5 pin	**17/6**
	0.1	negligible	−30						
80	5.5	0.6	−1.0	150	—	25,000	—	5 pin	**17/6**
	0.1	negligible	−25.0						
—	6.0	—	−3.0	500	10,000	30,000	100,000	5 pin	**13/6**
—	3.2	—	−3.2	1,000	—	30,000	—	7 pin†	**15/6**
—	25.0	—	−8.0	350	—	7,000	—	5 pin	**14/-**
200	40.0	6.5	−10.0	230	—	8,000	—	5 pin	**18/6**

† See pp. 42, 25.

OSRAM UNIVERSAL RANGE

Type.	Purpose.	Heater Volts.	Heater Current (Amps).	Amplification Factor.	Impedance (Ohms.)	Mutual Conductance m.a./v.	Max. Anode Volts.	Max. Screen Volts.
H.30	Triode	13.0	0.3	80	13,300	6.0	250	—
W.30	Vari-mu HF. Pen.	13.0	0.3	—	1,000,000	4.0 to 0.01*	250	250
DH.30	D-D-Triode	13.0	0.3	80	18,000	4.5	200	—
N.30	Output Pentode	13.0	0.3	—	30,000	3.9	250	250
U.30	Rectifier			See Table— OSRAM Rectifier Valves.				

* at Grid Volts −30

Type.	Purpose.	Filament Volts.	Filament Current (Amps.)	Max. Anode Volts.	Max. Screen Volts.	Recommended Oscillator Anode Volts.	As Frequency Changer under Conditions of Max. Anode Volts, Screen Volts 80 and Oscillator Anode Volts 150. Average Anode Current (m.a.)	Average Screen Current (m.a.)	Oscillator Anode Current (m.a.)	Grid Bias.
X.30	Heptode Frequency Changer	13.0	0.3	250	100	150	4.0 negligible	2.1 3.5	3.0 4.8	−3 −30

(INDIRECTLY HEATED CATHODE)

In Amplifier. H.T. Volts.	Average Anode Current (m.a.)	Average Screen Current (m.a.)	Approximate Grid Bias Volts.	Bias Resistance (Ohms.)	Optimum Load (Ohms).	Type of Base (see pages 24, 25).	Price.
250 180	5.5 4.0	— —	−1.7 −1.1	350	30,000	7 pin	**13/6**
250 180	12.3 8.0	6.0 3.0	−1.0 −1.0	100	High as possible	7 pin	**17/6**
200	3.8	—	−1.7	800	30,000	7 pin	**15/6**
250 180	32.0 30.0	8.0 6.0	−15 −8.0	375 220	7,500 4,500	7 pin	**18/6**
						7 pin	**15/-**

Bias Resistance (Ohms.)	Conversion Conductance Micromhos (approx.)		Type of Base (see pages 24, 25)	Price.
250	At grid volts −3 At grid volts −30	750 2	7 pin	**20/-**

OSRAM RECTIFY-

Type.	Description.	Type of Rectification.	Filament or Heater Volts.	Filament or Heater Current (amps.)
U.10	Directly Heated	Full wave	4.0	1.0
U.12	,, ...	Full wave	4.0	2.5
U.14	,, ...	Full wave	4.0	2.5
MU.12	Indirectly Heated	Full wave	4.0	2.5
MU.14	,, ...	Full wave	4.0	2.5
GU.1	Mercury vapour	Half wave	4.0	3.0
U.30	Indirectly Heated for Universal Range	Half wave	26.0	0.3
		Voltage doubler	26.0	0.3

ING VALVES

Max. Anode Volts R.M.S.	Max. D.C. Output Volts at Max. Current.	Max. D.C. Output Current (milliamps).	D.C. Output at Half Current (Volts.)	D.C. Output at Half Current (milliamps).	Type of Base.	Price.
250	260	60	300	30	4 pin	**12/6**
350	325	120	380	60	4 pin	**15/-**
500	540	120	620	60	4 pin	**20/-**
350	340	120	410	60	4 pin	**15/-**
500	540	120	600	60	4 pin	**20/-**
1,000	1,100	250	1,150	125	4 pin	**25/-**
180	136	120	175	75	7 pin†	**15/-**
110	152	75	198	45		
220	425	75	480	45		

† See pp. 24, 25.

OSRAM BARRETTERS (CURRENT REGULATORS)

A " Barretter " is a device which maintains the current passing through it substantially constant within certain limits, although fluctuating values of voltage be applied across the Barretter in series with the " load."

OSRAM Barretters are therefore designed for use with sets in which the valve heaters are wired in series and operate at a constant current. The Barretter may take the place of a wire resistance coil or mat, or electric lamp, and under correct conditions will cover a given range of supply voltages and cater for normal fluctuations in them, thus protecting the valves in circuit. For typical circuit see page 56.

OSRAM Barretter Type	Mean Current Rating (amps)	Voltage Range	Number of Valve heaters controlled in series	Type of Base	Price
251	0.25	100–180	4—5	4-pin	**12/6**
301	0.3	138–221	3—4	E.S. cap	**12/6**
302	0.3	112–195	5—6	E.S. cap	**12/6**
303	0.3	86–129	7—8	E.S. cap	**12/6**

TUNEON INDICATORS.

The Tuneon Indicator is a three-electrode neon-filled tube intended for use as a visual indication of the correct tuning point in an A.V.C. receiver.

On the passage of a small current (about 3 milliamperes) through the tube, a luminous glow spreads up the cathode (long electrode) and, if connected in a suitable circuit in conjunction with A.V.C. controlled variable mu valves, correct tuning is indicated by the maximum height of the glow. List Price, each **4/-**

OSRAM PILOT OR DIAL LAMPS.

		List Price, each.
For 2 volt Battery Receivers	3.5v .3 amp Coil Filament 12 m/m Round bulb (approximately .2 amp. on 2 volt)	**6d.**
For A.C. Receivers off 4 volt transformers	6.2v .3 amp. Coil Filament 15 m/m Round bulb (approximately .2 amp. on 4v.)	**9d.**

For " Universal " Receivers.

In series with .2 amp. valves 6.2v .3 amp. Coil Filament 15 m/m round bulb **9d.**

In series with .3 amp. valves 6.5v (S type) .3 amp. Coil filament 12 m/m round bulb ... ... **9d.**

Used under the above conditions an average life of 1000 hours will be obtained.

OSRAM FUSE BULBS.

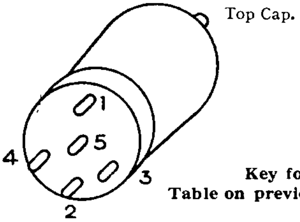
3.5v .15 amp. Coil Filament 12 m/m Round bulb ... ... **6d.**

TABLE OF PIN CONNECTIONS

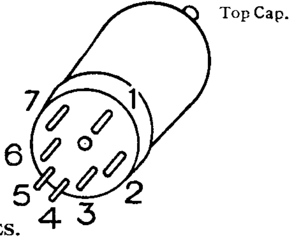
Type of Base.	Valve Type.	Pin Number. 1	2	3	4	5	6	7	Top Cap.
7 pin	**V.P.21** ...	M	G	GE	F	F	—	GS	A
	B.21	G_2	G_1	A_1	F	F	—	A_2	—
	Q.P.21 ...	G_2	G_1	A_1	F	F	GS	A_2	—
	X.21 Heptode	G_2	G_1	G_3 G_5	F	F	—	A	G_4
	V.M.P.4 ...	M	G	GE	H	H	C	GS	A
	M.S.P.4 ...	M	G	GE	H	H	C	GS	A
	M.H.D.4 ...	D	M	D	H	H	C	A	G
	M.P.T.4 ...	—	G	GS	H	H	C	A	—
	M.X.40 Heptode	G_2	G_1	G_3 G_5	H	H	C	A	G_4
	D.H.D. ...	D	M	D	H	H	C	A	G
	W.30 ...	M	G	GE	H	H	C	GS	A
	H.30	M	—	—	H	H	C	A	G
	D.H.30 ...	D	M	D	H	H	C	A	G
	N.30	—	G	GS	H	H	C	A	—
	X.30 Heptode	G_2	G_1	G_3 G_5	H	H	C	A	G_4
	U.30	—	A_1	C_1	H	H	C_2	A_2	—

5 pin	Valve Type.	1	2	3	4	5	Top Cap.
	H.D.22 ...	A	D nearest end of filament connected to No. 4	F M	F Diode Shield	D nearest end of filament connected to No. 3	G

STANDARD 5-PIN AND 7-PIN BASES



Key for
Table on previous page.



A Anode
G Control Grid
GS Screen Grid
GE Suppressor Grid
F Filament
H Heater
C Cathode
D Diode
M Metallising (where provided)

HEPTODES.

A Anode
G_1 Oscillator Grid
G_2 Oscillator Anode
G_3 Screen Grid
G_4 Detector Control Grid
G_5 Screen Grid (joined internally to G_3)
F Filament
H Heater
C Cathode

DEFINITIONS OF COMMON TECHNICAL TERMS

IMPEDANCE (sometimes called **A.C. RESISTANCE**)

This is a term to indicate the resistance offered to the flow of alternating current between cathode and anode. Its value is important in determining the correct external load resistance which couples the valve to the succeeding circuit. *Unit* — ohms.

AMPLIFICATION FACTOR, properly termed " Voltage Amplification Factor."

This figure indicates the ratio of the change in value of anode to grid voltage which requires to be applied to the valve in order to produce the same change in anode current. It shows the voltage step-up which occurs in the valve itself but does not necessarily represent the overall amplification per stage. Commonly termed ' m.'

MUTUAL CONDUCTANCE, sometimes called **" SLOPE "**

This is the ratio of a small change in anode current to a small change in grid volts producing it, all other voltages unchanged. Its value represents the efficiency which it is possible to obtain per stage with suitable external components. *Unit* — milliamps/volt.

CONVERSION CONDUCTANCE.

The term applied to superheterodyne frequency-changers which is the counterpart of mutual conductance in amplifying valves. Conversion conductance is the ratio of the Intermediate Frequency component of the anode current to the input grid voltage applied to the frequency changer. *Unit* — micromhos or microamps/volt.

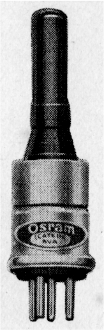
SECTION II

USING YOUR

Osram Valves

In the following pages will be found a number of typical circuits illustrating different classes of broadcast receiving valves used in modern sets. *The circuits shown are typical only and given merely to indicate the particular application of each valve. Wiring diagrams cannot be supplied but each circuit shown may be made the basis of practical broadcast receivers.*

THE OSRAM "CATKIN" VALVE



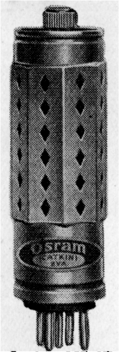
Catkin MH.4
(Unshielded).

The CATKIN Valve has established a world-wide reputation for strength, consistency, and freedom from service troubles—in a word: EXTRA RELIABILITY.

In all cases where small physical dimensions, coupled with robust performance and absence of valve "noise," are required, OSRAM "CATKIN" Valves are recommended.

In the OSRAM "CATKIN" Valve the glass "pinch" has been replaced by a clamped joint made of steel and mica. Wire bending and welding have been almost entirely eliminated.

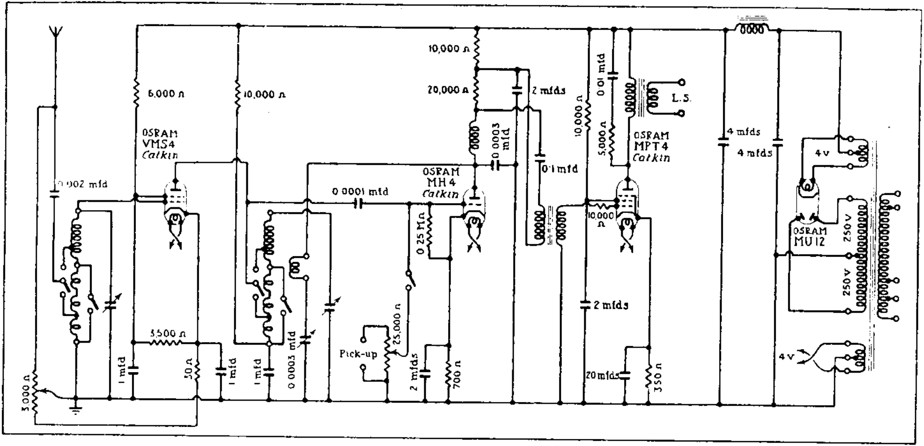
The range of CATKIN Valves is now extended by the introduction of a new and improved H.F. Screen Pentode, CATKIN V.M.P.4K.



Catkin MS.4B
(Shielded).

OSRAM "CATKIN" VALVES are available in types suitable for a large range of A.C. mains receivers.

"CATKIN" is the Trade Mark of the MO. Valve Co. Ltd., Manufacturers and Patentees.



Typical Circuit illustrating OSRAM (Catkin) Valves in an A.C. Mains Receiver.

OSRAM "K" SERIES 2-VOLT BATTERY VALVES

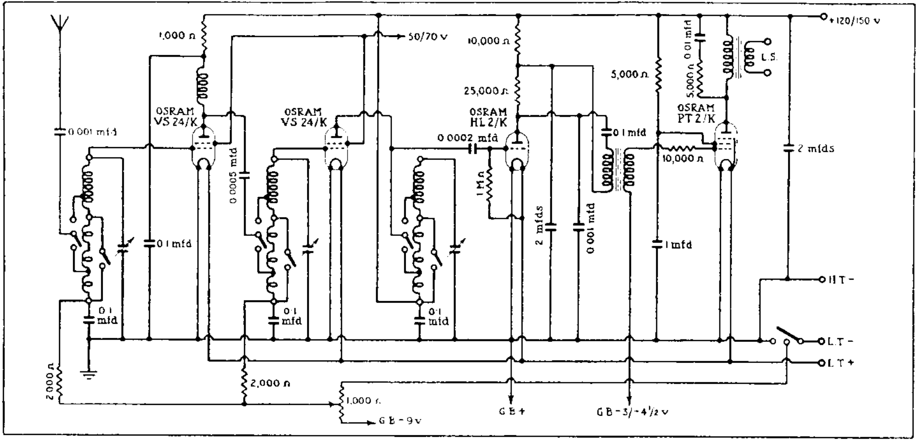
VS.24/K

In this range of 2-volt Battery Valves the essential features of the unique "CATKIN" patented construction are retained :

1. The electrodes are firmly held in a clamped joint made of stamped steel and mica pieces. This takes the place of a glass "pinch" and makes for smaller valve size and great strength.
2. A circular seal is employed for the lead-out wires. This ensures improved insulation and absence of "glass strain."
3. Bends and welds are avoided in the electrode system.
4. Each electrode is rigidly anchored to the whole system and to the valve envelope. This contributes to high uniformity and great rigidity, with entire absence of microphonics.

HL.2/K

OSRAM "K series" valves are available in types suitable for a large range of Battery (including portable) receivers.

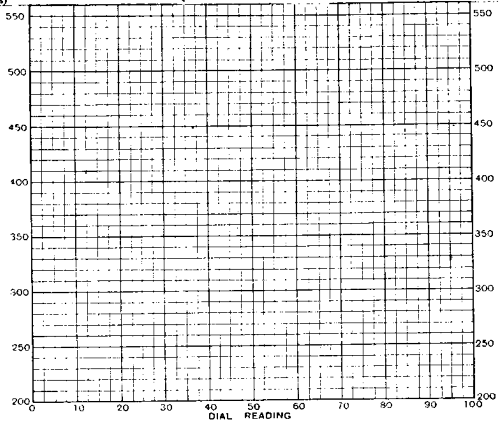


Typical Circuit illustrating OSRAM " K " Series Valves in a Battery Receiver.

STATION CHART

(Medium Waves)

GREAT BRITAIN & I.F.S.	WAVELENGTH (Metres)
ATHLONE (IFS)	531
NORTH REG.	449·1
MIDLAND REG.	391·1
SCOTTISH REG	373·1
LONDON REG.	342·1
WEST REG.	307·1
NORTH NAT.	296·2
SCOTTISH NAT.	285·7
BELFAST	267·4
LONDON NAT. / WEST NAT.	261·1
CORK	241·9
ABERDEEN	233·5
DUBLIN	222·6
NEWCASTLE	209·9
BOURNEMOUTH / PLYMOUTH	203·5



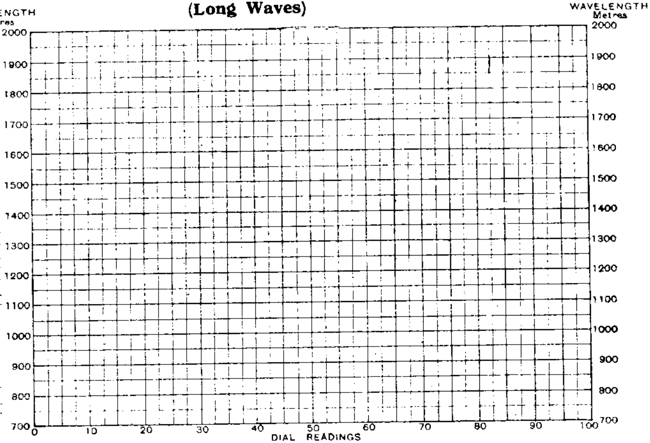
WAVELENGTH (Metres)	PRINCIPAL CONTINENTAL
549·5	BUDAPEST No. 1
539·6	BEROMUNSTER
522·6	MÜHLACKER
506·8	VIENNA
491·8	FLORENCE
483·9	BRUSSELS No. 1
476·9	LISBON
470·2	PRAGUE
455·9	LANGENBURG
443·1	SOTTENS
426·1	STOCKHOLM
420·8	ROME
415·8	KIEV
405·4	MUNICH
382·2	LEIPZIG
368·6	MILAN
360·6	MOSCOW
356·7	BERLIN
349·2	STRASBOURG
335·2	TOULOUSE
331·9	HAMBURG
315·8	BRESLAU
312·8	POSTE PARISIEN
301·5	HILVERSUM
291	HEILSBERG
283·3	BARI (ITALY)
271·7	MADRID
265·3	HORBY
257·1	MONTI CENERI
251	FRANKFURT
245·5	TRIESTE
238·5	SAN SEBASTIAN
224	MONTPELLIER
215·4	LYONS
206	FECAMP (NORMANDIE)

Station wavelengths subject to alteration.

STATION CHART

(Long Waves)

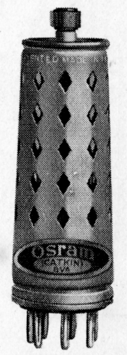
STATIONS	WAVELENGTH Metres
KAUNAS (Lith.)	1935
BRASOV (Rumania)	1875
HUIZEN (Holland)	1875
LAHTI (Finland)	1807
MOSCOW No. 1	1724
RADIO PARIS	1648
ISTAMBOUL	1621
KONIGSWUSTERHAUSEN	1571
DROITWICH (NAT.)	1500
MINSK (USSR)	1442
REYKJAVIK (Iceland)	1442
EIFFEL TOWER	1395
MOTALA (Sweden)	1389
WARSAW	1345
LUXEMBOURG	1304
KALUNDBORG (Denmark)	1261
LENINGRAD	1224
OSLO (Norway)	1181
MADONA (Latvia)	1132
MOSCOW No. 2.	1107
BUDAPEST No. 2.	833·4
BODEN (Sweden)	775·2
MOSCOW No. 3.	748



Station wavelengths subject to alteration.

THE H.F. PENTODE

For A.C. MAINS SETS.



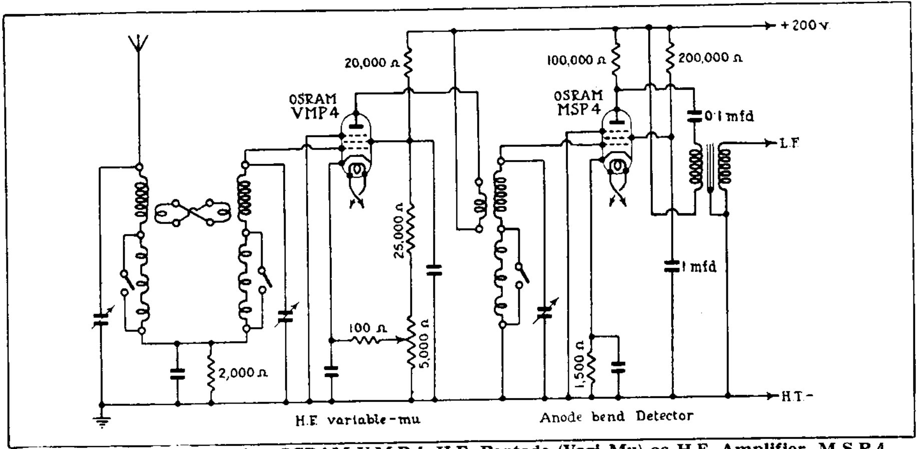
Catkin
VMP.4K

Valves to use—OSRAM V.M.P.4, CATKIN V.M.P.4K, M.S.P.4

The H.F. Pentode is a modification of the Screen Grid Tetrode Valve which gives the advantage of a greater voltage output without distortion providing suitable coupling coils are employed.

The OSRAM V.M.P.4 and CATKIN V.M.P.4K are H.F. Screen Pentodes with variable mu characteristics, being suitable for use in the High Frequency or Intermediate Frequency stages of a receiver where the amplification is controlled by grid bias (as in A.V.C. sets). The V.M.P.4K employs the CATKIN construction and has the advantage of a very small value of anode to grid interelectrode capacity.

The OSRAM M.S.P.4 is an H.F. Screen Pentode with " straight " characteristics. It is particularly applicable as the Detector Valve in any set where the moderately low capacity as compared with a triode—combined with the pentode characteristic makes both for great selectivity and sensitivity.



Typical Circuit illustrating OSRAM V.M.P.4, H.F. Pentode (Vari-Mu) as H.F. Amplifier, M.S.P.4, H.F. Pentode (Straight) as Detector.

THE H.F. PENTODE

FOR 2-VOLT BATTERY SETS.

Valve to use—OSRAM VP.21.

VP.21

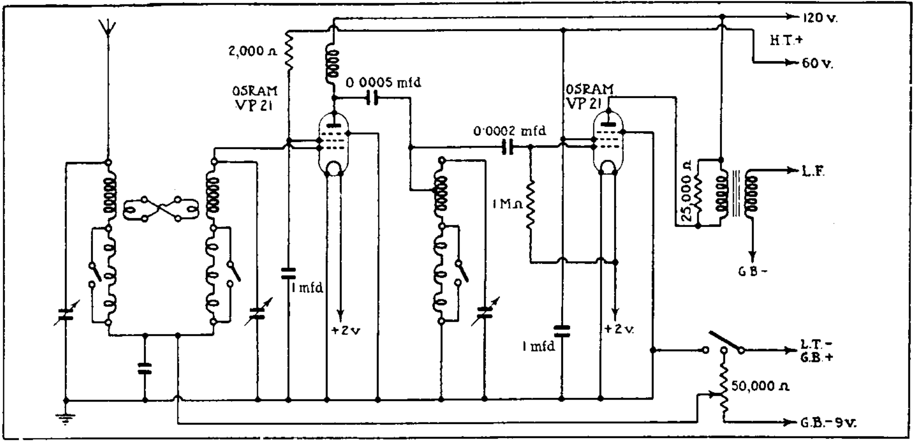
The principle of the H.F. Screen Pentode is particularly applicable to 2-volt battery valves where in general the H.T. voltage is limited.

One advantage of the H.F. Pentode compared with the tetrode screen grid is that, with suitable coupling coils, considerable voltage outputs can be obtained without distortion even though the applied H.T. voltage is moderately low.

The OSRAM V.P.21 gives this advantage and in addition incorporates a variable mu characteristic enabling distortionless volume control to be effected by means of variation of grid bias.

The interelectrode capacity of an H.F. Pentode is usually greater than that of a screen grid Tetrode, and to preserve stability a suitably tapped anode coil should be employed.

A circuit is shown indicating a typical application of the V.P.21 type in an H.F. amplifier with grid bias volume control.



Typical Circuit illustrating OSRAM V.P.21, H.F. Pentode as H.F. Amplifier and Detector.

THE HEPTODE FREQUENCY CHANGER

FOR A.C. MAINS SETS.

Valve to use—OSRAM MX.40.

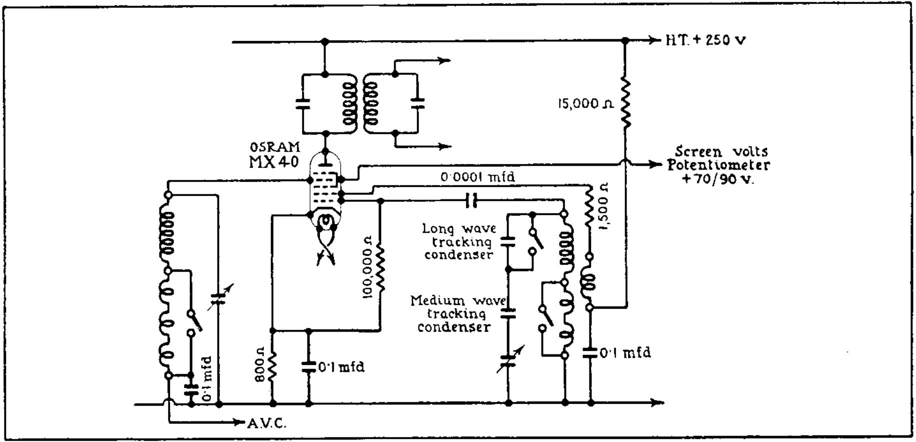

MX.40

The Variable Mu Heptode, of which the OSRAM MX.40 is an A.C. mains example, is primarily intended for use as an electron coupled frequency changer in superheterodyne circuits.

The valve contains five electrodes in addition to the normal cathode and anode, of which the innermost two provide the oscillator element and the outer three the detector element, incorporating a variable mu control grid and the necessary screens.

With suitable coils the valve is simple to employ and has the advantages—among others—over other forms of frequency changer of less " frequency pulling," simpler components, and absence of oscillator feed-back to the aerial.

A typical circuit diagram is given on page 39 showing type MX.40 operating as a bias controlled Frequency Changer.



Typical Circuit illustrating connections for use with OSRAM M.X.40, A.C. Mains Heptode, as Frequency Changer.

THE HEPTODE FREQUENCY CHANGER

FOR 2-VOLT BATTERY SETS.

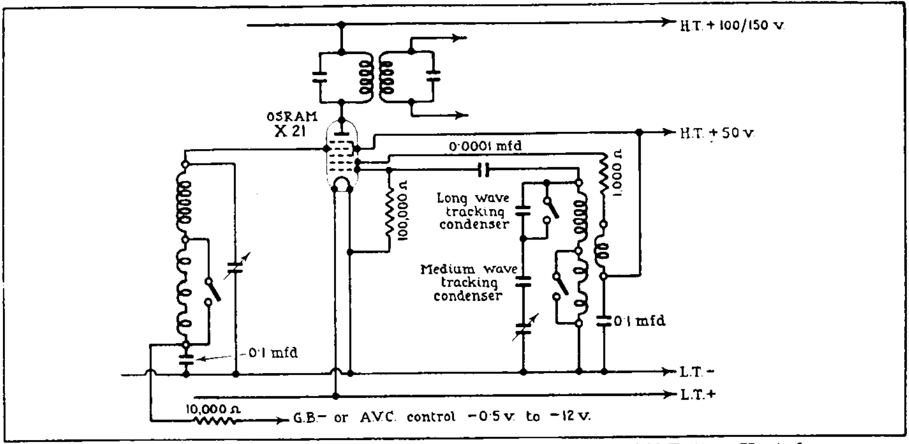
Valve to use—OSRAM X.21.

X.21

The use of a Heptode frequency changer for Superheterodynes is of particular advantage in 2-volt battery receivers for the following reasons :—

1. No coupling coils required in filament lead, "electron coupling" being the principle employed.
2. Reduced interaction between signal and oscillator circuits.
3. Increase in stability of oscillator frequency.
4. Negligible feed-back of oscillator volts to the aerial circuits.

The OSRAM X.21 is specially designed to be extremely economical in H.T. and L.T. current consumption, and under working conditions consumes only 1.7 milliamps from the H.T. battery while at the same time providing adequate conversion conductance.



Typical Circuit illustrating connections for use with OSRAM X.21 Battery Heptode as Frequency Changer.

THE DOUBLE DIODE TRIODE

FOR A.C. MAINS SETS.

Valve to use—OSRAM M.H.D.4

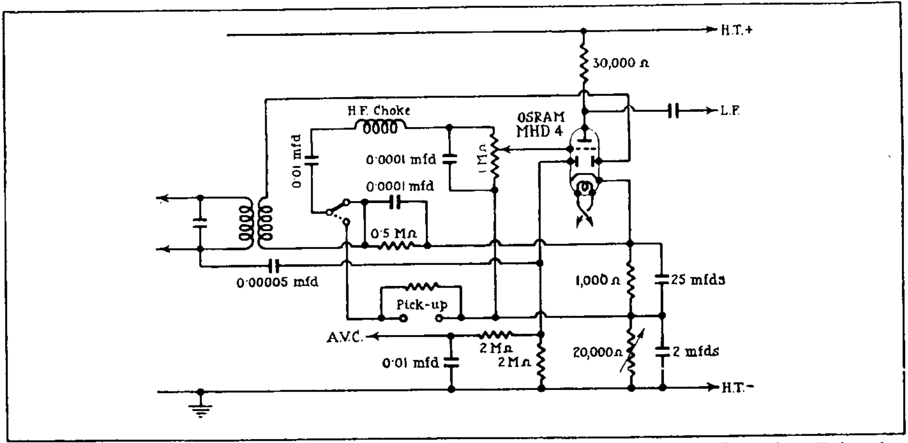
MHD.4

Diode detection can often be employed as a means of improving quality of reception. The double diode triode provides diode detection, triode amplification, and, if desired, Automatic Volume Control.

The valve includes a double diode rectifying system allowing for the use of either half wave or full wave diode detection, or delayed action Automatic Volume Control. The triode section is carefully shielded from the diode and is suitable either for use as an L.F. amplifier or in conjunction with the diodes for Amplified A.V.C.

Great care has been applied to the design of type M.H.D.4 in order that full benefits of A.V.C. may be obtained with complete absence of distortion in the triode element.

A typical circuit is given on page 43 showing type M.H.D.4 as a Detector for Delayed Automatic Volume Control.



Typical Circuit illustrating OSRAM M.H.D.4, A.C. Double Diode-Triode for Detection, Delayed A.V.C. and L.F. Amplification.

THE DOUBLE DIODE TRIODE

FOR 2-VOLT BATTERY SETS.

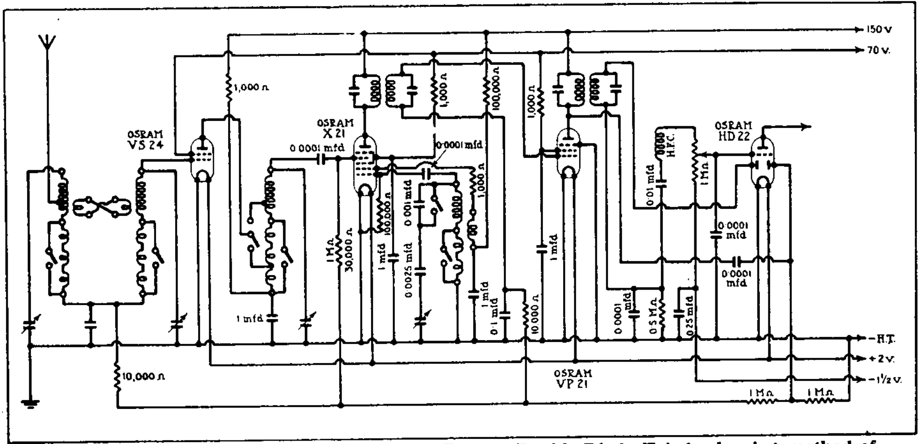
Valve to use—OSRAM H.D.22

HD.22

The OSRAM 2-volt Battery double diode triode type H.D.22 consists of two entirely separate electrode systems within the one bulb, thus permitting the diode section to be perfectly screened from the triode. An additional advantage is that the electron emission from the complete filament system of one half of the multiple valve is available for the triode, thus maintaining high characteristic efficiency.

Type H.D.22 can be coupled to an output valve of the P.T.2 or Q.P.21 type through a suitable step-up transformer, or to a driver valve of the L.21 or L.P.2 type which, in its turn, precedes a Class " B " output stage.

A typical circuit shows type H.D.22 operating in a superheterodyne circuit, the diodes of the H.D.22 being arranged to provide detection and Delayed A.V.C.



Typical Circuit illustrating OSRAM H.D.22 Battery Double Diode-Triode showing method of obtaining A.V.C. on Controlled Valves.

CLASS "B" AMPLIFICATION (Positive Grid Drive)

FOR 2-VOLT BATTERY SETS.

Valves to use—OSRAM B.21 (Driver Valves L.21 or L.P.2)

In Class "B" circuits the H.T. current is proportional to the signal so that when the set is working quietly, or when no signal is applied, the current consumption is negligible.

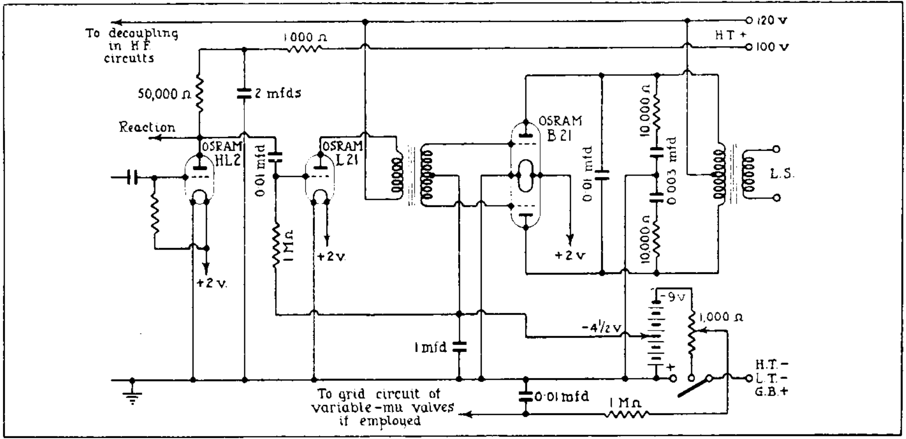
L.21

The OSRAM B.21 is a Positive Grid drive Class "B" double triode valve of the low impedance type, that is it requires a small negative grid bias. This form is very desirable for good quality reproduction, and simplifies transformer design.

The B.21 type is constructed with dual wound grid which increases the power output-to-input efficiency.

All positive grid drive Class "B" Valves require a driver stage and for the B.21 suitable driver valves are types L.21 or L.P.2. For all general purposes type L.21 is recommended—for maximum power output, type L.P.2 is required as driver.

B.21



Typical Circuit illustrating OSRAM B.21 Class "B" (Positive Grid Drive) Output, with L.21 Driver Stage and HL2 as Detector.

CLASS "B" AMPLIFICATION

Q.P.P. METHOD.

Valve to use—OSRAM Q.P.21

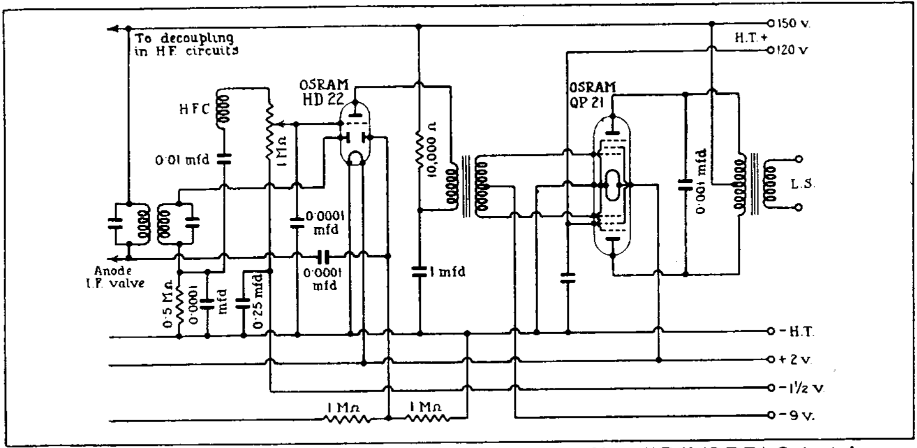
QP.21

An alternative method of obtaining considerable power output with low H.T. current consumption—it avoids driving the valve into positive grid current—is often termed " Quiescent Push-Pull." (Q.P.P.)

The OSRAM Q.P.21 is a Double Pentode designed to operate with sufficient grid bias to restrict the standing H.T. current to a very low figure. The actual H.T. current drawn from the battery is proportional to the strength of signal applied.

An advantage of the system using type Q.P.21 is that the necessity for a driver stage is avoided as the valve can operate from the detector through a suitable step-up transformer.

In order to obtain comparable power output to positive grid drive Class " B " a somewhat higher H.T. voltage is essential, and an H.T. Battery of 150 volts is recommended.



Typical Circuit illustrating OSRAM Q.P.21 Double Pentode Class "B" (Q.P.P.) Output, in conjunction with Double Diode-Triode Detector Stage.

OSRAM VALVES FOR HIGH QUALITY POWER OUTPUT

High quality electrical sound reproduction demands a good Loudspeaker, together with careful choice of working conditions and valves.

PX.4

Distortion-free power input to the loudspeaker depends on

1. Choice of output valve.
2. Correct values for associated circuit and components.
3. Adequate H.T. voltage and current.

The choice and operation of the output Power valve involves consideration of the following points :—

Triode or Pentode.

Both triode and pentode output valves are available in the OSRAM range, the Pentode being useful for higher sensitivity, but the Triode requiring fewer precautions to avoid distortion.

Correct Load Impedance.

Correct "matching" of Loudspeaker to Output valve is essential to realise the full undistorted power of the valve. An output Transformer of suitable ratio may be employed to do this.

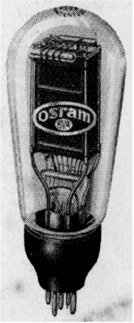
$$\text{Ratio of transformer} = \sqrt{\frac{\text{Optimum load impedance of valve.}}{\text{Working impedance of speaker.}}}$$

" Anode dissipation" of valve.

This term denotes the power used up in heat at the anode, and for good valve life should not exceed the rated value.

The correct working conditions are when the negative grid bias is so adjusted for each individual valve that the anode current in milliamperes corresponds with the ratio :—

$$I_A \text{ (m.a.)} = \frac{\text{Max permissible dissipation (watts)} \times 1000.}{\text{Anode volts.}}$$



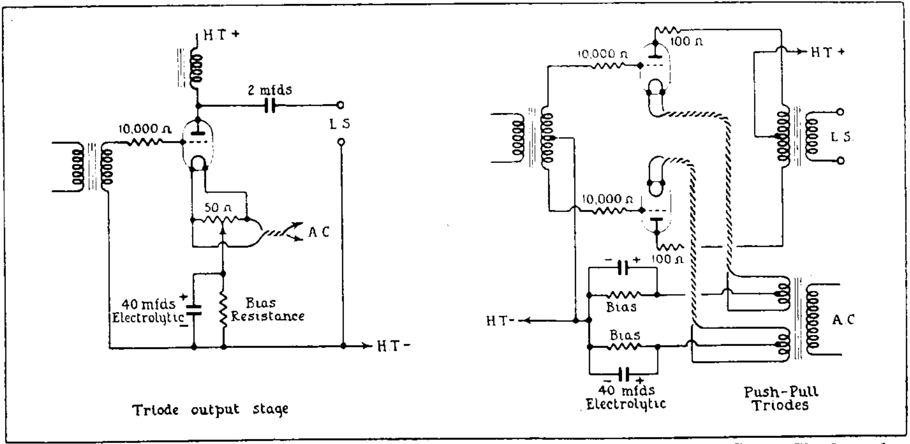
PT.25H

Harmonic distortion and Power Output.

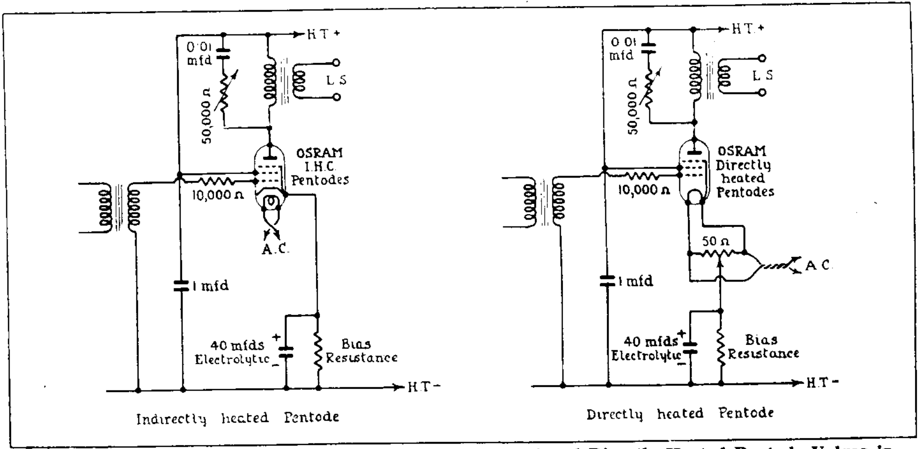
A certain percentage of distortion is in practice unavoidable and the amount permissible varies with the type of valve and loud-speaker used. With all Pentode valves a filter circuit is recommended to avoid an excessively high pitched reproduction and with both Triodes and Pentodes, the same care in choice of *correct load impedance is important.*

Again, the actual A.C. **power output** available to the loud-speaker is dependent on the percentage of distortion permissible.

This may be allowed to vary to a considerable extent for different conditions, and no hard and fast figure can in general use-fully be quoted.



Typical Circuits illustrating the use of Directly Heated Triode Valves in Output Stage, Single and Push-Pull arrangements with Automatic Bias.



Typical Circuits illustrating the use of Indirectly Heated and Directly Heated Pentode Valves in Output Stage, with Automatic Bias.

OSRAM VALVES UNIVERSAL RANGE

FOR A.C. MAINS SETS, D.C. MAINS SETS, COMBINED A.C.—D.C. SETS, and CAR RADIO.

H.30

The OSRAM Universal Range comprises a series of Indirectly Heated Valves with heater voltage and current selected for use in any of the following types of set :

1. With heaters wired in parallel (13 volt) for A.C. mains receivers.
2. With heaters wired in series (0.3 amp.) for D.C. mains receivers.
3. With heaters wired in series (0.3 amps.) for combined A.C.—D.C. receivers.
4. With heaters wired in parallel (13 volt) for motor car radio.

Application to Series running for A.C.—D.C. sets and D.C. sets.

A typical circuit is shown on page 56 indicating the recommended method of heater wiring in conjunction with a " Barretter " or series resistance. Suitable types of Barretter described on page 22.

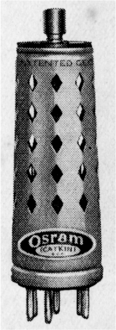
In this case the Rectifier type U.30 is used for half wave rectification on A.C. mains supply, and on D.C. mains is inoperative. In a Universal A.C.—D.C. receiver, the use of a step-up mains transformer is precluded, but OSRAM Universal valves are so designed that excellent results are obtained down to 180 volts H.T., which caters for the 200 volt mains condition.

Application to Parallel running for Car Radio and A.C. mains sets.

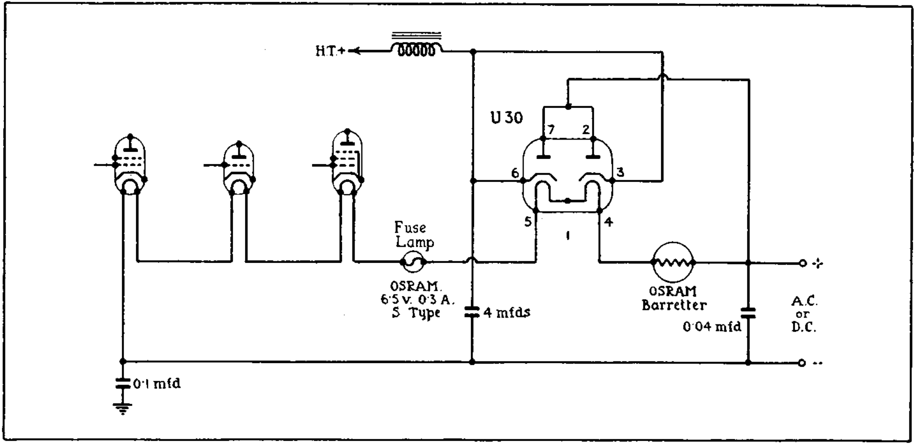
A typical circuit is shown on page 57 indicating a method of heater wiring for a Car Radio receiver, or with the inclusion of a Rectifier unit, for A.C. mains supply.

In these cases the heaters are wired in parallel.

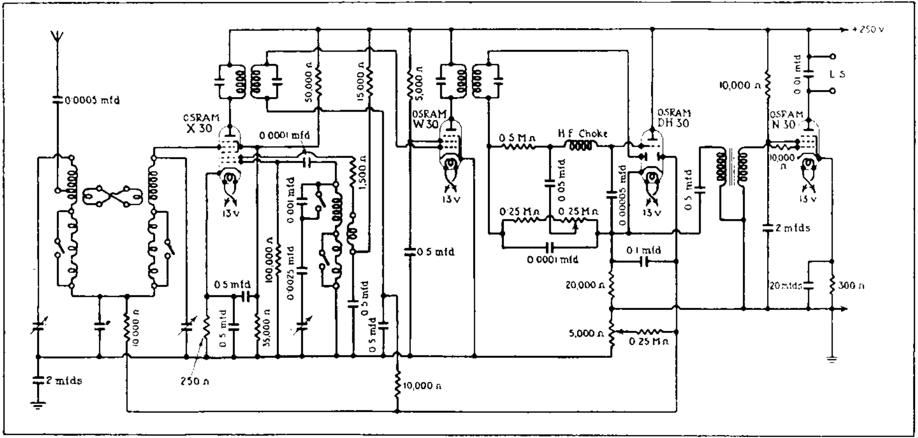
In such receivers adequate power output is obtainable from the pentode type N.30, but for more ambitious A.C. sets, a Directly heated Power valve such as the OSRAM PX.25, etc., could be employed, with a separate filament transformer winding in conjunction with a Rectifier of the OSRAM U.14 or MU14 type.



W.30



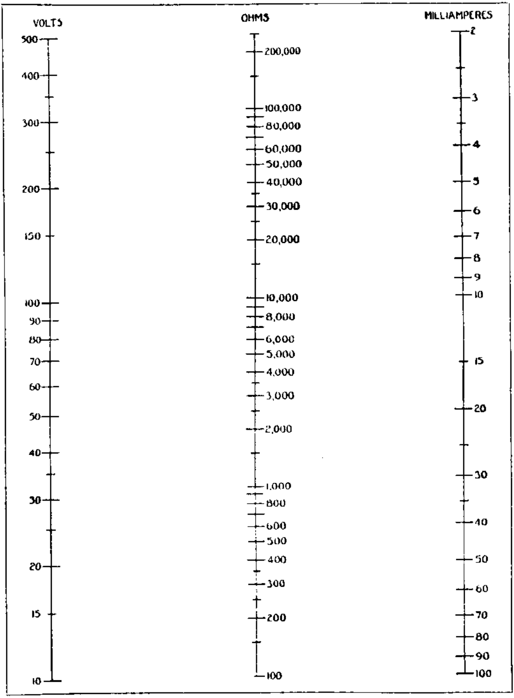
Typical Circuit illustrating the use of OSRAM Universal Range with Heaters wired in Series (0.3 amp.) for use in Combined AC-DC Receiver.



Typical Circuit illustrating the use of OSRAM Universal Range with Heaters wired in parallel (13 Volt) for a Car Radio Receiver or A.C. Mains Set.

OHMS LAW

Given two of the factors of volts, ohms, or milliamperes, the third may be found by placing a straight rule across the scales cutting the two given values.



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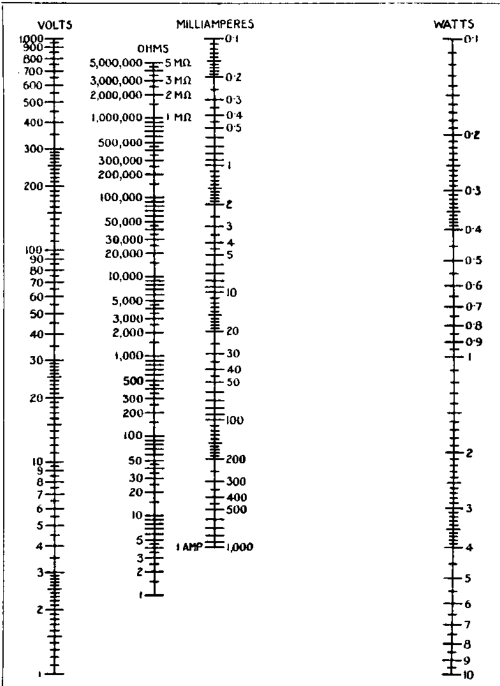
WATTS DISSIPATED

Given two of the factors of volts, ohms, milliamperes, or watts, the remaining two may be found by placing a straight rule across the scales cutting the two given values.



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OSRAM VALVES
COMPARATIVE TABLE OF VALVE TYPES

Osram	Cossor	Ferranti	Mazda	Micro-mesh	Mullard
VP.21	210.VPT	—	VP.215	—	VP.2
S.24	220.SG	—	S.215B	5.B1	PM.12A
S.23	215.SG	—	S.215A	—	PM.12
VS.24	220.VS	VS.2	S.215VM	—	PM.12M
X.21	—	VHT.2	—	—	—
H.2	210.H	—	H.2	—	PM.1A
H.210	210.RC	—	H.210	—	PM.1A
HL.2	210.HF	—	HL.2	HLB.1	PM.1HL
HL.210	210.HL	—	HL.210	HLB.1	PM.1HL
HD.22	—	H.2D	HL.21DD	—	T.DD2
L.210	210.LF	—	L.210	—	PM.1LF
L.21	215.P	—	L.2	—	PM.2DX
LP.2	220.PA	—	P.220	P.B.1	PM.2A
P.215	215.P	L.2	P.215	—	PM.2
P.2	220.P	—	P.220A	—	PM.202
PT.2	220.PT	—	PEN.220	PEN.B1	PM.22A
DG.2	210.DG	—	—	—	PM.1DG
B.21	—	—	PD.220A	—	PM.2BA
QP.21	—	—	QP.240	—	—
VMP.4	MVS/PEN	VPT.4	AC/VP.1	9.A1	VP.4
MSP.4	MS/PEN	SPT.4	—	8.A1	SP.4
MS.4B	41.MSG	—	AC/SG	SGA.1	S.4VB
MS.4	MSG/LA	—	AC/SG	—	S.4V

(In many cases characteristics are not exactly equivalent. Types shewn have approximately similar characteristics.)

Osram	Cossor	Ferranti	Mazda	Micro-mesh	Mullard
VMS.4	MV.SG	—	AC/SG.VM	—	VM.4V
VMS.4B	—	—	AC/2SVM	VSG A1	—
MX.40	41.MPG	VHT.4	—	15.A2	—
MHD.4	DDT.	H.4D	AC/HL.DD	11.A1	TDD.4
MH.41	41.MH	—	AC.2HL	HL.A1	904.V
MH.4	41.MHF	—	AC/HL	—	354.V
MHL.4	41.MLF	—	—	—	164 V
ML.4	41.MP	—	AC/P	PA.1	104 V
MPT.4	MP/PEN	—	AC/PEN	7.A2	PEN4VA
PT.4	PT.41	—	—	—	PM.24M
PX.4	4.XP	LP.4	PP.3/250	—	AC.044
PT.16	—	—	—	—	—
PX.25	—	—	PP.5/400	—	DO.24
PX.25A	—	—	—	—	DO.26
PT.25	—	—	—	—	PM.24D
PT.25H	—	—	—	—	PM.24D
DA.60	—	—	—	—	DO.60
DA.100	—	—	—	—	—
U.10	506.BU	—	UU.60/250	R.1	DW.2
U.12	442.BU	R4.A	UU120/350	R.2	DW.3
U.14	460.BU	—	UU120/500	R.3	DW.4
MU.12	—	—	—	—	IW.3
MU.14	—	—	—	—	IW.4

(In many cases characteristics are not exactly equivalent. Types shewn have approximately similar characteristics.)

OSRAM VALVES—PRICE LIST

Group.	Type.	Price.	See Page
2-volt Battery	S.23	12/6*	4
	S.24	12/6*	4
	V.S.24	12/6*	4
	V.S.24/K ...	12/6*	4
	V.P.21	13/6M	4
	H.L.2	5/6*	4
	H.L.2/K ...	5/6*	4
	H.D.22	9/-*	4
	L.21	5/6	4
	L.P.2	7/-	4
	P.2	12/-	4
	P.T.2	13/6	4
	P.T.2/K ...	13/6	4
	B.21	14/-	6
	Q.P.21	22/6	6
	X.21	18/6	6
2-volt Battery (replacement types)	H.2	5/6*	9
	H.210	5/6*	8
	H.L.210 ...	5/6*	8
	L.210	5/6	9
	P.215	7/-	8
	D G.2	20/-	8
	S.21	12/6*	9
	S.22	15/6*	9
	V.S.2	12/6*	8
A.C. Mains Receiving Power Triodes and Power Pentodes	M.S.4.B ...	17/6*	10
	M.S.4.B.CATKIN	17/6*	10
	V.M.S.4 ...	17/6*	10
	V.M.S.4 CATKIN	17/6*	10
	V.M.S.4.B ...	17/6*	10
	V.M.P.4 ...	17/6M	10
	V.M.P.4 K CATKIN	17/6M	10
	M.S.P.4 ...	17/6M	10
	M.H.4	13/6*	10
	M.H.4 CATKIN ...	13/6*	10
	M.H.41	13/6*	10
	M.H.D.4 ...	15/6*	12

A.C. Mains Types (*continued*)	M.L.4	**14/-**	12
	M.P.T.4... ...	**18/6**	12
	M.P.T.4 CATKIN	**18/6**	12
	M.X.40	**20/-**	12
	P.X.4	**16/6**	14
	P.X.25	**25/-**	14
	P.X.25A ...	**25/-**	14
	P.T.25	**45/-**	14
	P.T.25.H ...	**45/-**	14
	D.A.60 ...	**110/-**	14
	D.A.100... ...	**210/-**	14
(Replacement types)	M.S.4	**17/6***	10
	M.H.L.4 ...	**13/6***	12
	P.T.4	**18/6**	14
D.C. Mains O.25 amp.	D.S.	**17/6***	16
	D.S.B.	**17/6***	16
	V.D.S.	**17/6***	16
	V.D.S.B. ...	**17/6***	16
	D.H.	**13/6***	16
	D.H.D.	**15/6***	16
	D.L.	**14/-**	16
	D.P.T.	**18/6**	16
Universal Range 0.3 amp.	W.30 CATKIN ...	**17/6M**	18
	H.30	**13/6***	18
	D.H.30	**15/6***	18
	N.30 CATKIN ...	**18/6**	18
	X.30	**20/-**	18
Rectifiers	U.10	**12/6**	20
	U.12	**15/-**	20
	U.14	**20/-**	20
	M.U.12	**15/-**	20
	M.U.14	**20/-**	20
	U.30	**15/-**	20
	G.U.1	**25/-**	20
Current Regulators	Barretter 251 ...	**12/6**	22
	,, 301 ...	**12/6**	22
	,, 302 ...	**12/6**	22
	,, 303 ...	**12/6**	22
Gasfilled Relay	G.T.1	**40/-**	—

M Metallised bulbs only. *Metallised or plain.
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G.E.C. RADIO

The General Electric Co. Ltd. offers in the 1934/5 season's programme an extensive range of beautifully constructed and fully guaranteed quality receivers, providing a practical demonstration of the amazing efficiency obtainable by close liaison between the valve designer and the radio manufacturer. Each model incorporates a circuit specially chosen to take the fullest advantage of the most modern valve developments, and OSRAM Valves, of course, are used throughout.

Here are brief descriptions of a few of these interesting models :

G.E.C. "A.C./D.C. Mains 3"	A " Universal " Mains Set in bakelite cabinet, with built-in moving coil speaker.	1–H.30, 1–N.30 1–U.30 OSRAM Valves	**£7 15 0 Complete**
G.E.C. Radiogram Superhet A.V.C.5	A side-by-side floor model with induction gramophone motor, 5-valve A.V.C. Superhet chassis and moving coil speaker, for A.C.	1–X,30, 1–W. 30 1–D.H.30, 1–N.30 1–MU.14 OSRAM Valves	**22 Gns. Complete**
G.E.C. " Battery C.B.4"	A self-contained battery receiver, with built-in moving coil speaker, " Gecalloy " iron-core coils and Class " B " output.	1–VS.24, 1–VP.21 1—L.21, 1—B.21 OSRAM Valves	**£9 17 6 Complete with Batteries**

A folder describing the complete range of G.E.C. Radio for 1934/5 will be gladly forwarded on request.

Osram Valves

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A TONIC TO ANY SET

Manufacturers, Wholesale Only.

THE GENERAL ELECTRIC CO., LTD.,

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Telegrams: "Electricity, Westcent, London."
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