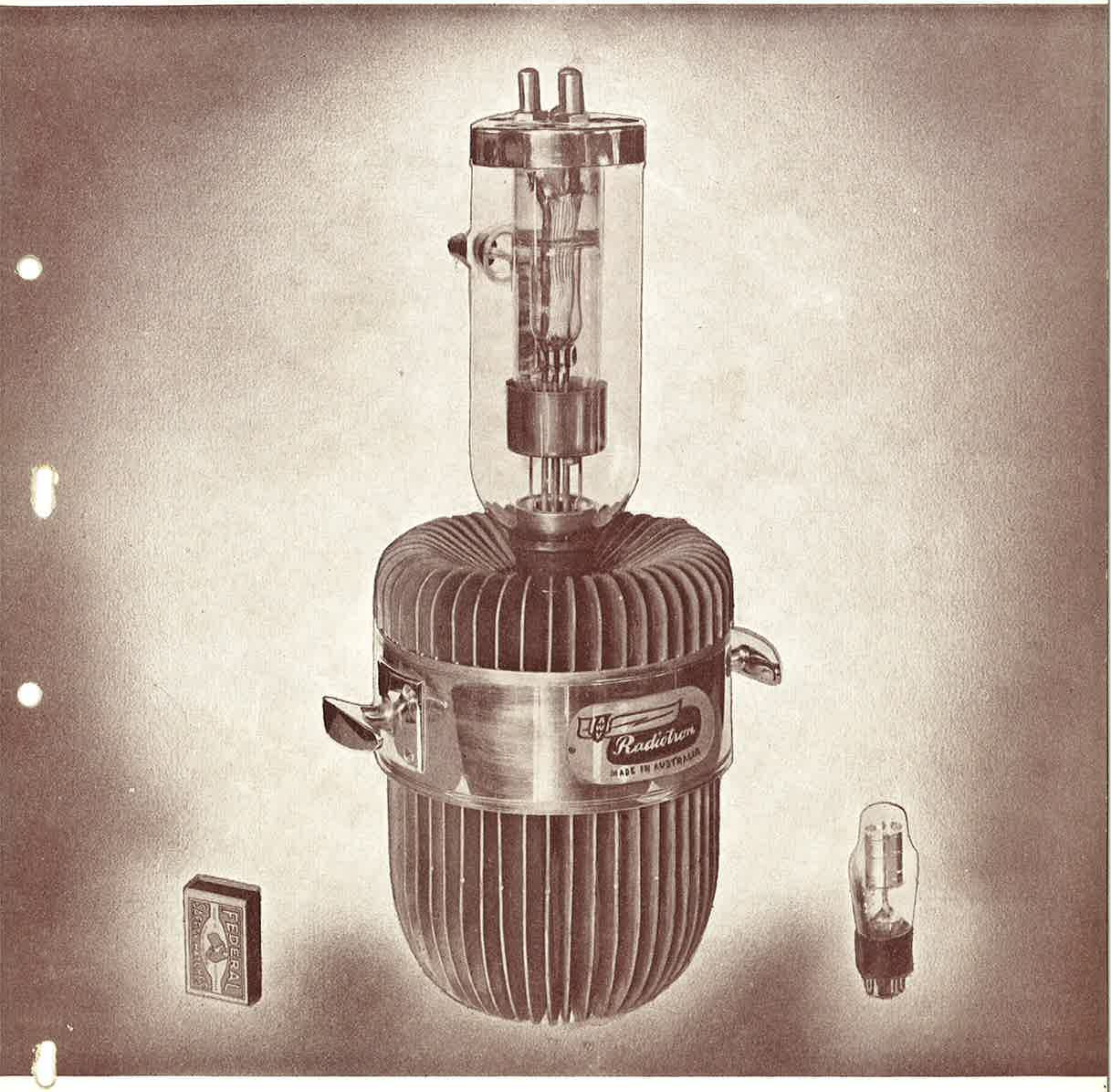
Radiotronics

Number 132 JULY — AUGUST 1948



THE RADIOTRON TYPE 892-R FORCED AIR-COOLED TRANSMITTING VALVE NOW BEING MANUFACTURED AT THE RADIOTRON VALVE WORKS, ASHFIELD, N.S.W.

RADIOTRONICS

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Radiotronics is issued six times a year and now forms part of "Radiotron Technical Service" for which the annual inclusive mailing fee is 7/6d.

All communications, subscriptions and change of address notices should be directed to the Valve Company — except in New Zealand, where correspondence should be addressed to Amalgamated Wireless (Australasia) Ltd., P.O. Box 830, Wellington C.1, N.Z.

Published by
Amalgamated Wireless Valve
Company Pty. Ltd.
47 York Street, Sydney, N.S.W.

Radiotronics is printed in Australia by the
Cloister Press (D. & W. Short),
Redfern, N.S.W.

The Choice of Operating Conditions for Resistance-Capacitance-Coupled Pentodes

by F. LANGFORD-SMITH, B.Sc., B.E.

HISTORICAL SURVEY

The analysis of the choice of operating conditions in r.c.c. pentodes followed a sequence of important steps or stages.

1. The first stage was the publication of the family of pentode dynamic characteristics in Radiotronics No. 69 (October, 1936). This article set out the general conditions for operation at output voltages approaching the maximum, and suggested a plate current of 0.56 E_{bb}/R_L. A similar article was also published in England — Laboratory Staff of Amalgamated Wireless Valve Company Ltd., Australia, "Resistance - coupled - pentodes", Wireless World, 41.13 (Sept. 24, 1937) 308.

2. The operating point to give minimum "total" distortion at low output voltages was proved experimentally to be the point of inflexion of the curve, which is also the point having the maximum dynamic slope (A.R.T.S. and P. Bulletin No. 46, August, 1937).

3. The writer carried out a number of tests with a wave analyser, operating with constant input voltage. From these there was derived a curve giving the plate current for minimum harmonic distortion for various values of input voltage. This paper was read before the Annual Meeting of the Adelaide Division of the Institution of Radio Engineers, Australia, on 2nd May, 1946, and also before the Melbourne Division, but was not published owing to the desire to make it more conclusive by the use of Intermodulation Distortion.

The present article gives the results obtained on the basis of intermodulation distortion, with constant output voltage.

GENERAL OPERATING CONDITIONS

It has been shown elsewhere that a resistance-coupled-pentode should be operated:

1. With any desired value of plate load resistor (usual values are from 0.1 to 0.5 megohm).

2. With the minimum bias provided that grid current does not flow under peak signal conditions and that the correct operating plate current can be maintained. A slight increase in grid bias is not seriously detrimental.

3. With a screen dropping resistor such that the correct operating plate current is maintained. Any change in grid bias requires a consequential change in the screen dropping resistor for optimum operating conditions.

4. With the highest permissible (or practicable) plate and screen supply voltage.

QUESTIONS AWAITING SOLUTION

The following questions have, up to the present, not been finally settled:

1. What is the optimum value of plate load resistor for minimum distortion?

2. What is the operating plate current for minimum distortion under any given conditions?

3. How does a pentode compare with a triode, on the basis of distortion, for the same output voltage?

4. How critical are the operating conditions of a pentode?

This article supplies the solution to these questions.

OPTIMUM PLATE LOAD RESISTOR

If gain is the only criterion, obviously the plate load resistor will be increased up to the value of the following grid resistor. Any further increase would result in a loss of gain* (for a fixed value of plate supply voltage).

If distortion is the only criterion, the curves provide the following results, with the following grid resistor equal to 4 times the plate load resistor, and fixed screen voltage.

Valve type	6SJ7	6SJ7	6SJ7
Plate supply voltage	250	250	250 volts
Plate load resistor	0.1	0.25	0.5 megohm
Screen Voltage	45	45	45 volts
Following grid resistor	0.4	1.0	2.0 megohms
Output Voltage	19	19	19 rms volts
Intermodulation distortion (min.)	1.5	3.0	4.4 %

Similar relative results were obtained with other valve types, output voltages, and following grid resistors, indicating that in all cases the intermodulation distortion increases as the load resistance is increased over the range from 0.1 to 0.5 megohm.

OPTIMUM PLATE CURRENT

It has previously been demonstrated that the plate current is the criterion for optimum operation, provided that both the grid bias and screen voltages are as low as practicable without danger of grid current.

It is now desired to determine the effect on the optimum plate current of:

(a) the load resistor,
(b) the following grid resistor,
(c) the change of valve type.

For convenience, let us adopt the constant K as the ratio of the operating plate current to the maximum possible plate current, i.e.

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* The loss of gain is due to the decreasing mutual conductance of the valve. The exact value of load resistor to give maximum gain may differ somewhat from the following grid resistor—see F. E. Terman, W. R. Hewlett, C. W. Palmer and Wen-Yuan Pan "Calculation and design of resistance-coupled amplifiers using pentode tubes" A.I.E.E. Transactions 59 (1940) 879.

$K = I_b/I_{bm}$

where I_b = operating plate current,

$I_{bm} = E_{bb}/R_L$,

E_{bb} = plate supply voltage

and R_L = plate load resistor.

The value of the maximum possible plate current (I_{bm}) may be obtained by short-circuiting the valve from plate to cathode, and measuring I_{bm} with a milliammeter in series with the load resistor.

The curves in Figures 1, 2 and 3 apply to type 6SJ7 or 6SJ7-GT, with plate load resistors of 0.1, 0.25 and 0.5 megohm respectively. Each curve corresponds to a constant output voltage, the values marked being the arithmetic sum of the rms values of the two component waves. This method appears to give a value most nearly comparable with the single frequency conditions. For example

RMS sum (A + B) = 16 volts

Component A = 3.88 volts

Component B = 15.52 volts (i.e. 4 times A)

Arithmetic sum (A + B) = E_o = 19.4 volts rms (shown as 19 volts on curves)

Peak value = 1.41 (A + B) = 27.4 volts

The equipment used was Altec-Lansing (T1 401 and T1 402).

Figures 4, 5 and 6 apply to type 6J7 under similar conditions.

The curves were carefully analysed, certain minor adjustments made, and the results averaged. A curve was then drawn to give the relationship between K and E_o (Fig. 8). This was checked against the individual readings for both types 6SJ7 and 6J7, and also against the previous results obtained with constant input voltage and Wave Analyser tests. Close agreement was obtained. This was also, rather surprisingly, found to agree quite closely with the remote cutoff type 6SF7 (Fig. 7). In addition, the value for zero output voltage ($K = 0.8$) was the point of inflection and also the point of maximum gain for low output voltages. At the other extremity, for $E_o = 80$ volts rms, $K = 0.55$ which is almost exactly the value given in Radiotronics No. 69 and quoted in the Radiotron Designer's Handbook (3rd edition, page 6).

From other tests, it may be taken as proved that the value of K is also very little affected by the plate supply voltage. This permits the results to be interpreted on the basis of E_o/E_{bb} and thus applied to any plate supply voltage.

These conclusions may therefore be drawn:

1. The value of K for minimum distortion is a function of the ratio of the output voltage to the plate supply voltage, and may vary between say 0.8 for zero output and 0.55 for maximum output (Fig. 8).

2. The optimum value of K is not appreciably affected by the type of valve, the load resistor, the following grid resistor or the plate supply voltage.

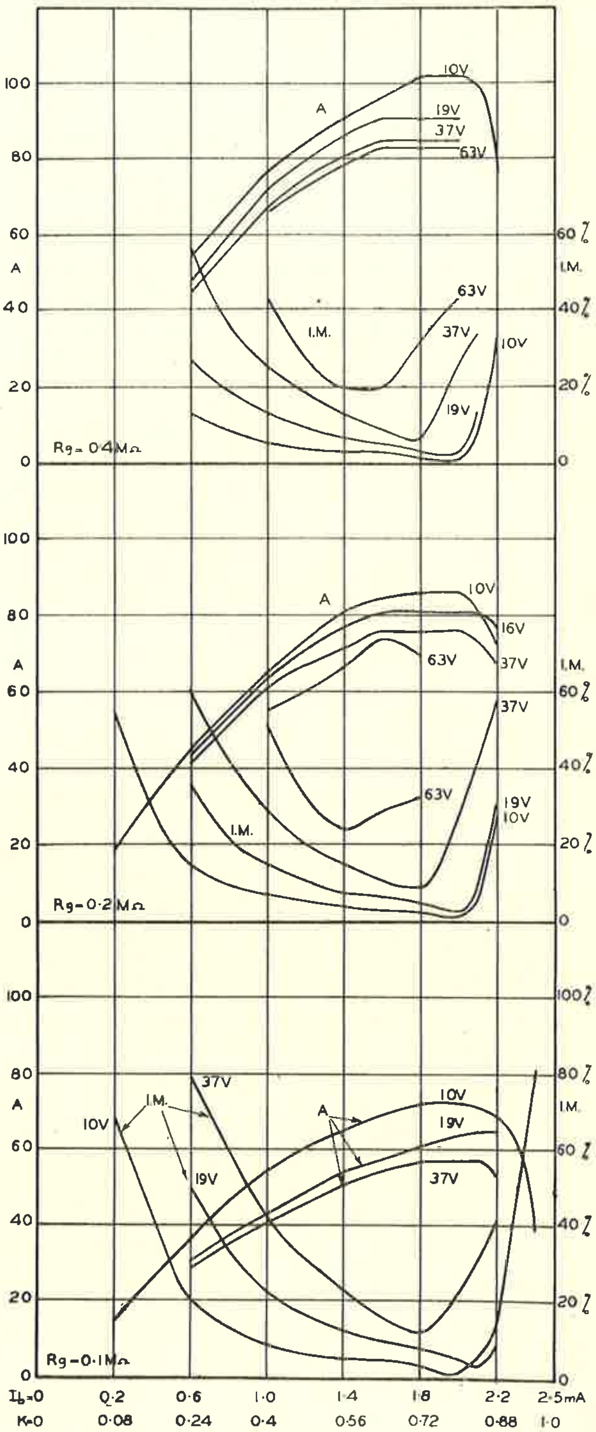

FIG. 1

Fig. 1 Type 6SJ7 with $R_L = 0.1$ *megohm,* $E_{bb} = 250$ *volts and* $E_{c2} = 45$ *volts. A is voltage stage gain, while I.M. is intermodulation distortion.*

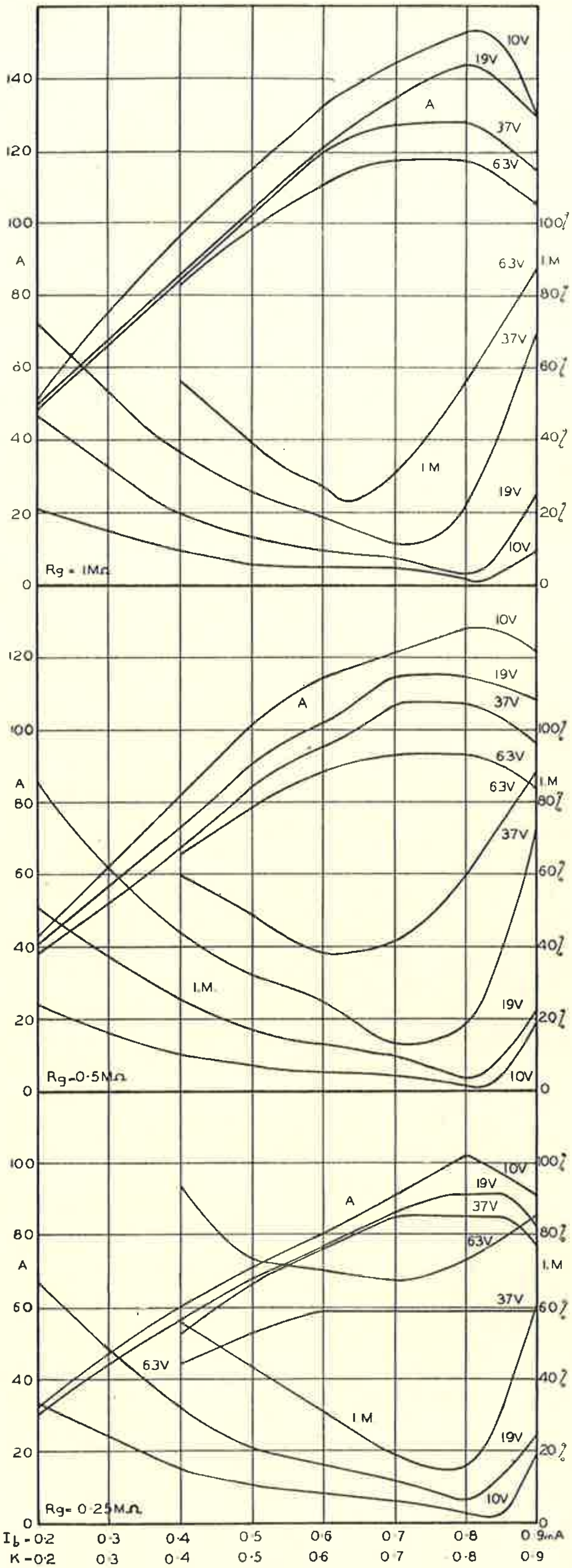

FIG 2

Fig. 2 Type 6SJ7 with R_L = 0.25 megohm, E_{bb} = 250 volts and E_{c2} = 45 volts.

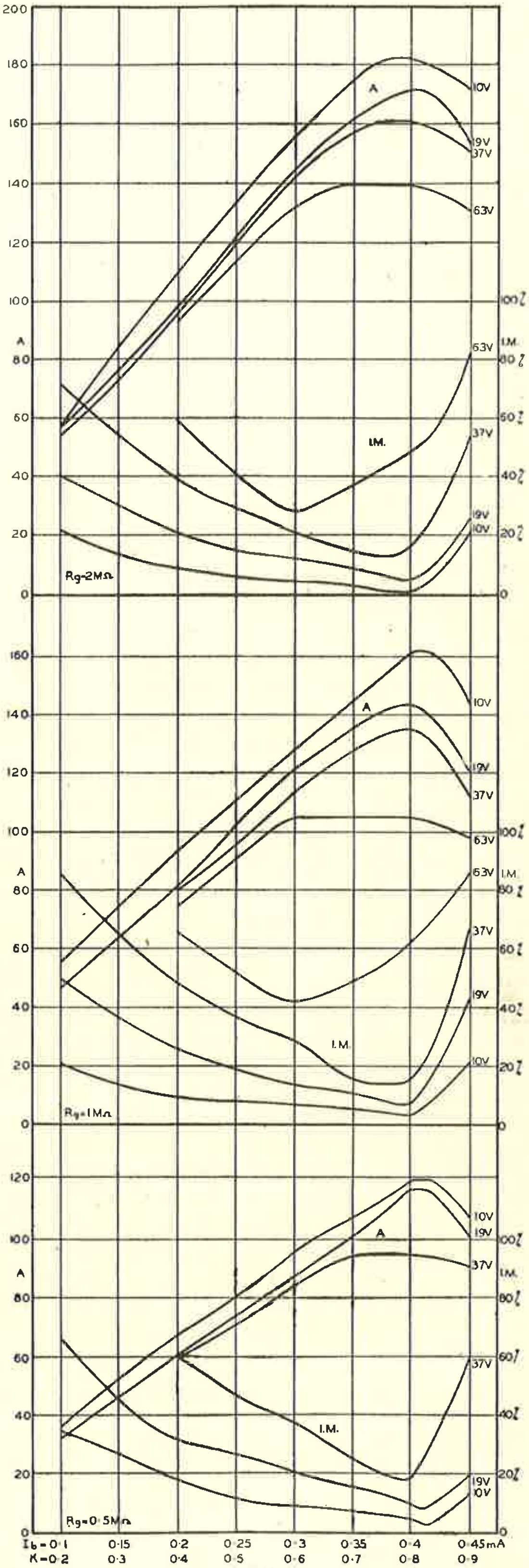

FIG. 3

Fig. 3 Type 6SJ7 with R_L = 0.5 megohm, E_{bb} = 250 volts and E_{c2} = 45 volts.

COMPARISON BETWEEN TRIODE AND PENTODE

Although it is popularly believed that a r.c.c triode gives less distortion than a r.c.c. pentode, tests conducted by R. H. Errey*, many years ago, indicated that under certain conditions a pentode can deliver a higher voltage output than a triode for the same distortion. This is equivalent to saying that at the same output voltage a pentode may have less distortion than a triode.

Some engineers have pointed out that the distortion of a triode is mainly second harmonic, while that of a pentode is mainly composed of higher harmonics so that the comparison, to date, must be regarded as undetermined.

In our Applications Laboratory, we have carried out measurements with a Wave Analyser, but the individual harmonics required to be "weighted" in order to make a true comparison, and there is no generally-accepted method of "weighting".

In order to settle the matter finally, it was decided to carry out tests with an Altec-Lansing Intermodulation Distortion Meter under the strictest conditions to ensure a true comparison:

1. The same valve was to be used, firstly as a pentode, and then as a triode (screen connected to plate).
2. The valve was carefully checked to ensure that it was a fair sample with no abnormal features.
3. The same plate load resistor was used for both triode and pentode operation.
4. The tests were repeated for a different value of load resistance.

The results obtained with R_L = 0.25 megohm and R_g = 1.0 megohm have been plotted in Fig. 10. The triode has a nearly linear relationship between intermodulation distortion and output voltage and has been drawn as a straight line. The pentode intermodulation distortion is considerably less than that of the triode at low output voltages — it is only 12% of that of the triode at 9.7 rms volts output. The two curves cross, and the intermodulation distortion is therefore the same for both triode and pentode, at about 31 rms volts output. At higher outputs the pentode gives the greater intermodulation distortion, the ratio being 2.3:1 at 63 rms volts output.

Tests with R_L = 0.1 and R_g = 0.4 megohm showed similar results, except that the cross-over point was at about 35 rms volts output. This is explainable by the known behaviour of triodes and pentodes with varying load resistances; triodes have less distortion with higher load resistances, while pentodes have less distortion with lower load resistances.

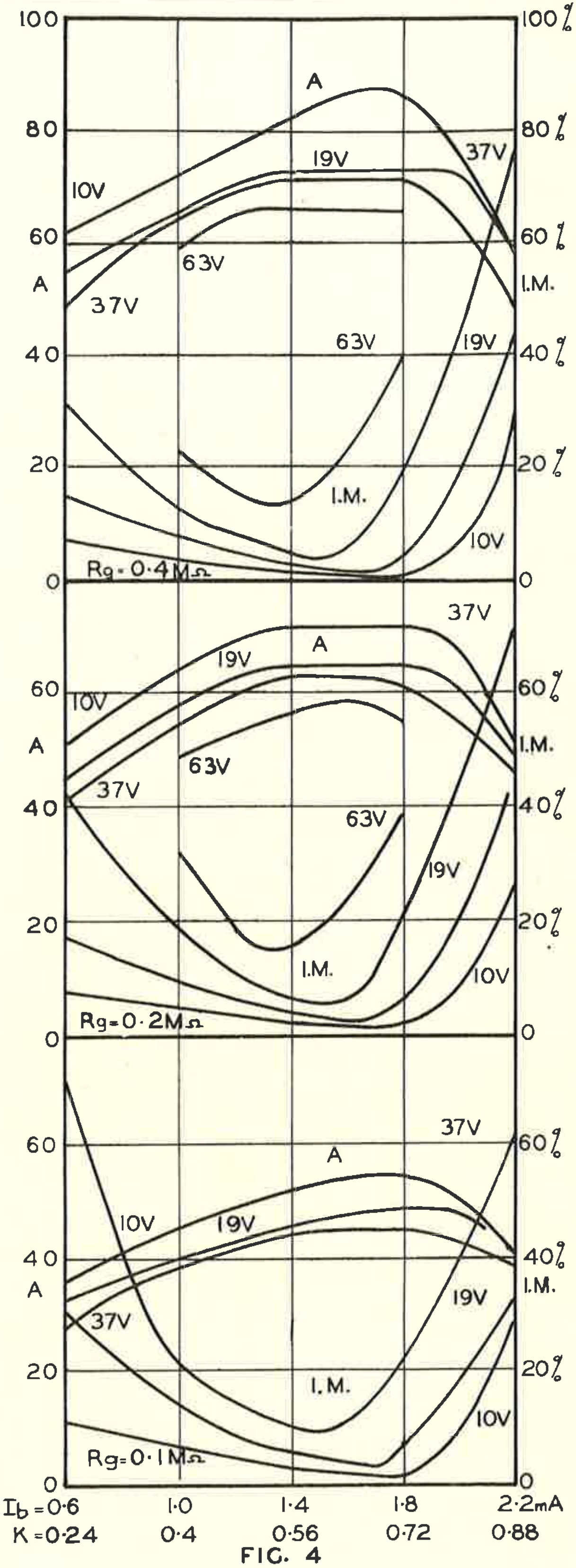

FIG. 4

Fig. 4 Type 6J7 with R_L = 0.1 megohm, E_{bb} = 250 volts and E_{c2} = 45 volts. Compare with Fig. 1 for type 6SJ7.

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* Article by laboratory staff of Amalgamated Wireless Valve Company "Resistance-coupled-pentodes" Wireless World, 41.13 (Sept. 24, 1937) 308.

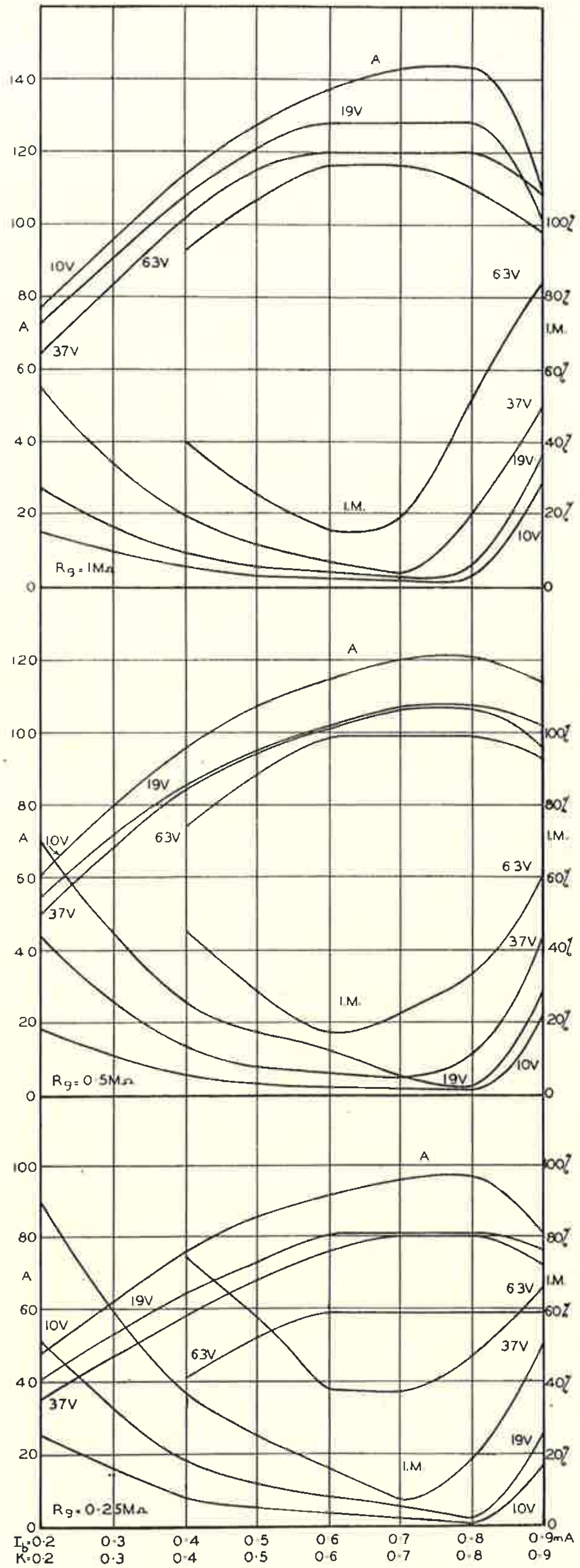


FIG. 5

Fig. 5 Type 6J7 with R_L = 0.25 megohm, E_{bb} = 250 volts and E_{c2} = 45 volts. Compare with Fig. 2 for type 6SJ7.

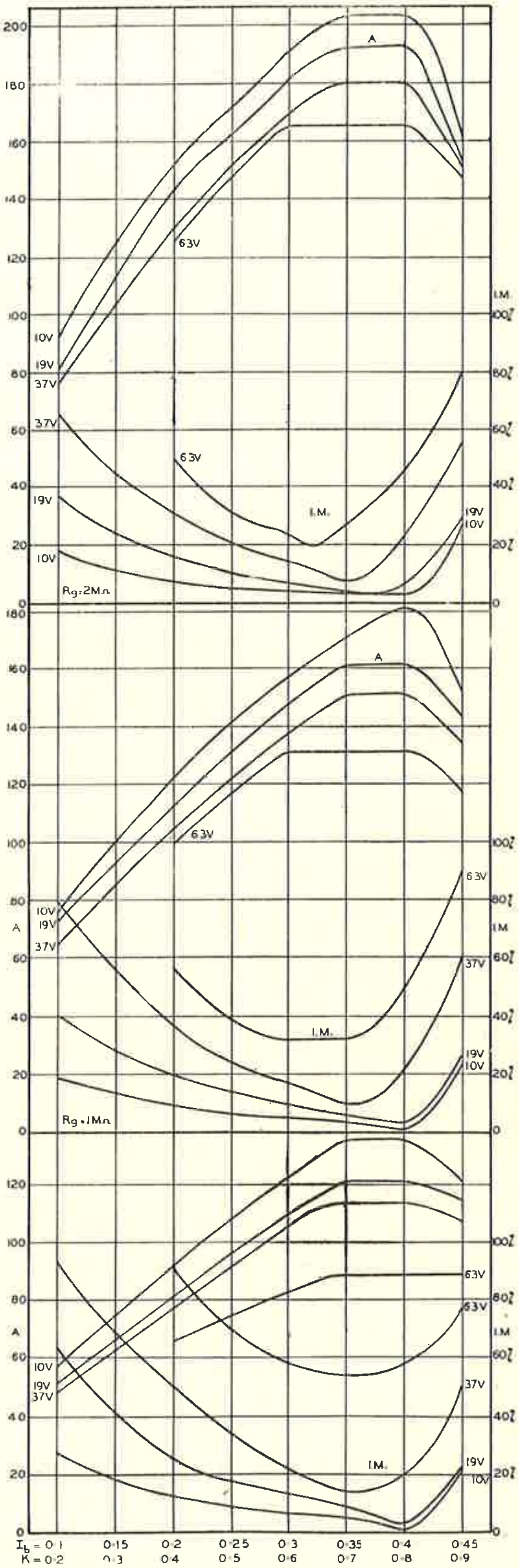


FIG. 6

Fig. 6 Type 6J7 with R_L = 0.5 megohm, E_{bb} = 250 volts and E_{c2} = 45 volts. Compare with Fig. 3 for type 6SJ7.

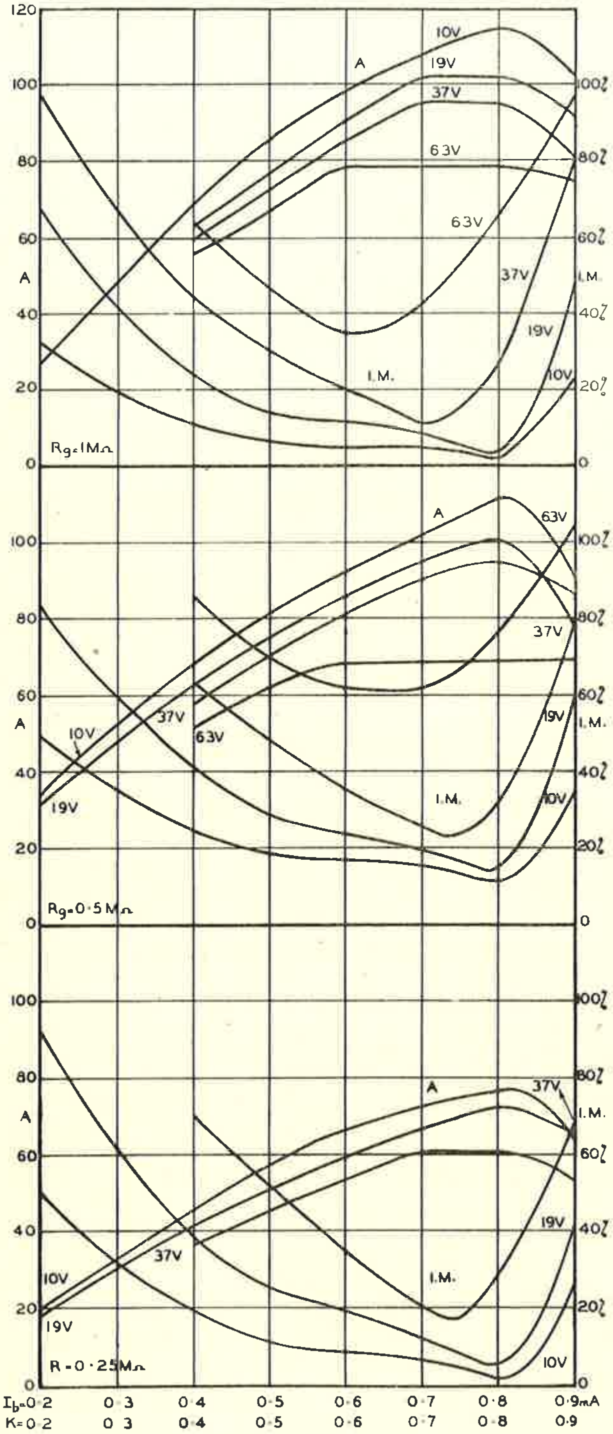


FIG. 7

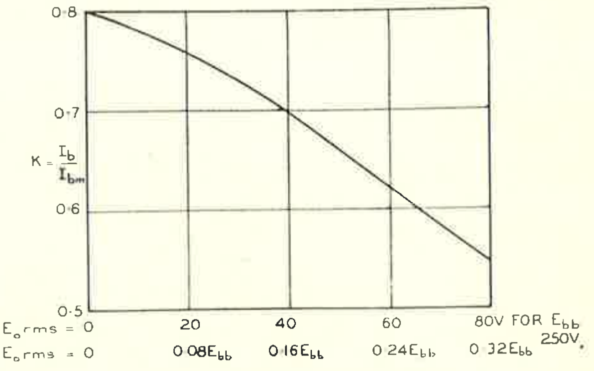


FIG. 8

Fig. 8 Value of K for minimum intermodulation distortion plotted against rms output voltage (E_o).

Thus it has been clearly demonstrated that pentodes have lower intermodulation distortion than triodes at rms output voltages up to about 31 to 35 volts for a plate supply of 250 volts. At higher output voltages the triode shows to advantage over the pentode. In all cases the operating point (i.e., the plate current) is adjusted for minimum distortion.

HOW CRITICAL ARE THE PENTODE OPERATING CONDITIONS?

If it be accepted that a pentode, when operated under its optimum conditions, gives less distortion over a range of output voltages than a triode also under its optimum conditions, the obvious question arises regarding the practicability of maintaining these conditions.

Taking a load resistance of 0.1 megohm with a following grid resistor 0.2 megohm as a fair basis, we can compare Fig. 1 (B) with Fig. 9 (B). With E_o = 10 volts rms, the triode minimum of 2% intermodulation is only excelled by the pentode between the values K = 0.72 and K = 0.82, reading from the original curves. (These are, obviously, only approximate between readings, but are sufficient to give a general indication). The triode rises to 4% intermodulation at K = 0.56 and K = 0.82, while the pentode corresponding values are K = 0.56 and K = 0.83 — almost identical to one another. These, and other values, are tabulated for ease in comparison.

Fig. 7 Type 6SF7 with R_L = 0.25 megohm, E_{bb} = 250 volts and E_{c2} = 18.5 volts.

6SJ7 TRIODE AND PENTODE COMPARISONS

R_L = 0.1 megohm, R_g = 0.2 megohm, E_{bb} = 250 volts.

	Range of K values			
Max. I.M.	E_o = 10V rms		E_o = 19V rms	
	Triode	Pentode	Triode	Pentode
2%	0.82	0.72–0.82	—	—
4%	0.56–0.82	0.56–0.83	0.77–0.80	0.74–0.82
6%	0.36–0.83	0.45–0.84	0.62–0.81	0.66–0.83

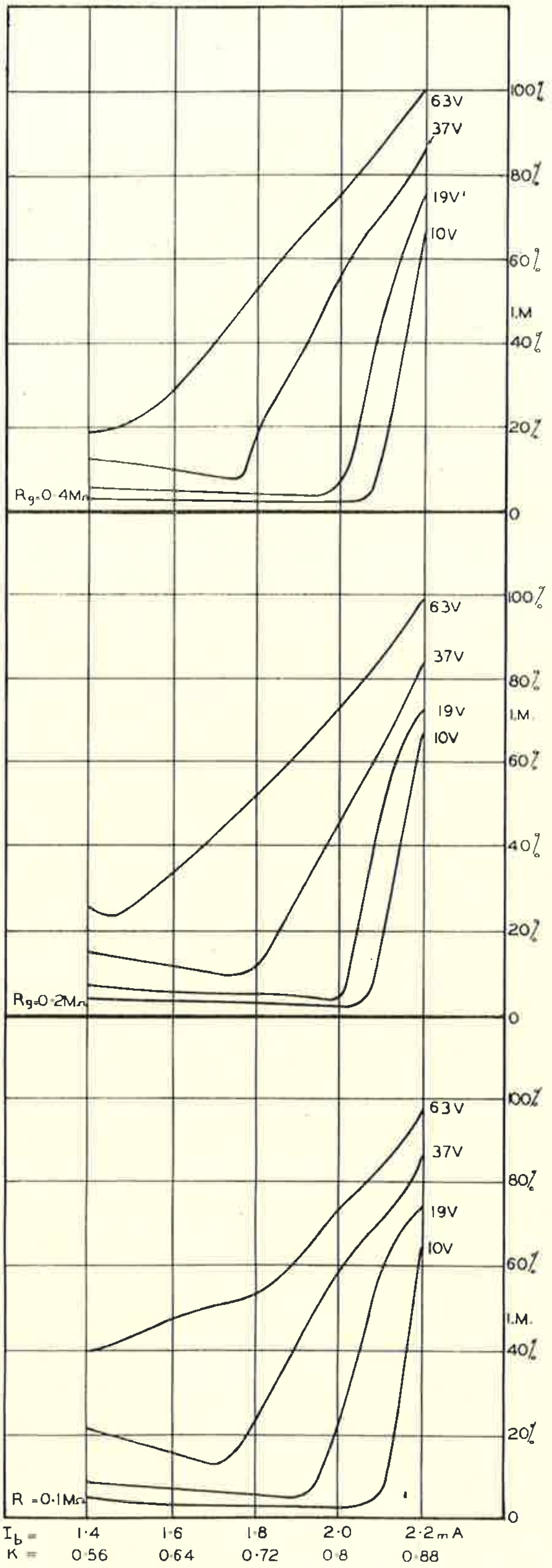


FIG. 9

Fig. 9 Type 6SJ7 triode with R_L = *0.1 megohm and* E_{bb} = *250 volts. Compare with Fig. 1 for pentode operation.*

Conclusions:

If I.M. is not to exceed 2%, the pentode has a range of *K* values, while the triode value is unique.

If I.M. is not to exceed 4%, the pentode has a slightly wider range of *K* values than the triode.

If I.M. is not to exceed 6%, the triode has a noticeably wider range of *K* values.

Summing up, it may be said that the pentode is fairly critical in its operating conditions if the lowest possible distortion is to be obtained. Both the triode and pentode are critical in the upwards direction, and values of *K* above 0.78 are probably unsafe owing to the rapid increase of distortion above the point of minimum distortion. In general, the distortion does not rise so rapidly in the triode as in the pentode, when *K* is reduced below the optimum value.

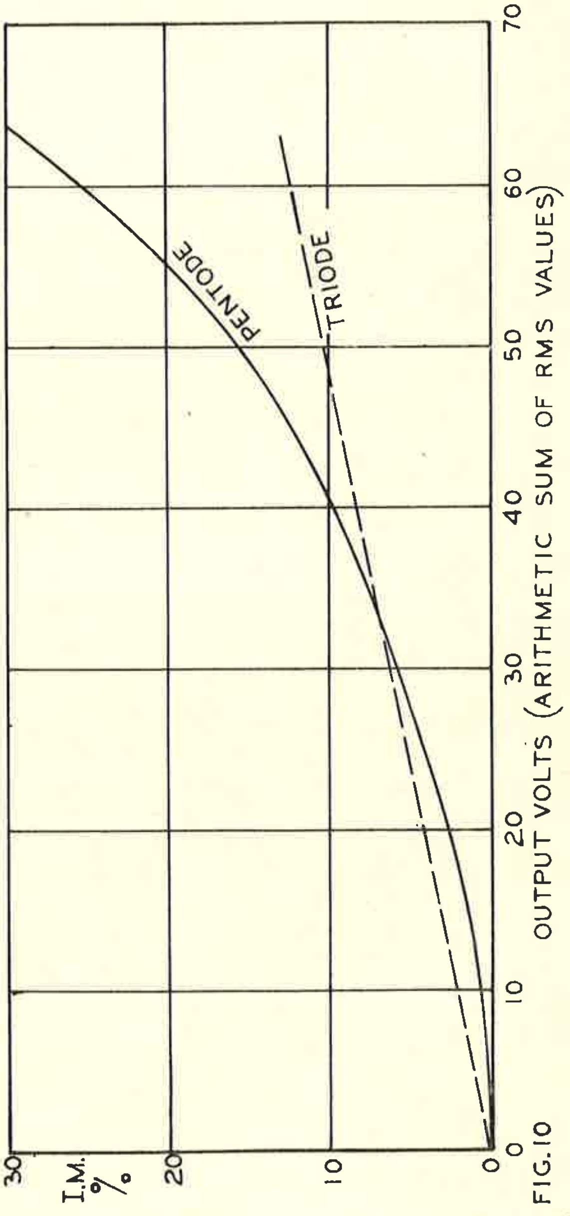


FIG.10

Fig. 10 Type 6SJ7 comparison between triode and pentode operation; intermodulation distortion plotted against output voltage for R_L = *0.25 megohm,* R_g = *1.0 megohm,* E_{bb} = *250 volts.*

Electronic Timers Employing Thyratrons 2D21 or 2050

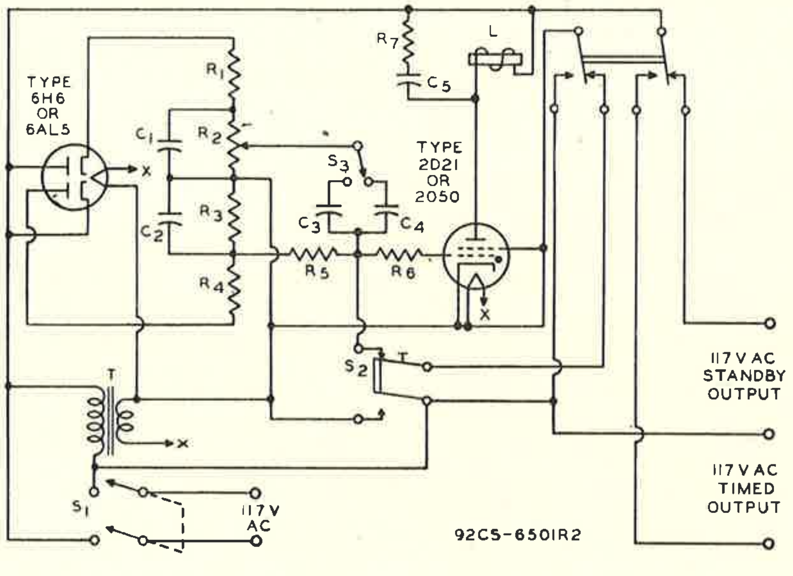
R.C.A. Application Note AN-131 reprinted by courtesy of the Radio Corporation of America.

Timing circuits employing the R.C.A.-2D21 or the R.C.A.-2050 are particularly suitable for controlling small time intervals. Because these tubes are thyratrons of the tetrode type designed to operate with low grid current, they permit the use of high values of resistance in the grid circuit to control the duration of timing intervals over a relatively wide range. They also have a high control ratio and, therefore, a small and relatively linear portion of the exponential charge or discharge curve of the capacitor in the grid circuit can be used to give accurate and consistent timing control. As is common to all gas tubes, these tubes provide a sudden transition from non-conduction to full conduction which facilitates accurate control of both the start and the end of timing intervals. Thyratrons also have the ability to control substantial amounts of power and, therefore, can be used to energise directly relatively large relays.

This note describes three representative electronic timing control circuits which can utilize either the 2D21 or the 2050. These circuits for small time intervals have an accuracy in the order of one per cent. obtainable with standard components. If voltage-regulated power supplies are used, even greater precision is obtainable.

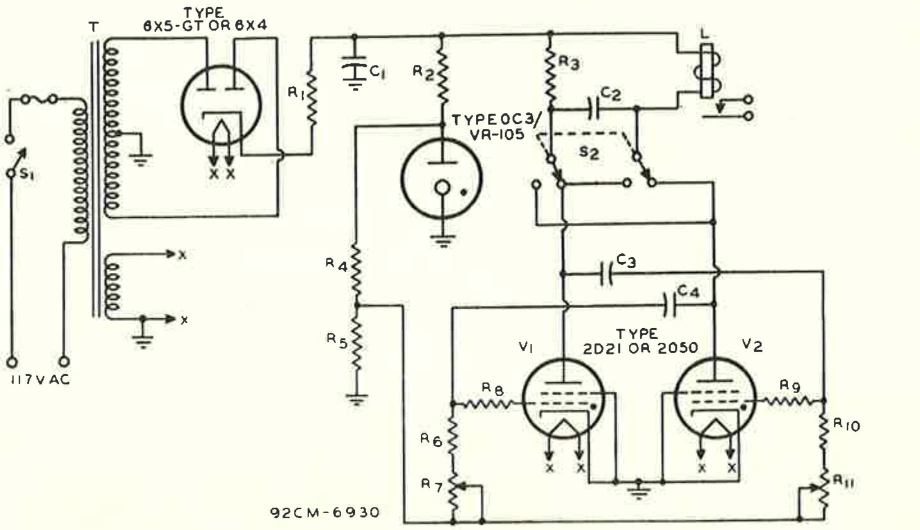
On-Off Interval Timer

An electronic timer for intervals adjustable from 0.3 to 30 seconds is given in Fig. 1. This timer is useful in applications in which a definite time interval is required for the performance of a specific operation such as, for example, turning the light source of a photographic enlarger on and off.



R1: 500 ohms, 0.5 watt
R2: Timing control, potentiometer, 15000 ohms
R3 R4: 15000 ohms, 1.0 watt
R5 R6: 5 megohms, 0.5 watt
R7: 1000 ohms, 2 watts
C1 C2 C5: 4 μf, electrolytic, 300 volts
C3: 4 μf, paper, 300 volts
C4: 0.4 μf, paper 300 volts
T: Filament transformer 6.3v @ 1.0a
S1: Switch, double-pole, single-throw
S2: Push-button actuating switch, non-locking, double-pole, single-throw
S3: Switch, single-pole, double-throw
L: Relay, 115v dc coil, 3000 ohms

Fig. 1 - On-Off Interval Timer



R1: 2500 ohms, 10 watts
R2: 1000 ohms, 1.0 watt
R3: 3000 ohms, 10 watts
R4: 51000 ohms, 0.5 watt
R5: 30000 ohms, 0.5 watt
R6: 860000 ohms, 0.5 watt
R7: Timing control, potentiometer, 7.5 megohms
R8: 1 megohm, 0.5 watt
R9 R10: 100000 ohms, 0.5 watt
R11: Timing control, potentiometer, 1 megohm

C1: 40 μf, electrolytic, 450v
C2 C3 C4: 4 μf, paper 400v
T: Power transformer 300-0-300 volts RMS, 70 ma., 6.3v @ 2.0a
S1: Switch, single-pole, single-throw
S2: Switch, double-pole, double-throw
L: Relay, 115v dc coil, 3000 ohms

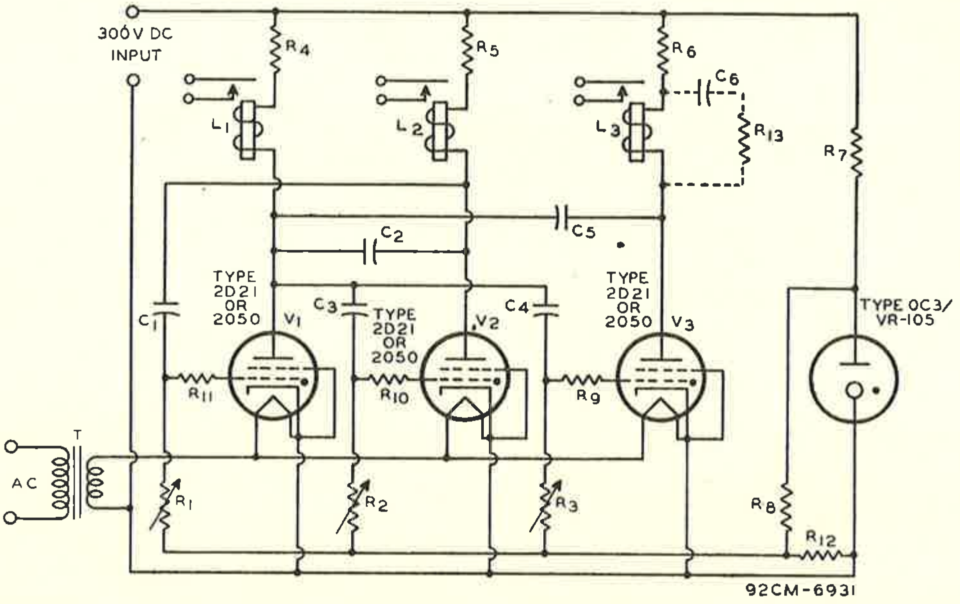
Fig. 2 - Repeating Sequence On-Off Interval Timer

In this circuit, the timing interval is controlled by the voltage obtained from the resistance-capacitance network in the grid circuit of the thyratron. When switch S_2 is actuated, the ac input circuit is completed and the timing operation begins. This switch applies ac voltage to the plates of the twin diode and the thyratron, and energizes the relay L. One set of relay contacts completes the output circuit so that power is supplied to one pair of the output terminals. The other set of contacts completes the ac input circuit so that it is not broken when the actuating switch S_2 is released. The 6H6 operates as a voltage doubler. The grid voltage for the 2D21 (or 2050) is taken from the rectified output at R_2. Initially, the voltage on the grid is positive with respect to the cathode, but as C_3 or C_4 charges the grid voltage becomes increasingly negative until it drops below the critical grid-voltage value. The thyratron then cuts off when the anode voltage is passing through a negative half cycle and stays cut off as long as the grid voltage is negative.

Because the charging time of C_3 is fixed, largely by the value of R_5, the timing interval is determined by the voltage obtained from the potentiometer R_2, the timing interval control. An interval ranging from 0.3 to 3 seconds is obtainable with C_3 (0.4 μμf) and an interval ranging from 3 to 30 seconds is obtainable with C_4 (4 μμf). The capacitors should be high-quality paper or oil-filled. The circuit constants are chosen so that the portion of the charging curve used is essentially linear. As soon as the operation cycle is complete, the grid capacitor is discharged through the relay contacts and the timer is ready for the next operation.

Repeating Sequence On-Off Interval Timer

An electronic timer which automatically repeats a sequence consisting of a definite "on" interval followed by a definite "off" interval is given in Fig. 2. In this circuit, the timing intervals are controlled by the resistances in the grid circuit of each thyratron. The thyratrons are used in a circuit resembling that of a free-running multivibrator with positive grid return except that the anodes are connected through a commutation capacitor C_2 so that when one tube starts to conduct, both the anode voltage and the grid voltage of the other tube will be reduced below the values required for conduction. The commutation capacitor is required because the anode voltage of the thyratron operating with a dc supply must be considerably reduced before the grid can take control. Capacitor C_2 charges or discharges rapidly and the anode voltage of the non-conducting tube is quickly restored but after the grid takes control. The resistance-capacitance network in the



R1 R2 R3: Timing control, potentiometer, 5 megohms
R4 R5 R6: 5000 ohms, 10 watts
R7: 7500 ohms, 10 watts
R8: 5000 ohms, 0.5 watt
R9 R10 R11: 100000 ohms, 0.5 watt
R12: 300000 ohms, 0.5 watt

R13: 1000 ohms, 2 watts
C1 C2 C3 C4 C5: 4 µf, paper, 400 volts
C6: 8 µf, electrolytic, 150 volts
T: Filament transformer, 6.3v @ 2.0a
L1 L2 L3: Relay, 115v dc coil 3000 ohms

Fig. 3 - Repeating Sequence 3-Step Interval Timer

grid circuit, determines the rate at which the grid voltage goes positive and, therefore, determines the tube firing time. Tubes V_1 and V_2 may be adjusted by means of resistors R_7 and R_{11} for conducting intervals ranging from 0.3 to 40 seconds. Switch S_2 shifts the relay from the anode circuit of one tube to the anode circuit of the other and thus provides a simple method of quickly interchanging the "on" and "off" intervals.

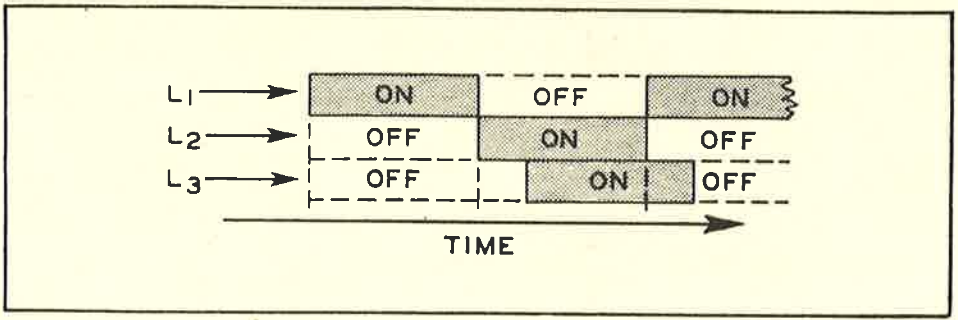
Corr.

Repeating Sequence 3-Step Interval Timer

An electronic timer which energizes and de-energizes three relays in sequence is given in Fig. 3. This circuit is similar to the preceding one but it has an additional thyratron V_3 which is connected so that its conduction interval follows that of V_2. The conduction interval of V_1 is terminated when either V_2 or V_3 starts to conduct. The start of conduction for V_2 is controlled by R_2; the start of conduction for V_3 is controlled by R_3. The conduction interval of V_2 and V_3 is terminated when V_1 starts to conduct. If it is desirable to have L_3 de-energize slightly later than L_2, a filter (C_6; R_{13}) connected as in Fig. 3. will delay its drop-out. A diagram illustrating the on and off sequence of each relay is given below.

The circuits described above are typical timing control circuits and serve to illustrate principles which may be readily applied to other timing devices.

Devices and arrangements shown or described herein may use patents of R.C.A. or others. Information contained herein is furnished without responsibility by R.C.A. for its use and without prejudice to R.C.A.'s patent rights.



A Dynamic Noise Suppressor

By R. H. ASTON, A.M.I.R.E. (Aust.).

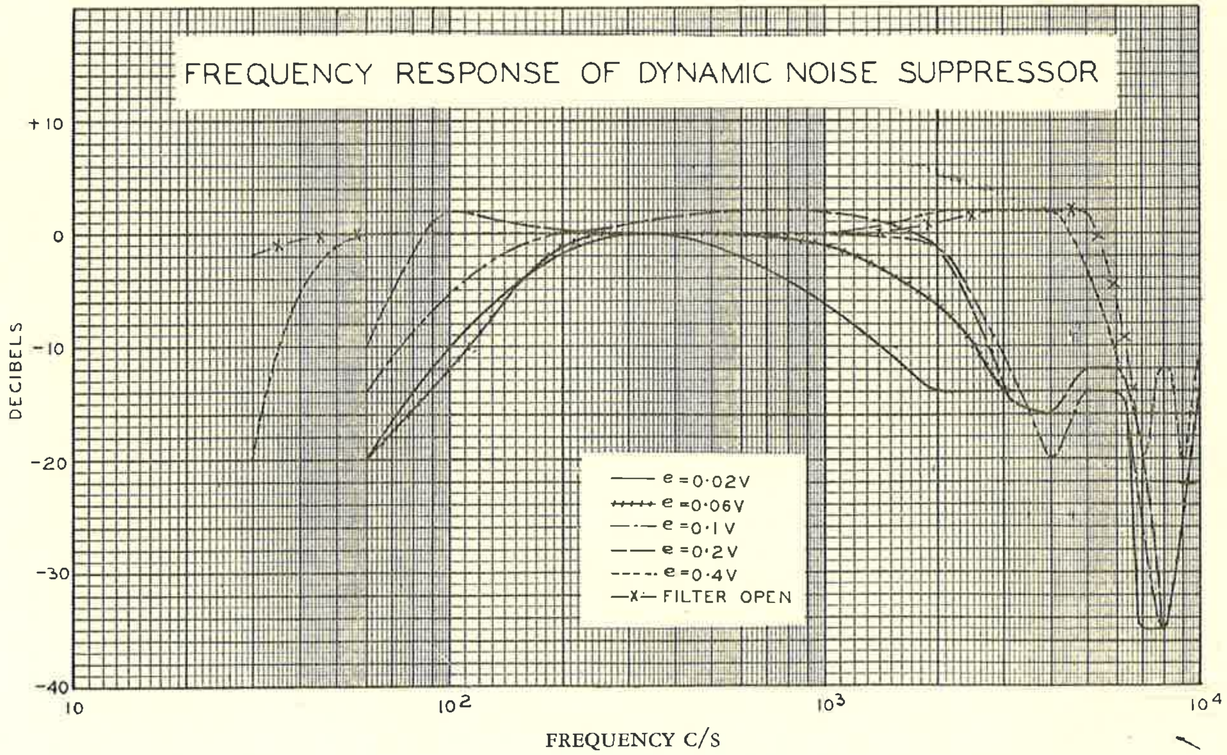
From the earliest days of recorded music surface noise has been a major limitation to fidelity and pleasurable listening. Efforts designed to improve the system have followed two general directions. On the one hand, there has been a steady improvement in materials used in the manufacture of recordings and, with the wider use of lighter pick-ups, a reduction in the abrasive content. On the other hand, there have been innumerable systems of tone controls designed to reduce noise. Unfortunately, they also reduce the musical frequency range, so it has been a compromise between wide frequency range and noise.

There have also been developed systems of pre-emphasis, such as the Orthacoustic, which, used with the correct equalizers, provide a high degree of freedom from noise.

However, these recordings are not generally available and are therefore not of great interest to the wide majority of record users.

There have recently been proposed systems of noise reduction which allow a greater reduction in noise for less restriction of frequency range. These new systems fall into two general classes. One of them assumes that the noise is small compared to the average musical level, and is so designed to eliminate all signals below a pre-set level. A non-linear circuit element (e.g. crystal or diode rectifiers suitably arranged) which conducts only when the signal exceeds a pre-determined level is connected between two filter circuits, having bandwidths not greater than one octave, and which pass the same band of frequencies. The distortion introducted by the non-linear circuit element is removed by the output filter so that substantially only those frequencies which were passed through the input filter circuit appear at the output of the second filter.

The other system of dynamic noise suppression operates rather more like a conventional tone control which is automatically varied by the signal to provide an optimum cut-off frequency. An advantage of this system is that it does not introduce non-linear distortion. However, with only one variable element, the range of variation of the cut-off frequency is not much greater than an octave; so that a complete system requires several valves. This system is readily adaptable to provide a low frequency cut-off which is varied with the high frequency cut-off so that optimum tonal balance may be preserved.



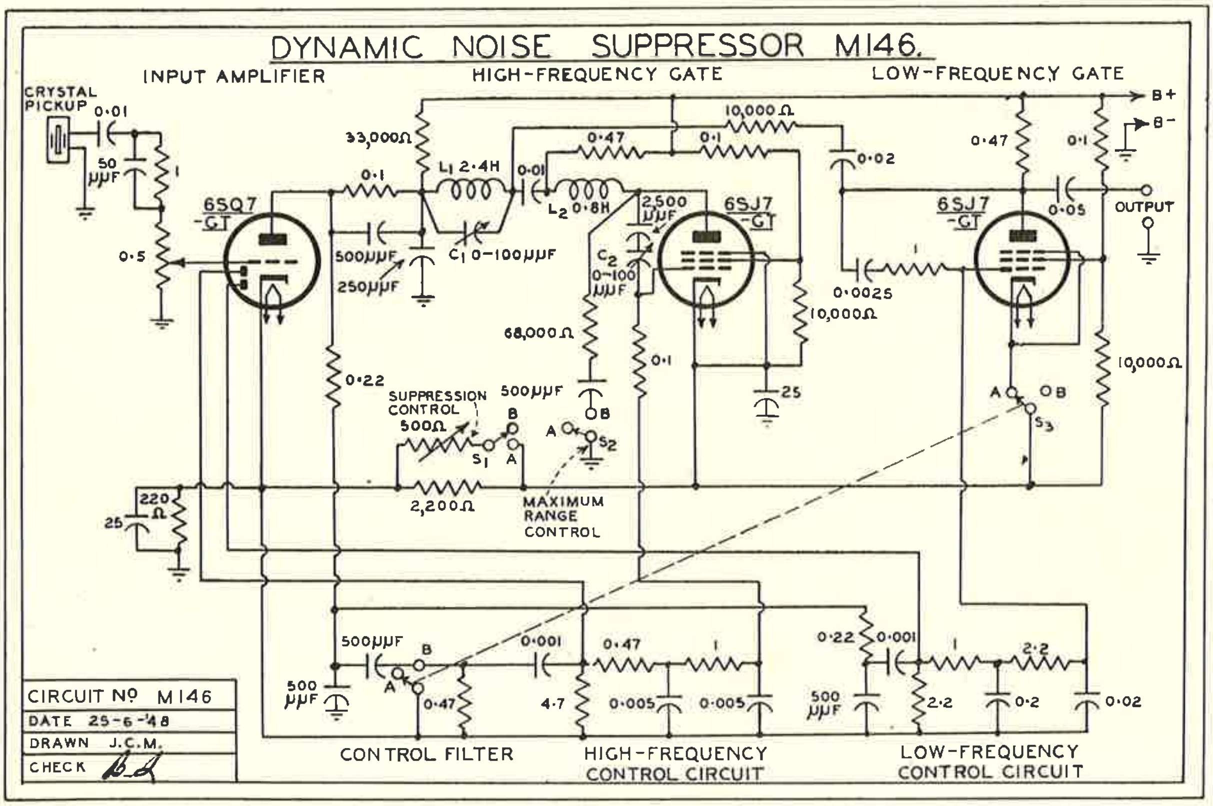
Examples of both types of dynamic noise suppressors have recently been described. [1,2] Of these, a relatively simple version of the latter type appeared sufficiently interesting to justify the construction of an experimental model in the Applications Laboratory. The circuit of figure 1 was used, and the unit set up on a separate chassis. The actual construction needs little comment other than mention of the need for a larger chassis than is usual for three valves. There are rather a lot of resistors and capacitors, which require considerable space if they are to be accessible. The coils were wound on toroidal iron dust formers.

Scott recommends that the trimmer C_1 should be adjusted for minimum output at 9 Kc/s — or 10 Kc/s for adjacent channel signal rejection. Trimmer C_2 should be adjusted for minimum response at 4 Kc/s when switch S_3 is in position B, and R_3 set at zero. It was found preferable, however, to tune C_1 and L_1 for minimum output at 7.5 Kc/s to avoid too great a rise in output between the two frequencies of maximum attenuation. The filter characteristics can easily be checked with an audio oscillator and an oscillograph or valve voltmeter. The effects of different positions of the controls can then be observed. Our experimental model thus showed a frequency range of 150 c/s to 900 c/s for an input of 0.02 V; and a range of 40 c/s to 5 Kc/s for an input of 0.4 V.

Switch S_1 allows the suppressor to be opened, providing the maximum range of about 6 Kc/s. Switch S_3 removes the low frequency suppressor control. Switch S_2 allows restriction of the maximum frequency range.

The experimental unit was connected in front of the Radiotron A515 amplifier, and supplied from a high grade pick-up and equalizer unit. An Altec-Lansing dual speaker, mounted in a vented enclosure, was connected so that listening tests could be made. Several representative recordings were used. They included some of the new extended range, low noise type and some of the older and noisier sort.

During quiet passages switching S_1 to maximum range gave a clearly apparent increase in noise level, for very little change in musical output, while on loud music there was no apparent difference with S_1 either way. The unit appeared to be performing up to the claims made for it; however, general listener impression was that the upper frequency limit of 6 Kc/s debarred the equipment from being classed as "high fidelity". It was considered that a more elaborate model, which is described in the article referred to, would be necessary to provide satisfactory control over a range extending up to 8 Kc/s.



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1. "Dynamic Noise Suppressor", H. H. Scott. Electronics. Dec. 1947. 97.

2. "Audio Noise Reduction Circuits", Harry F. Olson. Electronics. Dec. 1947. 119.

Frequency Response of Dynamic Noise Suppressor for Varying Input Voltages.

Frequency	e=0.02V	e=0.06V	e=0.1V	e=0.2V	e=0.4V	Filter open
30 c/s	—	—	—	—	–20db	–2db
50 c/s	—	—	—	—	– 1db	0
60 c/s	–20db	–20db	–14db	–10db	0	0
100 c/s	–10db	–12db	5db	+ 2db	0	0
200 c/s	– 2db	– 1db	0	0	0	0
300 c/s	0	0	0	0	0	0
1 Kc/s	– 6db	– 1db	0	+ 2db	0	0
2 Kc/s	–14db	– 6db	– 1db	– 1db	+ 2db	+ 1db
3 Kc/s	–14db	–14db	–10db	–14db	+ 2db	+ 2db
4 Kc/s	–14db	–14db	–20db	–16db	+ 2db	+ 2db
5 Kc/s	–14db	–14db	–14db	–12db	– 3db	+ 2db
6 Kc/s	–14db	–14db	–14db	–12db	–12db	– 6db
7 Kc/s	–35db	–35db	–25db	–20db	–20db	–20db
8 Kc/s	–35db	–35db	–35db	–35db	–14db	–14db
9 Kc/s	–20db	–20db	–20db	–20db	–20db	–20db
10 Kc/s	–14db	–14db	–14db	–14db	–14db	–14db

CORRECTION TO PRE-EMPHASIS CURVE IN RADIOTRONICS No. 127

On page 84 of Radiotronics 127 is shown a pre-emphasis curve. This is incorrect over the middle portion of the frequency range. Since it is somewhat more convenient, for receiver design, to have available the required de-emphasis curve, this is shown below rather than the corrected pre-emphasis curve. Of course, this is only the pre-emphasis curve turned upside down.

It might be noted that the response of the F-M receiver RF1 follows the correct curve shown below. The error occurred in the tracing of the standard pre-emphasis curve which was used to determine the required receiver response.

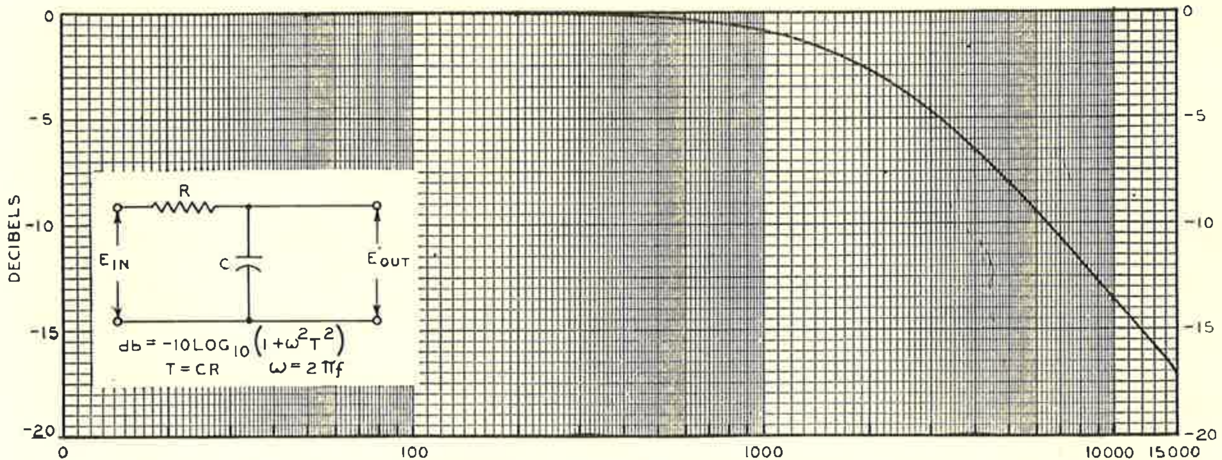
For those interested the expression for calculating the de-emphasis curve is

attenuation (db) = $-10 \log_{10} (1 + \omega^2 T^2)$

where $\omega = 2\pi f$ and $T = CR$.

For the particular case shown below of $T = 75\mu$ secs., and expressing f in Kc/s, this becomes

$$\text{db} = -10 \log_{10} (1 + 0.222 f^2).$$



75 MICROSECOND DE-EMPHASIS CURVE.

RADIOTRONICS' No. 132.

R.C.A. Tube Types Not Recommended for New Equipment Design

This list is supplementary to that given in Radiotronics No. 128. These lists are for the information of our readers, and it should be carefully noted that the recommendations apply to the U.S.A. and do not necessarily hold for Australian equipment.

RECEIVING TUBES

1Q5-GT
5T4
5W4
5X4-G
83v
5Y4-G
6F7
6K5-GT
6X5
82
10
25A6
25Z6
35Z4-GT
71A
41
42
43
46
47

POWER TUBES

10-Y
203-A
204-A
207
211
217-C
800
801-A
803
804
830-B
838
841
842
843
846
849
851
858
860
861
862-A
865
893-A
893-AR
898-A
1608
1610
1619
1623
1624
1626
8012-A

CATHODE-RAY TUBES

Type	Recommended Superseding Type
913	2BP1
908-A	*
3FP7-A	3JP7
5BP1-A	5UP1
902-A	2BP1
2AP1-A	2BP1
9AP4	12AP4

* Note — If any demand should arise, a companion to the type 3KP1 should be considered.

GAS TUBES

629
2A4-G
874
885
2051

SPECIAL TUBES

878
2C21/1642
2C22
2X2/879
559
1603
1634
1851

New R.C.A. Releases

Radiotron type 5WP15 — is a five inch cathode-ray tube intended primarily for use as the scanner in a flying-spot video-signal generator. Such a generator not only produces a repetitive picture signal, like that produced by a monoscope, but also has the advantages of permitting change of picture (or pattern) at will, and of reproducing the picture with the halftone fidelity of photographic film.

The type 5WP15 features a phosphor with a metallized back which effectively doubles the radiant energy of the flying spot in comparison with that obtainable with an unmetallized screen.

Radiotron type 6AR5 — is a miniature type power amplifier pentode intended for use in the output stage of a.c. operated receivers. Within its maximum ratings the type 6AR5 is the performance equivalent of the type 6K6-GT.

DISCONTINUED R.C.A. TYPES

Radiotron type 1J6-G — this has been replaced by the type 1J6-GT.

Note: This does not affect the Australian-made type 1J6-G, which will continue as heretofore.