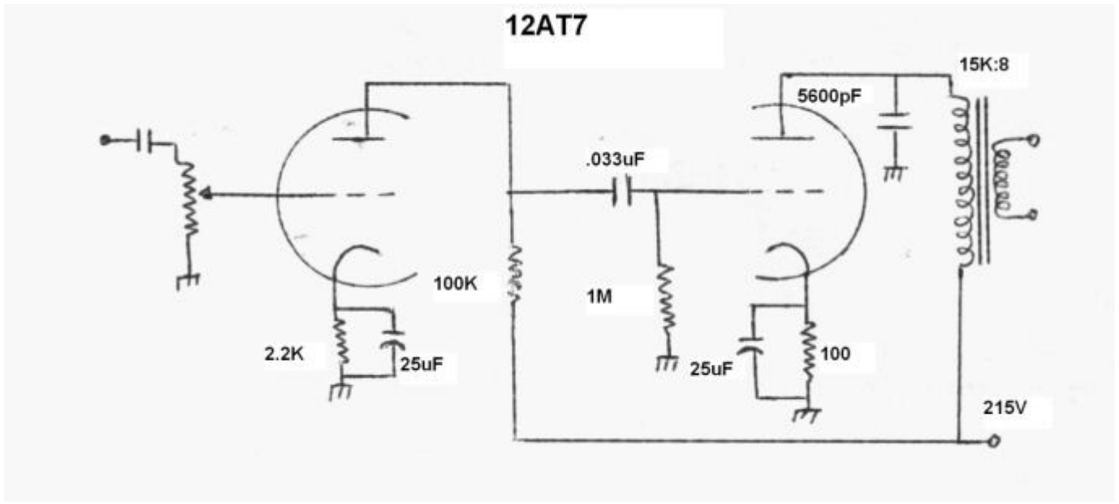
Simple Valve Amplifier Circuits

These are being presented to help those who need a simple valve amplifier to go with a receiver or some other apparatus, or just as a low cost way to try a valve amplifier for those new to the technology. All designs here are in use in various television and radio receivers that I have built, so I thought I'd bring them together as not all the receivers have been presented elsewhere in the site. All have 'line level' type sensitivity which suits most applications.

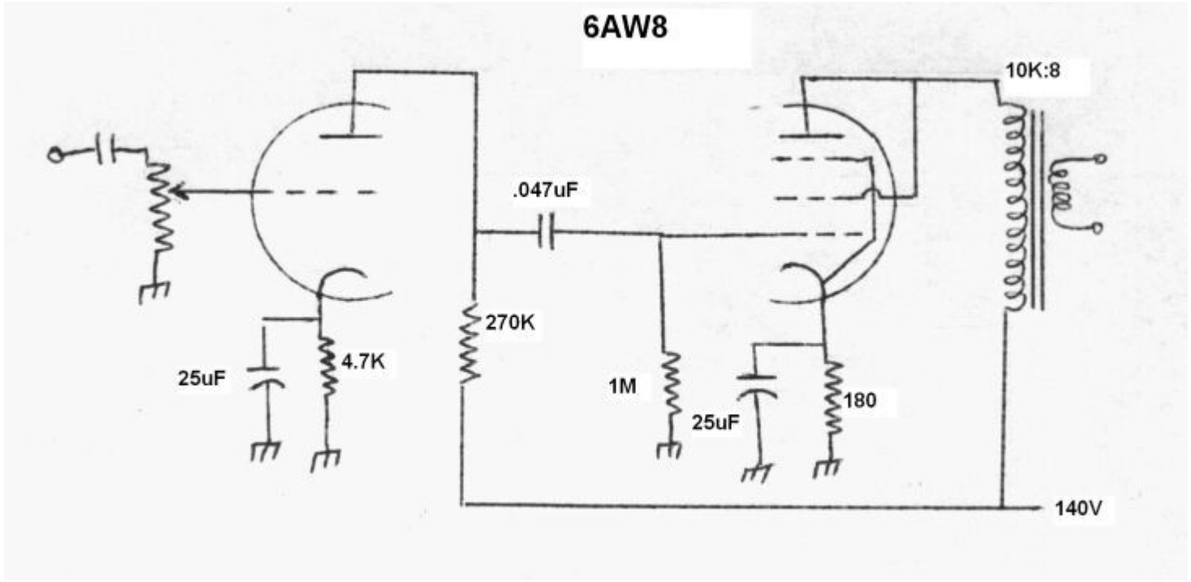
Some notes: Volume control resistances are not shown as these depend on the driving circuit. 500K is typical for valve circuits; 10K-50K for solid state. Likewise, the coupling condenser which has a non critical value; typically .01uF to .047uF when a 500K volume control is used, or 1 to 10uF with the lower values under 50K.
As class A single ended amplifiers are about 40% efficient, a rough calculation to determine power output can be made. P(approx) = .4(IxV) where P is the output in Watts, I is the plate current in Amps, and V is the voltage from plate to cathode.
Not always shown, but one side of the speaker transformer secondary should be earthed for stability. It is also assumed that the B+ supply has been filtered and has sufficient capacitance on the final filter condenser.
It is assumed the constructor is capable of working out voltage ratings of condensers and wattage ratings of resistors. Generally, cathode bypasses are 25V electrolytics, while others are polyester 400 or 630V types. Resistors are mostly half watt.
In most of the circuits 100V P.A line transformers have been used as they are cheap and readily available. Some more astute readers my notice that the impedance matching is not optimum in some circuits; however this did not detract from sound quality. Please see here for more information on using 100V line transformers in valve circuits.
As for speakers; let's get rid of this myth that low power amplifiers can only drive a "small speaker". In fact nothing could be further from the truth. How often do you see a project description where it used a low power output stage and the designer claims it can "drive a small speaker". No! Use the largest speaker you can find. Why? Simply because a large speaker has much more cone area. Thus, for a given voice coil movement, more air is moved about. Not convinced? Try it. The other thing so many project designers do wrong is fail to mention that the speaker needs to be put in a box or baffled. This will increase volume substantially, as well as improving bass response considerably. A bare 2" speaker hanging off some wires attached to a PCB is such a sad sight.
For those who want something with a bit more power, see this 6BM8 article.

12AT7 Amplifier



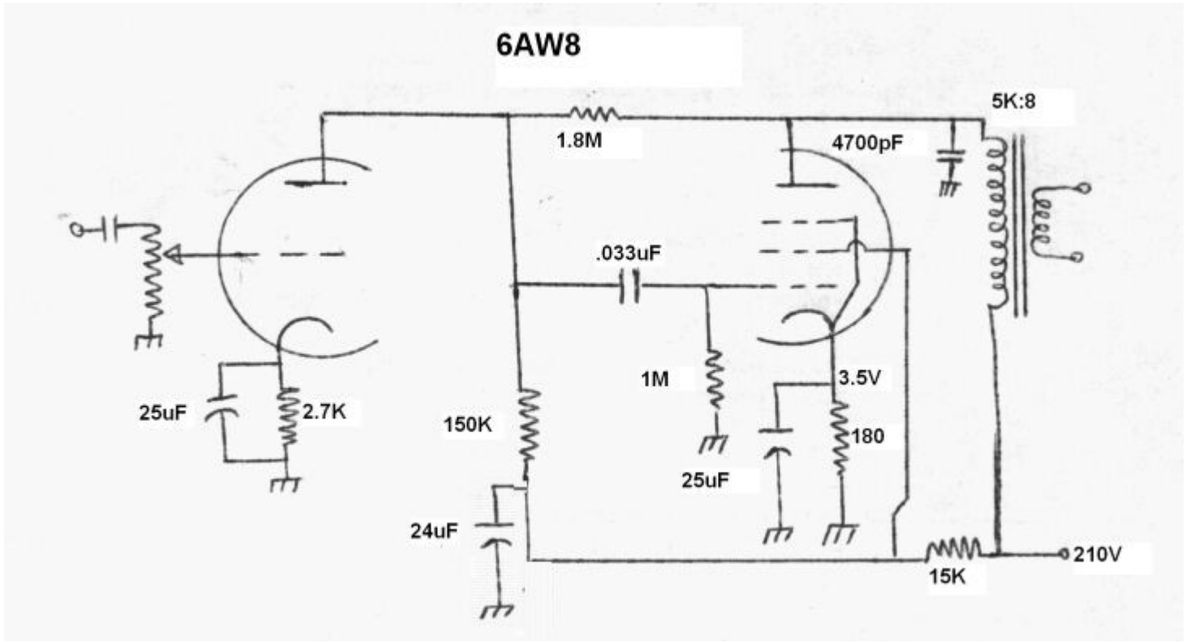
This circuit comes from my 5"TV receiver built around a 5BP1 picture tube. The speaker transformer used was actually a Jaycar M1112 with the 660mW tapping selected.
Current consumption is about 10mA. The 12AT7/ECC81 requires either 6.3V@300mA or 12.6V@150mA for the heaters. Do not use other twin triodes such as 12AU7 or 12AX7.
These are not plug in equivalents as some self appointed valve amplifier experts would have you believe. This amplifier has good sensitivity and surprising power output for a triode, and a small one at that. It is fed from the ratio detector in the TV set.

6AW8 Amplifier (triode connected)



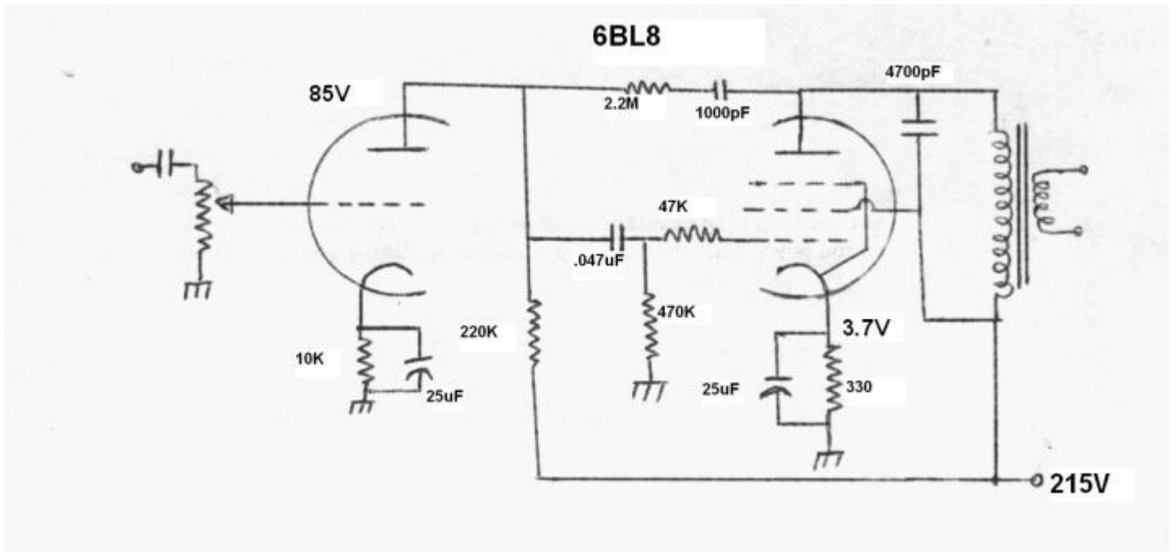
This one is from my home made Fremodyne receiver. Again, a 100V P.A line transformer is used with the 10K primary tapping selected. The 6AW8 pentode is intended for video output use and does not have audio data published. Nevertheless, a 20mA current rating makes it inviting for such use. Triode connection was chosen for stability. It also removes the need for a negative feedback network. The speaker used with this particular amplifier is an 8" dual cone. Heater current for the 6AW8 is 600mA@ 6.3V.

6AW8 Amplifier (pentode connected)



From my AM Stereo Receiver comes another variant of 6AW8 circuit. This one is connected in a conventional pentode circuit. Negative feedback is provided by the 1.8M resistor.
DSE M1100 line transformers were used. For stereo, the 15K and 24uF can be common to both channels. If this is done, parallel another 15K across the existing one. This circuit was fed from the Motorola CQUAM decoder IC. The rest of the receiver is standard with 6AN7, 6N8 and 6X4 valves.

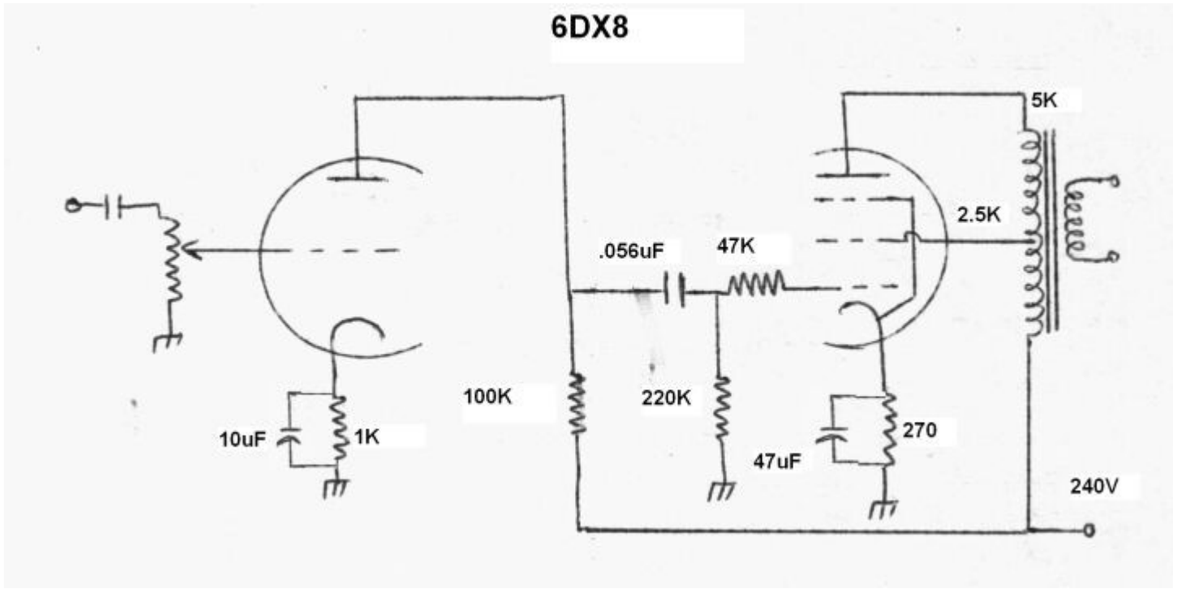
6BL8 Amplifier.



Used in one of my Pulse Counting FM Receivers, this design puts out about 300mW. It requires about 14mA at 215V for the B+ and 450mA at 6.3V for the heater. The 6BL8 is undoubtedly the most widely used TV valve in Australia. Europeans know it as the ECF80, or its series heater equivalent, the PCF80 or 9A8. It was originally designed for mixer/oscillator service in VHF TV tuners but ended up being used in just about every section of TV sets except for audio (well, there was the Thorn 980 chassis in the U.K that used it for audio output), and deflection output stages. There are other similar looking valves with the same pin connections; 6U8/ECF82, 6GH8, 6CQ8, 6EA8, etc., but they are not of the same characteristics. However, they would probably work without any modification. There is also another valve, the 6JW8/ECF802 which is a non microphonic version of the 6BL8 meant for line oscillator use. This should also work.
Output transformer in the FM receiver is a 240 to 6.3V 300mA power transformer. This was used for mains isolation as the receiver has a live chassis. A conventional speaker transformer of around 15K primary impedance can be used, but the 1000pF in the feedback network may need to be altered for correct frequency response.

- Complete article on using the 6BL8 and 6U8 as audio amplifiers.

6DX8 Amplifier



The 6DX8/ECL84 is another valve with the pentode intended for video output service, and the triode for general use such as AGC or sync separation. It is also a very common valve in Australian TV sets. Unlike the 6AW8, this valve was given by its Australian manufacturer Philips Miniwatt, ratings for audio output. Europeans would know this valve better in its series heater form, PCL84 or 15DQ8 (15V at

300mA for the heater). There is also a less common 450mA series heater version, 10DX8/LCL84.
The voltage across the 270R cathode resistor is 3.8V, making the B+ current about 15mA. Heater requirements are 6.3V at 720mA. I've used an ultra linear configuration in the output stage. This effectively converts the pentode to triode operation while retaining the benefits of the pentode. It's otherwise known as "Partial Triode" operation. This results in improved sound quality over a conventional pentode connection. An M1100 line transformer was used. As this is no longer available, the Jaycar MM1900 can be used.
A conventional untapped output transformer can be used by connecting the screen grid to B+. If this is done, a negative feedback circuit should be added. It may also be necessary to bypass the pentode plate in this situation. A typical value would be .0047uF 630V.
This amplifier is used in my Mains Operated 12AT7 Receiver.

"Miniwatt" 6DX8

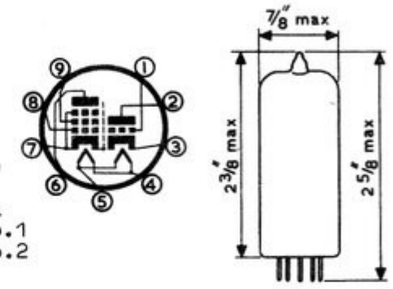
HIGH-MU TRIODE POWER PENTODE

GENERAL DATA

Cathodes	Coated unipotential
Base	Small-button Noval 9-pin
Bulb	T6½
Mounting position	Any

Basing Connections

Pin 1 - Triode grid
Pin 2 - Triode plate
Pin 3 - Triode cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Pentode plate
Pin 7 - Pentode cathode grid No.3, internal shield
Pin 8 - Pentode grid No.1
Pin 9 - Pentode grid No.2



GENERAL ELECTRICAL DATA

Heater voltage	6.3	volts
Heater current	0.72	amp

Direct Interelectrode Capacitances

Pentode Section:

Grid No.1 to all other electrodes except plate		8.7	µµF
Plate to all other electrodes except grid No.1		4.2	µµF
Plate to grid No.1	max.	0.1	µµF

Triode Section

Grid to all other electrodes except plate		3.8	µµF
Plate to all other electrodes except grid		2.3	µµF
Plate to grid		2.7	µµF
Grid to heater	max.	0.10	µµF

General

Triode plate to pentode grid No.1	max.	0.01	µµF
Triode grid to pentode grid No.1	max.	0.01	µµF

"Miniwatt" 6DX8

TYPICAL OPERATING CONDITIONS

Pentode Video Amplifier

Plate supply voltage	170	200	220	volts
Grid No.2 voltage	170	200	220	volts
Plate load resistor	3000	3000	3000	ohms
Grid No.1 voltage	-2	-2.8	-3.3	volts
Plate current	18	18	18	mA
Grid No.2 current	3.2	3.1	3.1	mA
Mutual conductance	10,400	10,000	9700	µmhos

Pentode Audio Power Amplifier-Class A (Single Valve)

Plate supply voltage	200	250	volts
Grid No.2 supply voltage	200	250	volts
Cathode resistor	113	235	ohms
Zero-signal plate current	20	16.0	mA
Max.-signal plate current	18.5	15.0	mA
Zero-signal grid No.2 current	3.4	2.7	mA
Max.-signal grid No.2 current	5.4	4.3	mA
R.M.S. signal input voltage	1.59	1.44	volts
Plate load resistance	11,000	17,500	ohms
Power output	1.65	1.65	watts
Total harmonic distortion	10	10	%

Pentode Audio Power Amplifier-Class AB Push-Pull (Two Valves)

Plate supply voltage	250	volts
Grid No.2 supply voltage	250	volts
Common cathode resistor	117	ohms
Zero-signal plate current	2x16	mA
Max.-signal plate current	2x18	mA
Zero-signal grid No.2 current	2x2.7	mA
Max.-signal grid No.2 current	2x4.7	mA
R.M.S. signal input voltage	3.5	volts
Plate load resistance	17,500	ohms
Power output	5.4	watts
Total harmonic distortion	4	%

NOTES

1. With plate current less than 0.1 mA. Maximum voltage pulse duration 18% of a cycle with a maximum of 18 µsec.

6DX8 "Miniwatt"

MAXIMUM RATINGS (Design-Centre Values)

Pentode Section

Plate voltage (without current)	550	volts
Plate voltage	250	volts
Plate dissipation	4	watts
Grid No.2 voltage (without current)	550	volts
Grid No.2 voltage	250	volts
Grid No.2 dissipation	1.7	watts
Cathode current	40	mA
External grid No.1 resistance:		
with cathode bias	2	megohms
with fixed bias	1	megohm
Heater-cathode voltage	200	volts
External heater-cathode resistance	20,000	ohms

Triode Section

Plate voltage (without current)	+550	volts
Plate voltage	+250	volts
Peak plate voltage (see note 1)	600	volts
Plate dissipation	1	watt
Cathode current	12	mA
External grid No.1 resistance:		
with cathode bias	3	megohms
with fixed bias	1	megohm
Heater-cathode voltage	200	volts
External heater-cathode resistance	20,000	ohms

TYPICAL CHARACTERISTICS

Pentode Section

Plate voltage	170	200	220	volts
Grid No.2 voltage	170	200	220	volts
Grid No.1 voltage	-2.1	-2.9	-3.4	volts
Plate current	18	18	18	mA
Grid No.2 current	3.0	3.0	3.0	mA
Mutual conductance	11,000	10,400	10,000	µmhos
Plate resistance (minimum)	0.1	0.13	0.15	megohm
Amplification factor (grid No.2 to grid No.1)	36	36	36	
Max. grid No.1 voltage at grid No.1 current = +0.3µA	-1.3	-1.3	-1.3	volts

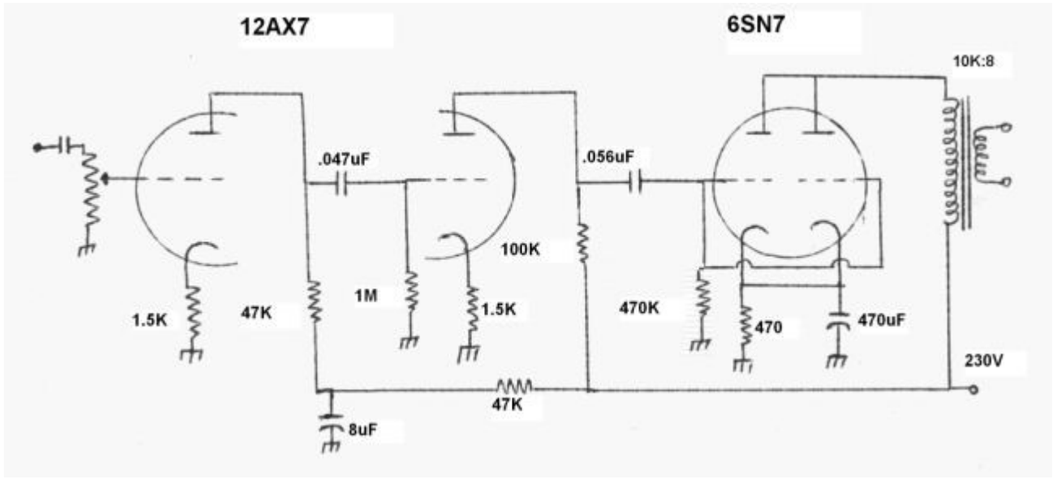
Triode Section

Plate voltage	200	volts
Grid voltage	-1.7	volts
Plate current	3	mA
Mutual conductance	4000	µmhos
Amplification factor	65	
Grid voltage at grid current = + 0.3 µA	-1.3	volts

1.6.1960 **Tentative data**

Philips in Australia provided data for single ended and push-pull audio output use.

6SN7 Amplifier.



This one is another from one of my Pulse Counting FM Receivers. Despite only putting out about 500mW, with a decent speaker it is one of my favourites. All triode means no negative feedback is required, although because of the high gain both 12AX7 triodes have their cathodes left unbypassed. The output transformer is a Jaycar M1109 with the 1W tapping used. The 12AX7 takes 6.3V@300mA or 12.6V@150mA for its heaters, while the 6SN7 requires 6.3V@600mA. B+ current is around 20mA.
The 6SN7 has a modern nine pin equivalent, the 6CG7 or 6FQ7. Another similar valve that should work is the slightly higher power 12BH7. It requires 6.3V@600mA, or 12.6V@300mA. 12AU7 should also work; it requires 6.3V@300mA or 12.6V@150mA for heaters.

6BM8 Amplifier.
See this design here. It has a power output of around 3W.

Miscellaneous Valves for Audio Amplifiers.

6J7 and 6B8 as Audio Output Valves.

SMALL TRIODES AS OUTPUT VALVES
Using the 6J7-G and 6B8-G

FOLLOWING on our use of the 6B8-G as an output pentode in the 4/40 Midget set, the following extract from "Radiotronics" has a particular interest.

It is not always realised that general purpose triodes and triode-connected pentodes are capable of an output of several hundred milliwatts when used as Class A1 power amplifiers. Types 6J7-G and 6B8-G are both capable of being operated as triodes with the screen connected to the plate, and under these conditions may be used with transformer coupling or as power amplifiers. The power output obtainable is quite sufficient to operate the loudspeaker of a small receiver.

TENTATIVE OPERATING CONDITIONS
(Screen connected to plate)

	6J7-G	6B8-G	
Heater	6.3	6.3	volts
Plate	250	250	volts
Grid	—8	—20	volts
Cathode Bias Resistor	1,230	2,500	ohms
Amplification Factor	20	8 3	
Plate Resistance ..	10,500	7500	ohms
Transconductance ..	1,900	1,100	umhos
Plate Current	6 5	8	mA
Load Resistance . ..	22,000	20,000	ohms
Power Output	275	350	mW.
Second Harmonic ..	5	5	%

SO much static electricity often accumulates in some tall buildings that a neon lamp can be lit by applying wires to a door knob.

INCREASED RATINGS
RADIOTRONS 6B8-G AND 6J7-G

THE 6B8-G as a pentode has, in the past, been limited to a maximum screen voltage of 125 volts, although triode operation has been permitted with a plate and screen voltage of 250 volts. The maximum screen voltage is now increased to 250 volts provided that the maximum cathode current does not exceed 11.5 mA., and provided also that the existing plate and screen dissipation limits are not exceeded. The amended maximum ratings are, therefore:—

Plate voltage	300	max. volts
Screen voltage	250	max. volts
Screen supply voltage	300	max. volts
Grid voltage	0	min. volts
Plate dissipation ..	2.25	max. watts
Screen dissipation ..	0.3	max. watt
Cathode current	11.5	max. mA.

These increased ratings will enable type 6B8-G to be used as a small A.F. power pentode with a screen voltage of about 140 to 150 volts.

The operating conditions should be adjusted so that the screen dissipation is not exceeded either at no signal or at maximum signal. With a bias of about —7.75 volts, a plate voltage of 250 volts, and a load resistance of 25,000 ohms, a power output of about 650 mW. will be obtained.

As a radio frequency amplifier there is normally no good purpose served by using a screen voltage in excess of 125 volts.

The 6J7-G as a pentode has previously been limited to a maximum screen voltage of 125 volts, although triode operation has been permitted with a plate and screen voltage of 250 volts. The maximum screen voltage is now increased to 250 volts. With 250 volts on screen and plate, the grid bias may be —8 volts as for triode operation, with a cathode current of 6.5 mA. This will enable type 6J7-G to be used as an A.F. power pentode with a power output in the region of 600 to 700 milliwatts.

Revised maximum ratings are now being prepared, and will be published when available.—Radiotronics.

This article is from Radio & Hobbies, Xmas issue 1940. Previously, R&H had used a 6B8 as a conventional pentode for the output stage of their "4-40" receiver from December 1940.

Revised data for the 6J7 and 6B8 as pentode output valves from May 1941 R&H

E88CC for class A and class B audio output.

This SQ (Special Quality) twin triode has official data for use as an audio output valve.

OPERATING CHARACTERISTICS

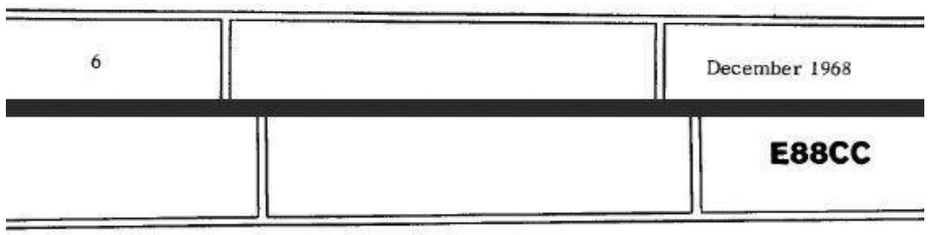
Output tube class A

Anode voltage	V_a		220		V
Load resistance	$R_{a\sim}$		20		kΩ
Grid voltage	$-V_g$		6.5		V
Input voltage	V_i	0	1.5	4.5	V_{RMS}
Anode current	I_a	6.5		9.2	mA
Output power	W_o		0.05	0.5	W
Total distortion	d_{tot}			7	%

Output tube class B (two tubes)

Continuous single tone input signal

Anode voltage	V_a		200		V
Load resistance	$R_{aa\sim}$		22		kΩ
Grid voltage	$-V_g$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5		2x9	mA
Output power	W_o		0.05	1.2	W
Total distortion	d_{tot}			3	%



OPERATING CHARACTERISTICS (continued)

Output tube class B (two tubes)

Speech and music inputsignal

Anode voltage	V_a		200		V
Load resistance	$R_{a\text{-}a\sim}$		10		kΩ
Grid voltage	$-V_{g_1}$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5		2x13.5	mA
Output power	W_o		0.05	1.5	W
Total distortion	d_{tot}			4	%

Since the characteristics are similar to the more common 6ES8/ECC189 it is interesting to speculate whether this valve can be similarly used.

12AX7 Class B output.

It is not well known, but the origins of the 12AX7 was for class B modulator use. This was soon forgotten about outside of the amateur radio world, and it became exclusively known as a high mu resistance coupled amplifier triode.

12AX7

ADDENDUM No. 1

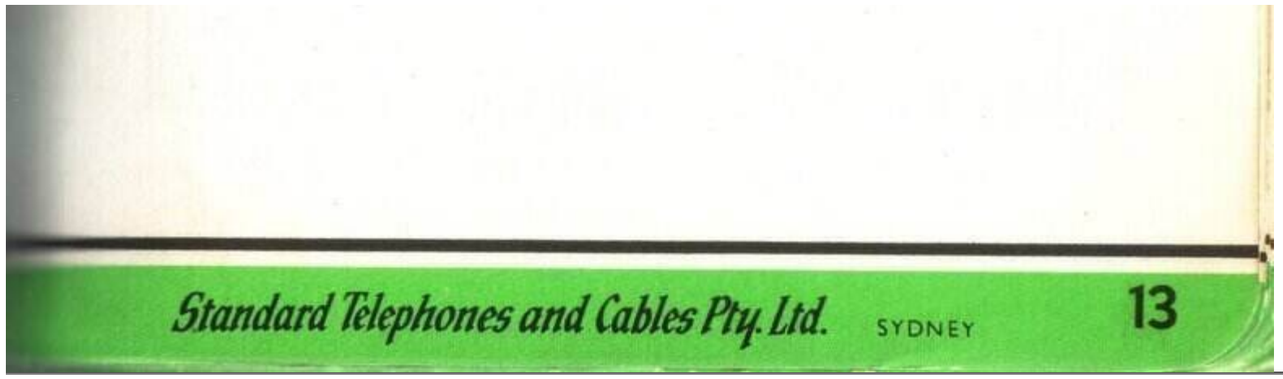
CLASS 'B' ZERO BIAS AMPLIFIER OR MODULATOR:

The 12AX7 may be used to give 8.0 watts output as a Class 'B' Zero Bias amplifier or modulator. Due to the high plate and grid dissipation under fully loaded operating conditions this valve should not be used under Class 'B' conditions in equipment for generating a continuous tone. It is, however, suitable for use in portable communication equipment where small weight and size considerations are of importance. Care must be exercised however, to ensure that the peak grid current is obtainable from the driver stage without distortion, and the regulation of the HT supply is adequate to supply the peak plate current. Suitable operating data are as follows :—

Plate voltage	280 volts
D.C. Grid voltage	0 volts
Output load impedance (plate - plate)	15,000 ohms
Plate current (no signal)	18 mA
Plate current (max. signal)	46.7 mA
Grid current (no signal)	0.35 mA
Grid current (max. signal)	17.7 mA
Input voltage (peak-peak)	33 volts
Input power	13 watts
Total harmonic distortion	7.5%
Power output	8.0 watts

Note: Values given are for two valves.

Curve No. 313.39 attached to this addendum shows the relationship between, plate current, grid current, harmonic distortion.

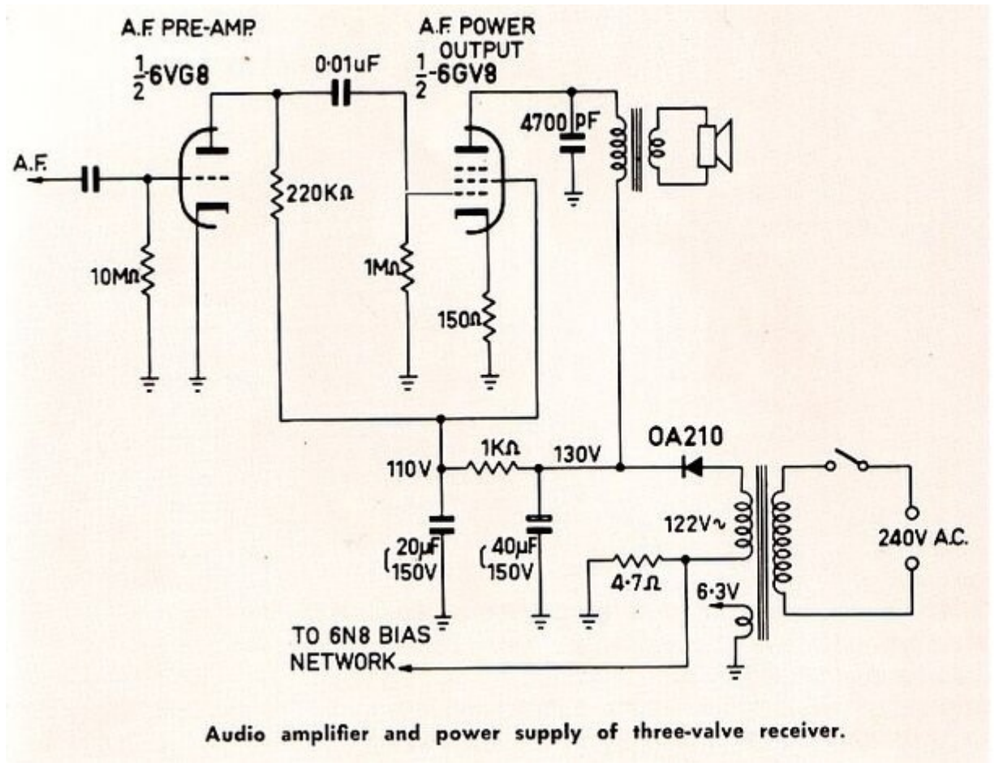


6GV8 Amplifier.

This valve was intended for frame oscillator and output use in TV sets. The European number is ECL85, but a later higher rated version also exists, as the ECL805. For European readers, the 300mA series heater version PCL85/18GV8 and PCL805 would be more familiar.

Because of the low plate voltage of this valve (as compared to typical 250V types), one may wonder about using the pentode as an audio output valve with lower than normal B+ voltage, while still obtaining good output power. As it happens, Philips in Australia did explore this possibility, as described in the Miniwatt Digest for March 1963.

Commercially, the 6GV8 was used as an audio amplifier in the Kriesler 11-99 mantel radio, and the Pye T23 TV set.



Audio amplifier and power supply of three-valve receiver.

Audio Amplifier

The 6GV8 is suggested as AF amplifier in spite of the fact that this valve is particularly designed for vertical oscillator and output service. Closer investigation shows that such a valve, which in TV has to deliver high peak plate current at low plate voltage, is just the type suitable for AF power output service at low HT voltage. Since there is also a triode section in the 6GV8, this can be used as AF pre-amplifier, thus eliminating another valve from the original five-valve receiver. The optimum operating conditions for the pentode section at 130 V plate supply and 110 V screen supply require a cathode resistor of 150 Ω and a plate load impedance of 2000 Ω. The DC plate current is then 40 mA and the power output at the plate 2.2 W at 11% THD. If feedback is applied by omitting the cathode bypass capacitor, and if a standard $\frac{9}{16}$" sq. stack output transformer is used, approximately 1.4 W of output power can be expected in the voice coil.

Since both the triode amplification factor and pentode mutual conductance of the 6GV8 are lower than those of, say, a 6BD7-6M5 combination, the AF sensitivity will be lower—in the above case by a factor of two.

Note that the operating conditions here are very similar to output valves often used in U.S. designed sets for AC/DC operation. For Australian constructors, the 6GV8 is an easier valve to obtain when wanting to duplicate such circuits,
provided of course the heater supply is taken into account. This is 900mA at 6.3V.

6CM5 Amplifier.

This was the most common line output pentode used in Australian TV sets. The European type number is EL36, but outside of Australia the 300mA series heater version PL36/25E5 is more common. This valve is *not* designed for single ended audio use, and is *not* ideal for the purpose.

Nevertheless, work was done to examine what could be done with it as a single ended output valve operating in class A. See article here.
The 6CM5 is more suited to push-pull operation, and Philips not only provided data for this, but produced several PA amplifiers with 6CM5's used for the output valves.

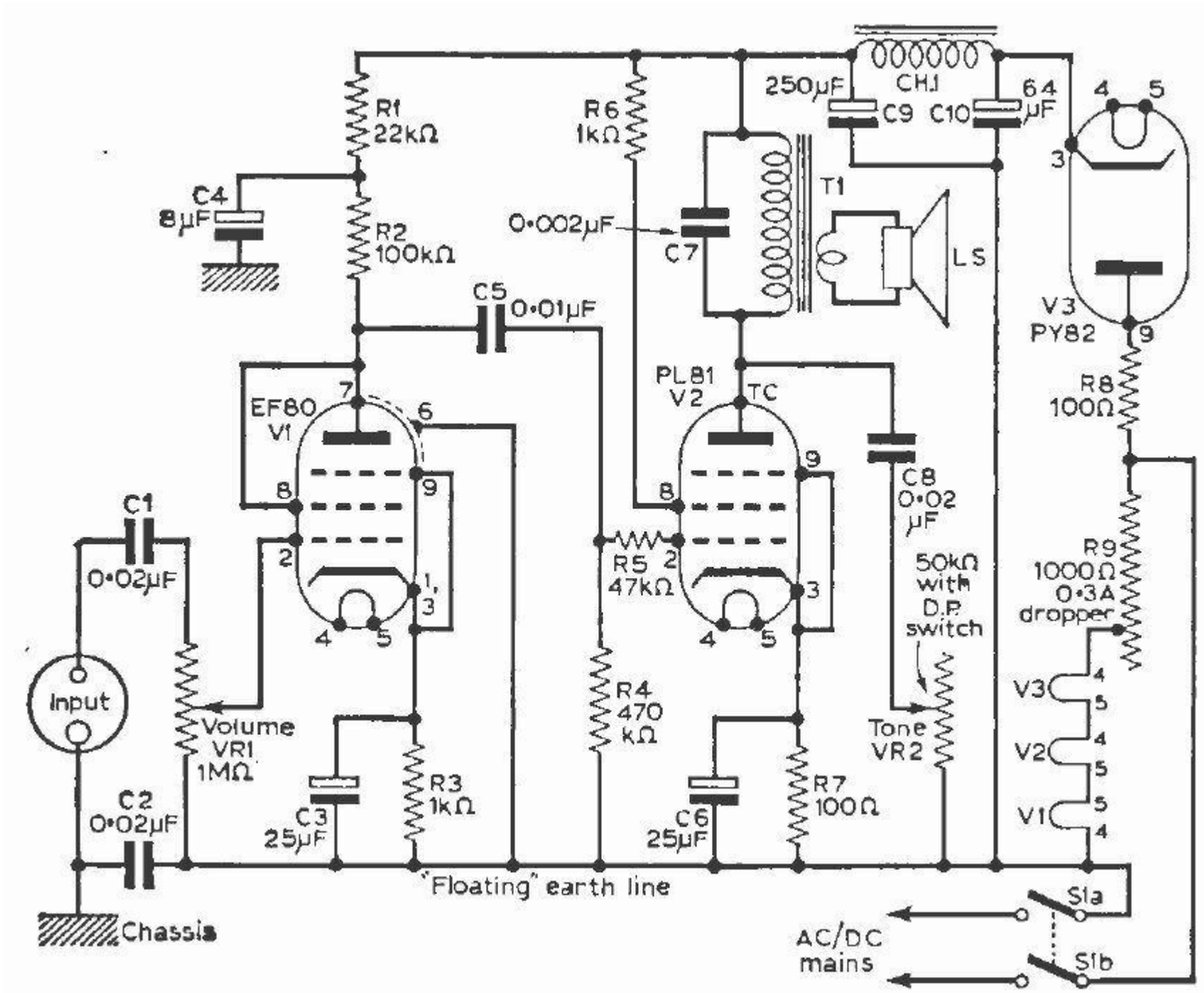
TYPICAL OPERATING CONDITIONS

Audio Power Amplifier - Class B (Two Valves)

Plate voltage	300	volts
Grid No.2 voltage	150	volts
Grid No.1 voltage	-29	volts
Zero-signal plate current	2×18	mA
Max.-signal plate current	2×100	mA
Zero-signal grid No.2 current	2×0.5	mA
Max.-signal grid No.2 current	2×19	mA
R.M.S. signal input voltage	20.0	volts
Load resistance plate to plate	3500	ohms
Power output	44.5	watts
Total harmonic distortion	7.2	%

PL81 Amplifier.
If one must use television line output valves for single ended audio, the PL81/21A6, or its 6.3V heater version, the EL81/6CJ6 is a better choice than the 6CM5.
I have had good results with the PL81 as a singled ended output valve as part of this receiver.

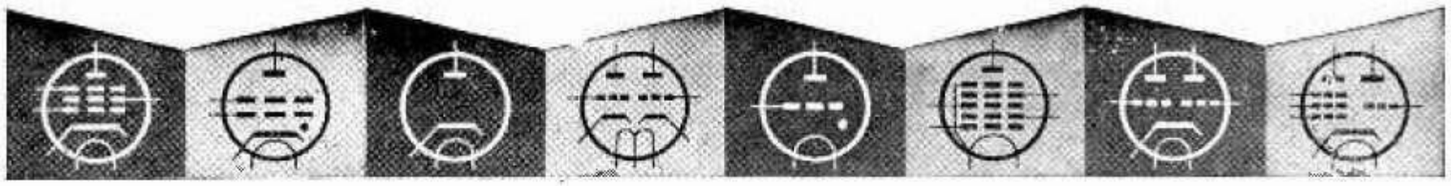
Practical Television for April 1968 described this "Teleamp" using a PL81.



Circuit of the Teleamp. Practical Television for April 1968, along with other issues, can be seen at the world radio history site.

The operating conditions are questionable, and the circuit is presented here as a curiosity only. I have not built or tested it. Aside from that, the recommended output transformer was a 240 to 6.3V CRT heater transformer, and there is no negative feedback. Not exactly hi-fi.

The following push-pull amplifier was designed by Mullard, and would be a better design. The "Class B" designation is questionable however, since there is no low impedance drive to provide grid current to the PL81's.



VALVES, TUBES & CIRCUITS

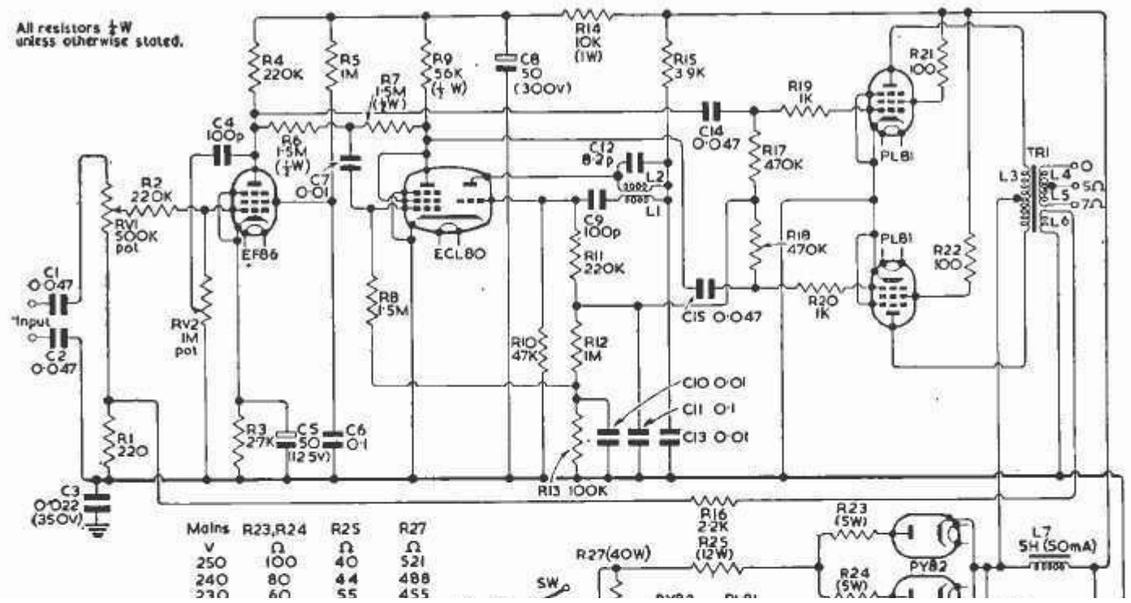
8. 15-WATT D.C./A.C. AUDIO AMPLIFIER

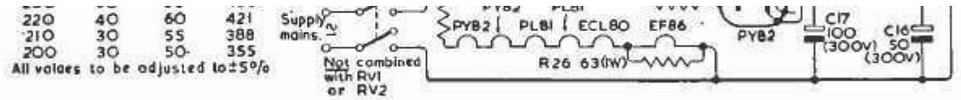
An amplifier suitable for use with D.C. or A.C. mains to give about 15 watts power output can be constructed with Mullard miniature noval-based valves. Two PL81 valves, used as a Class "B" push-pull output stage, are preceded by an ECL80 triode-pentode, the triode section of which operates as an R.F. oscillator at a frequency of about 2Mc/s. The direct voltage developed across its grid leak is used to bias the output valves and also the pentode section of the ECL80. The input signal is amplified by an EF86 and is fed direct to the control grid of one PL81. In addition, a portion of the signal voltage is applied to the pentode section of the ECL80 operating as a triode-connected phase inverter preceding the other PL81.

The power supply consists of two PY82's connected in parallel as a half-wave rectifier. The heaters of all the valves are connected in a 300 mA series chain, the 200 mA heater of the EF86 being shunted by a 63Ω resistor.

The potentiometer, RV2, acts as a treble tone control. An additional secondary winding L6 on the output transformer supplies a negative feedback voltage which is injected into the grid circuit of the EF86 via resistors R16 and R1. As the volume control RV1 is connected to R1, the feedback is minimum at maximum sensitivity of the amplifier and increases when the sensitivity is decreased. Care must be taken, as with all D.C./A.C. equipment, to avoid direct connection between the chassis and earth. In addition the chassis (H.T.—) line should be connected, where possible, to the neutral side of the mains.

An output of 16.2 W is measured at the primary side of the output transformer when the input at the grid of the EF86 is 220 mV. Without feedback the distortion is 6%, this being reduced to 1.8% by the application of feedback. The hum and noise level is 42 dB below at 16.2 W.





BIAS OSCILLATOR COILS L1, L2.
Standard M.W. local oscillator coil (mains). With no input, current through R10 should be 0.7 mA at 220V mains. Current increased by adding turns to L1 and decreased by removing turns.

OUTPUT TRANSFORMER, TR1.
Shell type core 1¼ in. wide. "No waste" series laminations 0.02 in. thick. 1 in. stack without air-gap. Overall dimensions: 3¾ x 3⅛ in.

L3 :	2 x 880 turns of 33	S.W.G.
L4 :	88 turns of 18	S.W.G.
L5 :	16 turns of 18	S.W.G.
L6 :	120 turns of 29	S.W.G.

Reprints of this advertisement together with additional data may be obtained free of charge from the address below

Mullard

MULLARD LTD., Technical Publications Dept., Century House, Shaftesbury Avenue, London, W.C.2

MVM235

The 807.
From RTV&H March 1947, this describes using the 807, which had recently been released inexpensively on the disposals market. Of interest is substituting an 807 for single ended 6V6 (and 6AQ5 or 6BW6) circuits by replacing the 250R cathode resistor with 350-400R (390R in preferred values). The 6F6 can be substituted by using a 500R cathode resistor.
Note the increase in heater current if doing this; 900mA for the 807, compared to 450mA for the 6V6.

REDUCED PRICE FOR 807's

USING THE VALVE IN B/C SETS

Type 807 valves, manufactured in huge numbers during the war years, are now being sold at 14/6 retail, plus 2/- war duty. This drastically reduced price, subject to normal trade discounts, makes them a proposition for domestic receivers and amplifiers, as well as being a boon to amateurs.

HE 807 started life essentially as a 6L6, with the plate brought out a top can. Refined mechanically nd electrically, it has since taken its ace as one of the most useful transitting valves on the market. It is ually suitable for use as an audio wer amplifier, an oscillator, or as an F power amplifier.

Electrically, the 807 is very similar to e 6L6 beam pentode but is fitted with five-pin low loss micanol base and s a top cap plate connection. The ate dissipation for normal service is watts, maximum plate voltage 600 nd the mutual conductance 6000 icro-ohms.

IGH-MU VALVE

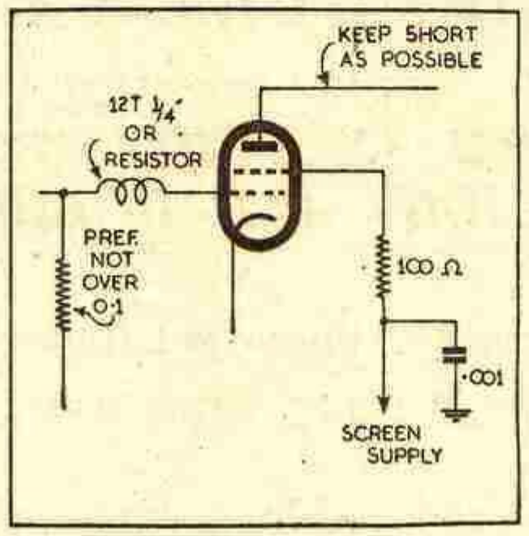
This high mutual conductance, upled with the other characteristics the valve, necessitates a certain mount of care in its use, if trouble is be avoided from parasitic oscillation. owever, self oscillation effects of this ature are by no means peculiar to the 7, for they become progressively more kely to occur with valves combining gh mutual conductance and high ate current capabilities.

This is probably why the 807 has en labelled by some as a "cranky be." Little wonder, if they are allowed oscillate madly at a supersonic frency while ostensibly serving as audio plifiers. Or, again, if they perform orly as modulated amplifiers because oscillation at UHF.

Actually there is no need to fear inability with the 807 if one or two rcuit precautions are taken as a but every effort should be made to keep the plate leads as short as possible and away from the input circuit wiring. Follow these simple rules and you can be just about certain that your 807 will do the right thing, irrespective of its circuit application.

In the light of the present bargain price the 807 takes a lot of arguing away as a valve for amplifier work and for general amateur use. Robust and reliable, a pair of them will deliver anything up to 120 watts of audio power with comparatively modest drive requirements — nominally one-twentieth that for a comparable pair of triodes.

As an RF power amplifier for class C telegraphy its maximum power output is 50 watts, with a plate circuit efficiency of some 66 per cent. and a nominal grid drive of 0.2 watt. This drive is only a fraction of that required by a comparable triode and, considering further that no neutralisation is



load of 2500 ohms a single 807 can deliver a power output of 6.5 watts. With negative feedback operative this is ample in quality and quantity for all normal home requirements. However, remember that the plate and screen current total 80-odd milliamps under these conditions, so that a power supply and filter system of ample design is essential. The same remarks apply for the output transformer.

REPLACEMENT

For those who may want to use an 807 as a replacement for, say, a 6F6-G or a 6V6-G it is possible to overbias the valve and so reduce the plate current (and with it the power output) to the same general level as the aforementioned valves. There is not a great deal of point in making such a substitution, but it can be done.

Thus an 807 will draw approximately 40 milliamps of plate and screen current with 250 volts applied to each and a bias of approximately 20 volts. This requires a cathode bias resistor of 500 ohms. With a cathode resistor of from 350 to 400 ohms the performance will approximate more than a 6V6-G, with a total plate and screen current of 50-odd milliamps.

Actually a single 6L6 or 807 can deliver 10 or more watts of audio power under carefully arranged operating conditions. This calls for fixed grid bias, a screen voltage of 250 and a plate voltage of 350 or more. Although attractive at first glance, it is not always convenient to provide the fixed bias source and a well regulated screen supply. The use of cathode bias and a simple series screen resistor do not allow the full rated power output to be obtained.

Nevertheless, the use of a single 807 as a driver for high power class B triode is an interesting and an economical possibility. The application of negative feedback to a tetrode driver stage should permit fidelity and regulation equal to the conventional triode drivers.

CLASS A TRIODE

There are ratings for the 6L6 or 807

atter of course. The precautions are uite simple and we would go so far as say that an 807 should never be sed without them.

According to the manufacturers, the ost important single measure to pre- ent parasitic effects is to connect a 0 ohm non-inductive resistor right at e screen pin of the valve and in series ith the screen voltage supply. Bypass e high tension end of the resistor to hassis with a .001 mfd mica condenser.

S R.F. AMPLIFIER

When used as an RF power amplifier is also wise to connect an RF choke the grid circuit and one can be made effectively by winding about a dozen rns of fairly heavy gauge wire around lead pencil and pulling it open to ace the turns a little. For audio mplifier applications, where substan- al grid current does not flow, a non- ductive grid stopper resistor of 1000 5000 ohms can well be used.

Chokes or resistors should not nor- ally be necessary in the plate circuit,

This circuit shows how to use suppressors with the 807 to avoid parasitics.

required, the 807 is a natural choice for amateurs operating in the 10, 20, 40 and 80 metre bands.

Coming to a more detailed review of the characteristics, the valve can be considered seriously for use in the output stages of domestic receivers and amplifiers. For this purpose it can be treated as a 6L6 and used under the same ratings. A point to remember is that the plate is brought out to the top cap so that some care is necessary to prevent accidental contact with the bare metal. Even a hundred or more volts can "bite" and a voltage substantially higher than that can be positively dangerous. Use bakelite insulated caps, if you can get them, or wrap the connection with adhesive tape.

With 250 volts on plate and screen a bias resistor of 170 ohms and a plate

as a class A triode, but the power output in this service is comparatively small.

Like the 6L6, the 807 operates to best advantage in push-pull audio circuits.

For large domestic receivers and amplifiers the valves can be used conveniently with equal plate and screen voltage and cathode bias. A power output of 14-odd watts is available for the 250 volt conditions, rising to 20 watts or thereabouts with higher plate and screen voltages.

For still higher figures of power output it is necessary to hold the screen voltage at its rating limit of 300 volts and progressively increase the plate voltage as desired. Operating under these class AB1 conditions, with 400 volts on the plate, a power output of 30 watts is obtained. Calculation shows that this would rise to 38 watts for 500 volt operation and 46 watts with 600 volts on the plate. In each case it is naturally assumed that due adjustment is made to the operating bias and output load.

The fact that the valves operate

USING THE 807 VALVE IN RECEIVERS

(Continued from Page 31)

der class AB1 conditions signifies at no grid current flows, so that any pe signal input circuit can be em- oyed, including resistance coupling. he signal voltage requirements are t difficult and it is naturally of great dvantage to obtain upwards of 40 atts audio power with nothing more han a phase invertor or phase splitter age to supply the grid signal voltage.

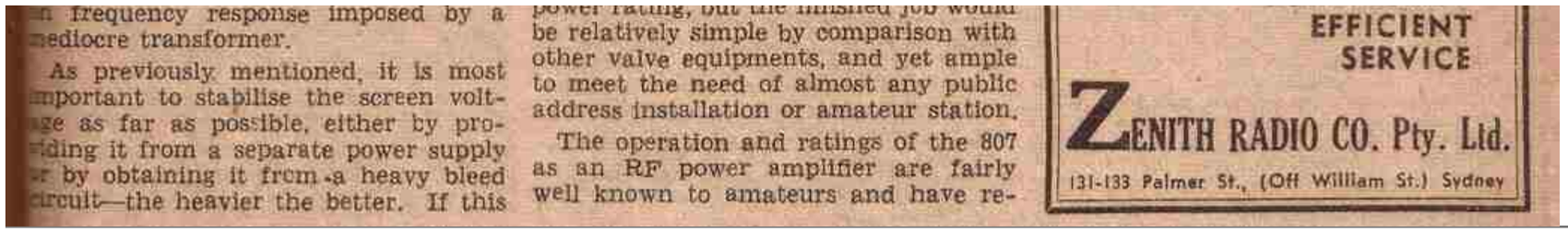
Use of transformer input confers a ight advantage, in that distortion does ot begin so sharply at grid current or verload point. This is a consideration modulator design, where ability to andle signal peaks, or the need for he last ounce of power, is often more mportant than any minor limitation

is not done the screen voltage will drop on sustained loud passages and limit the power output drastically. Where there is any doubt about the adequacy of the bleed circuit the screen can be heavily bypassed to earth—say with 32mfd—the condenser serving at least to maintain the screen voltage during sharp signal peaks as normally occur in speech.

Operated under class AB2 conditions, with fixed bias and well regulated plate and screen supplies, a pair of 807 valves will deliver up to 120 watts of audio, with a nominal grid input power of 0.2 watt. Plenty of care is necessary in designing an audio amplifier of this

celved no little attention in past issues. A single 807 will handle efficiently all the power which it permitted under a class B licence, while two of them in push-pull are more than adequate for the needs of class A licensees.

In view of the present price reduction it is hard to visualise a simpler or less expensive transmitter than the one described last month—one valve operating as oscillator and doubler driving an 807 to full power if necessary.



n frequency response imposed by a mediocre transformer.

As previously mentioned, it is most important to stabilise the screen voltage as far as possible, either by providing it from a separate power supply or by obtaining it from a heavy bleed circuit—the heavier the better. If this

power rating, but the finished job would be relatively simple by comparison with other valve equipments, and yet ample to meet the need of almost any public address installation or amateur station.

The operation and ratings of the 807 as an RF power amplifier are fairly well known to amateurs and have re-

Home

email: cablehack@yahoo.com