BRIMAR

RECEIVING VALVE

12AH8

APPLICATION REPORT VAD/520.2

Standard Telephones and Cables Limited

FOOTSCRAY, KENT, ENGLAND

1.0 INTRODUCTION: The Brimar 12AH8 is a miniature, Noval based, triode-heptode frequency changer intended for use in all wave broadcast and communication receivers. Particular attention has been paid to the attainment of high conversion conductance and impedance and good oscillator performance. The valve has been designed to operate from either a 250 volt or a 100 volt HT rail, and may be used in both AC and AC/DC type equipment. A centre tapped heater is provided so that the valve may be operated at 12·6 volts 0·15 ampere or 6·3 volts 0·3 ampere.

This report contains characteristics of the valve and details of its uses as a frequency changer in superheterodyne receivers.

2.0 DESCRIPTION: The valve consists of two units mounted one above the other having common heater and cathode connections. The lower unit is the heptode mixer and the upper the triode oscillator. The triode grid is internally connected to grid 3 of the heptode. The whole is enclosed in a $T6\frac{1}{2}$ bulb and mounted on a standard B9A (Noval) nine pin base.

3.0 CHARACTERISTICS:

3.1 Cathode:

Indirectly heated	
Voltage	6·3 or 12·6 volts
Current	0·3 or 0·15 amperes
Max. DC Heater to Cathode potential	250 volts
Max. Cathode Current	17·5 mA

3.2 Dimensions:

Max. Overall Length	2-5/8 ins.
Max. Diameter	7/8 in.
Max. Seated Height	2-3/8 ins.

3.3 Base: Type B9A (Noval) Nine Pin

3.4 Basing Connections: Pin 1 Screen $g_2 + g_4$
Pin 2 Heptode Control Grid g_{1h}
Pin 3 Cathode and Suppressor Grid $k + g_5$
Pin 4 Heater h
Pin 5 Heater h
Pin 6 Heptode Anode a_h
Pin 7 Triode Grid and Heptode Grid 3 $g_t + g_3$
Pin 8 Triode Anode a_t
Pin 9 Heater Centre Tap h_{tap}

3.5 Ratings:

HEPTODE SECTION:

Max. Anode Voltage	300 volts
Max. Screen Voltage	125 volts
Max. Anode Dissipation	1·5 watts
Max. Screen Dissipation	1·25 watts

TRIODE SECTION:

Max. Anode Voltage	150 volts
Max. Anode Dissipation	0·75 watts

3.6 Inter-electrode Capacitances (approx.)   Measured with close fitting external shield:

RF Input $c_{glh, all}$	5·0 pF
IF Output $c_{ah, all}$	8·0 pF
Triode Input	7·0 pF
Triode Output	2·5 pF
Heptode Grid to Heptode Anode	0·025 pF (max.)
Triode Grid to Triode Anode	1·2 pF
Control Grid to Triode Anode	0·1 pF
Control Grid to Triode Grid	0·2 pF

3.7 Characteristic Curves: Curves are attached to this report as follows:

I_{ah} and I_{g2+g4} versus V_{glh} with V_{ah} 100 volts and various values of V_{g2+g4}	320·14
Ditto with V_{ah} 250 volts	320·15
Conversion Conductance and Impedance versus V_{glh} with V_{ah} 100 volts and various values of V_{g2+g4}	320·16
Ditto with V_{ah} 250 volts	320·17
Conversion Conductance and Impedance versus I_{gt} with V_{ah} 100 volts and various values of V_{g2+g4}	320·18
Ditto with V_{ah} 250 volts	320·19
I_{ah} and I_{g2+g4} versus I_{gt} with V_{ah} 100 volts and various values of V_{g2+g4}	320·20
Ditto with V_{ah} 250 volts	320·21
I_{ah} and I_{g2+g4} versus V_{g3} with V_a 250 V_{g2+g4} 100 and various values of V_{glh}	320·22
Ditto versus V_{glh} with various values of V_{g3}	320·23
I_a/V_a Triode	320·24

4.0 TYPICAL OPERATION:

4.1 TYPICAL OPERATING CONDITIONS:

Heptode Anode Voltage V_{ah}	100	250	volts
Heptode Screen Voltage V_{g2+g4}	100	100	volts
Control Grid Voltage V_{glh}	—3	—3	volts
Cathode Bias Resistor R_k	220	220	ohms
Triode Anode Supply Voltage $V_{at(b)}$	100	250	volts
Triode Anode Series Resistor R_{at}	0	27,000	ohms
Triode Anode Voltage V_{at}	100	100	volts
Heptode Anode Current I_{ah}	2·5	2·6	mA
Heptode Screen Current I_{g2+g4}	4·5	4·4	mA
Triode Grid Current I_{gt}	200	200	μA
Triode Grid Resistor R_{gt}	47	47	kΩ
Conversion Conductance g_c	0·52	0·55	mA/V
Control Grid Bias for $\dfrac{g_c}{100}$ V_{glh}	—22	—22	volts
Conversion Impedance r_c	0·6	1·5	MΩ
Equivalent Noise Resistance (approx. r_{eq})	100	100	kΩ

4.11 TRIODE CHARACTERISTICS:

Anode Voltage V_a	100	volts
Grid Voltage V_g	0	volts
Anode Current I_a	14·6	mA
Anode Impedance r_a	4850	ohms
Mutual Conductance g_m	3·5	mA/V
Amplification Factor μ	17	

4.2 GENERAL RECOMMENDATIONS:

4.21 Triode Grid Current: The oscillator section of the 12AH8 has a relatively high mutual conductance so that normally there is no difficulty in obtaining adequate grid current. The optimum value of grid current is 200 μA and the coils should be designed so that an average valve operates at this value. At the weakest point of oscillation the grid current must not fall below 125 μA. Inspection of the Curves 320·18 and 320·19 shows that a rapid drop in conversion takes place below 150 μA grid current, and this region should be avoided if large variations in gain on production chassis are to be avoided.

It is desirable to place a maximum limit on oscillator grid current, as too high a value often leads to parasitic oscillations and, in particular, to tunable whistles due to the generation of oscillator harmonics. It is suggested that the oscillator grid current be held below 400 μA for these reasons.

If, due to the type of oscillator circuit used, a large variation in triode grid current is encountered over the tuning range, a low value resistor may be wired in series with either grid or anode directly to the valve holder tag to stabilise the feed back.

4.22 Application of A.V.C.: A.V.C. may be applied to the control grid, and its effect on the characteristics is shown in the curves. On 320·14 and 320·15 is shown the relation between anode and screen currents and A.V.C., and on 320·16 and 17 the effect of A.V.C. on the conversion conductance and impedance.

The DC resistance in the control grid circuit should be kept below 3MΩ. This is particularly important on the short waves as a high value grid leak increases the tendency for the control grid to draw current due to pick-up of the oscillator voltage through stray coupling or capacity within the valve.

In communication receivers it is best to operate the frequency changer without A.V.C., as its application causes a small amount of pulling of the oscillator frequency (Curve 320·31). If no RF amplifier exists before the frequency changer the bulk of the receiver noise originates in the mixer valve; running this at maximum gain reduces its noise level to a minimum.

4.23 Screen Voltage: The method of supplying the screen voltage has a great effect on the A.V.C. characteristics of the 12AH8. When the valve is operated from a 100 volt HT rail the screen is generally connected directly to this, or if any series resistance exists it is of low value purely for decoupling. Variations in the screen current due to the A.V.C. action then have no effect on the screen voltage, but if the screen supply is obtained by way of a dropping resistor from a higher voltage HT rail, the variations in screen current affect the screen voltage in such a way as partially to offset the A.V.C. action. The fall in screen current is accompanied by a rise in screen voltage which tends to maintain the level of anode current and conversion conductance. This effect is shown on graphs 320·15 and 320·17 where curves are given for operation with a series screen resistor. If a potential divider is used to derive the screen voltage the steady current drawn by the bottom resistor assists in stabilising the screen voltage. If both the frequency changer valve and IF amplifier valve have their screens fed through a common series resistor the A.V.C. control is extremely poor, as two valves are now opposing the A.V.C. action and assisting each other in the process. A common potential divider for the two valves, however, offers a solution which gives adequate A.V.C. control. On 320·28 are curves illustrating these effects, and the long cut-off tail of the sliding screen can be compared with that of the direct and potential divider supply. The curve showing the control when the potential divider is common to the frequency changer and IF amplifier includes the gain of the IF amplifier, whereas the other three curves are for the frequency changer alone.

Another reason why a common series screen resistor for the two valves is not recommended is because variations in the screen current of one valve necessarily affect the screen potential of both valves. Excessive variations in gain will then be experienced with valves with normal spread of screen current.

4.24 Methods of Bias: Bias for the control grid should be derived from a cathode bias resistor exclusive to the 12AH8. The practice of sharing a cathode bias resistor with another valve is not recommended as it makes the receiver gain too reliant on the total cathode current of the two valves.

Bias should not be obtained wholly from the contact potential of the A.V.C. diode as this is subject to very wide variations, in extreme cases being non-existent.

4.3 High Frequency Performance: The 12AH8 is very suitable as a frequency changer for broadcast type receivers in the V.H.F. 88 to 108 Mc/s band. Its signal to noise performance precludes its use from V.H.F. communication type equipment and television, but it has very definite possibilities for low and medium priced receivers for broadcast reception of FM or AM stations in the international V.H.F. band. Details of a suitable circuit and performance figures are given later in this report.

4.31 Input Impedance and Capacity: A curve showing the change of input impedance and capacity plotted against A.V.C. voltage at 90 Mc/s is given on 320·32. This indicates that it is undesirable to apply A.V.C. when the valve is used at high frequency because not only is the change in input capacity significant compared with the total circuit capacity, but the large change in input resistance will upset the damping controlling the bandwidth of the tuned circuit. At frequencies below 30 Mc/s the input impedance is sufficiently high to be neglected and the change in input capacity is small compared with the total capacity of the circuit.

4.32 Oscillator Stability: The three main factors affecting oscillator stability are the effects of temperature as the circuit warms up, the effect of mains supply voltage fluctuations, and the effect of the A.V.C. voltage.

The Curves 320·30 show the change of oscillator frequency with time as the circuit warms up after an initial 30 seconds have been allowed for the supply voltages to settle at their proper values. These curves, taken at signal frequencies of 18 and 90 Mc/s, are typical of the circuits shown on 320·57 and 320·58, and assume adequate ventilation and components of good quality which do not change their values through self heating. The exception to this last rule is at 90 Mc/s where a small amount of temperature compensation is provided by a negative temperature coefficient condenser across the oscillator tuned circuit.

Change of oscillator frequency with mains supply voltage variations is linear over all normal variations encountered, and is approximately 1 kc/s for 10% change in supply voltage. There is a further, but much smaller, frequency variation as the circuit settles down under the new conditions. This again applies to the typical circuits shown at the end of this report.

The effect of A.V.C. on the oscillator frequency at a frequency of 18 Mc/s is shown on 320·30 for the circuit shown on 320·57. This curve was taken with a well regulated HT supply, if the supply is poorly regulated the frequency shift may be increased.

4.33 Cross Modulation: When a receiver is tuned to a wanted signal and the signal grid of the mixer simultaneously receives another signal at some other frequency, a certain amount of interaction takes place between the two signals. If the unwanted signal is modulated, some of the modulation is impressed on the carrier of the wanted signal. If one assumes the two signals are modulated to the same depth the percentage of cross modulation is the ratio, expressed as a percentage, of the unwanted modulation appearing on the wanted signal to the wanted modulation. It is the custom to express the result as the level of interfering signal required to produce 1% cross modulation, and to modulate to a depth of 30% at 400 c/s. The level of the wanted signal does not affect the answer provided it is small enough not to exceed the linear range of the valve characteristic. For test purposes a level of 100 mV was used.

The curve on 320·33 shows for the 12AH8 the level of interfering signal for 1% cross modulation plotted against conversion conductance. For a given level of signal the cross modulation increases as the A.V.C. voltage is raised because the curvature of the characteristics increases. At low levels of conversion conductance where the A.V.C. voltage is very high the signals are wholly around the bend of the curve and the cross modulation decreases.

All valves are, to some extent, liable to produce cross-modulation due to non-linearity of their characteristics. Especially is this so when A.V.C. is applied, unless, by careful design, a smooth variable-μ characteristic is obtained. In the 12AH8 particular attention has been paid to this problem of providing a smooth A.V.C. characteristic without, at the same time, making the cut-off so remote as to require an excessive control voltage.

4.4 Typical Circuit Applications: Circuits are attached showing typical arrangements of a broadcast receiver for long, medium and short wave bands, and for the frequency changer of a V.H.F. receiver for 88 to 108 Mc/s. Data are given for aerial and oscillator coils for these circuits and curves are provided showing the variations in gain and oscillator grid current over each tuning range.

4.41 Long and Medium Waves: The circuit 320·57 shows an aerial and oscillator circuit of a 12AH8 frequency changer for normal broadcast reception. The coil data are given on pages 3 and 2 of 320·59. The gain figures and oscillator grid currents are shown on 320·27 and 320·26. When the HT voltage is 100 volts the screen and oscillator anode voltage dropping resistors are omitted, the connections being taken directly to the HT rail. The gain figures at signal frequency do not include the step-up in the aerial coil, being taken with a low impedance signal source connected directly to the signal grid.

4.42 Short Waves: The same circuit 320·57 is used for short wave operation. Coil data and gain figures are given for two wave bands. The normal short wave band found on receivers employing only one short wave band is 6 to 18 Mc/s. The coil data for this band is given on Sheet 1 of 320·59, and the gain and grid current curves are on 320·25. The gain figures do not include the step-up in the aerial coil.

Coil data for a further short wave band covering 18 to 30 Mc/s are given on Sheet 4 of 320·59. The gain and grid current figures are on 320·29.

On the short wave bands, when the oscillator must cover a wide frequency range, large variations in oscillator grid current are encountered as the tuning condenser is tuned from maximum to minimum. These variations can be reduced by including some series stabilising resistance in the feed-back circuit as shown on 320·57, where a 220 ohm resistor is connected in series with the oscillator anode on the short wave band. The optimum value of this resistor may, in practice, be different due to differences in circuit layout and coil construction, and account must be taken of its presence when the oscillator coil is designed so that more feedback may be provided in compensation.

4.43 V.H.F. Performance: A circuit is shown on 320·58 of the 12AH8 used as the frequency changer for a receiver to cover the international V.H.F. broadcast band of 88 to 108 Mc/s. For a cheaply priced receiver this valve could be used without a preceeding RF amplifier. Its equivalent noise resistance of 100 kΩ then sets a limit to the sensitivity of the receiver, as the noise voltage produced by the valve in a 200 kc/s bandwidth is approximately 18 μ volts. For local station FM reception this noise level is sufficiently below the threshold to be ignored.

The gain obtainable, including the aerial circuit step-up, is 16 times at mid band position, the extremes of the band yielding 15·8 and 18 times. The IF gain at 10·7 Mc/s is 11 times when the oscillator grid current is 200 μA. The IF bandwidth for these measurements was 200 kc/s which is that normally employed for FM of $\pm$75 kc/s deviation.

The coil details are as follows. Both coils are wound with 18 SWG tinned copper wire. The aerial coil consists of 2 turns, 1/2 in. internal diameter, 3/8 in. long. The tappings are, aerial 1/2 turn from earthy end, signal grid 1-3/4 turns from earthy end. The oscillator coil primary is wound on a 1/4 in. diameter form and has 3 turns. The coupling winding is 2-1/2 turns of insulated wire wound over the primary with a few layers of insulation such as "Alkothene" film in between.

The oscillator frequency is set lower than the signal frequency by the difference of the IF, as this simplifies the requirements for frequency stability. To compensate for the change in capacity across the oscillator coil as the circuit warms up in the cabinet a negative temperature coefficient condenser is shunted across the tuning condenser. The exact value of this condenser will depend on the tuning and trimming condensers, but normally something of the order of 5 pF with a negative temperature coefficient of 30 parts per million is required. On 320·30 is shown the oscillator frequency drift due to the valve warming up. The circuit here was adequately cooled so that the majority of the frequency shift was due to the valve. No negative temperature coefficient condenser was used for this test. Normally this condenser is connected close to the valve holder so that it warms up at about the same rate as the valve. In practice the frequency drift during warm up can thus be held to within 20 kc/s.
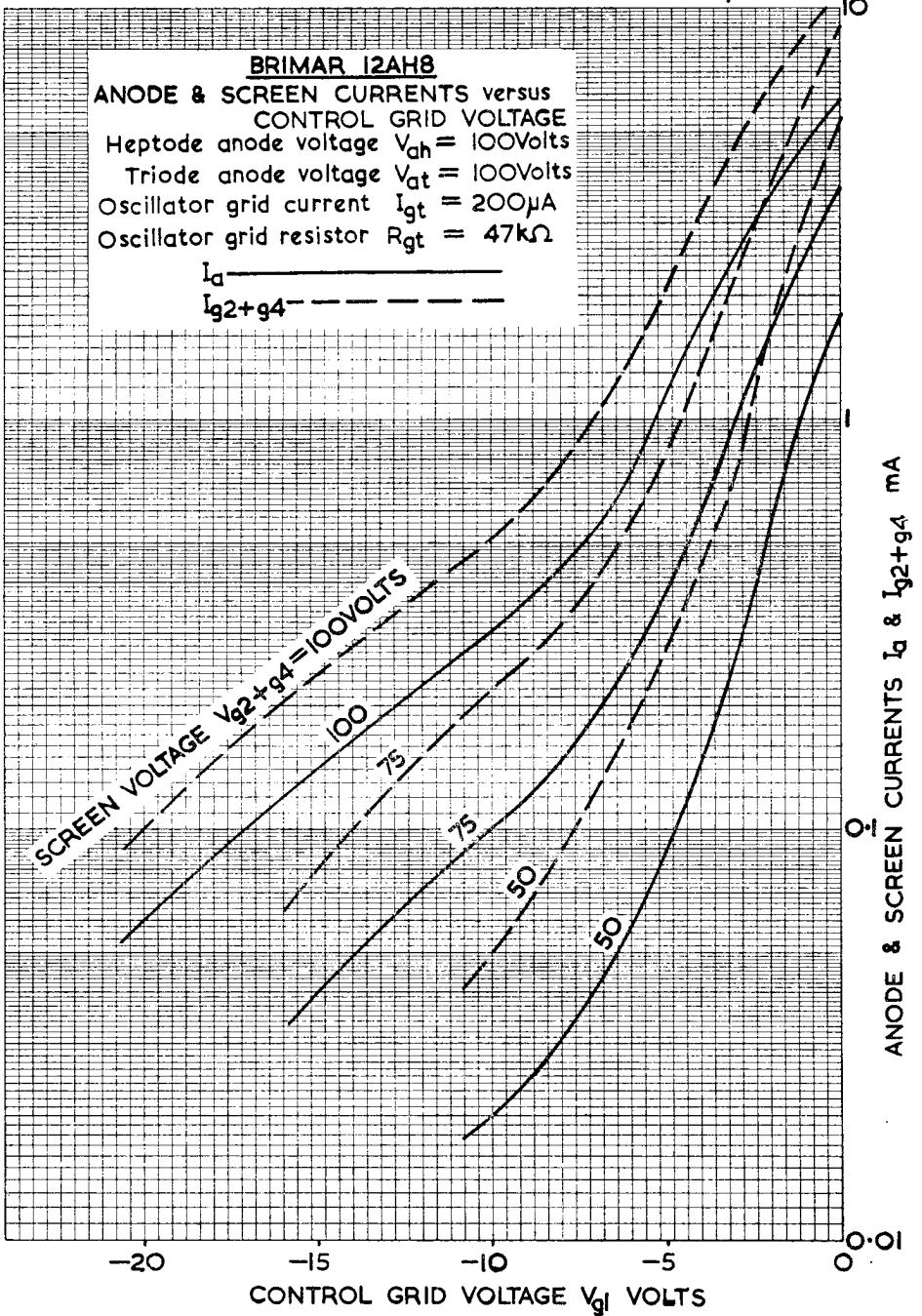
The purpose of the choke in the live filament lead is to reduce the possibility of regeneration at IF when, as is often the case, a high gain IF amplifier follows the mixer.

5.0 Other Applications: Triode Heptode frequency changer valves are not generally used for other than their intended purpose, as their characteristics are so specialised as to make them of little use in other applications.

One field, however, where they often find use is in circuits where control is required individually and/or jointly from two separate signals without mutual interaction. Signals are supplied to the heptode grid 1 and grid 3, so the anode current is controlled by either signal and is also a function of their relative values and phase. Two sets of static characteristic curves are given for the 12AH8, Nos. 320·22 and 320·23, which show the control of both grid 1 and grid 3 over the anode and screen voltage. It should be noted that as the bias is increased on grid 3 the screen current rises, as most of the electrons are diverted to the grid 2 part of the screen which preceeds grid 3.

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
CONTROL GRID VOLTAGE
Heptode anode voltage V_{ah} = 100Volts
Triode anode voltage V_{at} = 100Volts
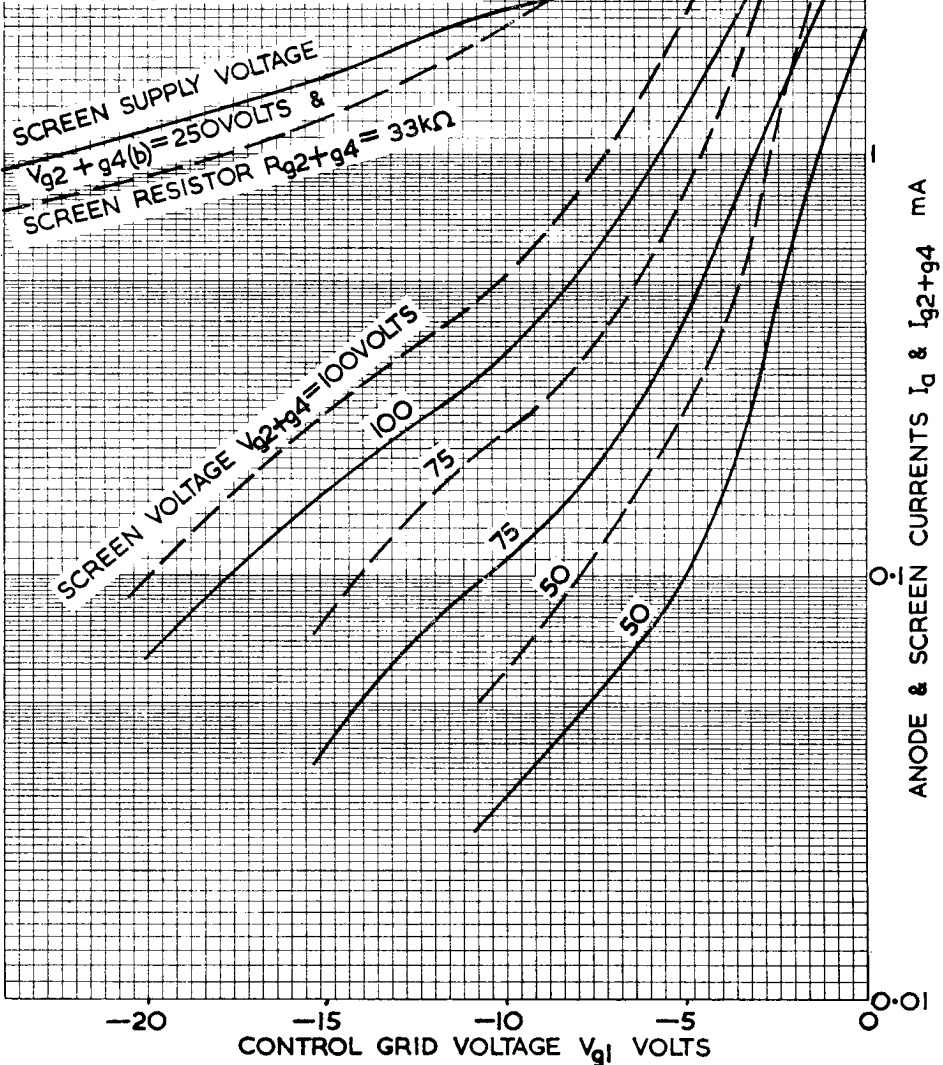Oscillator grid current I_{gt} = 200μA
Oscillator grid resistor R_{gt} = 47kΩ

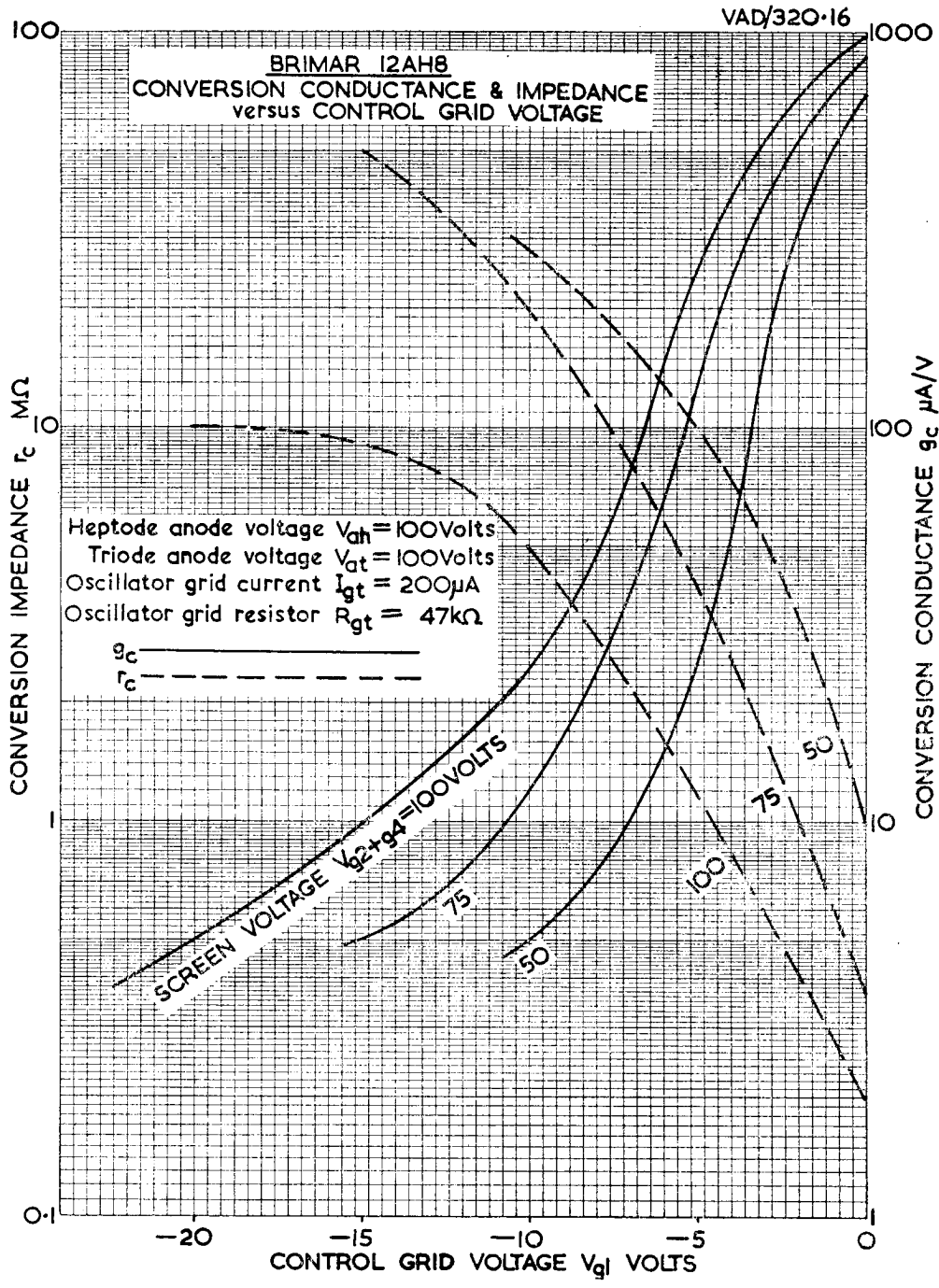I_a ——————————
I_{g2+g4} — — — — —

SCREEN VOLTAGE V_{g2+g4} = 100VOLTS

100

75

75

50

50

ANODE & SCREEN CURRENTS I_a & I_{g2+g4} mA

10

1

0·1

0·01

CONTROL GRID VOLTAGE V_{gl} VOLTS

−20   −15   −10   −5   0

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
CONTROL GRID VOLTAGE
Heptode anode voltage V_{ah}=250Volts
Triode anode voltage V_{at}=100Volts
Oscillator grid current I_{gt} = 200µA
Oscillator grid resistor R_{gt} = 47kΩ

I_a ——————
I_{g2+g4} — — — — —

VAD/320·15

SCREEN SUPPLY VOLTAGE
$V_{g2+g4(b)}$=250VOLTS &
SCREEN RESISTOR R_{g2+g4}= 33kΩ
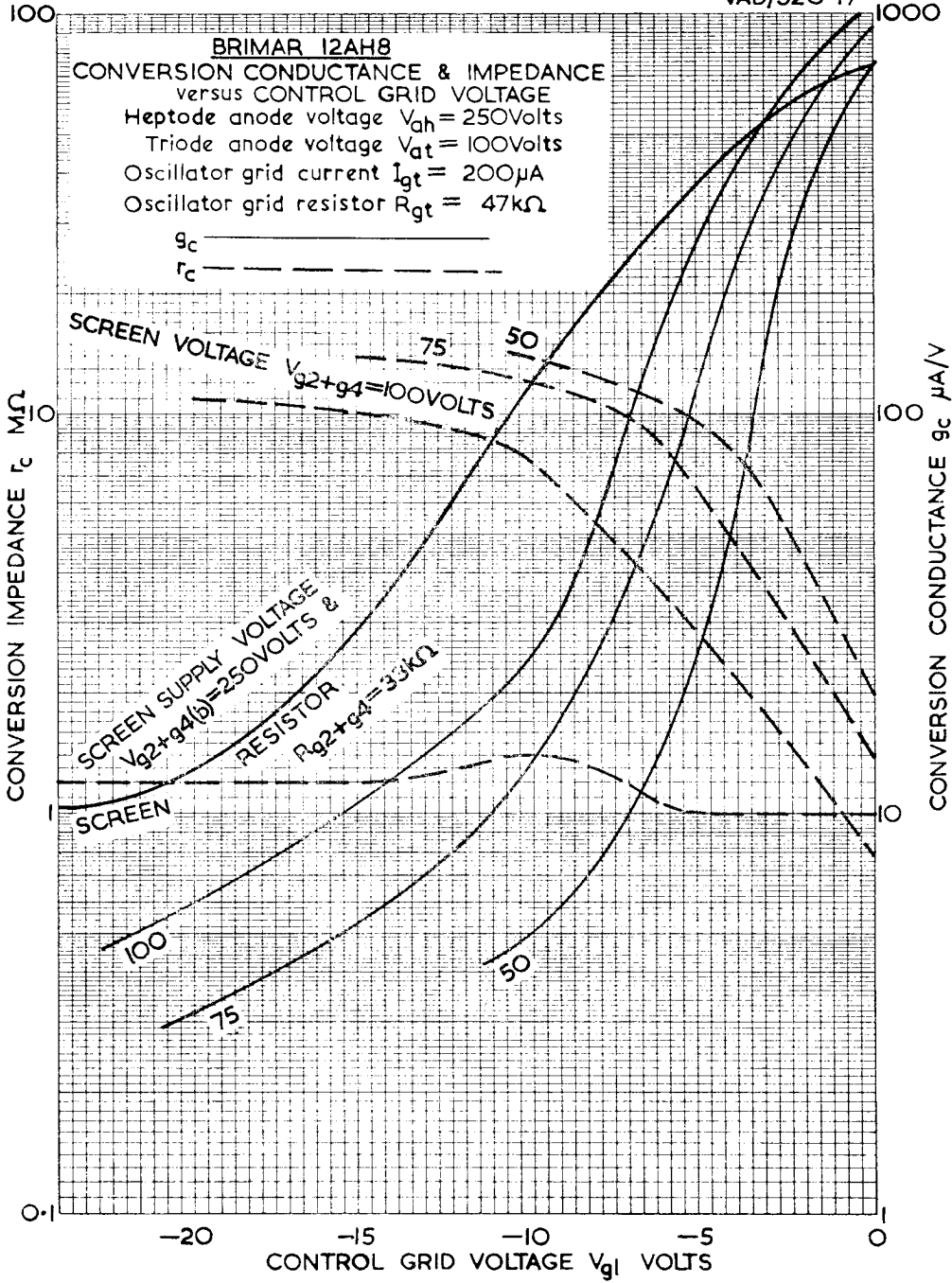
SCREEN VOLTAGE V_{g2+g4}=100VOLTS

100

75

75

50

50

ANODE & SCREEN CURRENTS I_a & I_{g2+g4} mA

10

1

0·1

0·01

CONTROL GRID VOLTAGE V_{g1} VOLTS

−20   −15   −10   −5   0

VAD/320·16

BRIMAR 12AH8
CONVERSION CONDUCTANCE & IMPEDANCE
versus CONTROL GRID VOLTAGE

CONVERSION IMPEDANCE r_c MΩ

CONVERSION CONDUCTANCE g_c µA/V

Heptode anode voltage $V_{ah} = 100$ Volts
Triode anode voltage $V_{at} = 100$ Volts
Oscillator grid current $I_{gt} = 200$µA
Oscillator grid resistor $R_{gt} = 47$kΩ

g_c ————
r_c — — — —

SCREEN VOLTAGE $V_{g2} + g4 = 100$ VOLTS

75

50

50

75

100

CONTROL GRID VOLTAGE V_{g1} VOLTS

VAD/320·17

BRIMAR 12AH8
CONVERSION CONDUCTANCE & IMPEDANCE
versus CONTROL GRID VOLTAGE
Heptode anode voltage V_{ah} = 250Volts
Triode anode voltage V_{at} = 100Volts
Oscillator grid current I_{gt} = 200μA
Oscillator grid resistor R_{gt} = 47kΩ

g_c ——————————
r_c — — — — — — —

SCREEN VOLTAGE V_{g2+g4}=100VOLTS   75   50

SCREEN SUPPLY VOLTAGE $V_{g2+g4(b)}$=250VOLTS &
RESISTOR R_{g2+g4}=33kΩ

SCREEN

100
75
50

CONVERSION IMPEDANCE r_c MΩ

CONVERSION CONDUCTANCE g_c μA/V

CONTROL GRID VOLTAGE V_{g1} VOLTS

100
10
1
0·1

1000
100
10
1

-20   -15   -10   -5   0

BRIMAR 12AH8
CONVERSION CONDUCTANCE & IMPEDANCE
versus OSCILLATOR GRID CURRENT
Heptode anode voltage $V_{ah} = 100$ Volts
Control grid voltage $V_{gl} = -3$ volts
Triode anode voltage $V_{at} = 100$ Volts
Oscillator grid resistor $R_{gt} = 47k\Omega$
g_c ————
r_c – – – –

SCREEN VOLTAGE $V_{g2+g4} = 100$ VOLTS

VAD/320-18

OSCILLATOR GRID CURRENT I_{gt} μA

CONVERSION CONDUCTANCE g_c μA/V

CONVERSION IMPEDANCE r_c MΩ

BRIMAR 12AH8

CONVERSION CONDUCTANCE & IMPEDANCE
versus OSCILLATOR GRID CURRENT
Heptode anode voltage V_{ah}=250Volts
Control grid voltage V_{g1}== —3Volts
Triode anode voltage V_{at}== 100Volts
Oscillator grid resistor R_{gt}= 47kΩ

g_c ————————
r_c — — — — — —

VAD/320·19

SCREEN SUPPLY VOLTAGE $V_{g2+g4}(b)$=250VOLTS
& SCREEN RESISTOR R_{g2+g4}=33kΩ

SCREEN VOLTAGE V_{g2+g4}== 50VOLTS

$V_{g2}+g4$=100V

$V_{g2}+g4$=75V

$V_{g2}+g4$=75V

$V_{g2}+g4$=50V

$V_{g2}+g4$=100V

$V_{g2+g4}(b)$= 250V & R_{g2+g4}=33kΩ
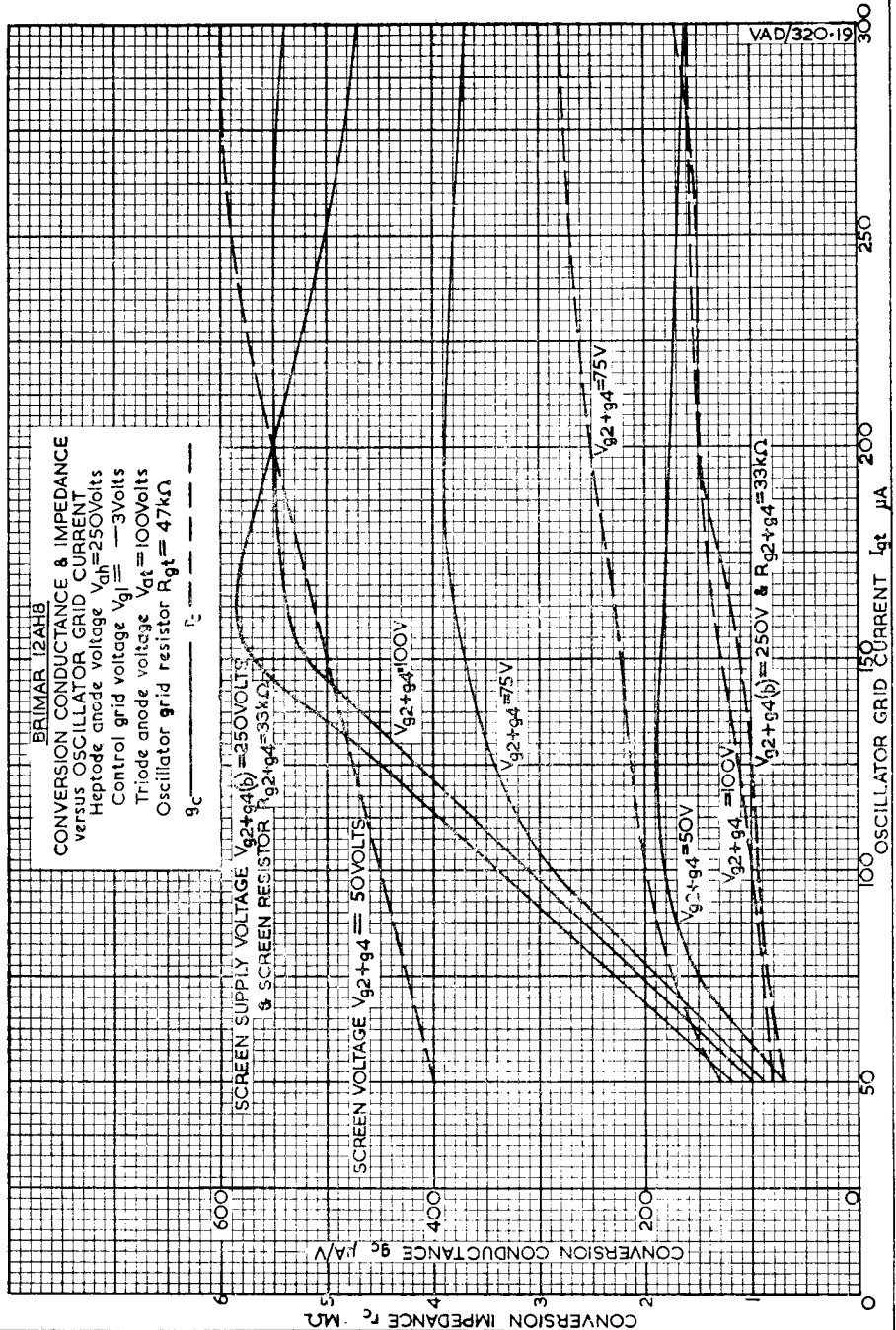
OSCILLATOR GRID CURRENT I_{gt} μA

50   100   150   200   250   300

CONVERSION CONDUCTANCE g_c μA/V

600   400   200   0

CONVERSION IMPEDANCE r_c MΩ

6   5   4   3   2   1   0

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
OSCILLATOR GRID CURRENT
Heptode anode voltage V_{ah} = 100volts
Control grid voltage V_{g1} = —3Volts
Triode anode voltage V_{at} = 100volts
Oscillator grid resistor R_{gt} = 47KΩ

I_a ——————
I_{g2}+I_{g4} ——————

GRID 300

OSCILLATOR GRID CURRENT I_{gt} μA

SCREEN VOLTAGE V_{g2+g4}=100VOLTS

100V

75V

75V

50V

ANODE & SCREEN CURRENTS I_a & I_{g2}+$g4$ mA

VAD/320·20

VAD/320·21

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
OSCILLATOR GRID CURRENT
Heptode anode voltage V_{ah} = 250Volts
Control grid voltage V_{gl} = −3Volts
Triode anode voltage V_{at} = 100Volts
Oscillator grid resistor R_{gt} = 47kΩ

I_a ——— I_{g2+g4}

SCREEN SUPPLY VOLTAGE $V_{g2+g4(b)}$ = 250VOLTS
& SCREEN RESISTOR R_{g2+g4} = 33kΩ

SCREEN VOLTAGE V_{g2+g4} = 100VOLTS

$V_{g2+g4(b)}$ = 250V
& R_{g2+g4} = 33kΩ

V_{g2+g4} = 100V

V_{g2+g4} = 75V

V_{g2+g4} = 75V

V_{g2+g4} = 50V

ANODE & SCREEN CURRENTS I_a & I_{g2+g4} mA

OSCILLATOR GRID CURRENT I_{gt} μA
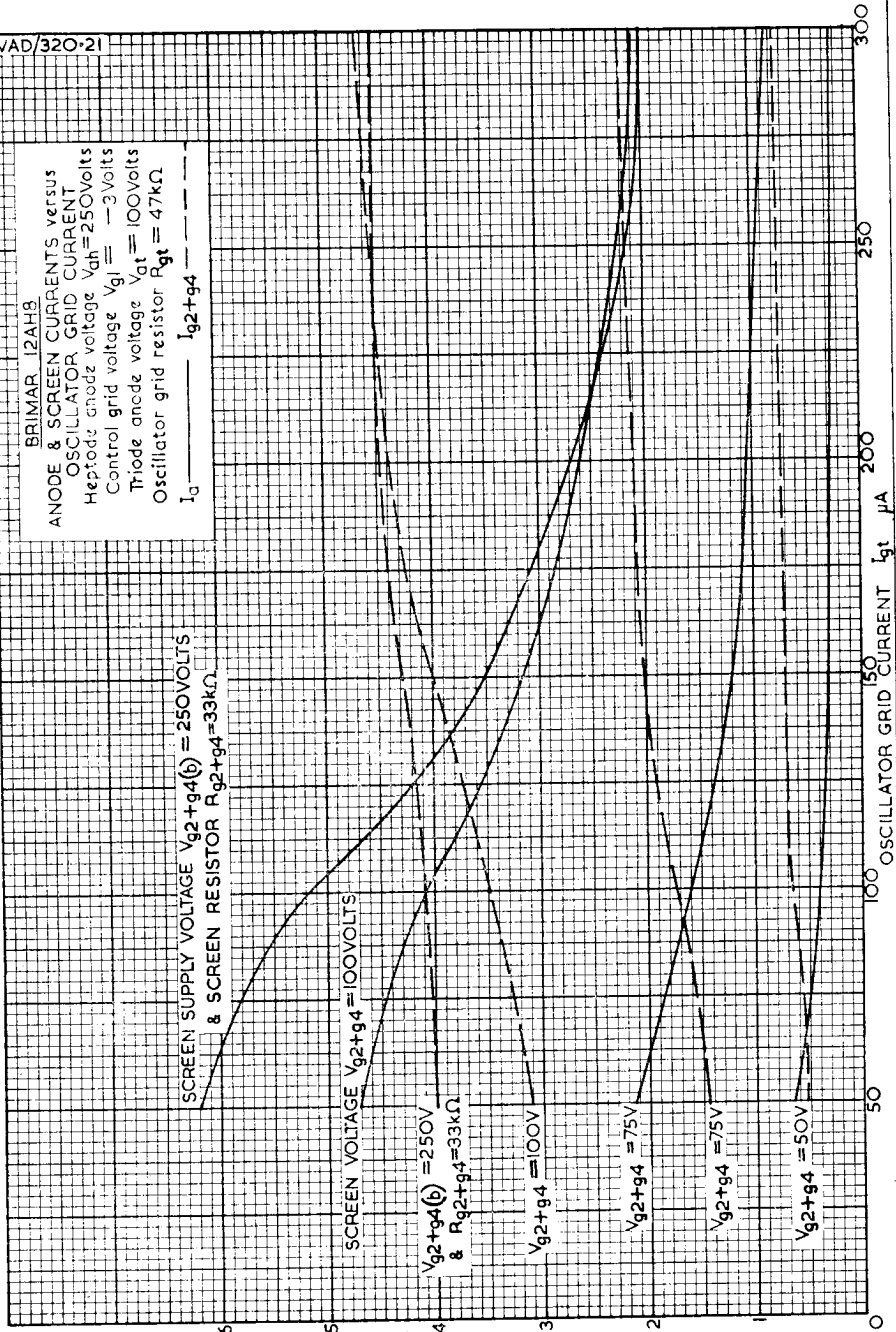
VAD/320·22

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
GRID 3 VOLTAGE
Heptode anode voltage V_{ah} = 250Volts
Screen voltage V_{g2+g4} = 100Volts

I_a ————
I_{g2+g4} — — —

CONTROL GRID VOLTAGE = 0VOLTS
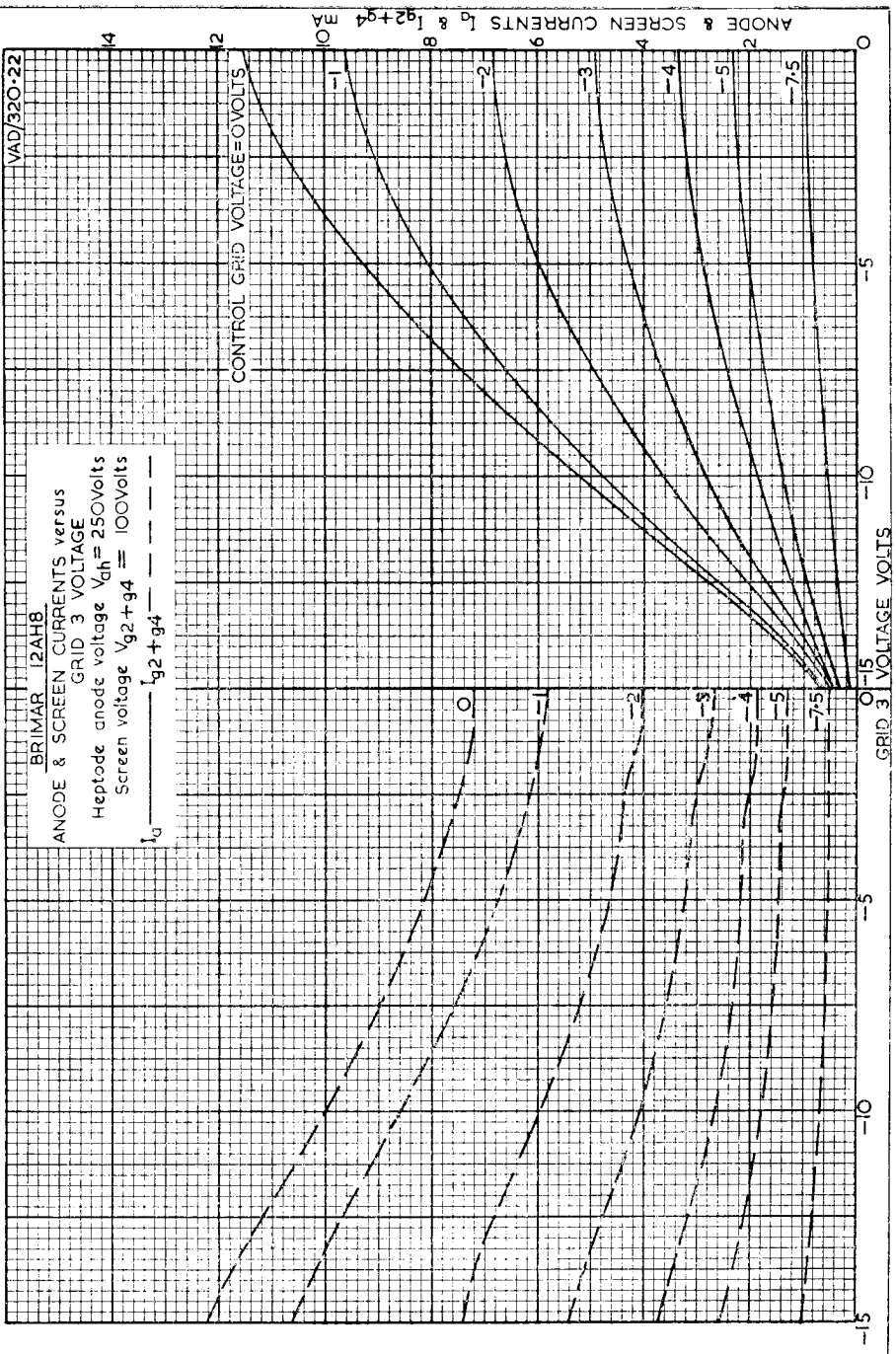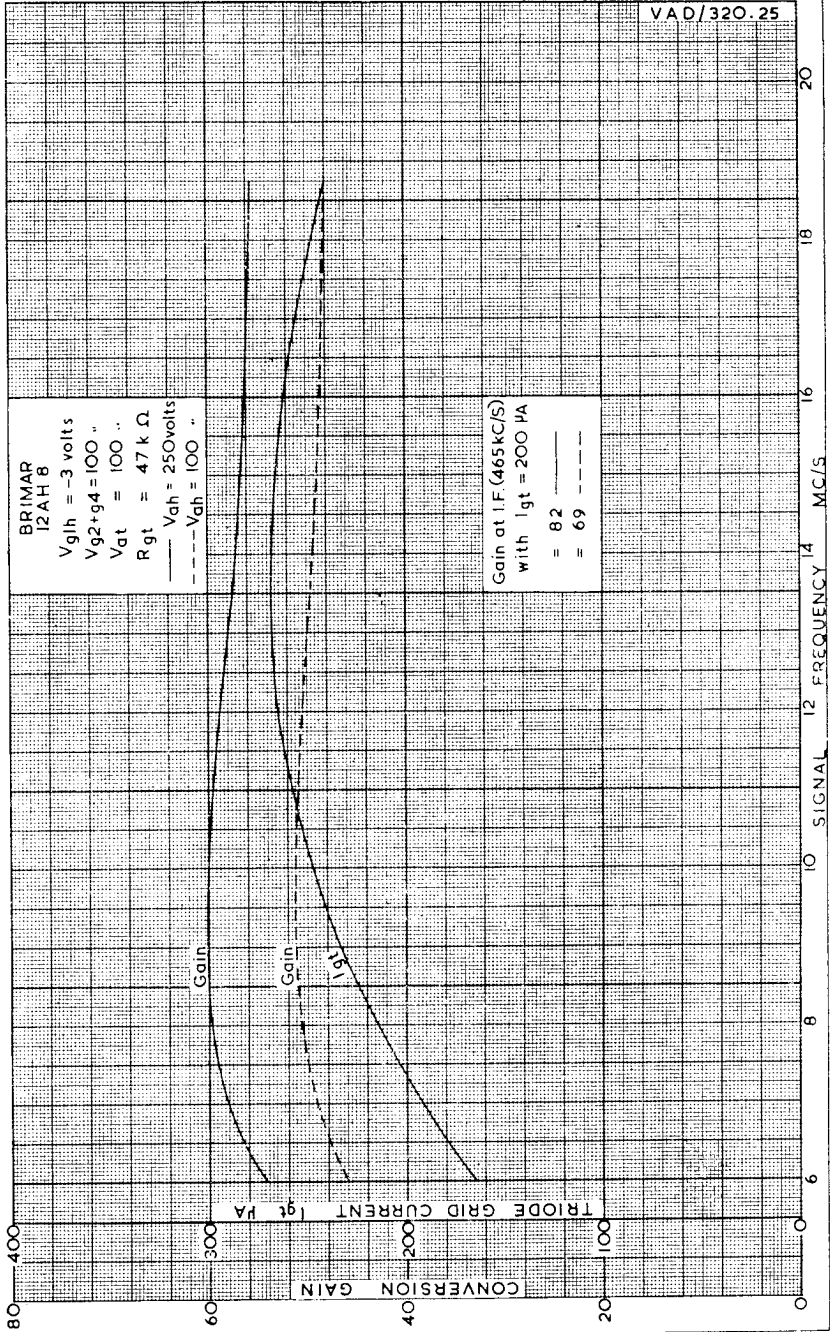
ANODE & SCREEN CURRENTS I_a & I_{g2+g4} mA

GRID 3 VOLTAGE VOLTS

BRIMAR 12AH8
ANODE & SCREEN CURRENTS versus
CONTROL GRID VOLTAGE
Heptode anode voltage $V_{ah} = 250$ Volts
Screen voltage $V_{g2+g4} = 100$ Volts

I_{g2+g4} ————
I_a ————

GRID 3 VOLTAGE = 0 VOLTS

ANODE & SCREEN CURRENTS I_a & I_{g2+g4} mA
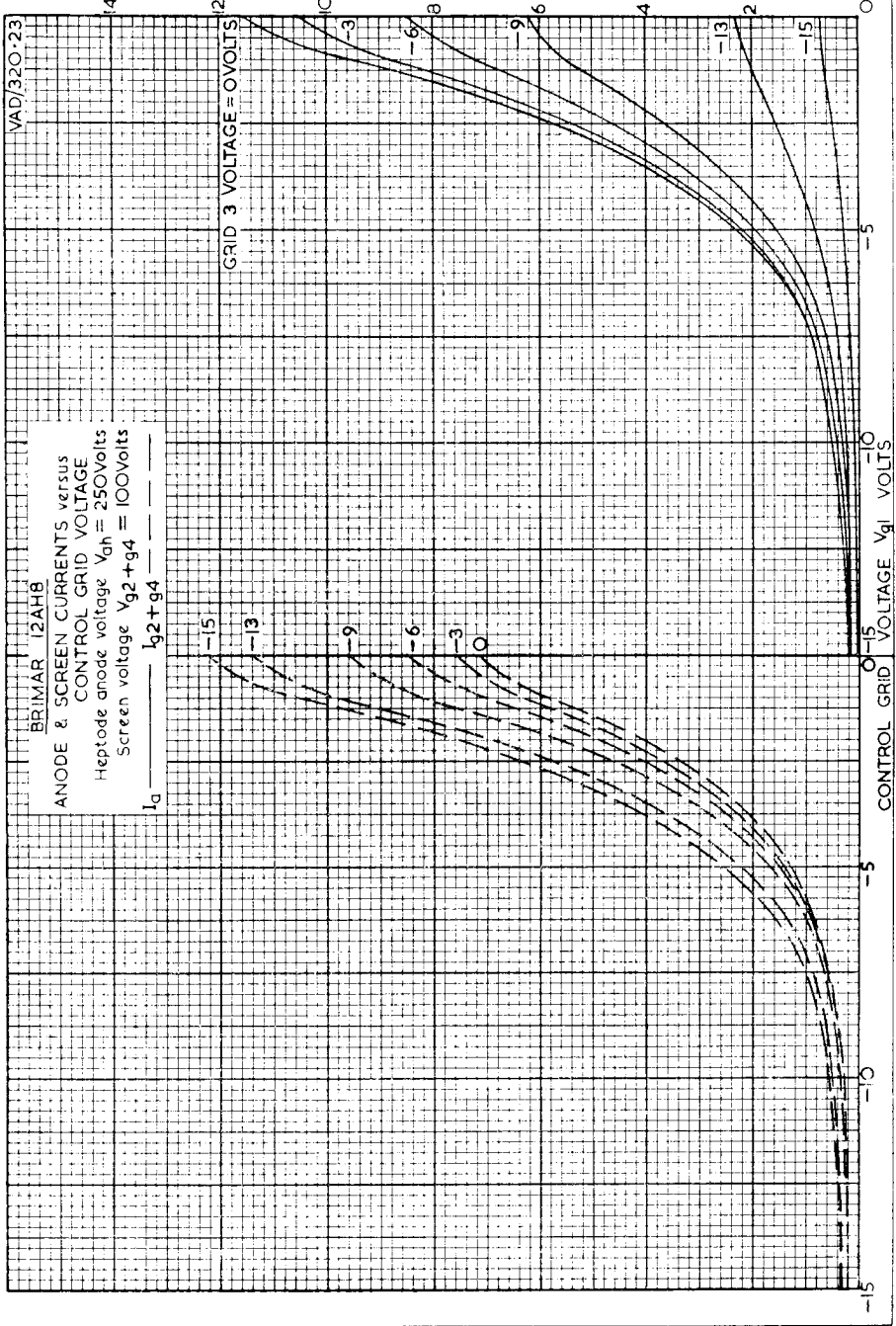
CONTROL GRID VOLTAGE V_{g1} VOLTS

VAD/32O·23

VAD/320.25

BRIMAR
12 AH 8

V_{glh} = -3 volts
V_{g2+g4} = 100 ,,
V_{at} = 100 ,,
R_{gt} = 47 kΩ
——— V_{ah} = 250 volts
– – – V_{ah} = 100 ,,

Gain at I.F. (465 kC/S)
with I_{gt} = 200 µA

= 82 ———
= 69 – – – –

Gain

Gain

I_{gt}

SIGNAL FREQUENCY MC/S

20 18 16 14 12 10 8 6

TRIODE GRID CURRENT I_{gt} µA

400 300 200 100 0

CONVERSION GAIN

80 60 40 20 0

VAD/320.26

BRIMAR
12AH8
Vg1h = -3 volts
Vg2+g4 = 100 "
Vat = 100 "
Rgt = 47 kΩ
——— Vah = 250 volts
— — — Vah = 100 "

Gain at I.F. (465 kC/S)
with Igt = 200 µA
" = 82 ———
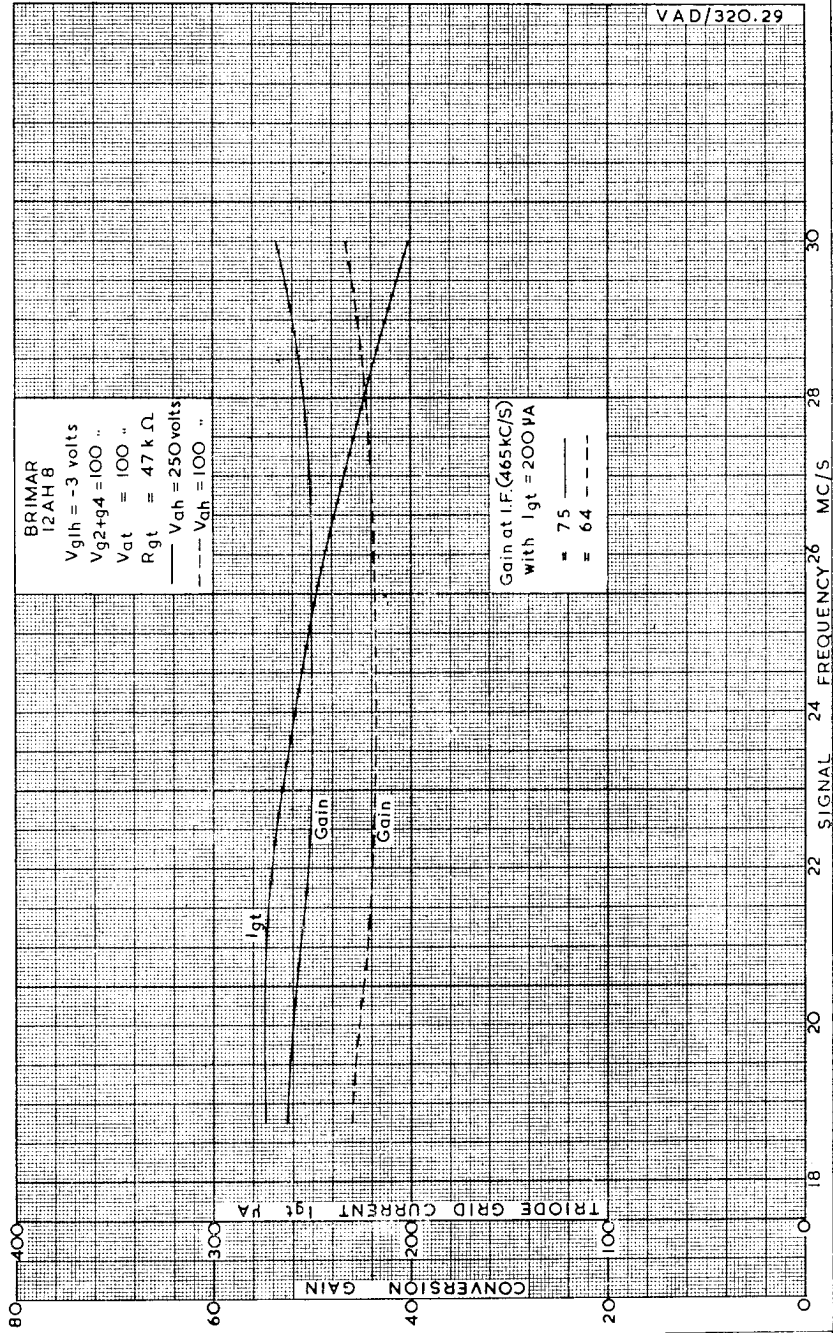" = 69 — — —

CONVERSION GAIN

TRIODE GRID CURRENT Igt µA

SIGNAL FREQUENCY kC/S

500   750   1000   1250   1500   1750

VAD/320.27
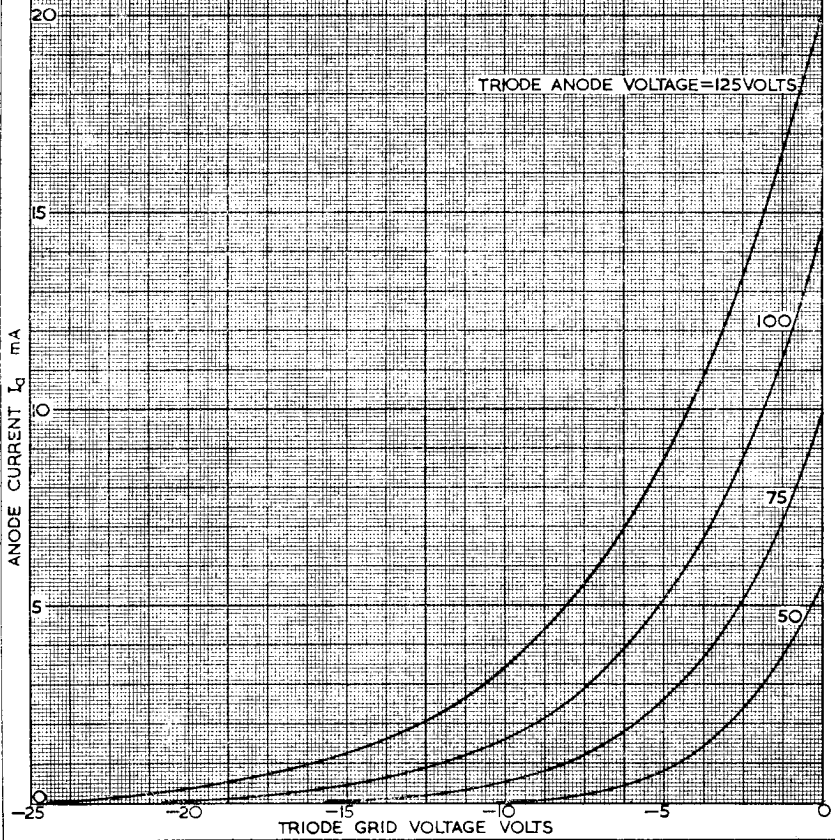
BRIMAR
12 A H 8
$V_{g1h} = -3$ volts
$V_{g2+g4} = 100$ „
$V_{at} = 100$ „
$R_{gt} = 47 k\Omega$
——— $V_{ah} = 250$ volts
– – – $V_{ah} = 100$ „

Gain at I.F. (465 kC/S) with $I_{gt} = 200$ µA

= 82   with $V_{ah} = 250$ volts
= 69   „   „   = 100   „

Igt

Gain

Gain

SIGNAL FREQUENCY — kC/S

150   200   250   300   350   400

TRIODE GRID CURRENT Igt µA

CONVERSION GAIN

0   100   200   300   400

0   20   40   60   80

VAD/320.28
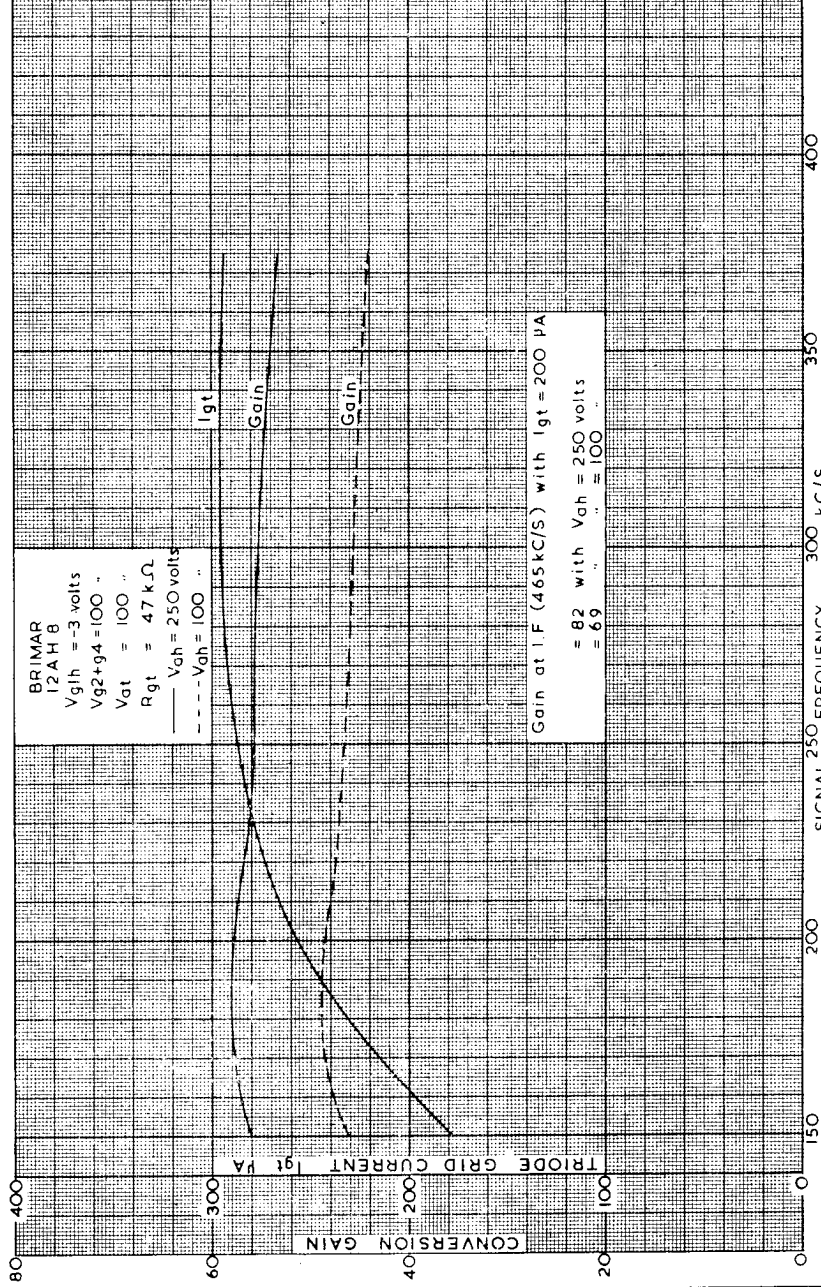
BRIMAR
12AH8
A.V.C.
CHARACTERISTIC
$V_{g1h} = -3$ volts
$V_{at} = 100$ "
$R_{gt} = 47$ k Ω

Curve 1. $V_{ah} = 250$ volts. $V_{g2+g4} = 100$ V
at zero AVC, via series resistor 33 k Ω
Curve 2. $V_{ah} = 250$ V. $V_{g2+g4} = 100$ V. at
zero AVC, via potentiometer with 10 k Ω
in each arm.
Curve 3. $V_{ah} = V_{g2+g4} = 100$ V. direct.
Curve 4. Mixer + 6BA6 I.F. amplifier.
H.T. rail 250 V. Screens via
common potentiometer with 10 k Ω in
upper arm, 18 k Ω in lower arm.

RELATIVE CONVERSION GAIN

Curve 1
2
3
4

A.V.C. VOLTS

-20   -15   -10   -5   O

1.0

0.8

0.6

0.4

0.2

VAD/320.29

BRIMAR
12AH8

$V_{g1h} = -3$ volts
$V_{g2+g4} = 100$ "
$V_{at} = 100$ "
$R_{gt} = 47$ k Ω
——— $V_{ah} = 250$ volts
– – – $V_{ah} = 100$ "

Gain at I.F. (465 kC/S)
with $I_{gt} = 200$ μA
" = 75 ———
" = 64 – – – –

CONVERSION GAIN

TRIODE GRID CURRENT I_{gt} μA

SIGNAL FREQUENCY MC/S

Gain

Gain

Igt

VAD/320.30
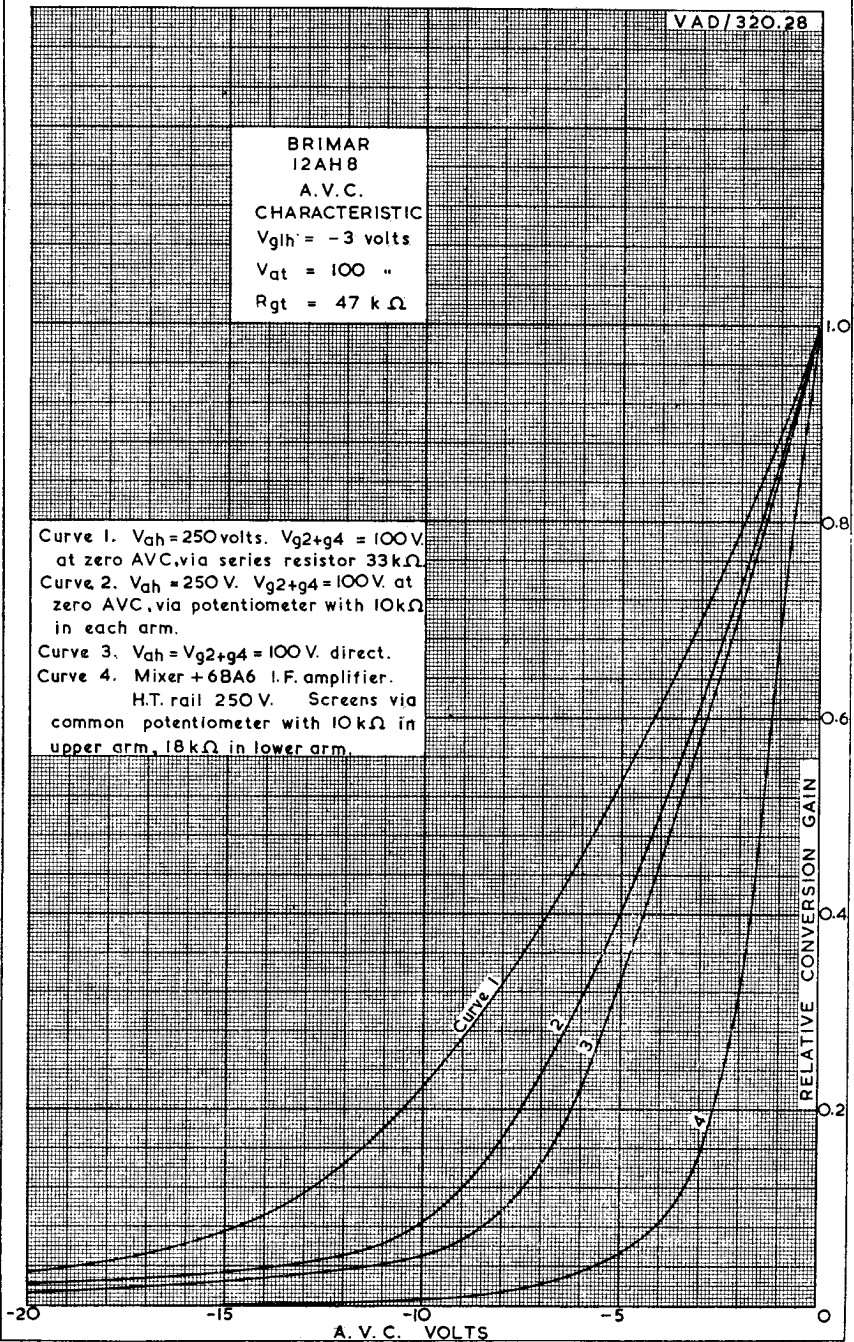
BRIMAR 12AH8
OSCILLATOR FREQUENCY
DRIFT
versus
WARM-UP TIME
SIGNAL FREQ.=18 & 90 MC/S
After initial 30 secs. from
cold start
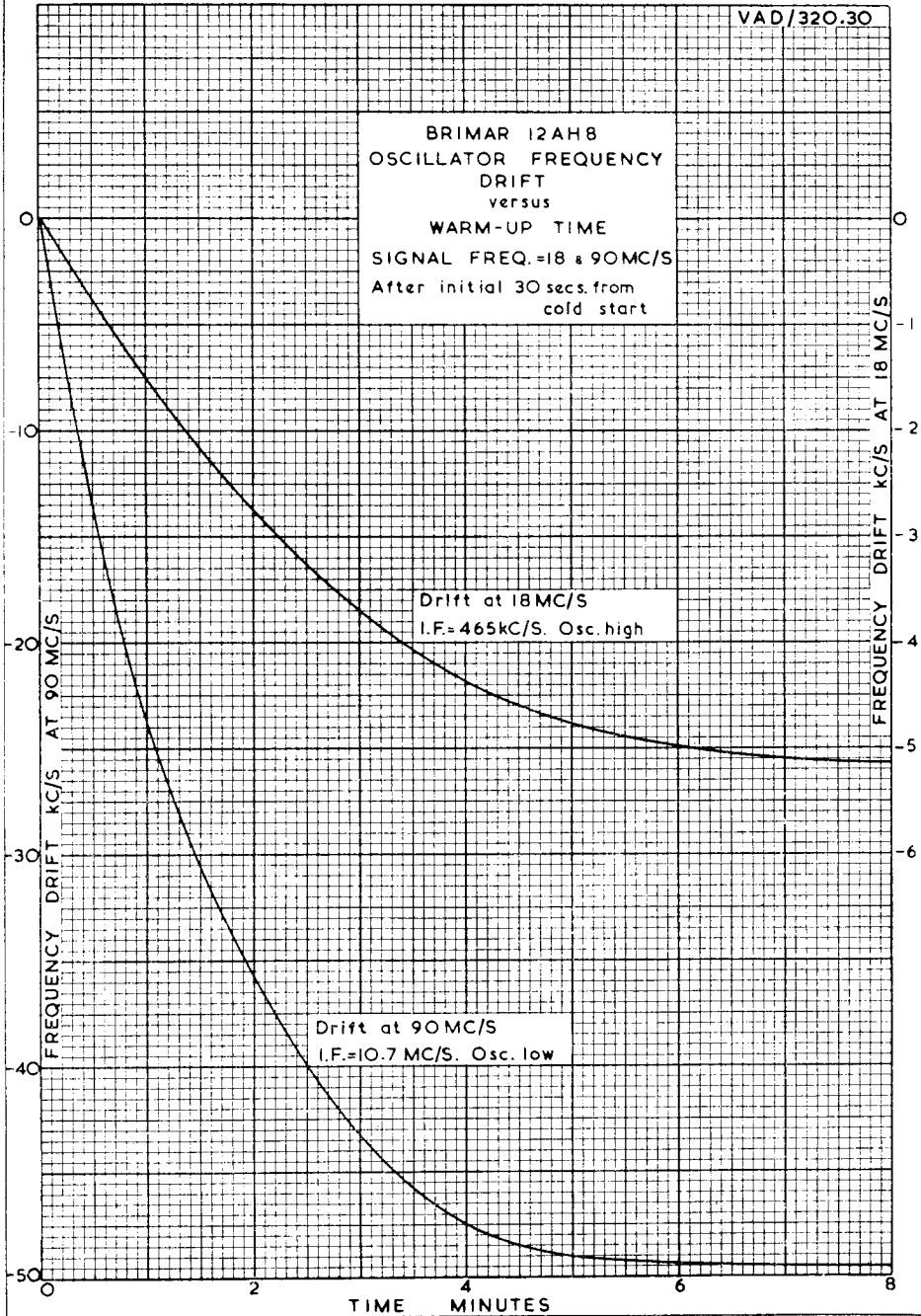
Drift at 18 MC/S
I.F.=465 kC/S. Osc. high

Drift at 90 MC/S
I.F.=10.7 MC/S. Osc. low

FREQUENCY DRIFT kC/S AT 90 MC/S

FREQUENCY DRIFT kC/S AT 18 MC/S

TIME   MINUTES

VAD/320.31

BRIMAR 12AH8
OSCILLATOR FREQUENCY DRIFT
versus
A.V.C. VOLTAGE
SIGNAL FREQ. = 18 MC/S. I.F. = 465 kC/S

FREQUENCY DRIFT + kC/S
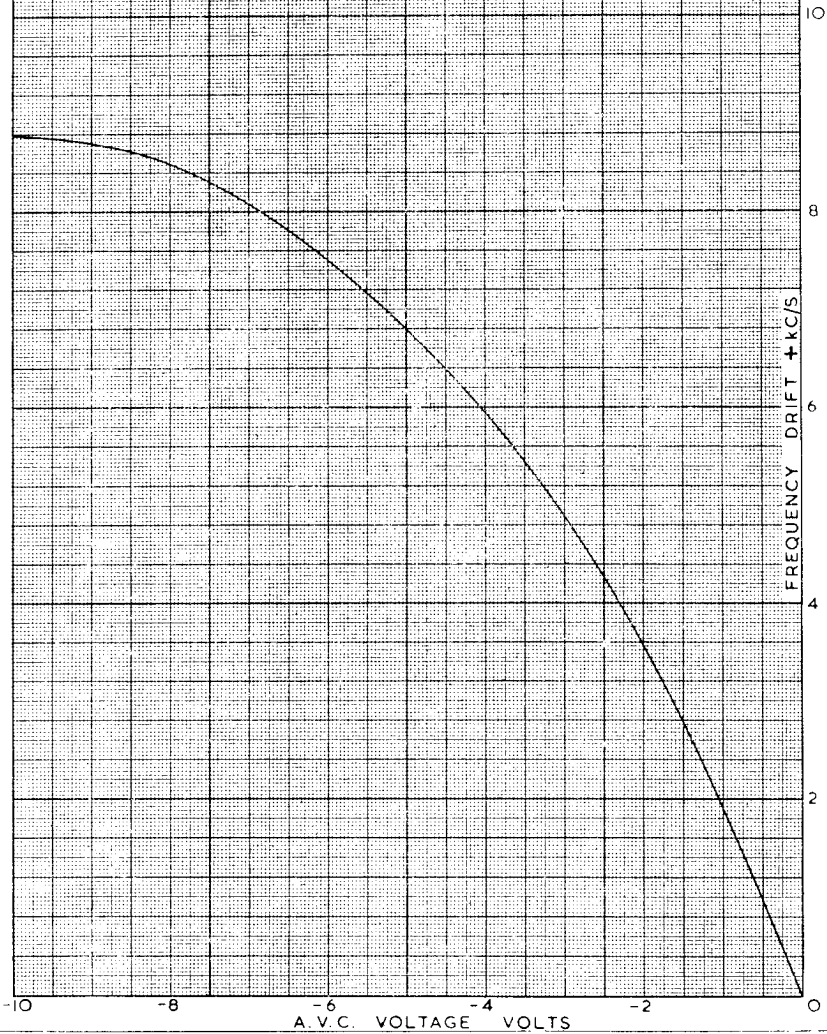
A.V.C. VOLTAGE VOLTS

VAD/320.32

BRIMAR 12AH8
INPUT RESISTANCE &
CAPACITY AT 90 MC/S
versus
A.V.C VOLTAGE

$I_{gt} = 200 \mu A$ $R_{gt} = 47 k\Omega$
$V_{ah} = 250$ volts. $V_{g2+g4} = 100$ V.
$V_{at} = 100$ volts

INPUT CAPACITY c_{in} pF

INPUT RESISTANCE r_{in} $k\Omega$

c_{in}

r_{in}

A.V.C. VOLTAGE   VOLTS

BRIMAR 12AH8
INTERFERING CARRIER MODULATED 30%
$V_{ah} = 250V$. $V_{g2} + g4$ via $10k\Omega + 12k\Omega$ pot.
$V_{at} = 100 V$. $R_{gt} = 47 k\Omega$. $I_{gt} = 200 \mu A$.

VAD/320.33

CONVERSION CONDUCTANCE $\mu A/V$
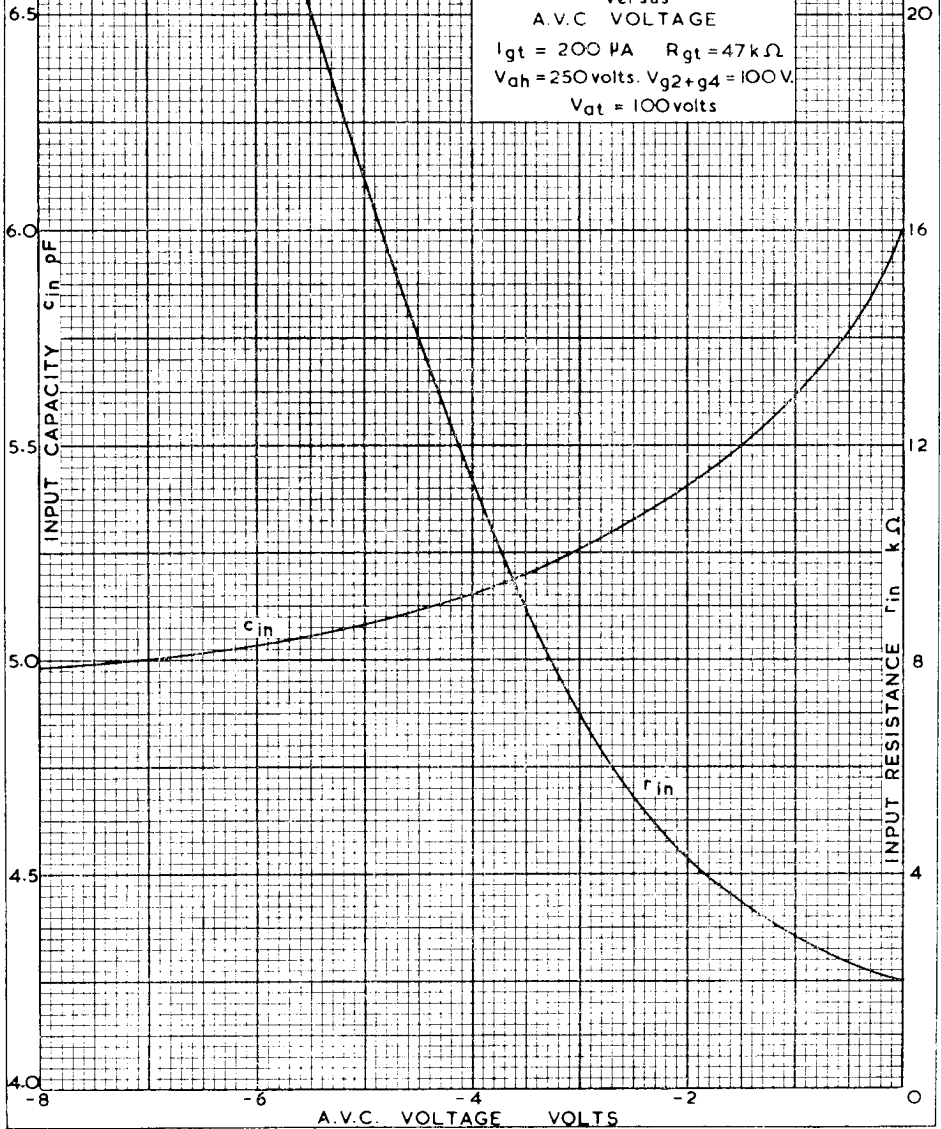
INTERFERING VOLTAGE FOR 1% CROSS-MOD.

BRIMAR 12AH8 LONG MEDIUM & SHORT WAVE CONVERTER CIRCUIT

+ 250 V.

I.F. OUTPUT
465 kC/S

27 k

33 k

47 k

100 pF

100 k

220

220

0.1

0.1

0.1

0.05

0.1

600 pF

195 pF

A.V.C.

18 - 550 pF GANGED

L1 L2 L3 L4 L5 L6

L7 L8 L9 L10 L11 L12

C1 C2 C3 C4 C5 C6

a b c d
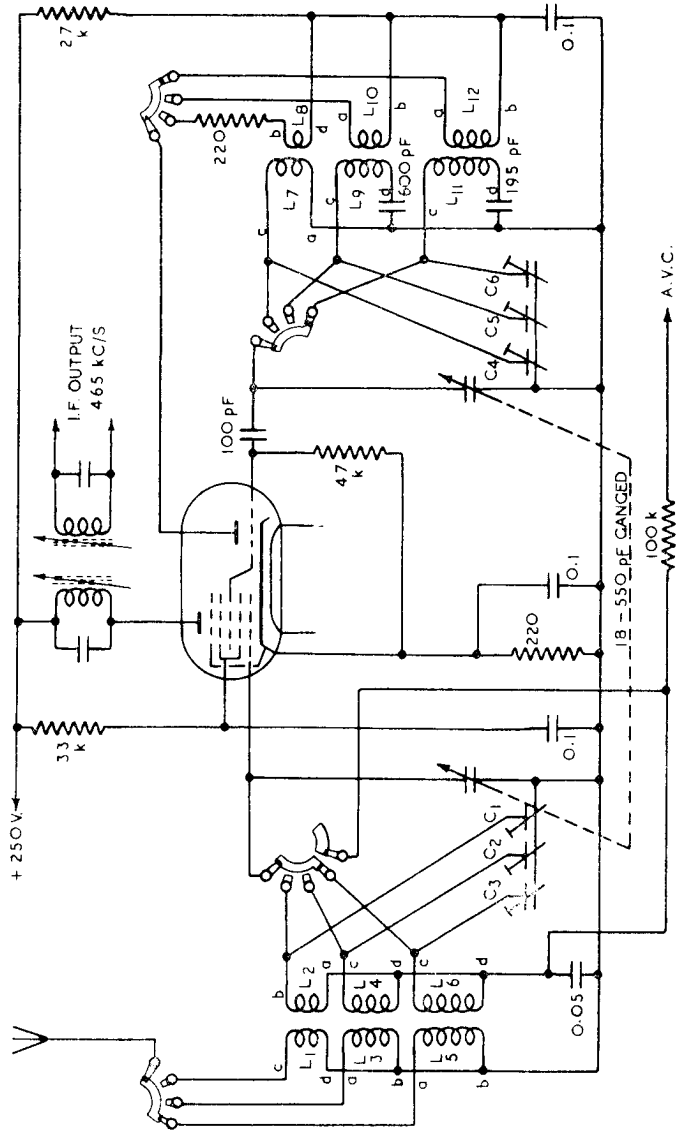
BRIMAR 12AH8 CONVERTER CIRCUIT FOR V.H.F. BAND
88 - 108 MC/S

VADI320.58

+250 V

27k

10·7 MC/S
I.F.OUTPUT

50 pF

50 pF

47 k

3-30 pF

TEMP. COMPENSATING
CONDENSER 5 pF

33k

.001

20pF

R.F.C.

.001

220

.001

.001

5 - 25 pF GANGED

3-30 pF

.001
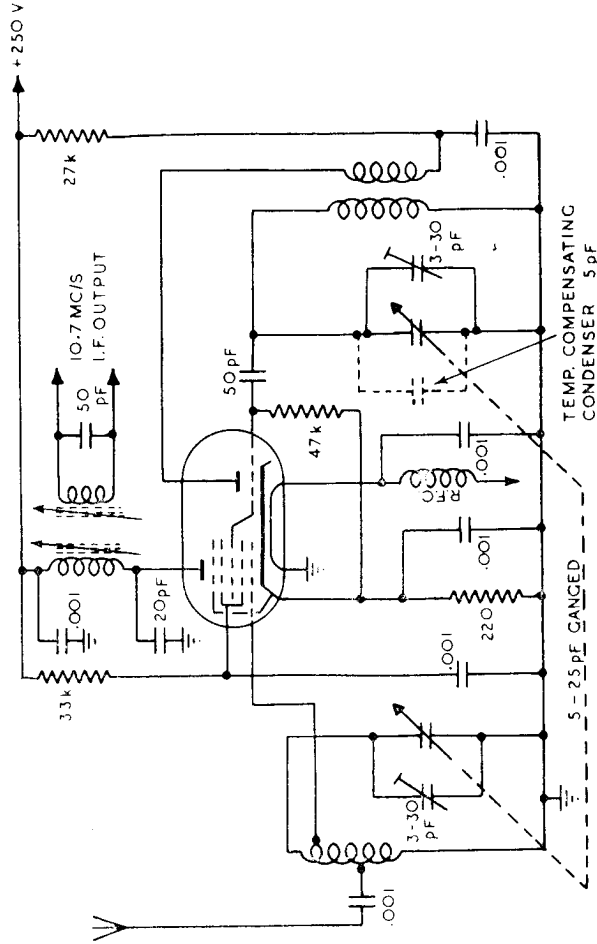
BRIMAR 12AH8

SHORT-WAVE COIL DATA
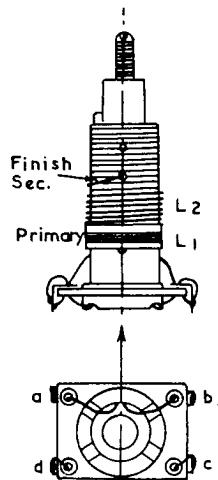
S.W. AERIAL

Former: 1/2″ outside diameter moulded bakelite, threaded 10 turns per cm.

Iron Dust Core: Neosid Z.11.B.

Secondary: 9 turns of 22 SWG En. Cu. wire wound in grooving, clockwise from start in the direction of arrow.
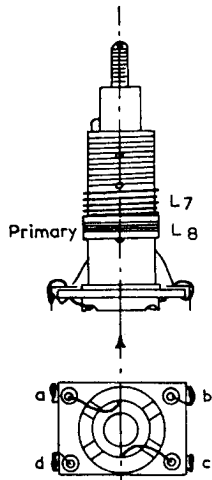
Start taken through hole in former to tag "a".

Finish taken through hole in former to tag "b".

Primary: 4 turns of 38 SWG D.S.C. wire close wound on two layers of Bitumenised paper, 3/16″ wide, placed over the earthy end of the coil, clockwise from start in direction of arrow.

Start taken to tag "c".

Finish taken to tag "d".

Trimmer: C.1. 4—40 pF.

Finish Sec.

Primary

L 2

L 1

a   b

d   c

$L.2 = 1.42\ \mu H$

$Q\ at\ 10\ Mc/s = 72$

S.W. OSCILLATOR

Former: As above.

Iron Dust Core: As above.

Secondary: 8-1/2 turns of 22 SWG En. Cu. wire wound in grooving, clockwise from start in direction of arrow.

Start taken through hole in former to tag "a".

Finish taken through hole in former to tag "c".

Primary: 4 turns of 38 SWG D.S.C. wire close wound on two layers of Bitumenised paper, 3/16″ wide, placed over the earthy end of the coil, clockwise from start in the direction of arrow.
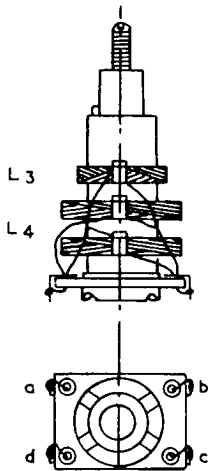
Start taken to tag "b".

Finish taken to tag "d".

Trimmer: C.4. 4—40 pF.

Primary

L 7

L 8

a   b

d   c

$L.7 = 1.24\ \mu H$

$Q\ at\ 10\ Mc/s = 70$

BRIMAR I2AH8

MEDIUM-WAVE COIL DATA

M.W. AERIAL

Former: 1/2″ outside diameter moulded bakelite.

Iron Dust Core: Neosid Z.11.B.

Secondary: L.4. 57 + 57 turns of 30/48 Litz. Single-wave wound, in two sections 1/8″ wide, spaced 1/8″.
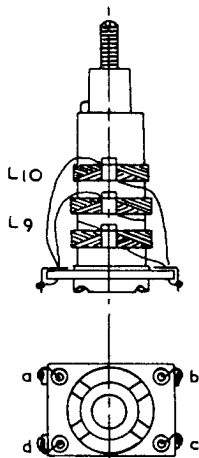Start taken to tag "c".
Finish taken to tag "d".

Gears: (Douglas) 50—32—34—50: 60—60.

Primary: L.3. 30 turns of 38 SWG D.S.C. wire. Double-wave wound, 1/8″ wide, spaced 1/8″ from L.4.
Start taken to tag "b".
Finish taken to tag "a".

Gears: 50—41—42—50: 40—80.

Trimmer: C.2. 4—40 pF.

L 3
L 4

a b
d c

L.4. = 170 μH
Q at 1 Mc/s = 145

M.W. OSCILLATOR

Former: As above.

Iron Dust Core: As Above.

Secondary: L.9. 38 + 38 turns of 38 SWG D.S.C. wire. Double-wave wound in two sections 1/8″ wide, spaced 1/8″.
Start taken to tag "c".
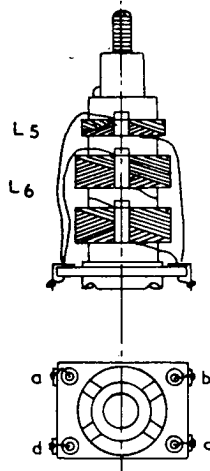Finish taken to tag "d".

Gears: 50—41—42—50: 40—80.

Primary: L.10. 28 turns of 38 SWG D.S.C. wire. Double-wave 1/8″ wide, spaced 1/8″ from L.9. Wound in same direction from start as L.9.
Start taken to tag "b".
Finish taken to tag "a".

Gears: As for L.9.

Trimmer: C.5. 4—40 pF.

L 10
L 9

a b
d c

L.9 = 89 μH
Q at 1 Mc/s = 58

BRIMAR I2AH8
LONG-WAVE COIL DATA

L.W. AERIAL

Former: 1/2″ outside diameter moulded bakelite.

Iron Dust Core: Neosid Z.11.B.

Secondary: L.6. 220 + 220 turns of 38 SWG D.S.C. wire, single-wave wound in two sections, 1/4″ wide, spaced 1/8″.
Start taken to tag "c".
Finish taken to tag "d".

Gears: (Douglas) 50—41—42—50: 60—60.

Primary: L.5. 100 turns of 38 SWG D.S.C. wire, double-wave wound, 1/8″ wide, spaced 1/8″ from L.6.
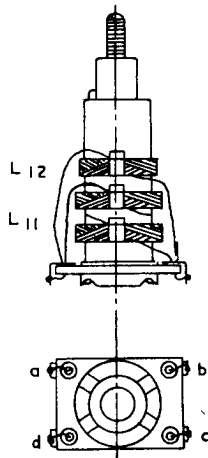Start taken to tag "b".
Finish taken to tag "a".

Gears: 50—41—42—50: 40—80.

Trimmer: C.3. 40—80 pF.

L 5
L 6

a   b
d   c

L.6 = 1·9 mH
Q at 200 kc/s = 62

L.W. OSCILLATOR

Former: As above.

Iron Dust Core: As above.

Secondary: L.11. 97 + 97 turns of 38 SWG D.S.C. wire, double-wave wound in two sections, 1/8″ wide, spaced 1/8″.
Start taken to tag "c".
Finish taken to tag "d".

Gears: 50—41—42—50: 40—80.

Primary: L.12. 53 turns of 38 SWG D.S.C. wire, double-wave wound, 1/8″ wide, spaced 1/8″ from L.11. Wound in same direction from start as L.11.
Start taken to tag "b".
Finish taken to tag "a".

Gears: As for L.11.

Trimmer: C.6. 40—80 pF.

L 12
L 11

a   b
d   c

L.11 = 440 μH
Q at 500 kc/s = 55

BRIMAR 12AH8

18—30 MC/S BAND COIL DATA

AERIAL

Former: 1/2" outside diameter moulded bakelite, threaded 10 turns per cm.

Secondary: 5-1/2 turns of 22 SWG En. wire wound in grooving clockwise from start in direction of arrow.

Start taken through hole in former to tag "a".
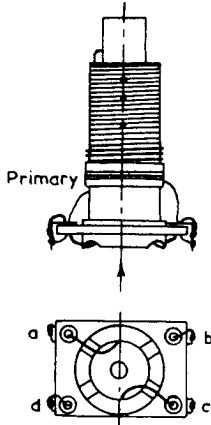
Finish taken through hole in former to tag "c".

Primary: 3 turns of 38 SWG D.S.C. wire close wound on two layers of Bitumenised paper, 1/4" wide, placed over the earthy end of secondary, clockwise from start in direction of arrow.

Start taken to tag "b".

Finish taken to tag "d".

Trimmer: 4—40 pF.

Secondary inductance = 0·56 μH

OSCILLATOR

Former: As above.

Secondary: As for Aerial.

Primary: 4 turns of 38 SWG D.S.C., otherwise same as Aerial.

Tag "a"—Earth: tag "b"—osc. anode via 150Ω: tag "c"—Tuning condenser: tag "d"—100 volt HT line.

Trimmer: 4—40 pF.

Tuning Condenser: 12—136 pF.