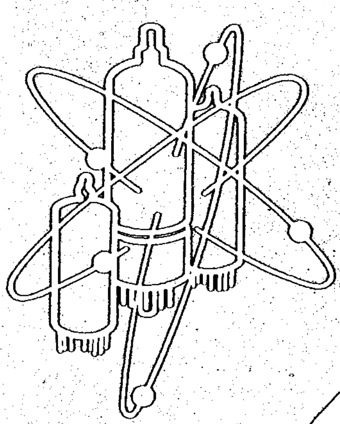
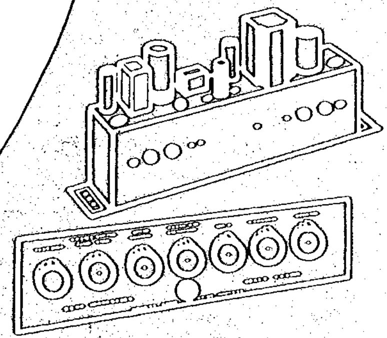
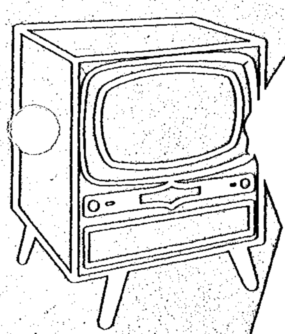
VOL. 23 NO. 2 FEBRUARY 1958 ONE SHILLING



ELECTRONIC VALVES

AUDIO





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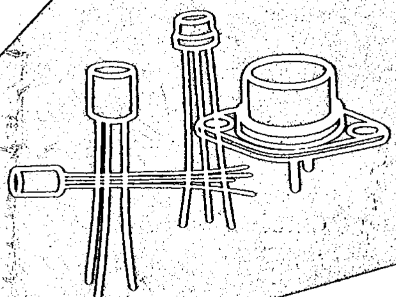
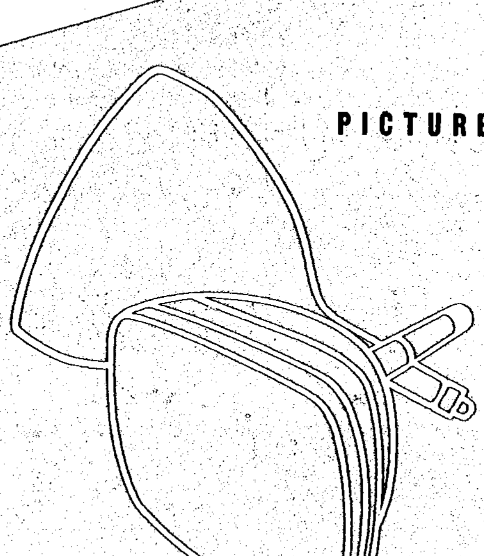
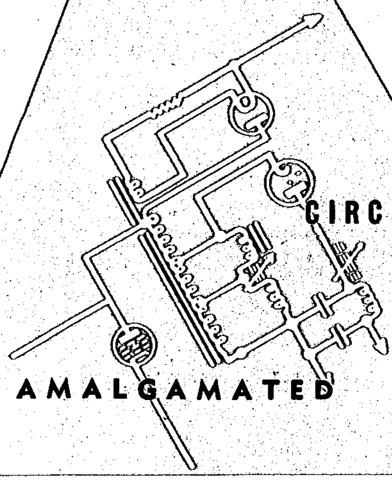


TRANSISTORS

RADIOTRONICS

PICTURE TUBES

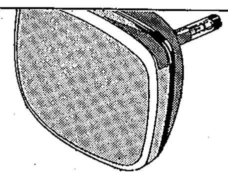


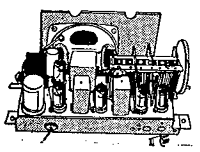


CIRCUITRY

AMALGAMATED WIRELESS VALVE COMPANY PTY. LTD.

IN THIS ISSUE





Radiotronics is published twelve times a year by The Wireless Press for Amalgamated Wireless Valve Company Pty. Ltd. The annual subscription rate in Australasia is 10/-; in U.S.A. and dollar countries $1.50, and in all other countries 12/6. Price of a single copy is 1/-.

Subscribers should promptly notify Amalgamated Wireless Valve Company Pty. Ltd., 47 York Street, Sydney, and also the local Post Office of any change in address, allowing one month for the change to become effective.

R.C.A. Application
Note AN-162*

NECK SHADOW PROBLEMS IN PICTURE TUBES

This Note discusses circuit and component design considerations necessary to avoid neck-shadow difficulty in picture tubes. Such difficulty, revealed by the presence of dark areas or "shadows" at corners or edges of a picture tube screen during scanning, indicates that the beam is not reaching these areas but is, instead, striking the picture tube neck. This condition, known as "Neck Shadow" or "BSN" ("Beam Strikes Neck"), usually manifests itself during initial adjustment of the deflection and picture-centring circuits.

Under normal circumstances, neck shadow is merely an indication that deflecting or picture-centring components are not properly positioned on the picture tube neck, or that circuits associated with these components are out of adjustment. In some cases, however, neck shadow cannot be "adjusted out" or can be eliminated only by sacrifice of picture linearity. In such cases, the difficulty is usually the result of improper design in the deflection or picture-centring circuits and can be corrected only by a design change.

PICTURE-CENTRING CONSIDERATIONS

Since neck shadow is directly associated with improper picture-centring, it is desirable to review briefly the picture-centring mechanisms employed.

The figure shows a section through the neck and funnel of a magnetic-deflection, electrostatic focus picture-tube, including the external deflecting and beam-controlling components normally used. If the yoke and the ion-trap magnet are correctly positioned on the picture tube neck, and if no extraneous fields are present, the beam emerges from the gun at the centre of the aperture coincident with the picture tube axis. In the absence of scanning, the beam continues along the tube axis and strikes the centre of the viewing screen.

With linear scanning, the raster will be symmetrical and will also be centred in the picture tube screen. The picture, however, will not be centred because unequal areas at the edges of the raster will be darkened by the blanking components of the video signal. Consequently, in order to obtain a full-size centred picture it is necessary to overscan the screen and to de-centre the raster. Under ideal conditions, the amount of overscanning required is 17.5% horizontally and 7.5% vertically. Under practical conditions, however, somewhat greater ranges are usually necessary to permit compensation for deviations in raster position or picture phasing caused by normal differences in tubes, components, and circuit voltages.

In order to maintain good deflection symmetry, picture centring (raster decentring) should be accomplished after scanning, and preferably at a point as close as possible to the screen. It is impractical, however, to install a centring device between the yoke and the screen. Consequently, centring is usually accomplished either by the use of d.c. bias currents in the yoke windings (electrical centring), or by the use of adjustable permanent magnets between the focusing field and the yoke.

Electrical centring permits very precise picture positioning, and can easily be given sufficient range to compensate for larger deviations in raster position. This method, however, requires the use of additional circuit components and controls. It also increases the dissipation requirements of the yoke as well as the power consumption of the equipment. Consequently, it has largely been supplanted in television receiver design by non-electrical centring devices. For electrostatic-focus picture tubes, they are usually small adjustable magnets installed on the picture tube neck. Under normal conditions these devices make it possible to obtain a full-size picture free from shadow centred in the viewing screen.

SPECIFIC DIFFICULTIES

When neck shadow cannot be eliminated with the aid of the centring devices described above or of the other adjustments provided in the equipment, the following possibilities should be considered.

(1). **Improper yoke for the picture tube type used.** If the yoke selected is longer than the one recommended by the picture tube manufacturer, the radius of curvature of deflection will be greater than the optimum, and the beam may strike the neck before reaching the corners of the screen.

* Printed with acknowledgment to RCA.

A yoke having an improper funnel contour may also make it difficult or even impossible to obtain a full-sized, centred picture free from neck shadow, since such a yoke cannot be properly seated on the picture tube neck. The yoke contour must exactly match the funnel contour of the particular picture tube for which it is designed and care must be exercised in handling and positioning the yoke to assure that its contour is not distorted.

(2) **Improper mechanical arrangements for positioning the yoke on the picture tube neck.** Yoke positioning arrangements should permit the yoke to be seated firmly against the picture tube neck funnel, and to be rotated about its axis approximately 15° in either direction when in this seated position. These arrangements must also be so designed that positioning operations will not result in deformation of the yoke contour or in excessive pressure on any part of the picture tube.

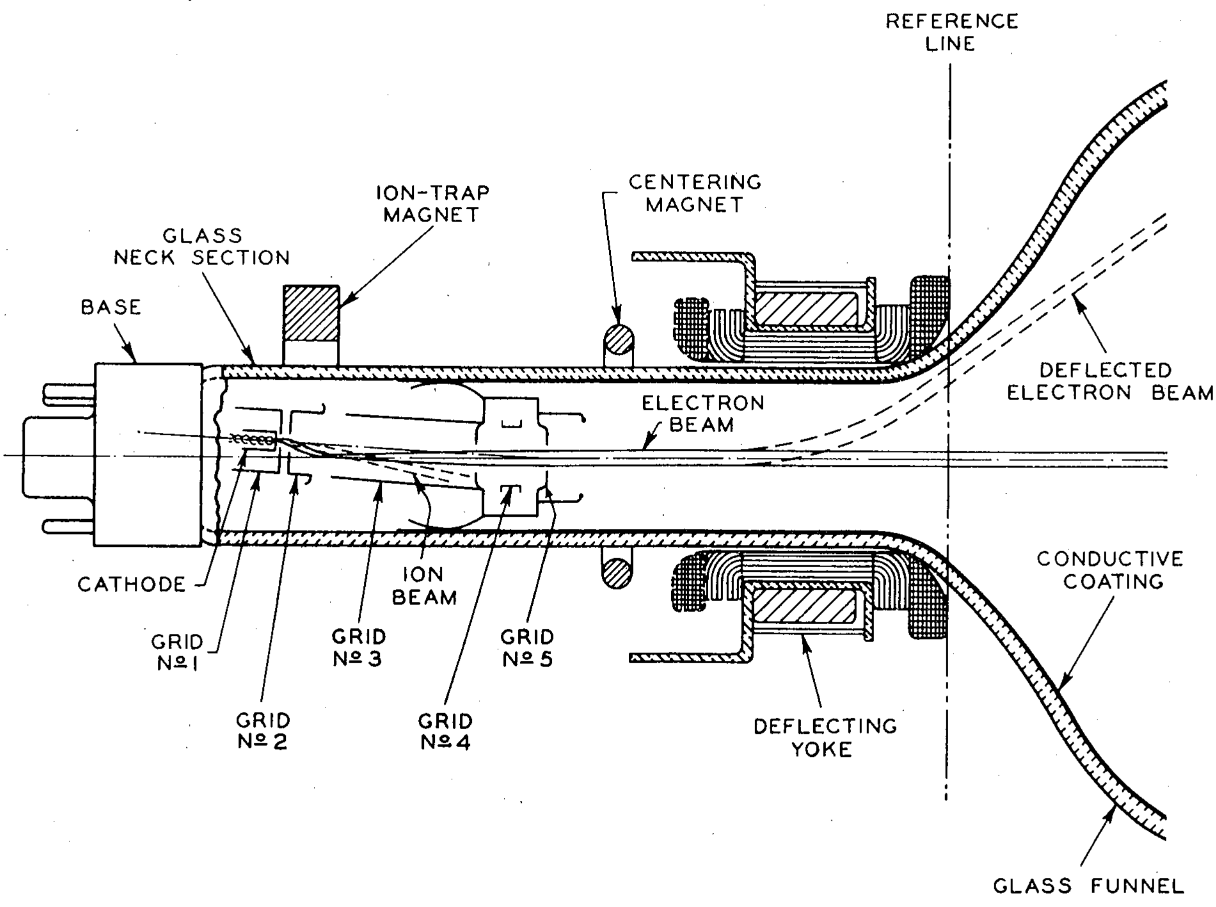
(3) **The use of an ion-trap magnet of improper strength for the conditions under which the picture tube is operated.** The point in the gun aperture at which the beam emerges and the direction of the beam at this point are determined by the design of the internal ion-trap lens, the ultor voltage, and the effective strength of the external ion-trap magnet in the lens area. The proper position for the ion-trap magnet has already been discussed. The field strength B required for this magnet is determined by the ultor voltage, E_u, and is given by the expression

$$B = 33 \sqrt{E_u/16},$$

where B is in oersteds and E_u, is in kilovolts.

The specific ion-trap magnet strength recommended in technical data for a Radiotron picture tube is based on the highest ultor voltage permissible within the tube ratings. Consequently, the use of an ultor voltage lower than the maximum must be accomplished by a corresponding reduction in effective ion-trap magnet strength to minimise beam decentring and attendant neck-shadow difficulties.

In some cases where the ultor voltage employed is smaller than the maximum, the required reduction in the effective strength of the ion-trap magnet can be achieved by moving the magnet from its proper position to one nearer the tube base. Although a certain amount of latitude in positioning is generally permissible, consideration must be given to the fact that a relatively small change in ion-trap magnet position may result in damaging bombardment of the aperature edges as well as in a large change in raster position. Consequently, it is extremely



important to select an ion-trap magnet having the proper strength.

(4) **Extraneous Magnetic Fields.** The presence of even moderately strong extraneous fields in the vicinity of a picture tube can cause serious neck-shadow difficulties. Consequently, considerable care should be used in the selection and placement of such components as transformers and loudspeakers to minimize the decentring effects of their external fields.

Test equipment near the picture tube may also contribute magnetic fields causing neck shadow. For the same reason, it is usually necessary that metal parts (particularly those in the vicinity of the yoke) not be magnetized. Controlled magnetization of the yoke frame may be used to correct beam deviations caused by other factors such as scanning non-linearity.

(5) **Ultor-supply regulation.** Changes in brightness which occur normally in the transmitted picture vary the load on the ultor supply and cause variations in ultor voltage. The resulting variations in ultor voltage affect the position of the beam and, if excessive, may cause intermittent neck-shadow. Consequently, the regulation of the ultor supply must be good enough to assure that the ultor does not vary appreciably over the normal brightness range.

(6) **Scanning Non-linearity.** Any non-linearity in scanning causes an apparent decentring of the raster and therefore may be responsible for neck-shadow when an attempt is made to centre the picture. If the non-linearity causes a substantial difference in raster dimensions on opposite sides on the zero-deflection point, it may be necessary to shift the beam so far off axis for picture centring that neck shadow cannot be avoided. The linearity of the scanning system must therefore be taken into consideration in the design of the picture-positioning mechanism.

In some cases apparent decentring due to scanning non-linearity can be compensated by the use of a yoke frame permanently magnetized in the direction and to the degree necessary.

Improper phasing between the scanning waveform and blanking pulses may also contribute to neck-shadow problems by offsetting the picture excessively in the raster. Since modern deflection systems seldom include phasing adjustments, it is important that proper phasing characteristics be incorporated in the design.

(7) **Normal variations in individual picture tubes.** The principal picture tube factors affecting beam position are the angles formed by the internal ion trap and the tilt of the gun assembly with respect to the tube axis. Because manufacturing standards permit some variation in these angles, deviations in initial position can normally be expected in individual tubes. In order to avoid neck-shadow difficulties, the range of these deviations must be considered in the design of the positioning mechanism.

BOOK REVIEW

HOW TO GET AHEAD in the Television and Radio Servicing Business

(BY JOHN MARKUS. FIRST EDITION 1957.)
(Published by the McGraw-Hill Book Company Inc.)

The purpose of this book is described in its sub-title "HOME COURSE OUTLINE for the McGraw-Hill TV, Radio and Changer Servicing Course". In the preface of this book emphasis is placed on the easy-to-understand instructions in the McGraw-Hill literary course: this characteristic also applies throughout this introductory book.

Although this is an American publication the various suggestions and methods are applicable to Australian conditions.

The first chapter of this "outline" points out to the reader the jobs he can undertake after completing this course or even while studying. His future in each is discussed in terms of his own abilities and preferences.

In the next three chapters the author discusses the various methods of studying and the gaining of practical experience. The complete experience-gaining programme for the course is summarized in one highly important chapter.

Finally, Mr. John Markus in the three remaining chapters gives valuable business advice. He points out how it is possible for you to earn money while studying the course. The book ends with a very helpful chapter on business administration.

(J. A. HARRISON)

KT88 Output Beam Pentode

The KT88 is a pentode having an anode dissipation of 35W. It is primarily designed for use in the output stage of an A-F amplifier in which two valves will provide up to 100W.

GENERAL DATA

Max. overall length	125	mm.
Max. seated length	110	mm.
Max. diameter	52	mm.
Heater Voltage	6.3	V
Heater Current	1.8	A

Maximum Ratings

Plate Voltage	600	V
Grid No. 2 Voltage	600	V
Plate Dissipation	35	W
Screen Dissipation	6	W
Cathode Current	174	mA
Heater-Cathode Voltage	150	V

CHARACTERISTICS

Pentode connection

Plate Voltage	250	V
Screen Voltage	250	V
Plate Current	140	mA
Transconductance	11	mA/V
Plate Impedance	12	kΩ

Triode connection

Plate Voltage	450	V
Grid Bias	-46	V
Transconductance	13	mA/V
Plate Impedance	6150	Ω
Amplification factor	8	

TYPICAL OPERATION

Pentode connection. Push-pull. Cathode Bias (Data per pair)

Plate Supply Voltage	400	450	475	V
Plate Voltage	360	400	425	V
Screen Voltage	255	295	320	V
Plate Current (zero signal)	120	140	160	mA
Plate Current (max. sig.)	135	155	180	mA
Screen Current (zero sig.)	7.5	10	12	mA
Screen Current (max. sig.)	25	30	38	mA
Plate Dissipation (per valve)	22.5	30	35	W
Screen Dissipation (per valve)	1	1.5	2	W
*Cathode Resistor (per valve)	440 ± 5%	440 ± 5%	440 ± 5%	Ω
Signal input (grid-grid)	50	60	70	V
Plate load (plate-plate)	6000	6000	6000	Ω
Power Output	34	42	48	W
Distortion	3	3	3	%

*Separate bias resistors are essential.

Pentode connection. Push-pull. Fixed Bias (Data per pair)

Plate Supply Voltage	460	625	V
Plate Voltage	450	600	V
Screen Voltage	345	330	V
Plate Current (zero signal)	100	100	mA
Plate Current (max. sig.)	240	250	mA
Screen Current (zero sig.)	7.5	6	mA
Screen Current (max. sig.)	35	32	mA
Plate Dissipation (per valve)	25	32	W
Screen Dissipation (per valve)	1.5	1	W
*Grid Bias (approx.)	-48	-45	V
Signal input (grid-grid)	70	50	V
Plate load (plate-plate)	4000	5000	Ω
Power Output	65	100	W
§Distortion	5-7	3-6	%

*A bias voltage range of not less than 40 to 65 is recommended.

§The distortion may vary accordingly to matching of pairs.

Triode connection. Push-pull. Cathode Bias (Data per pair)

Plate Supply Voltage	400	485	V
Plate Voltage	350	425	V
Plate Current (zero sig.)	135	170	mA
Plate Current (max. sig.)	145	180	mA
Plate Dissipation (per valve)	24	40	W
*Cathode Resistor	560 ± 5%	560 ± 5%	Ω
Signal Input (grid-grid)	60	70	V
Plate load (plate-plate)	4000	4000	Ω
Power Output	15	27	W
§Distortion	1-3	1-3	%

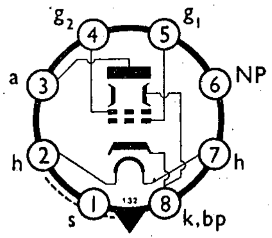
*Separate bias resistors are essential.

§The distortion varies between 1% and 3% according to the degree of matching.

The external grid circuit resistance should be kept as low as possible and must not exceed 220kΩ ± 20% with cathode bias, or 1000kΩ ± 20% with fixed bias.

SOCKET CONNECTIONS (Bottom view)

Pin 1. Shield.
Pin 2. Heater.
Pin 3. Plate.
Pin 4. Grid No. 2.
Pin 5. Grid No. 1.
Pin 7. Heater.
Pin 8. Cathode, Internal Shield.



KT88 Push-Pull Amplifier Circuits*

The KT88 may be used in pairs in either triode, pentode or "ultra linear" push-pull circuits, as shown in figs. 1, 2 and 3. The ultra linear circuit is recommended when the maximum output coupled with the lowest distortion is required. The screen grids are connected to tapping points on the output transformer which may include from 20% to 50% of each half-primary, counting from the centre tap; 20% taps were used in the preparation of this data.

Either cathode bias or fixed bias may be used. The former has the advantage of simplicity whereas the latter provides the maximum output of 100W and higher efficiency. A maximum grid resistance of 265KΩ is permitted with cathode bias and 120KΩ with fixed bias. Resistors of 220KΩ ± 20%, 100KΩ ± 20% respectively, may be used. It is necessary with fixed bias to have a means of indicating the correct d.c. grid voltage and resistors of 10Ω in each cathode circuit (R30, R31 in fig. 3) are convenient as meter shunts. These are not essential with cathode bias but may be used if desired in series with R16, R17.

The power output of the ultra linear circuit is not less than with the pentode connection at

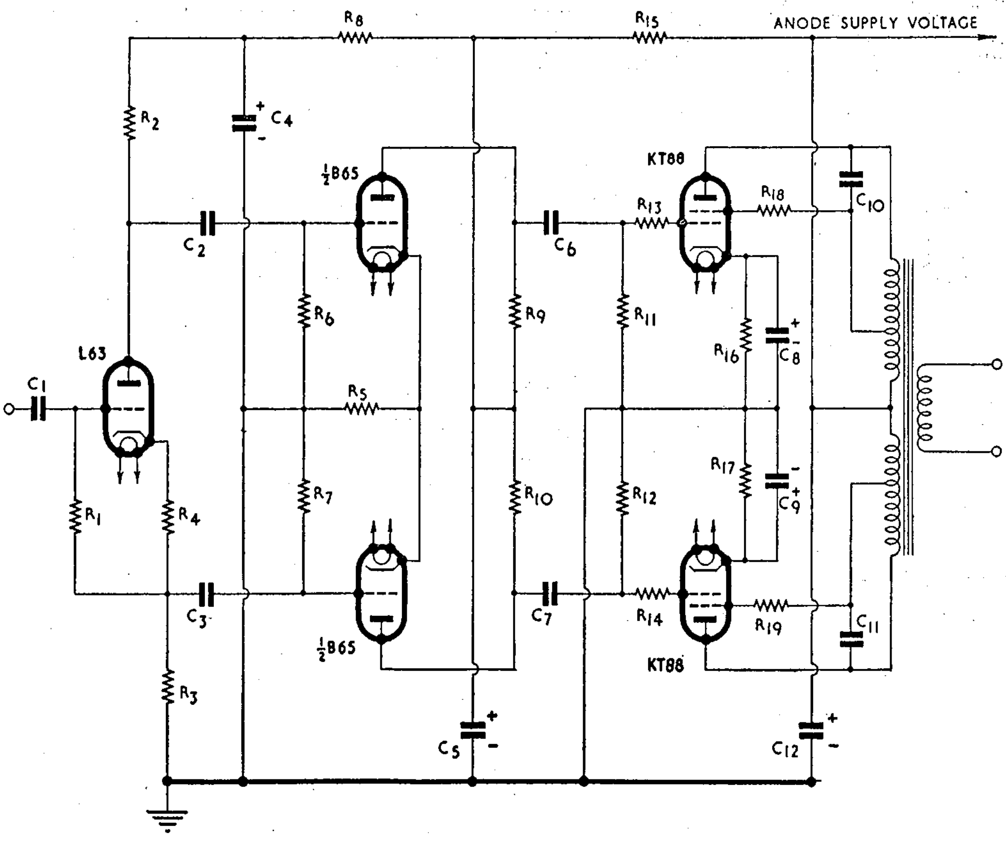


Fig. 1. Complete ultra-linear amplifier circuit. For triode operation, R18 and R19 are connected to the anodes and C10, C11 are omitted. Component values are given on page 26. The input required at the first stage for 50W output is about 2.5V rms with an h.t. voltage of 500.

* Reprinted with acknowledgment to G.E.C.

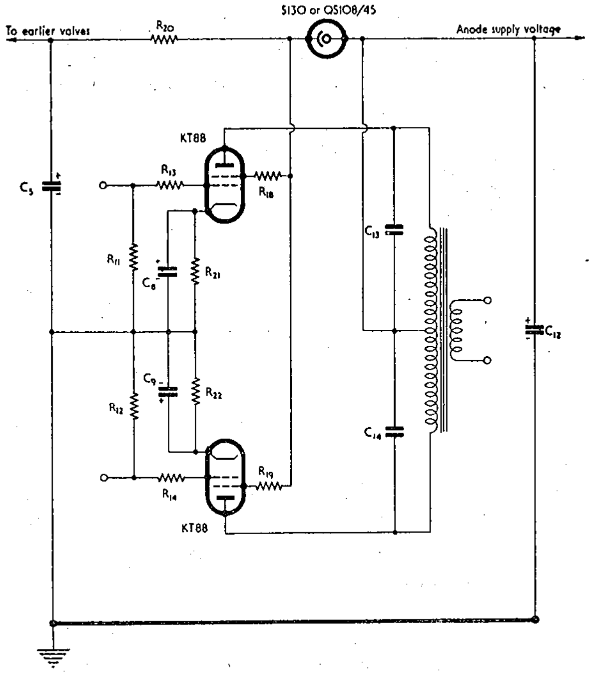


Fig. 2. For pentode operation, fig. 1 is modified as shown above. The ignition electrode of the gas stabiliser should be connected to the anode.

any given supply voltage, and has the advantage that a low impedance screen grid supply is not required. As shown in figs. 2 and 4, the pentode circuit calls for one or two gas stabilisers in order that the screen may operate below the anode potential. QS108/45 or S130 are suitable. The ultra linear circuit does, in fact, show a rather higher efficiency in that a lower current is required from the power supply e.g. with fixed bias and a supply voltage of 460, an output of 65W is obtained with an anode current of 240mA in each case, but the pentode requires, in addition, a screen current of 35mA. The output impedance and distortion are both more favourable, the former being 6.5KΩ, compared with 50KΩ, and the latter being almost entirely independent of load impedance in the ultra linear circuit. This is illustrated in fig. 8.

The triode connection is useful when a moderate power output with low distortion is required. The operating data shows that an output of up to 27W is obtainable with a line voltage of 485 and cathode bias, and even at lower voltages, the output is adequate for domestic amplifiers. The distortion will depend on the degree of matching between pairs, but it is normal to obtain a distortion below 2% by the selection of two out of any three valves since

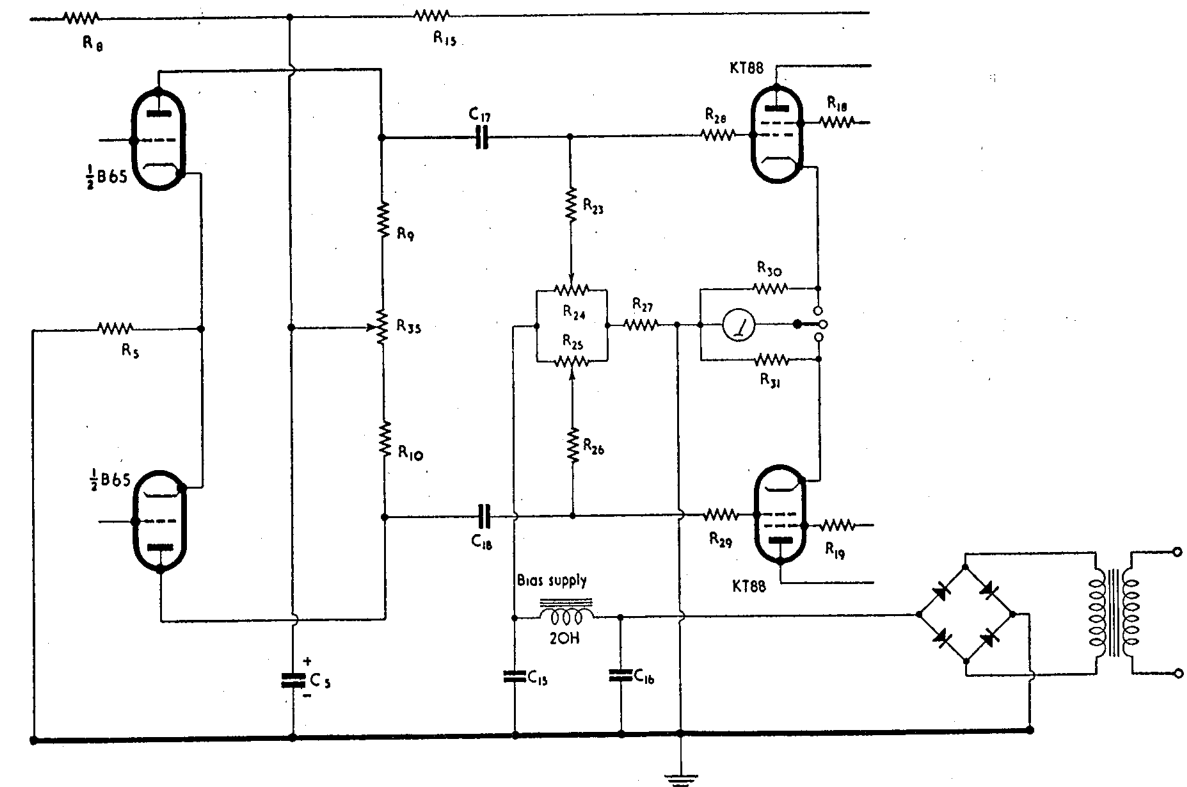


Fig. 3. Illustrating the modifications to figs. 1 and 2 necessary for fixed bias operation. R35 is adjusted at 90% full output to give identical KT88 cathode currents as measured by the meter. R35 is optional but it does allow the reduction of distortion to the minimum.

this procedure, at worst, halves the normal variation in characteristics (fig. 5).

Due to the high mutual conductance some precautions have to be taken against parasitic oscillation whichever connection is used. Control grid and screen grid series resistors 10KΩ and 270Ω, respectively, are recommended. In the ultra linear circuit, small capacitors of 1000-2000 $\mu\mu$F may be found necessary between the anode and screen grid tappings on the output transformer. With some transformers they will not be needed and they become less necessary as the tapping points include a greater part of the primary due to the reduction in leakage inductance.

The bulb temperature rating of 250°C must not be exceeded and any cabinet used must provide adequate ventilation. Under free air conditions this temperature is not reached at maximum ratings, but where a valve is enclosed check that adequate air circulation exists.

The type of power supply required will depend on the operating condition. A capacitance input filter circuit is satisfactory with the triode and ultra linear connections when cathode bias is used and may be used with the pentode circuit although inductance input is preferable.

With fixed bias the large change in anode current requires a low impedance power supply and an inductance input filter is essential. It is desirable for the terminating capacitor to be of high value to prevent an instantaneous fall in voltage on the application of a transient. Satisfactory performance will be obtained with a single inductor and a capacitance of 50-150 μF (fig. 4). Two 160 μF, 450V electrolytic capacitors in series have been found very successful with the higher voltage working conditions of the ultra linear and pentode connections.

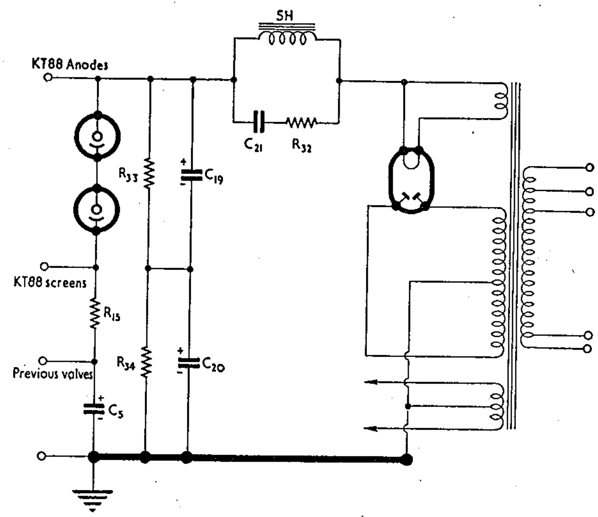


Fig. 4. Details of an inductance input power supply for fixed bias operation. The stabilisers are required only in pentode operation.

The choice of a rectifier will depend on the power output required. The U54 is suitable for powers up to 50W, but for amplifiers designed to cover the range 50-100W, two U19 or two 5R4GY should be used.

With the pentode operating condition: Eb = 600, Ec2 = 330, the screen is supplied via two QS150/45 to provide a voltage approximately 300 below that of the line voltage, as shown in fig. 4. With lower line voltages, either one QS/108/45 or S130 is used. The exact voltages quoted in the table will not always be obtainable due to variations between the stabiliser valves recommended; however, the performance will not be affected greatly if the bias is adjusted to give the correct quiescent current.

CLASS AB1 PUSH-PULL PAIR — SELECTED OPERATING CONDITIONS

	Triode Connection	Ultra Linear‡	Pentode Connection	Pentode Connection	Ultra Linear‡	Pentode Connection	Ultra Linear‡	Pentode Connection
E_{bb}	485V	500V	375V	475V	460V	460V	560V	625V
E_b	425V	425V	330V	425V	450V	450V	550V	600V
E_{c2}	(425V)	425V	330V	320V	450V	345V	550V	330V
I_b §	170-180mA	175-200mA	170-190mA	160-180mA	100-240mA	100-240mA	100-300mA	100-250mA
I_{c2} §	†	†	15-40mA	12-38mA	†	7.5-35mA	†	6-32mA
Rk (per valve)	525	525	**180	440	Fixed bias -65V	*Fixed bias -48V	*Fixed bias -80V	*Fixed bias -45V
R_L (A-A)	4KΩ	6KΩ	3.4KΩ	6KΩ	4KΩ	4KΩ	4.5KΩ	5KΩ
P_{out}	27W	50W	40W	48W	66W	66W	100W	100W
D	2%	2%	3%	3%	3%	5%	3%	3%

* Approx. voltage. Allow ± 25% variation.

‡ 20% transformer taps.

† Included in I_b.

Quiescent and max. signal values.

ULTRA LINEAR CONNECTION
Cathode Bias

20% Taps. Data per pair.

E_{bb}	425	465	500	V
E_b	375	400	425	V
I_b (zero sig.)	150	165	175	mA
I_b (max. sig.)	175	190	200	mA
*R_k (per valve)	525 ± 5%	525 ± 5%	525 ± 5%	Ω
†P_{out}	32	45	50	W
†D	2	2	2	%
R_L (a-a)	6000	6000	6000	Ω
E_{in} (gl-gl)	70	74	80	V
W_b	30	34	40	W

*Separate bias resistors are essential.

†These figures refer to an average pair. With a matched pair the distortion will be reduced and on a mismatched pair it may rise to 4%.

The curve of fig. 6 shows the performance at E_b = 425 with various anode loads. A corresponding performance is obtained at lower anode voltages.

ULTRA LINEAR CONNECTION
Fixed Bias

20% Taps. Data per pair.

E_{bb}	460	560	V
E_b	450	550	V
I_b (zero sig.)	50 + 50	50 + 50	mA
I_b (max. sig.)	240	300	mA
*E_g (app.)	-65	-80	V
R_L (a-a)	4000	4500	Ω
P_{out}	65	100	W
†D	3-6	3-6	%
W_b (max. sig.) (per valve)	20	33	W

*A bias voltage range of at least ± 25% is recommended.

†The distortion will vary between 3% and 6% according to matching as adjusted by R35 in fig. 3.

Curves figs. 8 and 9 show the behaviour at E_b = 450 and 550.

COMPONENT VALUES

Resistors

(20% 0.25W unless otherwise stated).

R1	1MΩ		
R2	33KΩ matched to 5%		1W
R3	33KΩ		1W
R4	1.5KΩ		
R5	1KΩ		
R6	470KΩ	10%	
R7	470KΩ	10%	
R8	33KΩ		1W
R9	33KΩ	10%	1W
R10	33KΩ	10%	1W
R11	220KΩ	10%	
R12	220KΩ	10%	
R13	10KΩ		
R14	10KΩ		
R15	4.7KΩ		1W
R16	525Ω	5%	5W
R17	525Ω	5%	5W
R18	270Ω		0.5W
R19	270Ω		0.5W
R20	10KΩ	10%	1W
R21	440Ω	5%	5W
R22	440Ω	5%	5W
R23	100KΩ	10%	0.5W
R24	20KΩ		w.w.
R25	20KΩ		w.w.
R26	100KΩ	10%	0.5W
R27	10KΩ	10%	1W
R28	5.6KΩ		
R29	5.6KΩ		
R30, R31	Meter Shunts		
R32	10KΩ		0.5W
R33	100KΩ	10%	1W
R34	100KΩ	10%	1W
R35	10KΩ	10%	w.w.

Capacitors

C1	0.01μF	350V	Paper
C2	0.05μF	350V	Paper
C3	0.05μF	350V	Paper
C4	8μF	350V	Electrolytic
C5	8μF	450V	Electrolytic
C6	0.05μF	500V	Paper
C7	0.05μF	500V	Paper
C8	50μF	50V	Electrolytic
C9	50μF	50V	Electrolytic
C10	0.001μF	500V	Paper
C11	0.001μF	500V	Paper
C12	8μF	500V	Electrolytic
C13	0.005μF	500V	Paper
C14	0.005μF	500V	Paper
C15	8μF	250V	Electrolytic
C16	8μF	250V	Electrolytic
C17	0.1μF	500V	Paper
C18	0.1μF	500V	Paper
C19	160μF	450V	Electrolytic
C20	160μF	450V	Electrolytic
C21	0.01μF	750V	Paper

EDITOR'S NOTE

Radiotron equivalents for the valves type B65 and L63 are the 6SN7GT and the 6J5GT respectively. In the power supply, for output powers upto 50W., the Radiotron 5AS4 may be used in lieu of the U54 mentioned in the text, and two 5AS4's may be used in the 50 to 75W. range. In the circuit of Fig. 4, Radiotron 0D3's may be used where the maximum signal screen current of the KT88's plus the current drawn by the earlier stages does not exceed 45 mA. With lower HT line voltages, one or two 0C3's may be used (approximately 105V. each) where the total current does not exceed 45 mA. The same remark applies to the circuit of Fig. 2.

An ultra-linear amplifier using KT88's is now under development in the Radiotron Application Laboratory, and it is hoped to publish full details in the near future.

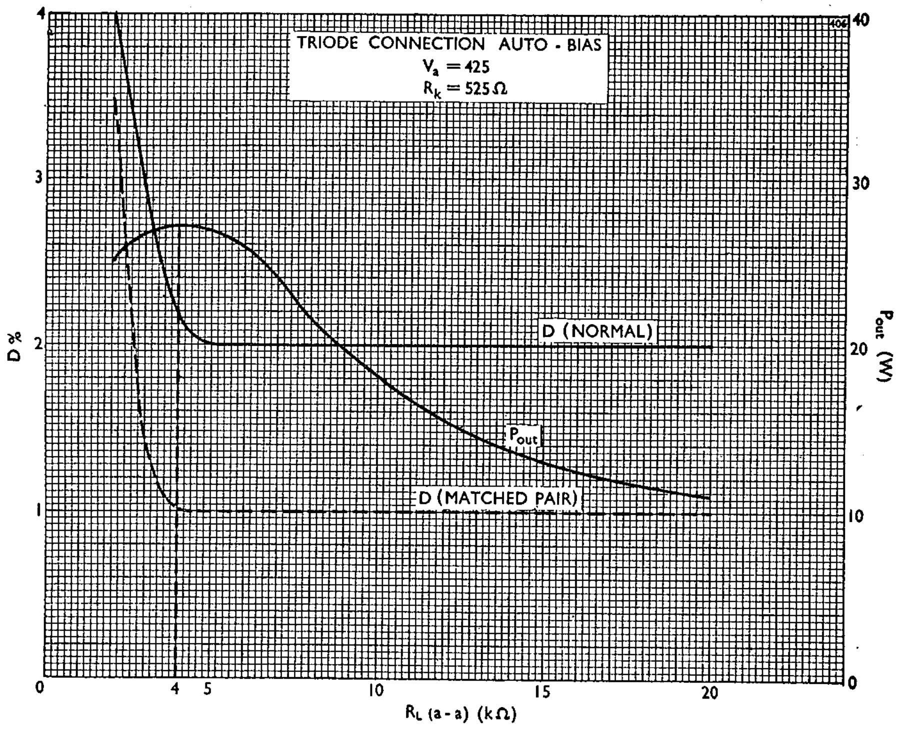

TRIODE CONNECTION AUTO - BIAS
V_a = 425
R_k = 525 Ω
D %
P_{out} (W)
D (NORMAL)
P_{out}
D (MATCHED PAIR)
4
3
2
1
0
40
30
20
10
0
4
5
10
15
20
R_L (a - a) (kΩ)

Fig. 5

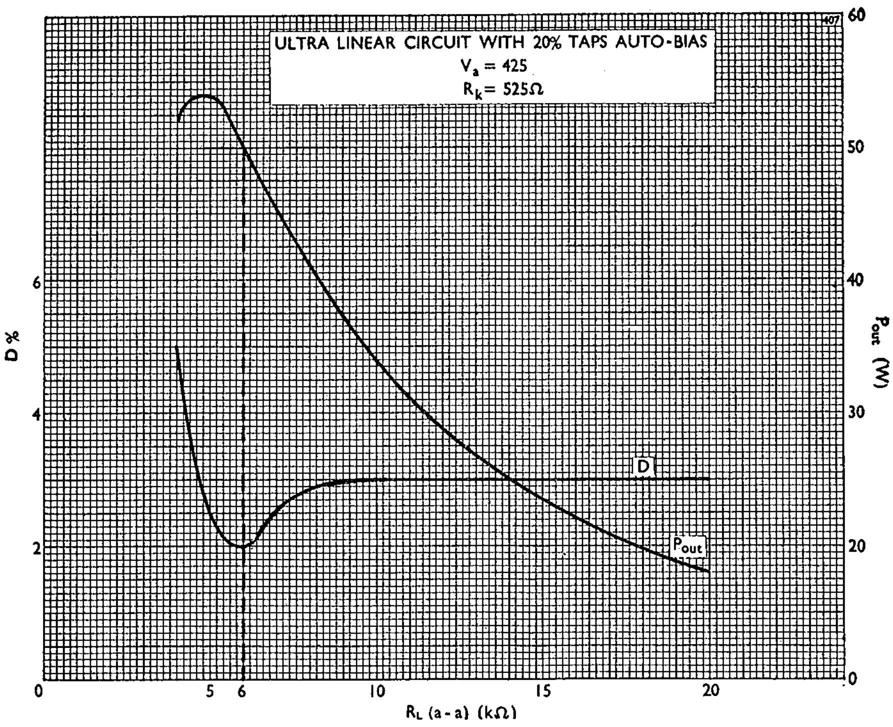

ULTRA LINEAR CIRCUIT WITH 20% TAPS AUTO-BIAS
V_a = 425
R_k = 525Ω
D %
P_{out} (W)
D
P_{out}
6
4
2
0
60
50
40
30
20
0
5
6
10
15
20
R_L (a - a) (kΩ)

Fig. 6

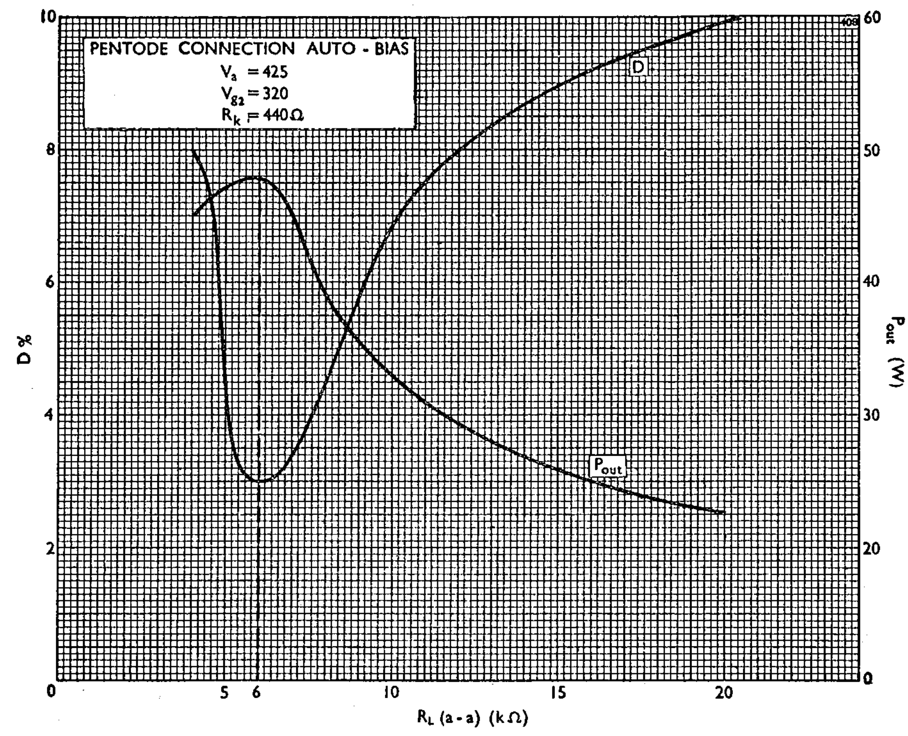

PENTODE CONNECTION AUTO - BIAS
V_a = 425
V_{g2} = 320
R_k = 440Ω
D
P_{out}
D %
P_{out} (W)
R_L (a - a) (kΩ)
0
5
6
10
15
20
2
4
6
8
10
30
40
50
60

Fig. 7

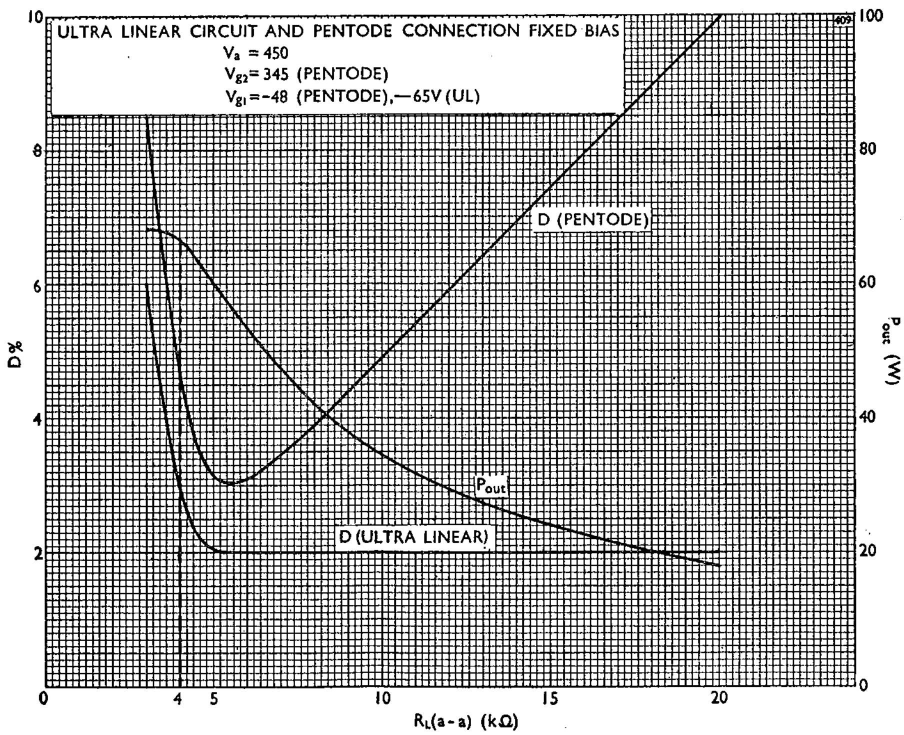

ULTRA LINEAR CIRCUIT AND PENTODE CONNECTION FIXED BIAS
V_a = 450
V_{g2} = 345 (PENTODE)
V_{g1} = −48 (PENTODE), —65V (UL)
D (PENTODE)
P_{out}
D (ULTRA LINEAR)
D%
P_{out} (W)
R_L(a - a) (kΩ)
0
4
5
10
15
20
2
4
6
8
10
40
60
80
100

Fig. 8

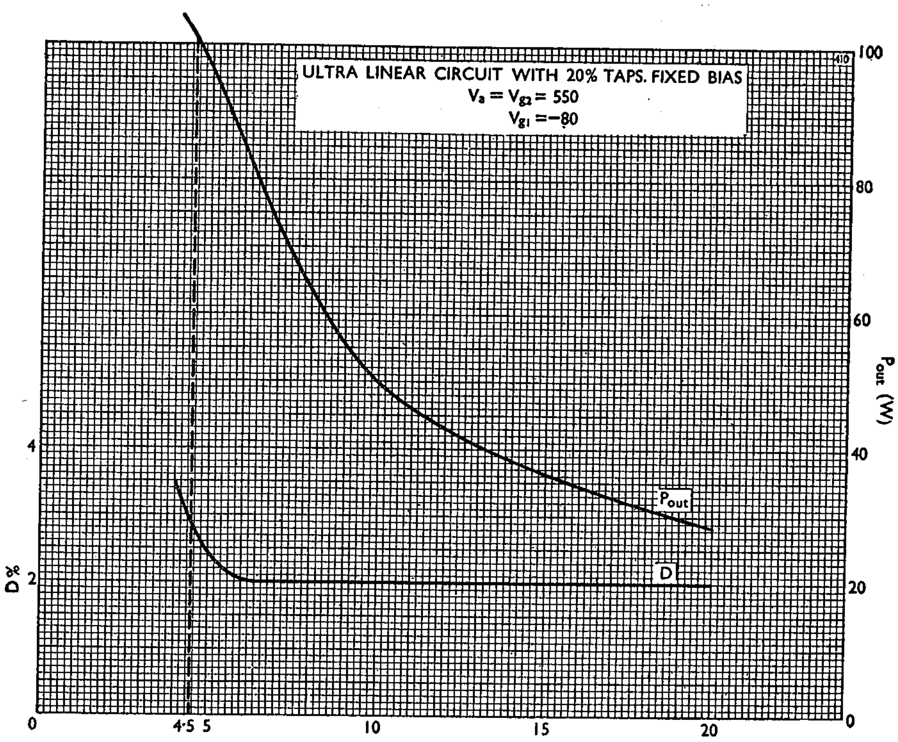

ULTRA LINEAR CIRCUIT WITH 20% TAPS. FIXED BIAS
Va = Vg2 = 550
Vg1 = −80
Pout
D
D%
Pout (W)
0
4·5 5
10
15
20
RL (a-a) (kΩ)

Fig. 9

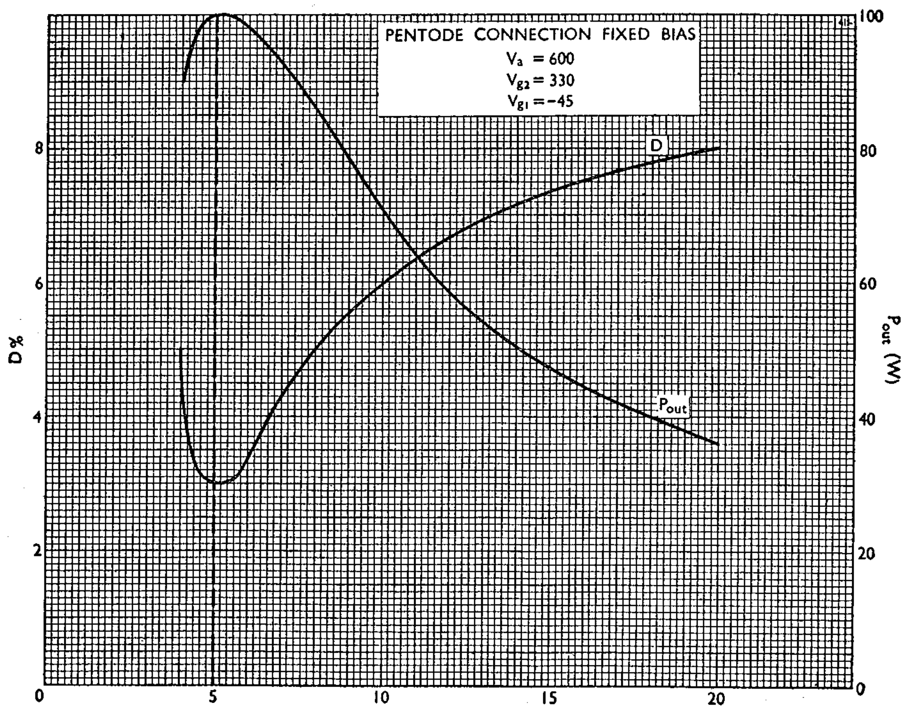

PENTODE CONNECTION FIXED BIAS
Va = 600
Vg2 = 330
Vg1 = −45
D
Pout
D%
Pout (W)
0
5
10
15
20
RL (a-a) (kΩ)

Fig. 10

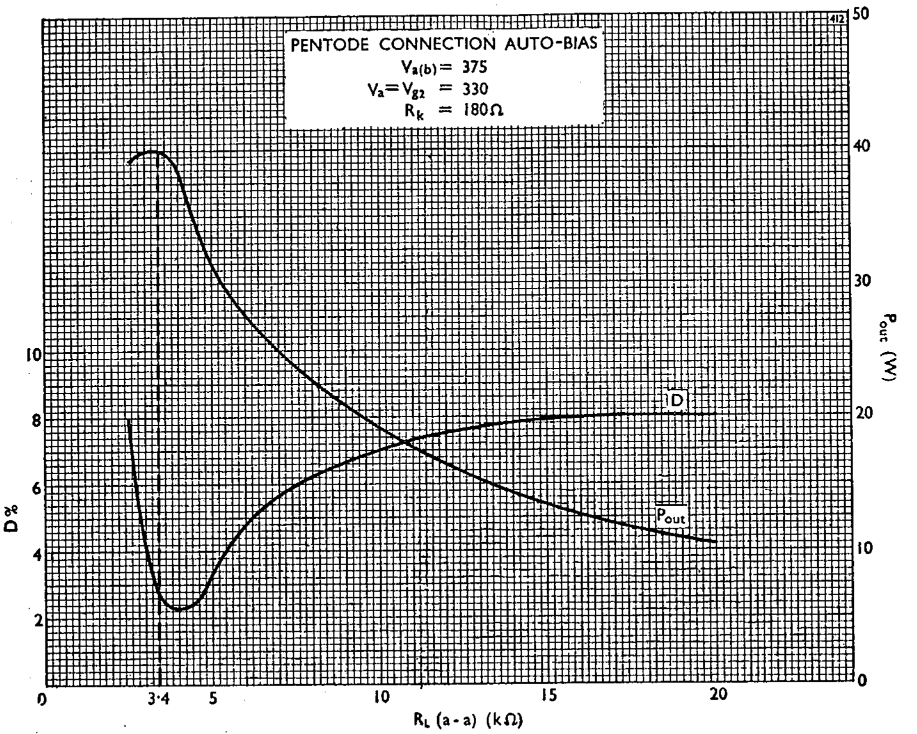


Fig. 11

NEW RCA RELEASES

RADIOTRON — 14ATP4
NEW 90° PICTURE TUBE

Radiotron 14ATP4 is the latest addition to the Radiotron picture-tube line. It is designed with a 450-mA/8.4-volt heater having a controlled warm-up time to insure dependable performance in television receivers employing a single, series-connected heater string.

Weighing only 8-1/2 pounds, this rectangular glass picture tube has a 14" envelope diagonal, and an overall length of 13-3/16".

Another design feature of the 14ATP4 is its new electron gun of the "straight" type designed to minimize deflection distortion. This new gun permits a shortened neck — only 5-1/2" long, and eliminates the need for an ion-trap magnet. Because of its short neck and use of wide angle (90°) deflection, the 14ATP4 is approximately 3" shorter than a type having the same size faceplate and 70° deflection.

The 14ATP4 is of the low-voltage electrostatic-focus and magnetic-deflection type. It has a spherical Filterglass faceplate, an aluminized screen 12-1/16" x 9-1/2" with slightly curved sides and rounded corners, and a minimum projected screen area of 104 square inches. In addition, the 14ATP4 has an external conductive bulb coating which with the internal conductive coating forms a supplementary filter capacitor.

RADIOTRON — 6350

The 6350 is a 9-pin miniature type designed for use in a wide variety of applications in electronic computers particularly of the high-speed digital type, and in other "on-off" control equipment.

In such service, the 6350 maintains its emission capabilities even after long periods of operation under cut-off conditions and, therefore, provides good consistency of plate current during its "on" cycles. Futhermore, balance of cut-off bias between the two units is closely controlled during manufacture. Production controls correlated with typical electronic computer operating conditions as well as rigorous tests for interelectrode leakage, high-resistance and intermittent shorts, and cathode interface, insure long dependable performance from the 6350.

RADIOTRON — 6CQ8 MEDIUM-MU TRIODE-SHARP-CUTOFF TETRODE

Radiotron 6CQ8 is a multi-unit valve of the 9-pin miniature type containing a medium-mu triode and sharp cut-off tetrode in one envelope. This valve may be used in a wide variety of applications in television receivers, particularly as a combined v.h.f. oscillator and mixer in tuners of such receivers utilizing an intermediate frequency amplifier valve.

The tetrode unit is intended for use as a mixer valve. It is also useful as a video intermediate-frequency amplifier valve. The triode unit, which features a high value of transconductance (8000 micromhos), is suitable for use not only as a v.h.f. oscillator, but also as a phase splitter, sync-clipper, sync-separator, and r-f amplifier. The 6CQ8 utilizes a 450-milliampere heater having a controlled warm-up time to insure dependable performance in television receivers employing a series heater-string arrangement.

The tetrode unit of the 6CQ8 features a plate current characteristic with a sharp knee, at relatively low plate voltages. As a result, mixer operation with good linearity can be obtained. The tetrode unit also features a low value output capacitance. The low value of capacitance between grid No. 1 and plate minimizes feedback problems often encountered in mixer circuits operating at an intermediate frequency in the order of 40 Mc/s. When an intermediate frequency of this order is employed, feedback problems are especially troublesome on channel No. 2 because of the small difference between the channel frequency and the intermediate frequency. The low value of output capacitance enables the valve to work into a high-impedance plate circuit with resultant increase in mixer gain.

Design features of the 6CQ8 include a separate cathode for each unit with individual base-pin terminal. This separate connection for each of the two cathodes provides the equipment designer with greater flexibility of circuit connections, particularly in those applications requiring series connection for the triode unit and the tetrode unit across a common plate supply. In addition, the valve utilizes an internal shield which provides effective shielding between the triode unit and the tetrode unit to prevent electrical coupling between them.

RADIOTRON — 6CU8

The 6CU8 is a general-purpose medium-mu triode — sharp-cut-off pentode of the 9-pin miniature type intended for a wide variety of applications in television receivers. This valve is designed with a 6.3 volt/450 mA heater having a controlled warm-up time to minimize voltage unbalance during starting in TV receivers employing a series heater-string arrangement.

The pentode unit, featuring high transconductance and low grid-No. 1-to-plate capacitance may be used as an intermediate-frequency amplifier, video amplifier, a.g.c. amplifier, and reactance valve. The triode unit which has a relatively high zero-bias plate current is well suited for use in low-frequency oscillator, sync-separator, sync-clipper, and phase-splitter circuits.

The design of the 6CU8 utilizes a structure in which the triode unit is shielded from the pentode unit to prevent coupling between them, and in which each unit has its own cathode connected to a separate base pin. These features together with relative freedom from microphonics, make the 6CU8 especially useful in TV receivers.

RADIOTRON 7094

The Radiotron 7094 is a high perveance beam power valve with high power gain. It is useful in fixed and mobile equipment as an RF power amplifier and oscillator, as well as an AF power amplifier and modulator. The valve has a maximum anode dissipation of 125 watts under ICAS conditions in modulator service and in CW service. In the latter service it can be operated with full input to 60 Mc/s. and with reduced input to 175 Mc/s. Because of its high power gain, the 7094 can be operated with relatively low anode voltage to give large power output with small driving power.

Small and compact for its power output capabilities, the 7094 has a rugged button-stem construction with short internal leads. an internal shield connected to grid number 2 within the valve, triple base-pin connections for the second grid, to permit effective RF grounding, an anode structure with large radiating fins for effective cooling, and ceramic mount supports to provide additional sturdiness in the electrode structure. The anode lead is brought out of the bulb to a rigid terminal opposite the base to facilitate separation of input and output circuits.

RADIOTRON 7102

The Radiotron 7102 is a head-on type of multiplier phototube intended for use in the detection and measurement of low-level red and near infrared radiation. It is well suited for use in red and near infrared spectrometry, infrared ranging, astronomical measurements involving near infrared radiation, optical pyrometry, and in applications utilizing near infrared radiation for communications.

The spectral response of the 7102 covers tne range from about 4200 to 11000 angstroms, with maximum response at approximately 8000 angstroms. Design features of the 7102 include a semi-transparent cathode having a minimum diameter of 1.24 inches on the inner surface of the face end of the bulb, and ten electrostatically-focussed dynode stages. The relatively large cathode permits efficient collection of the radiation from sources of scattered radiation.

The Radiotron 7102 is capable of very short time resolution. For an input pulse having a duration of 1 millimicrosecond or less, the time spread of the pulse at the anode is about 5 millimicroseconds measured at 50% of the maximum pulse height. This time spread corresponds to an electron transit time spread of about 4 millimicroseconds. The transit time spread can be reduced to about 2 millimicroseconds by irradiating only a small central area of the cathode.

RADIOTRON 7029

The Radiotron 7029 is a sturdy dormer-window type of multiplier phototube intended for use in the detection of low-level light signals in the presence of relatively high background illumination. It is therefore especially suited for low-contrast applications. The spectral response of the 7029 covers the range from about 2900 to 6200 angstroms, with maximum response at approximately 4900 angstroms. The tube is capable of very short time resolution. For an input pulse having a duration of 1 millimicrosecond or less, the time spread of the pulse at the anode is less than 5 millimicroseconds measured at 50% of the maximum pulse height.

Outstanding features of the 7029 are its median cathode sensitivity of 125 microamperes per lumen and its stabilized sensitivity. Other distinguishing features include a dormer window through which light is directed onto a semi-transparent photocathode located on the inner spherical surface at the end of the bulb, and 10 electrostatically-focussed multiplying (dynode) stages having stabilized secondary-emission characteristics.