A 100W FIXED BIAS ULTRA-LINEAR AMPLIFIER

The circuit of this amplifier is given in fig. 8 and it provides 100W output at 5% distortion with an h.t. potential of 560V. The performance is shown graphically in fig. 9 and Table III gives the operating conditions for the output stage.

With fixed bias, the large change in anode current necessitates a low impedance power supply and, with normal rectifier circuits, an inductance-input smoothing filter is essential. The smoothing capacitor should be of high value to prevent an instantaneous fall in h.t. potential upon the occurrence of a transient signal. Satisfactory performance will be obtained with a single inductor and a capacitance of 50—150μF. The circuit diagram shows two 160μF 450V electrolytic capacitors in series as an economical method of obtaining the required capacitance.

Reducing the h.t. potential to 460V, the load impedance to 4kΩ and the grid bias to −65V results in an amplifier giving 65W output. The performance of this version is shown in fig. 10 and the appropriate operating data are included in Table III.

Protection Against Bias Failure

Should the bias supply fail, the KT88 anode currents would increase excessively and it is recommended that some device be incorporated for protecting the output valves in the event of bias failure. The arrangement illustrated in fig. 11 inserts a suitable resistor into the output stage cathode circuit which will enable the amplifier to function temporarily at half maximum output.

A triode, which could be one half of a double triode used also in the first stage of the amplifier, is connected in series with a relay across the main h.t. supply. The relay contacts are normally closed and short-circuit the emergency cathode resistor R1. The triode is held at cut-off by the connection of its grid to the bias supply at a point about 50V negative to earth. Should the bias fail, the grid of the triode will rise to earth potential and current will flow through the triode. This energises the relay, the contacts of which will open and bring into circuit the cathode bias resistor.

TABLE III

100W ULTRA-LINEAR AMPLIFIER

Operating Conditions

(Fig. 8)

$V_{a(b)}$	460	560	V
$V_{a,g2}$	450	550	V
$I_{a+g2(o)}$	2×50	2×50	mA
$I_{a+g2(max\ sig)}$	2×120	2×150	mA
$P_{a+g2(o)}$	2×25	2×30	W
$P_{a+g2(max\ sig)}$	2×20	2×33	W
*V_{g1}	−65	−80	V
P_{out}	65	100	W
$R_{L(a-a)}$	4	4·5	kΩ
z_{out}	6·5	6·5	kΩ
†D	3—6	3—6	%
$V_{in(rms)}$ (to first stage)	1 to 1·5	1 to 1·5	mV

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

†The distortion will vary according to the degree of matching by R11.

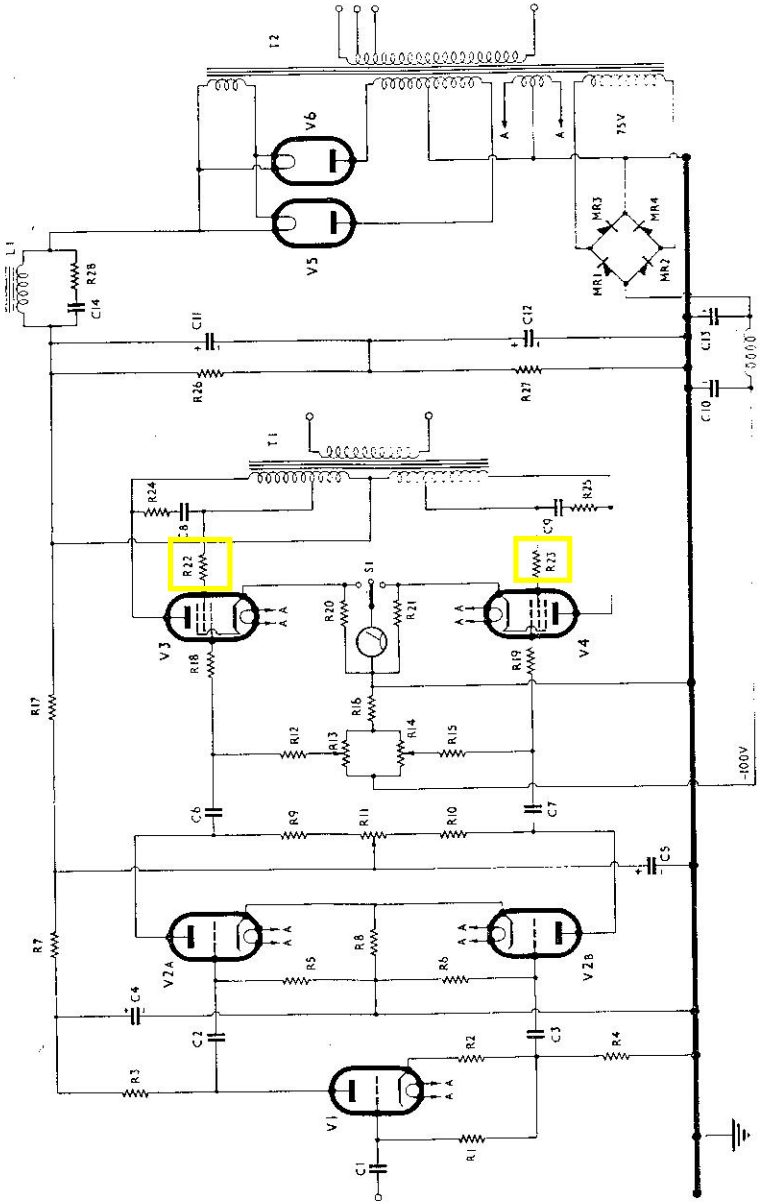


Fig. 8. Circuit diagram of the KT88 100W fixed bias ultra-linear amplifier. R26 and R27 equalise the voltages across C11 and C12, the series-connected smoothing capacitors. C14 and R28 prevent the build-up of high voltage transients across L1.

COMPONENT VALUES FOR FIG. 8

100W FIXED BIAS AMPLIFIER

G.E.C. VALVES

V1 L63/6J5
V2 B65/6SN7
V3 KT88
V4 KT88
V5, V6 } U19 (or GXU50 with delay)

RESISTORS

(20%, 0·25W unless otherwise shown)

R1 1MΩ
R2 1·5kΩ
R3 33kΩ 1W, R4 33kΩ 1W } matched to 5%
R5 470kΩ 10%
R6 470kΩ 10%
R7 33kΩ 1W
R8 1kΩ
R9 33kΩ 10% 1W
R10 10kΩ
R11 33kΩ 10% 1W
R12 100kΩ 10% 0·5W
R13 20kΩ w.w. preset
R14 20kΩ w.w. preset
R15 100kΩ 10% 0·5W
R16 10kΩ 10% 1W
R17 4·7kΩ 1W
R18 5·6kΩ
R19 5·6kΩ
R20, R21 } Meter shunts
R22 270Ω 0·5W
R23 270Ω 0·5W
R24 470-1500Ω 0·5W
R25 470-1500Ω 0·5W
R26 100kΩ 10% 1W
R27 100kΩ 10% 1W
R28 10kΩ 0·5W

CAPACITORS

C1 0·01μF
C2 0·05μF
C3 0·05μF
C4 8μF 350V
C5 8μF 450V
C6 0·1μF
C7 0·1μF
C8 1000pF
C9 1000pF
C10 8μF 250V
C11 160μF 450V, C12 160μF 450V } each 100+60 dual
C13 8μF 250V
C14 0·01μF 750V

MISCELLANEOUS

L1 5H 325mA
L2 20H 10mA
T1 100W Ultra-linear transformer
4·5kΩ anode-anode (100W)
4kΩ anode-anode (65W)
Primary inductance : ⩽40H
Leakage inductances :
Prim.—sec. : ⩾6mH
½ prim.—UL tap : ⩾6mH
T2 Mains transformer
Secondaries :
700—0—700V 325mA
6·3V 5A CT
5V 7A
75V 10mA (bias)
S1 1-pole 3-way
MR1, MR2, MR3, MR4 } 75V 10mA

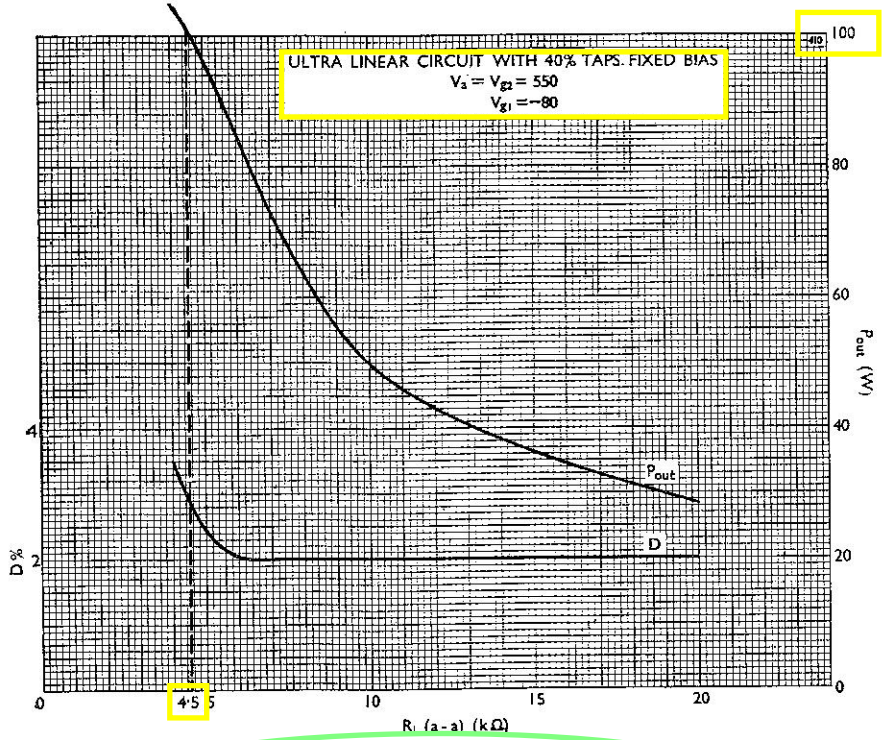


Fig. 9. Performance of the KT88 100W amplifier of fig. 8.

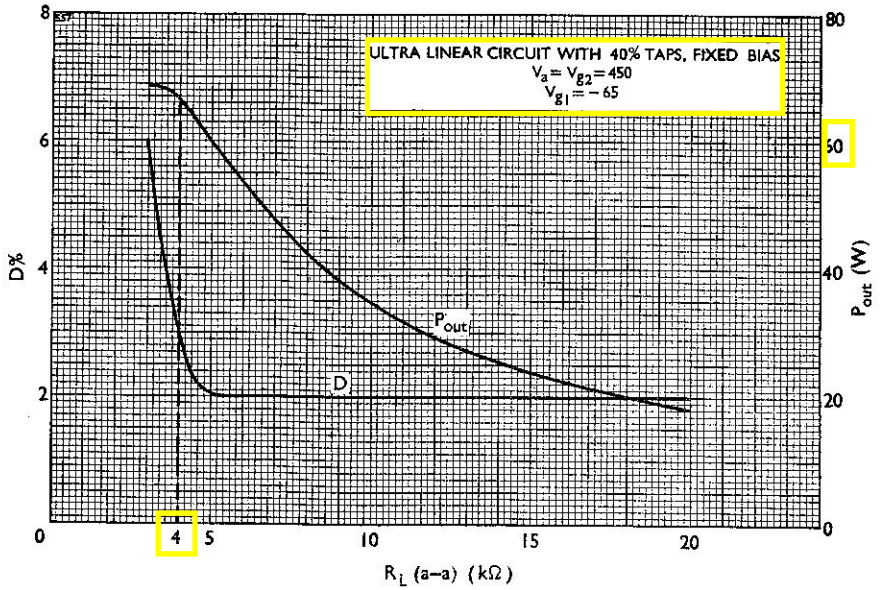


Fig. 10. The modified characteristics of the amplifier in fig. 8 when it is arranged for 65W maximum output (see Table III).

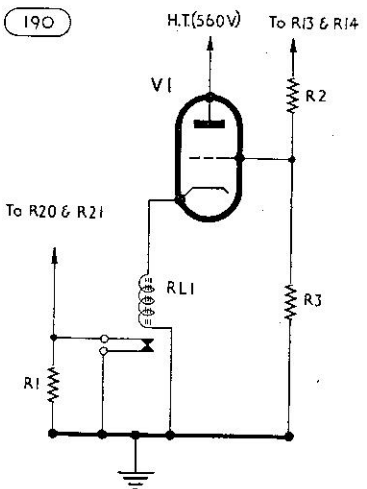


Fig. 11. Bias failure protection for the KT88 fixed bias amplifier. R2 is connected to the positive (earthy) junction of R13 and R14 in fig. 8. R2 and R3 take the place of R16 in the amplifier. The earth connection to the meter in fig. 8 is broken and the meter (and R20, R21) taken to R1. Component values : V1 : G.E.C. L63/6J5 ; R1 : 330Ω 10% 5W ; R2 : 6·8kΩ 10% 0·5W ; R3 : 15kΩ 10% 0·5W ; RL1 : 20kΩ.