THE AUSTRALASIAN

Radio World

Registered at the G.P.O., Sydney, for transmission by post as a periodical.

VOL. 8 . . . . . NO. 5 OCTOBER 15 1943

★ Details of instrument to show resistance, capacity & inductance

★ Circuit design for receiver of greatest possible performance.

★ Some servicing suggestions for A.C.-D.C. type receivers.

★ New short-wave station lists made excellent reception guide.

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117 Reservoir Street, Sydney

★ **Subscription Rates** —

6 issues	5/3
12 issues	10/6
24 issues	£1

Post free to any address.

★ **Service Departments** —
Back Numbers, 1/- ea. post free
Reply-by-mail Queries, 1/- each

Vol. 8. OCTOBER, 1943 No. 5.

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EDITORIAL

Once again the question of Marconi's early work on the development of radio communication has been brought into the limelight. The Supreme Court of the United States has ruled that Marconi did not invent radio and has invalidated the American patents of his, dated 1904. The court's opinion was based largely on the fact John Stone showed a four-circuitthat a patent granted in 1902 to wireless telegraph apparatus substantially like that later specified and patented by Marconi.

Irrespective of court decisions, however, there is no doubt that Marconi was the practical man who knew how to make the most from the new science.

Which brings us to the point we wish to stress; there is a wonderful field of opportunity waiting for the firm or individual who can organise a really effective way of entering the field of electronics.

Being so closely allied to radio, it is only natural that we turn to the radio engineers as the most likely men for the job.

It has been demonstrated beyond a shadow of doubt that there are remarkable prospects for the commercial application of the photo-electric cell, thyratron, ignitron, kenotron, magnetron and the hundred and one other recently introduced applications of the electron stream.

These units can be of great service to industry, yet they lie comparatively dormant, waiting for the right kind of publicity campaign to bring their merit under the notice of those who should be interested in their possibilities as aids to production. There is no need to wait until after the war is over, as they might well be obtained on the lend-lease plan to help in our war effort.

Design for a Simple A.C. Bridge

Full constructional details of a service instrument for measuring resistance capacity and inductance.

RECENTLY we discussed methods for the measurement of resistance and followed by describing a simple type of Wheatstone Bridge, which gives surprising accuracy considering the small number of parts used in its construction. Now

By

J. W. STRAEDE, B.Sc.

7 ADELINE STREET, PRESTON
VICTORIA

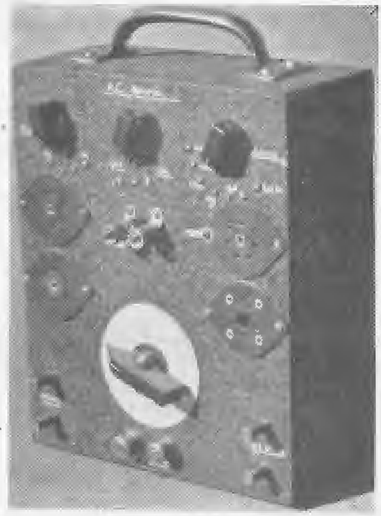
we present a more elaborate version, suitable for the serviceman, advanced amateur or experimenters' club.

Changes.

In place of a battery (D.C. source) or buzzer (A.C. source), a simple one-tube valve oscillator is used, thereby obtaining a fairly pure A.C. source which is reasonably stable in output. The slide-wire is replaced by a good-quality wire-wound potentiometer which can be fitted with a circular scale. Unfortunately, the wire-wound potentiometer must be calibrated—the lengths of resistance wire cannot be directly measured. A number of standard resistors and condensers are built into the instrument to cover most values of resistance and capacitance likely to be met by the serviceman. These standards are brought into action as required by a simple multi-way tapping switch. For "detection" of the balance point, a pair of phones or a single ear-phone (any resistance above 200 ohms) is used.

Valve Oscillator.

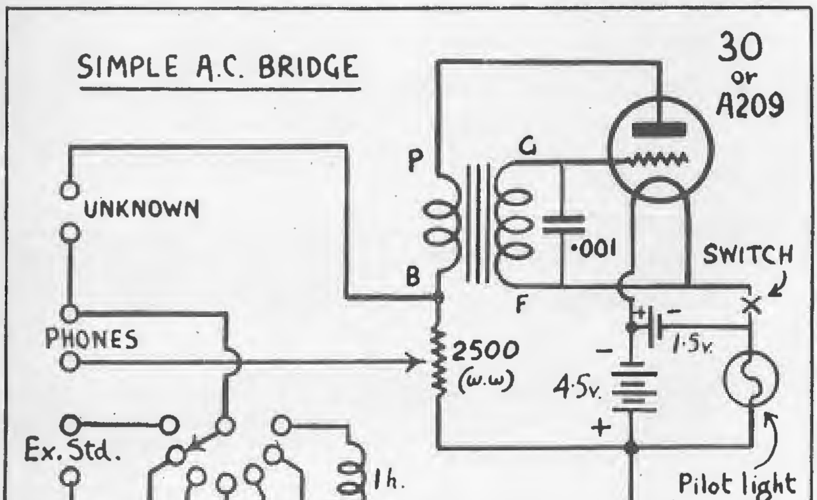
The A.C. source consists of a 2-volt medium-mu triode, the output of which is fed back to its input by an audio-frequency transformer, which, strange to say, should be one of the cheap and nasty variety, preferably one made for an early A.C. set. The inductance of the windings should be small, otherwise the note in the phones will be very low-pitched and almost inaudible. If the transformer is on the large side, some of the transformer laminations can be removed to reduce the inductance and thereby raise the frequency. In the one we built up, about half the laminations were removed, and to provide a control of frequency, a number of small condensers could be shunted across the grid winding by means of an extra switch. It will be noted that the grid return from the A.F. transformer goes to the A minus and not the A plus.



A photograph of the finished instrument.

Voltages.

Although the valves specified (A209 or 230 were best) are nominally 2-volt valves, they give quite a useful emission on the 1.5 volt, and as the drain is small, an ordinary 1.5 volt torch cell is suitable for filament supply. You don't use an A.C. Bridge all day long — in fact you may use it only a few hours per week, so a torch cell lasts several months. The H.T. supply consists of 2, 3 or 4 similar cells wired in series. Here the current drain is so low that a life of one year can be expected. One valve, we found, would oscillate even with no H.T. supply, the H.T. positive lead being connected to the positive side of the filament battery. (That particular valve was an A209.) Some 1.4 volt valves were tried, but the results were not so good as for the 2 volt ones, probably due to the low anode voltages. A 9-volt C bias battery makes a very good H.T. supply, giving a very distinct signal in the phones and making for increased accuracy. By using a 90-volt battery (with suitable grid bias) enough output for a permag. speaker is obtained.



Circuit for the A.C. Bridge, which measures resistance, capacity and inductance.

Construction.

The entire job was mounted in good old 1925 style on the front panel,

(Continued on next page)

A.C. BRIDGE
(Continued)

which was a piece of masonite soaked in melted paraffin wax. A panel of good-quality bakelite or with bakelite or ceramic inserts would probably be best. However, one job built up using shellacked ply-wood gave quite satisfactory results, except on very high resistances (over 3 megohm). The A.F. transformer and valve socket were fastened to the front panel by means of small brackets made from oddments of panel iron. There is no need to use shielded wire for any of the connections. See that the batteries cannot short against the handle or any of metal parts.

Three switches are shown in the photograph for pitch, on-off and range. The first one can be omitted if the valve oscillator has a pleasing tone.

A number of valve sockets are shown in the photograph — these are for making inter-element leakage tests and use an additional circuit not shown in the schematic diagram. The two pilot sockets are for checking pilot lights for continuity (just connect them across the 1.5 volt filament battery) and for resistance.

Calibration.

The first step after wiring up the bridge is to calibrate the scale of the potentiometer. To do this accurately, about four standard resistors are required, say 40,000 ohms, 20,000 ohms, 10,000 ohms and 10,000 ohms. The range switch is set to "external standard" and one of each of the 10,000 ohm resistors is connected to the "unknown" terminals and to the "external standard" terminals. The potentiometer is now turned until no sound is heard in the phones and the position is marked on the scale. This position is called X1. To check it, interchange the two resistors. Now the "unknown" resistors is replaced by a 20,000 ohm one and the potentiometer is re-adjusted and the position found is marked and labelled X2. The other resistors are now connected up in various series and parallel combinations and other points are marked. The scale is marked off in numbers which indicate the ratio of the unknown to the external standard. On one side of the scale, ratios will be X2, X3, etc. whilst on the other side the ratios will be less than unity (.9, .8, .7, etc.). Intermediate marks may be inserted "by eye." If possible, the bridge should be checked on each range with some standard instrument. On capacity ranges the scale is reversed, X3 being read as "divide by 3" and so on.

Inductance.

To measure inductance, a low-resistance inductor is required as standard. This should preferably be air-cored. Details for winding a IH air-core choke coil appeared in an old number of Australasian Radio World. A good standard can be made from a speaker transformer winding if its inductance when air-cored, of course, is first obtained from the makers or from some recognised laboratory.

Capacitance.

Accurately measured capacitors may be obtained from several manufacturers for use as standards. It's a good idea to try checking a number of paper condensers for capacity, noting how the ratio on the scale is inverted. **A badly leaking condenser is shown by the lack of a definite balance point.** Electrolytic condensers may also be measured for capacity by this bridge, the very low A.C. voltage used being insufficient to cause a breakdown (although from a theoretical point of view it is liable to cause a reduction in capacity if kept up for a long time, say a year!

Shielding.

The picking-up of induced currents from mains supplies and telephone wires makes the determination of balance points difficult. This may be overcome by shielding the entire apparatus and earthing the shield. A layer of graphite or metallic paint over the inside of the case makes a good shield. Another way of removing hum is to connect a 50,000 ohm potentiometer across either the wire-wound potentiometer **or** the phones and earth the moving arm. The 50,000 potentiometer is then used as a hum-bucking control.

A. C. Operation.

It is possible to use a power transformer and A.C. valve in place of the battery operated one. Also a cathode ray tuning indicator may be used as an indicator in place of phones or a loudspeaker. This is very handy for use in noisy locations. There is no need for a rectifier!

Care is needed in layout and shielding in order to keep the sensitivity high. A typical unit would consist of a 6J7G or 6U7G resistance-coupled to a 6E5 "magic eye." These valves are the "detector" or "galvanometer" section. A.C. for the bridge is supplied either from another valve or from the main (via the power transformer). In the latter case, balance is sometimes obtained at different points depending upon polarity of mains connections.

MAKING A POWER CHOKE

Material Required

OLD jam tins, wire, preferably d.s.c. or cotton over enamel, cardboard, shellac varnish or wax.

Tools Required

Pliers, tin snips, scissors, razor blade.

Other Essentials

Space, patience.

This will sound rather like a cookery recipe out of "And Now All This". Take the old jam tins and cut longitudinally into strips ½-inch wide. Flatten strips. Keep on with the good work until you have a bundle 1¼-ins. by ½-in. or more, preferably more. Tie strips with an oddment of wire and place in kitchen fire until red hot. Avoid, or fail to notice comments. Remove strips, using pliers or not, as you please. Allow to cool slowly. (If blood boiling, ditto.)

When cold wrap central third of bundle with 3 layers of paper and wind on 1000 turns of wire of gauge to suit current to be carried (say 2000 amps per square inch cross-section of single wire — see table below). If tired, then only 900 turns. Winding will probably not be in layers, but don't worry — you're not making a power transformer. Bind over with 3 layers of stout paper or cardboard. At ends of winding fit washers of cardboard. There should now be a fair length of dirty, scaly, iron strip at each end. Bend these over one at a time so that they meet over the winding. If they overlap insert pieces of paper to prevent them touching. Bind with string to prevent strips moving back. Soak entire choke in wax (melted!) or thick shellac varnish to (a) insulate wire; (b) prevent strips from buzzing.

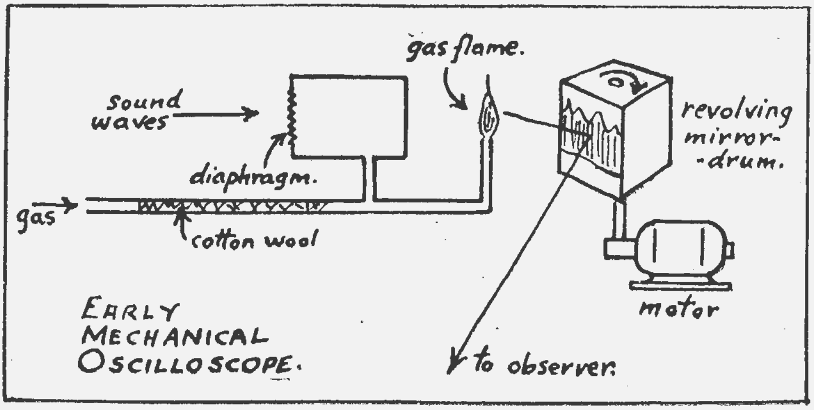
Safety first — insert the choke in the negative side of the H.T. supply, not the positive. Waxing the choke in a tin can will improve its appearance and make it easier to mount.

Notes—This choke **can** be made — it will work (if you haven't busted the wire).

"And Now All This" is by Sellar and Yeatman, authors of "1066 And All That."

History of the Cathode Ray Oscilloscope

AN oscilloscope is merely a device for drawing the graph of some function that is periodic in character. In looking at an oscilloscope the locus of (or path traced out by) a point is seen. The point usually moves so fast that it looks like a continuous line. In most oscilloscopes, Cartesian Co-ordinates are used, i.e., there are two axis at right angles, but special oscilloscopes have been made in which Polar Co-ordinates are used.



An oscilloscope consists of the following parts:—

(a) a device which moves a spot of light according to some impressed force or voltage.

(b) A device to spread the image out over an interval of time and to repeat that process continually.

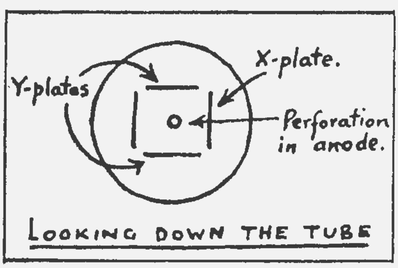
There are two main types of oscilloscopes:—

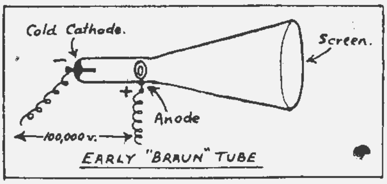
(1) Mechanical or semi-mechanical. In this type, the spot of light may be the tip of a sensitive flame controlled by fluctuations in gas pressure, or a spot of light which moves up and down a certain kind of neon type. The device to spread out the image is a rotating mirror, or series of mirrors

(2) Cathode Ray. In this type, the spot of light is produced by the impinging of a cathode-ray beam (stream of electrons) on a fluorescent screen. Vertical movement of the spot is controlled by electrostatic deflection — charged metal plates placed above and below the beam produce the deflection which is approximately proportional to the voltage between the plates. Horizontal movement of the spot (to spread out the image) is controlled by electrostatic deflection between a pair of plates placed on the left and right-hand sides of the beam. In order to spread out the image uniformly the voltage between these plates must increase uniformly with time, return abruptly to its original value, and repeat that process indefinitely.

History of the C.R.O.

Early cathode ray tubes were of the cold cathode type and extremely high voltages were required between the cathode and anode in order to extract enough electrons to make a sufficiently intense beam. Early tubes contained only two electrodes, any deflector plates being placed on the outside. Some of these early tubes were called Braun tubes. Most modern tubes are of hot-cathode type. The cathode is a film of oxide (calcium, strontium or barium) and is heated by passing electricity through a wire which carries the oxide film, or which is inside a nickel cylinder which carries the film. Electrons evaporate readily from this oxide film when it is heated and so only a few hundred volts p.d. is required between the anode and cathode. Deflection plates, together with focussing electrodes are now built into the tube. The fluorescent screen consists of a very thin coating (only two or three molecules in thickness) so that the light produced on one side by the cathode ray beam is readily visible through the glass on the other side.





Comparison of Frequencies.

The frequencies of two alternating voltages may be compared by applying one voltage between the horizontal deflector plates (or X-plates) and other voltage between the vertical deflector plates (or Y plates). The ratio between the frequencies may be estimated from the appearance of the Lissajous figure produced on the screen.

Study of Wave Form.

The way in which an alternating voltage varies may be observed by applying the voltage between the verti deflector plates (or Y plates) and by applying a suitable time-base voltage between the horizontal deflector plates (or X plates). The time-base voltage must have a frequency equal to that of the voltage to be studied or an exact sub-multiple of it. The time-base voltage must not be sinusoidal but must vary according to a saw-tooth pattern, i.e., the voltage must increase uniformly with time over practically the whole of its period and return abruptly to its original value.

Time Base Voltage.

The saw-tooth voltage for periodic horizontal deflection may be produced by a neon-tube oscillator, a gas triode oscillator, a two-valve oscillator or a motor-driven potentiometer. The neon tube oscillator only a very poor wave. The motor driven potentiometer is used when very low frequencies are to be studied. If the sloping part of the saw-tooth wave form is not perfectly straight, then the oscilloscope does not give a faithful account of the way in which the applied voltage varies.

Synchronisation.

The frequency of the time base voltage is adjustable so that different frequencies may be studied, and it is difficult to set the frequency control exactly. To overcome this difficulty, a portion of the voltage to be studied is fed to the oscillator that is producing the time-base voltage. This makes the time base oscillator jump

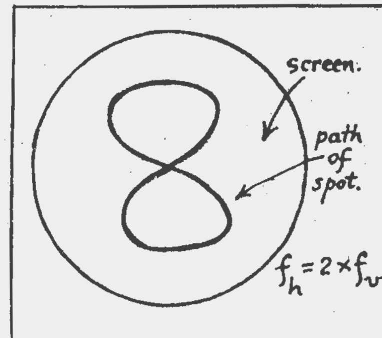
(Continued on next page)

THE C.R.O.
(Continued)

exactly into step when its frequency is approximately correct.

Other Features of the C.R.O.

A cathode ray beam consists of a stream of negative particles (electrons) and the stream tends to diverge or spread out because the par-



LISSAJOUS FIGURE

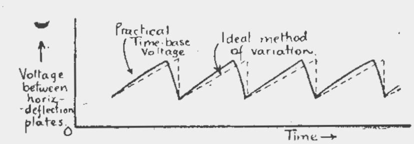
ticles repel one another. To prevent this, a negatively charged electrode is placed around them. The voltage between this focussing electrode and the cathode controls the degree of convergence of the beam; if too great, the beam is brought to a focus before the screen is reached and is wide again when it strikes the screen.

Amplifiers.

To increase the magnitude of alternating voltages applied between the deflector plates, valve amplifiers are often inserted. Unfortunately, these amplifiers introduce a slight distortion of the voltage and they do not respond to voltages of very low frequency. The phase of the alternating voltage is also changed.

Horizontal and Vertical Shift.

The entire image on the screen may be shifted by applying a steady



Variation of Sweep Voltage with Time.

(D.C.) voltage between an appropriate pair of plates. This is very handy when the voltage to be studied is markedly asymmetrical.

Intensity Control.

The intensity of the cathode ray

(Continued on page 26)

A RECEIVER CIRCUIT FOR UTOPIA

By

R. B. NEVIN, B.Sc.

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New Zealand

A FEW days a go I was looking through some back numbers of the Australasian Radio World, and noticing the number of circuits you have published on amplifiers and tuners, it struck me that you might be interested to have a description of one which I built recently, writes Mr. Nevin.

Audio Portion

The audio portion originally started out as a volume expanding amplifier, with a 6L7 first stage, controlled by a 6J7 as triode, with a 6H6 rectifier, followed by a 6N7 paraphase, driving two 6F6 pentodes in push-pull. Inverse feedback was applied to the screen of the 6L7. This amplifier expanded successfully and the tone was quite good, but I was not entirely satisfied with it. I doubt if the 6L7 makes a good audio valve; probably a 6K7 could be used and would prove better. The amplifier was built on a steel chassis, and try as I did, I could not get the hum level down to the very small amount which I consider is so desirable with a good amplifier.

After experimenting around with various set-ups I finally devised the circuit which I enclose herewith for publication. To the general description of the tuner, amplifier and power supply I have added some information on audio transformer construction, and also some notes on the use of feedback to get balanced acoustic output. I have taken the trouble to present some parts in what may seem superfluous detail, in the hope that some of the points covered may assist others to get over a few of the many difficulties one strikes in amplifier work, especially where transformers are involved.

The Amplifier

The amplifier consists of three stages of triodes, all in push-pull, built on a fabricated aluminium chassis, made up from sheet aluminium rivetted together.

The first stage is a slightly modified form of the paraphase circuit usually employed for phase inversion. Type 6J7 valves are used in this stage, so that if greater gain should be later required for use, say, with a microphone the transformer T1, can be disconnected and the 6J7's used as pentodes, with different plate resistors, etc. It would probably be better, though to use a single triode or pentode pre-amplifier.

The transformer T1 steps up the output from V1 and V2 in the ratio of 1 to 2, and so compensates for the comparatively low gain from the tubes. The input from the tuner is via a bulgin-type jack, which automatically breaks the tuner connection when the pick-up jack is inserted. The 6C5's drive through the step down (2 to 1) transformer T2. This transformer is a home-made product and is rather interesting in its construction and frequency response, so it is des-

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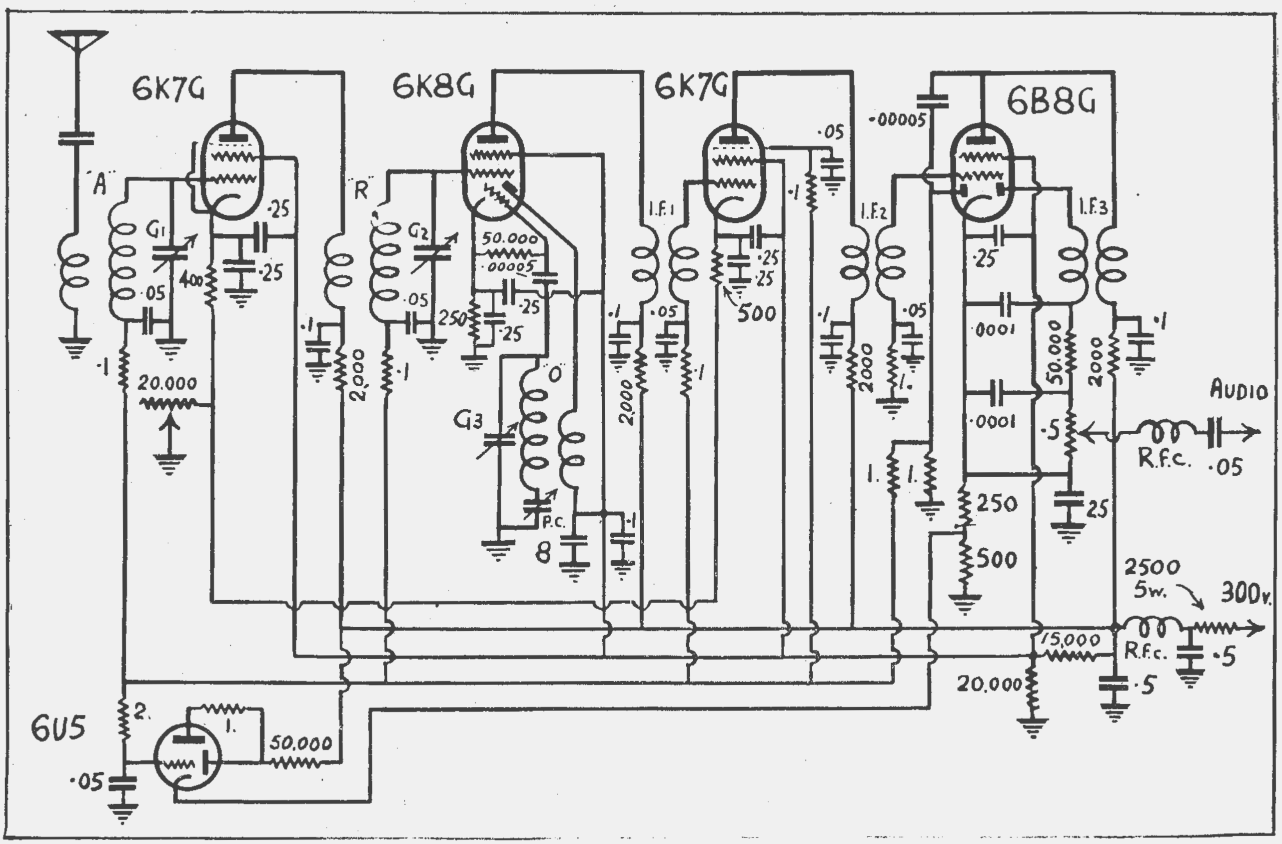

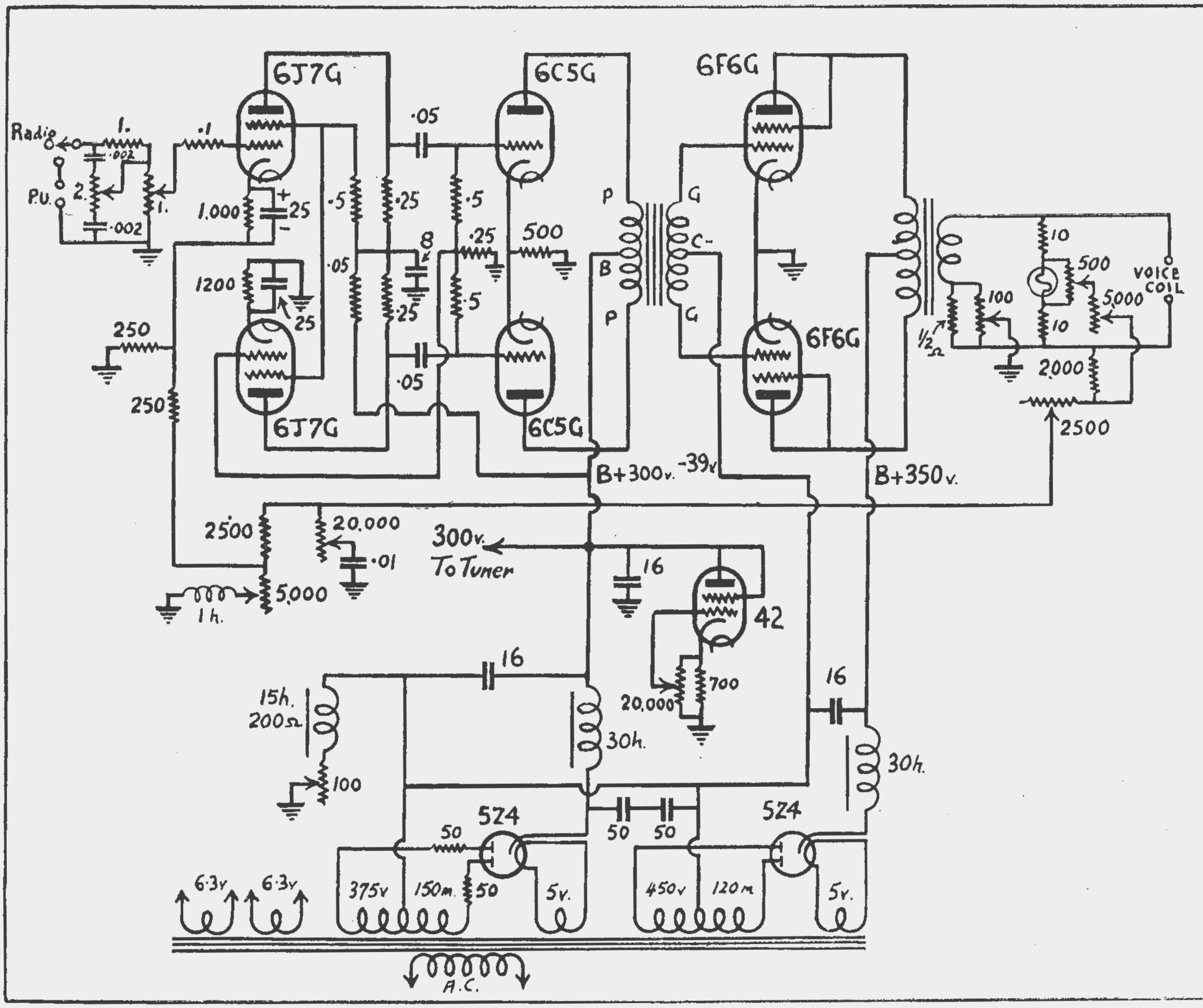

UTOPIA SET

(Continued)

cribed more fully later. The step-down ratio was necessary because types 6A6 and 6B4 are at present unobtainable and so 6F6 types had to be used as class AB2 triodes, thus requiring power to be supplied to the grids.

The output transformer T3 is a Ferranti, with a tapped secondary. Bias for the output valves is obtained by semi-fixed back-biassing from the power pack.

The filter system in the plate supply to the first stage is possibly not necessary, but it was thought desirable to have at least R1 and C1, so a double 8 mfd. electrolytic was used. As the output transformer supplied with the speaker was not needed it was easy to run an extra connection to the speaker and utilise the primary of the transformer as a small choke through which to supply V1 and V2 from the high tension off the end of the field coil. This connection actually runs to the power pack chassis, together with all the other connections, field coil and voice coil. From there the connections for heater and plate supplies, bias voltage and output from the amplifier are all made through an octal plug and an octal socket on the power pack chassis. Extension leads with a six-pin plug at one end and a six-pin enclosed socket at the other enable the speaker to be shifted about as to position.

Variable inverse feedback is taken off the voice coil to the cathode of V1 and is effective on both V1 and V2 through the paraphase connection.

One side of the heater circuit is earthed; the leads of the other side being shielded.

Power Output.

The amplifier has a useful power output of about 10 watts and really sounds good. The speaker is a moderately priced one with a ten-inch cone. It has a 1,000 ohm field coil, energised with 11 watts, and while not the best obtainable, it gives very realistic reproduction. To me, this is most important, as I have played the violin for a number of years and I am somewhat critical about tone of reproduction, especially of stringed instruments.

Frequency Response.

The frequency response is flat from 100 to 10,000 cycles per second, and is only about 1 decibel down at 75 and 13,000 cycles.

The Tuning Portion.

The tuner is a conventional broadcast superhet. with one r.f. stage, a converter, two i.f. stages and a tuning indicater. Careful attention has been paid to such points as adequate de-coupling, by-passing, and so on. The sensitivity control R1 in the cathode circuit of the r.f. and first i.f.

SERVICE IN N.Z.

In New Zealand it is now illegal for anyone to repair radio receivers without a Radio Serviceman's Licence. This licence allows the serviceman to stock spare parts and components for use in his work, but he cannot sell radio parts unless he also has a Radio Dealer's licence.

It is stated that these regulations are being rigidly enforced.

UTOPIA SET

(Continued)

stages has the advantage of giving almost silent tuning, as the heavy bias due to the combined cathode currents effectively prevents the noise signals getting through, but as soon as a station is tuned in, the a.v.c. bias reduces the plate currents and with a strong signal the cathode bias drops to only a few volts so that the a.v.c. bias, as it were, takes over most of the control from the cathode bias.

The Magic Eye.

The amount of closing of the shadow in the 6U5/6G5 tuning indicator can also be adjusted by R1, which is useful in accurately tuning in both strong and weak stations. On strong signals the shadow tends to close completely, but can be made to open up slightly by putting R1 at a maximum. It thus saves having to use a voltage divider on the 6U5/6G5 grid, which might make the shadow close too little on weak signals.

Intermediate Transformers.

All the i.f. transformers are iron-cored type.

The suppressor grid of V3 is on the a.v.c. line, as well as the grid. This increases the control somewhat, but is mainly used to broaden the i.f. tuning, thereby allowing better audio quality. The action is automatic; the stronger the station the broader the tuning and vice versa. This is rather desirable in restricting noise on weak stations.

The resistor R2 is not by-passed, which gives feedback and prevents variations of input impedance with change of bias. Automatic volume control is not applied to V4.

High tension supply for the screens and oscillator plate is taken through the voltage divider R3 and R4, while R5 drops the 350 volts high tension down to 260 for the plates of the valve.

The tuning is quite broad, but is selective enough for proper separation of stations. There seems to be little of the usual superhet. "sideband cut," judging by ear from the reproduction of the higher audio frequencies.

The tuner connects to the amplifier chassis by an octal plug carrying leads for filament and power supply as well as the audio output.

The Power Supply.

The power pack is mounted on a separate chassis. The circuit used embodies a voltage doubler, as at the time, no suitable high voltage transformer could be obtained for the job. A home-made transformer with specially strong insulation supplies the 6.3 and 5 volts for heaters which absorb just on 50 watts of power.

The two low-impedance 5Z4 rectifiers deliver 130 milliamps at 480 volts to the first choke, with actually 520 volts across the rectifiers. The speaker field absorbs about 11 watts, so that the output voltage is 350. The 25,000 ohm 10 watt bleeder resistance helps to steady the bias for the output valves.

Alternating current from the power mains is fed direct to the plates of the rectifiers, but as this not allowable in Australia I am not giving the circuit used by me. A suggestion for a normal type of power pack, however, is given.

CIRCUIT CONSTANTS FOR RESISTANCE - CAPACITY COUPLING

HERE is a chart giving suitable values of resistance for various English and Continental type valves.

These values are not commonly known and experimenters have been puzzling in the dark and failing to get the best results from these valves, some of which are still obtainable.

The meanings of RL, Rs, etc., are shown in the accompanying diagram. The resistances are not critical and a variation of plus or minus 10 per cent. has only a negligible effect. The values shown are not the absolute optimum, but are convenient practical values. A range of bias resistors (half-watt types are suitable) is given and the gain is therefore specified only approximately. However, even at the ends of the range, the variation is within 12 per cent.

Some of the valve data given in the chart has not appeared before in any technical publication, and is presented in accordance with our policy of giving something really new each month. Part of the data for the CBC1 and CF1 valves was taken from various issues of the Mullard Valve Guide.

Tube Type	Fil. Volts.	H.T. Volts.	Anode Res. (R_L)	Sceen Res. (R_S)	Bias Res. (R_K)	Grid res. of next valve (R_g)	GAIN. (approx.)
E44AN	4	250	·2 meg.	1·0 meg ·25 bleed	1500 to 2000 Ω	1·0 meg.	90
(S4VA) E452T	4	250	·5 meg.	3·0 to 4·0 meg.	1500 to 2000 Ω	1·0 meg.	120
EBC3	6·3	250	·2 meg.	–	3500 to 4500 Ω	·75 to 1 meg.	25
EF6	6·3	250	·25 meg.	·5 to ·75 meg.	2500 to 3500 Ω	·75 to 1 meg.	165
E424 244V.	4	200	·1 meg.	–	4000 to 6000 Ω	·5 meg.	20
E435 354V.	4	200	·1 meg.	–	2000 to 4000 Ω	1 meg.	28
E499 904V.	4	200	·25 meg.	–	2000 to 3000 Ω	1 meg.	55
SP13 CF1	13 (·2 a)	200	·25 meg.	·1 meg. ·1 bleed.	5500 to 8000 Ω	1 meg.	195
CBC1	13 (·2 amp)	200	·15 to ·25 meg.	–	10,000 to 15,000 Ω	1 meg.	19

. . . . . . but civilian requirements of Australian-made Radiotrons have not been neglected. Most widely used types are available, but if the particular valve you want is not obtainable, consult your Radiotron dealer regarding an alternative type.

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REVIVALS IN RADIO PRACTICE

An article showing how nothing is dead for certain in wireless receiver design.

Order of Introduction.

IN this article it is proposed to deal with ideas as they were first introduced. The original and revived version of each will be considered.

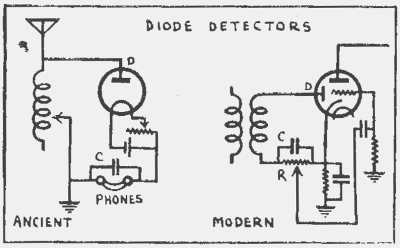
Today we are approaching the use of ultra-shortwaves. Few people know that these were the first type of etheric wave to be produced by electrical means! It's a fact. Hertz's experiments with a spark coil and resonating loops utilised waves of less than a metre in length. Now these ultra-short wavelengths are being formed from oscillations from vacuum-tube circuits and ultra-short waves are being employed for television and facsimile transmissions.

Diode Detection.

The first thermionic valves were made by Edison, who introduced metal plates into carbon filament lamps. Early in the twentieth century, Fleming applied these one-way devices to the rectification (detection) of wireless telegraphy signals. The diode was at that time the most reliable of the various forms of detection. Almost thirty years later, about 1934, diode detection was re-introduced, not for reliability, but because of improved tone. Today, ninety per cent. of receivers use diodes as detectors (and almost all A.C. sets use diode as power rectifiers!). The simpler diode detector circuits of today are exactly the same in principle as those of 1908, the only difference being that the diode load is now a resistor (part of an A.F. amplifier) instead of a telephone receiver.

Supers.

After Fleming used the diode and Lee de Forest added the third electrode, multi-valve receivers were built. A limit was found to the maximum number of R.F. or A.F. amplifiers and so amplification at an intermediate frequency was introduced, giving rise to the superheterodyne. Early superhets. used triode valves, the accepted number being **eight** (oscillator, first detector, 3 I.F. stages, second detector and two transformer coupled A.F. stages). Some seven and six valve jobs were built up, but these were not felt to be "the real thing." The superhet. died out on account of its cost, but was re-introduced (and how!) about ten years ago. Nowadays fewer valves are employed in most cases. The first detector and oscillator are usually combined in one tube, there may be one, two or three I.F.

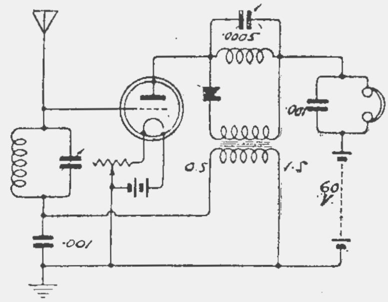


stages (or there may be none!), the second detector is usually a diode built in with first A.F. stage in one tube and A.C. valves are used. Today the main virtues of the superhet. are increased selectivity and ease of coil-changing for all-wave reception.

Reflex Receivers.

In the "good old days" when simple bright emitter triodes cost a couple of pounds, many attempts were made to make one valve do the work of two. After using the valve as a radio-frequency amplifier, the signal was rectified (usually by a crystal detector) and then the A.F. signal so produced was fed through the same valve.

Early reflex receivers produced



Early Reflex Circuit

many a headache! As valves decreased in price (April, 1925: Wecovalves reduced to 25/-) and increased in efficiency, the reflex idea was gradually dropped. Reflexing reappeared in the 1934-35 area, but this time I.F. and A.F. signals were amplified by the same valve. Experimenters have shown increased interest in reflex designs during the last year or so as parts have become scarce. Several reflex circuits have been published in A.R.W. this year, so we are not printing a modern reflex circuit in this issue.

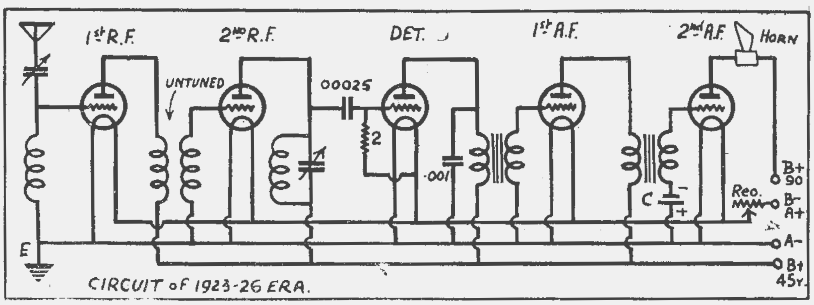
Super-regeneration.

Another idea to get the utmost in amplification from a single valve was to increase the reaction (or regeneration) enormously and at the same time prevent continuous oscillation by swamping the valve with a large signal at a supersonic frequency. Sometimes the supersonic frequency was produced by a separate valve connected similar to an A.F. oscillator.

One ambitious enthusiast built a 3-valve super-regen. set about the 1923 mark using a regenerative detector, a separate quenching oscillator and a power output stage. The third stage really **did** give a useful power output as a high-tension supply of 300 volts was used! The valves were 201A's and the set cost a small fortune to run.

The super-regen. died out for several reasons. Although giving extreme gain, it suffered from poor selectivity and did quite a bit of radiating.

Short wave enthusiasts have recently applied the super-regen. circuit to the reception of 2½ and 5 metre signals. Sometimes a buffer stage consisting of a 58, 6D6 or similar valve is connected between the aerial and detector to prevent radiation and interference. Small power valves, e.g., 38,



CIRCUIT of 1923-26 ERA.

(Continued on next page)

REVIVALS
(Continued)

89, 33, make good super-regen. detectors of the self-quenching type.

R.F. and T.R.F.

Early one valve sets lacked range and this defect was overcome most easily by the addition of either a tuned or an aperiodic (untuned) R.F. stage.

Aperiodic coupling was by untuned transformer, R.F. choke and condenser, or by resistance-capacity coupling (King George V possessed a set with res.-cap. coupled R.F. stages). The gain was extremely low and so aperiodic R.F. stages soon disappeared. Tuned R.F. stages became popular after Hazeltine showed how to prevent oscillation by neutralising valve capacities (remember the "neutrodyne?") and the introduction of the screen-grid valve further increased the popularity of the T.R.F.

All went well until the superhet. reappeared and then the T.R.F. disappeared from broadcast-band receivers. Now there is slowly but surely arising a demand for high-quality reception and the T.R.F. is re-appearing (for modern T.R.F. designs see A.R.W. for September, 1942 and Nov.-Dec. 1942). Even untuned stages are being used as buffers in front of superhets. and to obtain extra gain without much extra cost or complication. An aperiodic R.F. transformer is by far the easiest means of feeding a diode detector in a "T.R.F." receiver.

Modern aperiodic R.F. transformers are similar to their prototypes of 20 years ago, in that they employ iron cores, but today the cores are of iron dust whilst those of 1932 were usually of laminated iron.

Speaker Designs.

Early speakers consisted of a headphoneunit attached to a horn, the function of which was to increase the efficiency of energy transfer from diaphragm to air: "Cone" speakers replaced the horn speakers, the larger diaphragm actuating the air directly. Now horns are being re-introduced in certain high-quality receivers and amplifiers. Modern cabinet horns are usually folded and are coupled to the rear of the speaker diaphragm, the front side of the diaphragm radiating directly.

Peridyne Trimming.

Another revival is that of aligning receivers by inductance variation in place of capacitance variation. One way to change the inductance of a coil is to shift a piece of metal placed near it. This system was used in the "Peridyne" one of the T.R.F. receivers designed by Hugo Gernsbach. Inductance-trimming by the metal vane system is used in some set designs today.

Other Revivals.

The four electrode valve was known in 1920, but it did not become popular until eight years later. Space-charge tetrodes, popular for a while in the early twenties have been brought into style again by the Philips Valve people, who have produced tetrodes for low-voltage operation (types E441N and A441NX).

Battery sets died out in areas supplied with A.C., but the portable made a dashing re-appearance when 1.4 volt valves became available.

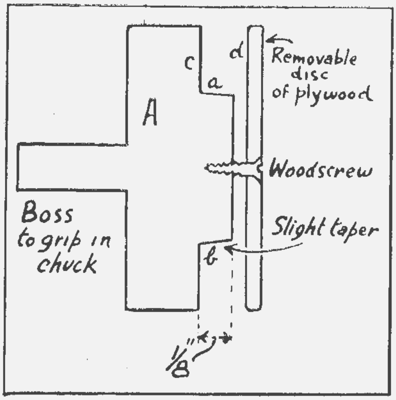
Talking of valves, the making of valves in Australia has shown a revival — remember the Australian-made 99 and 33 valves? (The latter was no relation to the 33-pentode, it was merely a triode). The "slope" or conductance of these valves was approximately .34 ma/volt, the maximum undistorted output was about one-hundredth of a watt and they were recommended for use in power stages.

Let us conclude with another revival: Prices!

Building a High-Grade Audio Transformer

THE construction of an audio transformer, such as used in the receiver described on page 9 is detailed, as it may help others who want to make a good audio transformer to suit special requirements.

To obtain an efficient core is probably the biggest problem, but the writer was fortunate in having on hand the core of an old Ferranti, but minus the concentric composition formers used by Ferranti to get distributed windings. The core section was about 1-inch square. Those who are unable to get efficient cores from old transformers should remember that this is one of the limiting factors in audio transformer design and many cheap audio transformers can never be any better than their core will permit, so that it is little use rewinding them. If an efficient core is not available it is better to give up all idea of neatness and compactness and use a big transformer core.



The Windings.

The windings are made up in flat pies about an eighth of an inch thick, wound on a wooden former with a removable end. The former, as shown in the diagram, is first turned up in a lathe. The surfaces are covered with paper discs and strips. The groove is then filled up with layer after layer of 43 gauge s.w.g. enamelled copper wire, until 4,000 turns have been put on. This should leave about a sixteenth of an inch clear at the circumference.

The whole winding and former is then soaked with melted pure paraffin wax and when hard, the end is removed from the former and the coil eased off with a hot thin palette knife or similar piece of metal.

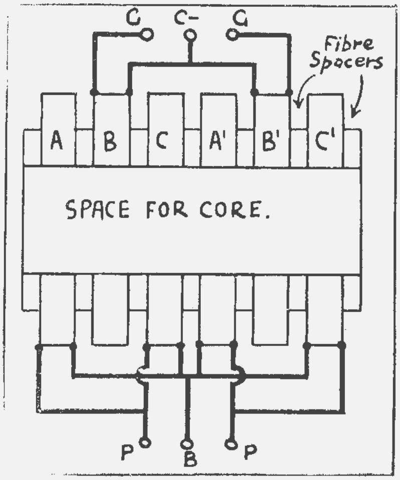
After soaking in paraffin, the disc is unscrewed, and gently eased away from the paper disc with the hot knife. If the inside of the groove is covered with a layer of thin strip, with only its end secured by a spot of wax the coil will slide off the former quite easily. The windings are fitted with connections, made from shim brass strips, and then wrapped in narrow linen tape and given a thorough varnishing with thick alcoholic shellac solution (shellac dissolved in methylated spirits). This sealing up com-

By
R. J. NEVIN, B.Sc.

pletely excludes moisture and stiffens up the coil winding.

Six of these coils are required, four of 4,000 turns each of 43 s.w.g., and two of 2,000 turns each of No. 40 s.w.g.

The windings are then mounted on a piece of fibre tubing or suitable material of a size to fit over the core. Each winding is separated from the next by a strip of fibre about a sixteenth of an inch thick. Tape is then run over and under and around the coils to keep them all together firmly, with fibre end pieces to take the strain. The coils can then be connected together in several different



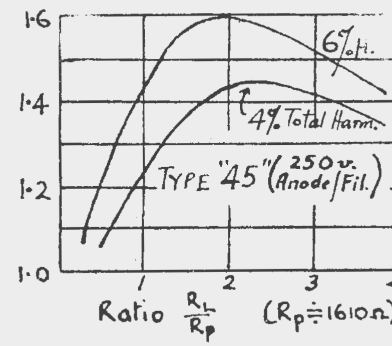
ways, giving a wide range of ratios and applications.

Considering the six coils as running down the core from left to right as A, B, C, A1, B1, and C1; the coils B and B1 will have 2,000 turns, and all the other 4,000 turns.

To get a step down ratio of 2 to 1, A and C together with A1 and C1,

(Continued on next page)

VALVE DATA FOR 45 TYPE



Designers of power amplifiers frequently employ triode output valves when comparatively small power, but high quality, is required. One of the most popular of these valves is the 45. It is a very inexpensive robust valve and easily withstands a slight overload. This month we publish a pair of curves showing how the output varies with speaker impedance when the distortion is limited to (a) 4 per cent, (b) 6 per cent. total harmonic. It will be noticed that the power does not vary very much when the speaker impedance rises from 1600 to 6500 ohms. The variation in power is less than 20 per cent. and this slight variation cannot be detected by ear.

Consequently, the power output is almost independent of frequency and bass and treble response is better than usual.

Most of the distortion is second harmonic in nature and may be eliminated by the use of push-pull circuits (a pair of 45's will give 6 watts in push-pull without any grid current flowing and without exceeding the maker's maximum ratings. With only a slight overload, nearly 10 watts can be obtained, still without grid current flowing!

AUDIO TRANSFORMER
(Continued)

will be in parallel to form each one half of the primary. B and B1 will be connected in series to form the centre-tapped secondary.

Other Connections.

For a single valve driver to push-pull valves, with a step-up ratio of 1 to 2: B and B1 in series will form the primary, with (A and C) (A1 and C1) in parallel series for the secondary. For a single valve driver to push-pull with a 1 to 1 ratio: A, A1, C, C1 will all be in parallel as primary, with B and B1 in series for the centre tapped secondary.

For a push-pull driving stage to push-pull output, with a step up ratio of 1 to 1½: A and C1 in series as primary, B, B1, A1 and C in series as secondary.

For push-pull output, with a load of 8,000 ohms stepping down to a 500 ohm line: A, C, A1, C1, in series as primary, B and B1 in parallel as secondary.

For single valve to push-pull with an overall step-up of 3 to 1: A and C1 in series for primary and the other windings in series for the secondary.

Getting the Wire.

The 43 gauge s.w.g. enamelled copper wire for the job can be easily obtained from discarded ignition coils, to be had for the asking from most garages, where they are usualy thrown away. This was how the writer obtained his; due to sheer force of necessity, it not being possible at the time to obtain any wire finer than 40 gauge, which is too coarse to allow 4,000 turns to fit into the space available.

The ignition coil is opened up with a hammer and small cold chisel, the pitch being chipped away, the overlaying primary coil wound off and then the start of the secondary will be found attached to the inside end of the primary.

In most coils the trouble is a single break in the secondary, usually near the inside high tension end which is connected to the iron core. A few may have the secondary cooked by the overheating of the primary, but usually the wire is in good condition, and with care exercised in removing the alternate layers of impregnated paper insulation, will wind off layer after layer in fine style.

A good way to wind is to mount the secondary coil by a piece of metal tube through the hole formed by knocking out the core strips, and letting it revolve on a rod through the metal tube. The rod is gripped in the tool clamp of a lathe, the bobbin held in the chuck, and with the tube and its axle well oiled quite a good speed of winding on to the bobbin and unwinding off the coil can be obtained. Care is necessary when the wire gets to the end of a coil layer. The lathe has to be stopped in order to remove the paper layer. Any jerk of the last turn of the layer against the next paper layer will usually break the wire.

Lightly guiding the wire back and forth with the fingers puts it on evenly enough, especially if the wire is viewed against a white background as it travels on to the bobbin. A counter, such as the type used in electricity meters is desirable to get the exact number of turns on each coil. It can be driven off the pinion on the chuck drive shaft, or off the end of the bobbin, connected by a rubber tube.

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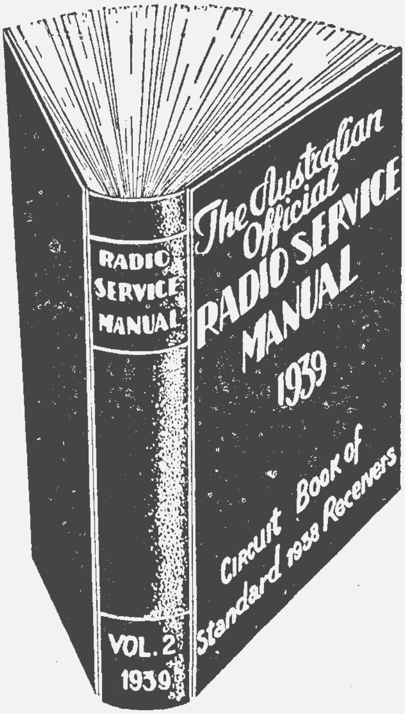

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SERVICING SUGGESTIONS FOR A.C.-D.C. SETS

From the Technical Department, Amalgamated Wireless Valve Co. Pty. Ltd., Sydney

MOST faults in AC/DC receivers can be serviced as for A.C. sets, but difficulties are experienced at the present time owing to the failure of the power valve or the rectifier, replacements for which are not generally available. If the set is being operated in an area where A.C. is available, it is suggested that the set might be converted to A.C. operation, and some suggestions in this direction are given below.

Failure of Power Valves.

In the event of failure of the power valve, this could be replaced by a 6.3-volt power valve with the addition of a transformer to supply the 6.3 volt heater. In many cases, this would be the only alteration necessary to the receiver, the remaining valve heaters being left in their series arrangement merely with the omission of the power valve heater. If a barretter is used, this should make the necessary accommodation to give the correct heater current, but if no barretter is used, it would be necessary to incorporate a resistor in place of the high voltage heater. Alternatively, all the heaters could be connected to the 6.3 volt winding, with the exception of the rectifier heater, which will require some suitable arrangement for the supply of its correct voltage. As a further possibility, the rectifier also could be replaced by a standard 5-volt filament rectifier, such as type 80 or 5Y3-G, and thus avoid the difficulty regarding the high voltage rectifier heater.

Failure of Rectifier Valve.

The rectifier valve could be replaced by type 80 or 5Y3-G, provided that a transformer is added to supply the requisite 5-volt filament. There is a possible danger to the electrolytic condensers through the use of a quick heating rectifier valve, and it may be necessary in some cases to replace the first electrolytic condenser with one suited to the new conditions.

New A.C. Power Pack.

It would be possible to build an A.C. operated power pack for use in connection with any A.C./D.C. receiver which is to be modified for use on A.C. This would need to incorporate a power transformer such as is generally used in A.C. receivers, together with a rectifier valve, such as type 80 or 5Y3-G. The transformer would have a 6.3-volt heater winding which could be used for one or more of the heaters in the set, while the 5-volt winding would be used for the filament of the rectifier valve in the power pack itself. It will be necessary to connect the power pack to the set by means of a heavy twisted flexible lead for the 6.3-volt heaters, as well as flexible leads for B+ and B—.

Procedure in D.C. Areas.

If the set is being operated in a D.C. area, the use of a transformer is impracticable, and the following action is suggested.

Failure of Power Valve.

This may be replaced by any indirectly heated 6.3-volt 0.3-amp. triode or pentode. The power output obtainable will obviously be much reduced, but this is far preferable to having a set out of operation. Valves suitable for this operation include types 6J7-G, 6C6, 6B8-G, 6B7 and any general purpose triodes. It is desirable to change the loudspeaker transformer to give as high load impedance as possible, say 25000 ohms, but this is not necessary, and reasonably satisfactory results may be obtained with the existing transformer.

Failure of Rectifier Valve.

Since the rectifier valve does not play an effective part in the operation of an A.C./D.C. set in a D.C. area, it may be cut out of operation without effecting the operation of the set, but care should be taken to prevent the power plug being accidentally reversed, since this would damage the electrolytic condensers in the set. If the heater of the rectifier valve is still continuous, the heater circuit need not be disturbed. If the heater has become open-circuited, it may be replaced by a resistor which will carry the heater current and give the required voltage drop.

Failure of Barretter

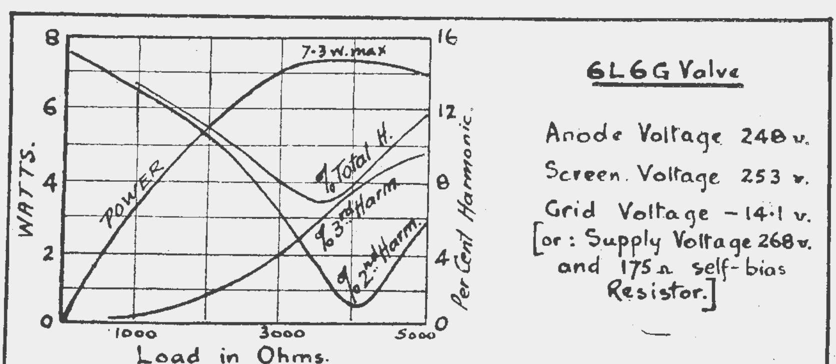
In the case of the failure of a barretter, this may be replaced by a suitable resistance which is capable of carrying the full dissipation. Specially wound resistors capable of dissipating a considerable heat are required; for example, the replacement of a barretter dropping 170-volts at 0.3 amp. would require a resistor dissipating about 50 watts.

VARIATION OF POWER WITH LOAD

In the July issue, we showed how the power output and distortion of triode and pentode valves varied with load impedance. To supplement that article and to give amateur designers working data, we are publishing extra valve data from time to time.

This month we show the effect of load on a 6L6G valve working in ordinary class A operation with "250 volt" ratings. In the graphs, it is assumed that the signal voltage is sufficient to produce zero grid voltage on the positive peaks, i.e., the signal voltage is $1/\sqrt{2}$ of the grid bias or 10 volts R.M.S.

In practice the variation of power with load is quite important, as speaker impedances are not constant over the entire frequency range. In the chart it will be noticed that the anode voltage is specified as being slightly lower than the screen voltage. This is to allow for the voltage drop due to the resistance of the speaker transformer winding and is quite normal.



WIRE GAUGES FOR POWER TRANSFORMERS

In accordance with our policy of giving really useful information, we publish this month the following table showing the resistance and current-carrying capacity of copper wire.

Only even gauges are shown. For the intermediate odd gauges the values can be found fairly accurately by averaging.

The current-carrying is based on a current density of 2000 amps per square inch — the highest safe value for ordinary chokes and transformers. Three or four times the current can be carried by a bare wire in open air with plenty of ventilation. The very best design of power transformers requires a gauge of wire one larger than that indicated in the tables — that is for really "cold" operation.

Current-Carrying Capacity of Wire.	
Gauge (s.w.g.)	ma. (2000amp/s.in.)
30	241
32	183
34	133
36	91
38	56
40	36

RADIO PUZZLE

Under what conditions can two 200 volt components in parallel be equivalent to one of 100 volt rating, but of only half the wattage?

For answer see page 26.

A FEW TIPS ABOUT HEADPHONES

Headphones, if treated correctly, will last indefinitely, but they are delicate instruments and need to be treated with care. Any jars will be liable to destroy the magnetism of the polepieces and upset the delicate adjustment, thus rendering them insensitive. Sometimes the diaphragm becomes rusty. In this case the ebonite cap of the earpiece should be unscrewed and the metal diaphragm carefully slid off sideways, taking care not to bend it in any way. It can then be wiped with an oily rag. Be careful to replace any spacing washers correctly. When using headphones on a small battery set always be careful to attach them so that the polarity is correct. The positive usually has a red tracer, and this is attached to the B+ output terminal.

Shortwave Review

CONDUCTED BY L. J. KEAST

NOTES FROM MY DIARY—

AS TIME GOES BY

Restrictions on manpower as it applies to the Printing Trade makes it imperative that Short Wave Notes are sent in as early as possible, and as usual, all times mentioned are Eastern Australian Standard. Therefore, should the Federal Government bring in Daylight Saving just after these Notes have been set up it will be necessary to add to the times shown just what difference they, in their wisdom, have decided on.

Apart from these alterations, it is just about that time of the year when the B.B.C. makes changes in Schedules. So, of course, will the 'Frisco and "The Voice of America" stations. Listeners will be well advised to note carefully any alterations, and my anticipatory thanks go to those who will advise early any that they may notice.

GROANS

I welcome a fine report from Mr. John Verge, of Leura, and a good many of his loggings will be found under Short Wave Notes. Mr. Verge takes me to task for not making greater reference to stations over 50 metres.

Their absence is because so few receivers cover above 49 metres, and those listeners who can tune in the 60 metre band seldom do, on account of the noise that is invariably there. However, I have mentioned in this issue a few that may be fairly free from noise.

Mr. Verge says he "has another "groan" — no reference to the Broadcast DX. Well, this is not likely at present; firstly, it would mean the cutting down of the Short Wave Section; and secondly, it is only a fluke if long distance broadcast is heard. Actually, the frequency allotted a broadcast station on the medium wave band is expected only to cover a very short distance, and the programmes, etc., are all prepared with this in view. The shared frequencies in this country alone will confirm this and the relays that take place show how little faith is placed in the station reaching very far.

With Short Wave it is the reverse, everything that can be done to assure them "getting out" IS done and the programmes are International in character. As pointed out in these columns many times, it is the reports from our readers regarding reception that has helped considerably in the choice of frequencies and for which the stations are duly grateful.

So we will continue to give service in the shortwave section and leave the Broadcast to my friends, Roy Hallett of "Radio and Hobbies," and Lindsay Walker, of "The Broadcaster," who are doing a fine job and still send me some shortwave notes.

IS WLW O.K.?

They certainly are as regards signal strength, but what about that O. and K.? Just when I thought I had them sorted out and felt my allotments were confirmed by the arrival of the Programme sheet for September from The Crosley Corporation, which gave them as follows:—

WLWO, 17.800kc, 16.8m. 7.30—10.15 a.m. for Latin America. 11.15 p.m.—5.30 a.m. for Europe.

11,710kc, 25.6m. 8—11 p.m.; 5.45—7.15 a.m. for Europe.

9590kc, 31.3m. 10.30 a.m.—2 p.m. for Latin America.

6080 k.c., 49.3m. 2.15—4 p.m. for Europe.

WLWK, 15,250kc, 19.67m. 7.30 a.m. 2 p.m. for Latin America. 10.30 p.m. —7.15 a.m. for Europe.

7575kc, 39.6m. 2.30—6.30 p.m. for Europe.

You can imagine my surprise at 4.30 pm when tuned to 7575 kc., I heard: "This is WLWO on 39.6m. WLWO now concludes etc." and my further shock when on 6080 kc., at 6.30 p.m.: "this is WLWK now concluding, etc." So WLW is not O.K. and neither the schedules or direction afford any help in determining how the O and the K are arrived at.

THE VOICE OF THE ANDES

Listeners anxious to tune in a South American can find an easy one on Monday mornings in HCJB, the Missionary station in Quito, Ecuador. Transmitting in English on 12,460 kc, 24.08m. from 7 till 9.30 they can be heard very often in a religious service. When you hear the call HCJB, "La Voz de los Andes" you will know it is coming from Quito, the capital of Ecuador, a city with a population of 150 000. Although only 15 miles south of the equator, Quito is known as the "City of Eternal Spring," the explanation being it is situated at an elevation of 9110 feet and surrounded by snow-clad volcanic mountains. Heralding Christ Jesus' Blessings broadcasts in 9 languages in 84 sessions weekly, using more than 50 speakers.

ALL-WAVE ALL-WORLD DX CLUB

Application for Membership

The Secretary,
All-Wave All-World DX Club,
243 Elizabeth Street, Sydney.
Dear Sir,

I am very interested in dxing, and am keen to join your Club.

Name ....

Address ....
(Please print both plainly) ....
....

My set is a ....

I enclose herewith the Life Membership fee of 2/- (Postal Notes or Money Order), for which I will receive, post free, a Membership Certificate showing my Official Club Number. NOTE—Club Badges are not available.

(Signed) ....

(Readers who do not want to mutilate their copies can write out the details required.)

Shortwave Notes and Observations

Australia

Several alterations in overseas transmission times will be found under Schedules.

VLQ, Brisbane, 41.44m and VLQ-2, 41.58m. are O.K., but often cannot hear VLQ-3 at all, doubtless due to "skip distance." (Gaden). (Dr. Gaden is now residing in a Brisbane suburb. L.J.K.)

VLW-3, 25.36m. is good in daytime and VLW-5 is satisfactory at night; VLG-6, 19.69m. and VLG-7, 19.79m. very good VLG-3 25.62m and VLI-2 25.27m. splendid; VLR-3 25.25m. and VLR-8 25.51m. good, but VLR 31.32m. not up to summer form (Gaden). VLR 31.32m. R6 at night but an awful fader (Perkins).

VLQ-2 is O.K. at 10 pm and VLQ very good at 9.33 pm (Verge). R8-9 from 5.30 till 10.30 pm, only a slight, but vicious surge noticeable now (Perkins).

VLR-3 25.25m. R6 throughout the day, but bad morse often annoys (Perkins).

VLR-8, 25.51m. R8 around 8.30 am, VLQ 41.44 R7 at 8.45 am (Perkins).

VLR-8 and VLG-7 no good before breakfast; VLQ and VLQ-2 are not as good in Brisbane as in the North and VLQ-3 is a wash out; VLR-3 good and VLR looks like getting back its summer form (Gaden).

New Zealand

ZLT-7, Wellington 6.715 mc, 44.68m. Now open at 7.30 pm but hardly possible to hear (Verge), Woeful signal here too. L.J.K.) R5 around 8.05 pm but a very noisy signal (Perkins).

New Caledonia

FK8AA, Noumea seemed to have settled down on their new frequency of 6.20 m.c., 48.39m. and at the same time have made a change in times. See schedules (L.J.K.).

FK8AA going great guns last evening at 7.30 (Gaden). Good as ever at 6.30 pm (Verge).

R4-5 at 5.30 pm and a lot of noise (Perkins). Mr. Perkins is most likely getting interference from 'planes that cut signal right out at times, L.J.K.)

Tahiti

FO8AA, Papeete, 6.98 mc., strong at 2 p.m. (Verge). (This station is very seldom reported, think it is only transmitting on Wednesdays and Saturdays. L.J.K.)

AFRICA

Algeria

AFHQ, Algiers, on 8.96 mc is heard nicely at 7 am, but fades by 8 (Gaden). Only fair at 9 am (Verge).

French Equatorial Africa

FZI, Brazzaville, 11,975 kc, 25.06m. at 6.45 am, fine talk by female on Corsica (Gaden).

AMERICA

U.S.A.

KWU, 'Frisco 19.53m roars in of a morning around 7 o'clock. I heard KWU on September 13 the first time for ages, but signal was only R3 Q3 (L.J.K.).

KROJ, 9.89 mc, not nearly as good as KWID at night (Gaden).

(KROJ is a low-powered station and in amongst a lot of noise L.JK.).

KWID and KGEI both equally good at night in 41m. band (Gaden).

KWV, 27.68m. is splendid, but KWY 39.6 and KES-3, 28.25 not so good. (At the moment KWY is very hard to hear around 7 pm, but at 11 pm is very good. L.J.K.).

WKRD 5.98mc good some nights at 6 o'clock; WLWO 6.08 mc O.K. at 11 pm; WBOS 6.14 mc O.K. at 6.15 pm; WKTM, 6.37 mc not bad at 5.30 pm; KGEI, 7.25 mc weak at 5 pm; WKRX 7.82mc good at 8 pm; KES-2 weakening at 10 pm (Verge).

KWIX, 31.35m. Heard at 10 pm (Perkins).

KGEI programmes heard recently on 9.65 mc, 31.08m. but no call given (Cushen).

(Mr. Cushen does not state time, but it is quite likely WGEO will show up on 31.08 as they were there with a good signal last September from 8 till 10 pm L.J.K.).

Mr. Cushen also mentions another that so far has not been noticed here, KROJ on 9.92 mc, 30.42m.

WLWK now on 15.25mc, 19.67m. till 2 pm for Latin-America (Cushen).

WLWK on 7575 kc, 39.6m. gives news at 6 pm in transmission for Europe (Cushen).

KWU, 19.53 the best Yank on any band in mornings (Gaden) R5-6 at 8 am (Perkins).

KWID 19.62 R5-6 when signing at 9 am (Perkins). Better than KROJ in the mornings (Gaden).

KGEI, 41.38m. is very fine at 7 pm and at 9 pm is a shade better than KWID (Gaden).

KROJ 30.31m. sometimes quite nice at night, at others needs the doctor (Gaden).

Lindsay Walker, from Applecross, W.A., sends these notes, (times are E.A.S.):—

KROJ, 'Frisco 19.75m., when heard, which is seldom, is never successful 8 am is the time (KROJ is admittedly weak, but can be heard most mornings around 7.30. L.J.K.).

WGEA, 15.53 mc, 19.57m. can be heard fairly well at 10 pm, later weak.

WCBX 19.64m. quite fair of a morning till 9.30 in Spanish. Heard fairly well at 10 pm, too.

WLWK, 19.67m. This call is used of a morning when in Spanish.

WBOS, 19.72m. Moderately strong signal from 10 pm onwards.

WKRD, 19.75m. Closes at fair strength at 10 pm.

WNBI, 19.81m. Is heard around 10 pm, with other Americans; very fair.

WKRD, 23.13 m. News at 9 am can be followed, closes soon after.

WKTM 25.23m. Is the strongest East-Coaster heard here. News 9 am, closes 10 am.

WBOS 25.27m. Weak around 9—11 am.

WGEA 25.33m., quite strong at

(Continued on next page)

10.30 when beamed to South America.

WCDA, 25.36m. Fair around 9.30 pm in French.

WCRC, 25.36m. Puts a whistle on VLW-3 of a morning.

KGEI, 25.45m. On favourable mornings can be heard at 10.30 am.

WKRX, 30.31m. News at 9 am, signal fair when closing at 10.45 am.

KROJ, 30.31m. Some nights good, others weak, but never up to KWID.

WKLJ, 30.77m. From 7 am is fine. Contacts Algiers daily at 9 am.

WNBI, 31.02m On closing at 4 pm is fair —not heard from 9 to 11 am now.

WLWO 31.30m. Excellent when opening at 10.30 am. Note call.

KWIX, 31.55m. This new one opens at 10 am with programme for The Americas.

KWID 31.35m. Superb from 6 to 8.15 pm.

WGEO, 31.48m. Fine from 9 to 11 pm; weak 6—8 pm.

WCBX, 31.61m. Opens at fine strength at 9.50 am.

KRCA, 31.61 m. Interfered with in afternoon, otherwise strong. (Not audible here now. L.J.K.)

WKRD, 38.36 m. Opens 9.30 am at fair strength. News on the hour. Good till 11 am.

WKTS, 39.6m. Heard well at 10 am in news.

WLW0, 39.6m. Not as good as when first heard. Fair at 6.30 pm.

KWY, 39.6m. Good all evening.

KWID, 41.49m. Good from 8.30 on.

KGEI, 41.38m. Not strong in evenings. (Peaks here at 5 pm L.J.K.).

WKTM, 47.01m. Is good from just after 10 am onwards.

(There is a fine list from W.A., but you will notice how very different reception is there compared with Sydney. L.J.K.)

South America

HCJB, 24.11m. Good from 9 till 10.30 am and fair at same time on 30.12m. (Walker). Is heard here on Mondays from 7 till 9 am. At 7.30 "The Church of the Air", Philadelphia, Pennsylvania was heard on September 13. L.J.K.) R-4 and R-3 respectively at 9.15 am but irregular (Perkins).

Great Britain

GWE, 19.44m. is good at night (Gaden). GWC 19.91 quite nice with news at 9 pm (Gaden).

—, London 15.42 m.c. 19.46m. This transmitter, still without a call sign, is on the air from 8 pm almost without a break till 1.45 am. It is a little early to expect to follow it on opening, but that funny language at 11.30 pm is Thai. This transmitter is beamed to India and the Far East. L.J.K.

GRV, 12.04 m.c., 24.92m. which, during the winter has been putting in a wonderful signal all the morning, in Spanish directed to South America, is in parallel with —, 19.46 m. from 11.30 pm till 12.45 am. L.J.K.

China.

XGOY, Chungking, 11.90 m.c. 25.21 m. Back again on this old frequency in the evening, but while strength is good and even so much better than when on 15.205 m.c., modulation is dreadful. Not certain of schedule, but opens in Chinese a little before 8 pm and at 8 o'clock give news in English. Followed by Chinese and then music. At 1.47 am are heard in Russian and English news is given at 2 o'clock L.J.K.

On 25.21 m. at 8.15 pm are good, but noise level high; XGOA 30.86 R4 at 9 pm (Perkins).

India

VUD-3, Delhi, 6.01 mc. 49.92 m. Very good at 2 am (Verge).

Thrill of DX last week was logging of Colombo on 4.88 m.c. in the 60 metre band. They were heard at good strength from 9.30 pm till closing at 2 am. Rebroadcast BBC news at 1 am, and followed with dance session.

(This may be a new one as my records show VUB-2, Bombay, on 4.88 m.c., 61.48m. L.J.K.)

VUC-2, Calcutta, 4.84 m.c., 61.98m. is good at 10 pm with news (Cushen).

VUD-3, 19.62 m. R6 lunch-time and early evening (Perkins). Fair to medium at night (Gaden). Can be heard testing most days at about 2.50. Announcement in French by lady then fluty notes, and man calls letters very slowly. L.J.K.

VUD-6, 25.45 R6 at 10 pm (Perkins). This call is excellent for news at 11 pm. L.J.K.

U.S.S.R.

Kuibyshev 8.05 mc. very strong at 9 am. (Verge).

Heard Moscow on 25.36m. at 2.58 pm, with terrific signal. Kremlin Bells at 3 pm and announcer then spoke in French. At 3.34 they were mixed up badly with VLW-3, and it was amusing to hear a race description from W.A. and just as the horse's name was announced in came a Russian speaking in German. L.J.K.

A seldom reported U.S.S.R. station is the one on 13.42 mc. 22.35m. This is used in the Home Service during the day and at night from 11.45 is often heard in parallel with 30.43m. At 1.20 am the other morning signal was R7 Q4 L.J.K.

Moscow on 25.36m. opening at 2 pm gets all mixed up with VLW-3, but as they are speaking in French can be copied. Moscow has several sessions but at 12.30 am. open in Hindustani. English news is given at 1 am L.J.K.

On 19.7 is R7 at 8.47 am with news commentaries, etc. (Perkins).

Khabarovsk on 31.36m. is R7 at 7 pm but is a noisy station (Perkins). (This chappie has been spreading a trifle of late and causing a little interference to KWID. L.J.K.)

Heard a new frequency for Moscow the other night at 8.15, approximately 19.54m. They were carrying same programme as Khabarovsk on 31.36 Tuning later at 10.14 they were relaying BBC news, L.J.K. Think I heard Moscow one about 19.53m. one night, (Gaden). Have heard Moscow on 19.7 metres at 7.20 am, 8.50 am, and 1.15 pm in English and easily followed (Gaden).

Iceland

TFJ, Reykjavik, 12.235 m.c., 24.52m. is reported being heard again between 3.15 and 3.30 pm.

Iran

EQB, Teheran, 6.155 mc, 48.74m. is now known as Radio America when it opens at 2.45 am. in special news, read by Ed. Brown, an American, for the benefit of The Persian Gulf Command. Signal is R7 Q4 (L.J.K.).

Allied and Neutral Countries Short-Wave Schedules

These schedules which have been compiled from listeners' reports, my own observations, and the acknowledged help of "Globe Circler" and "Universalite" are believed to be correct at time of going to press, but are subject to change without notice. Readers will show a grateful consideration for others if they will notify me of any alterations. Please send reports to: L. J. Keast, 23 Honiton Ave. W., Carlingford. Urgent reports, 'phone Epping 2511.

Loggings are shown under "Short Wave Notes and Observations." Symbols: N—New stations; S—Change of Schedule; F—Change of frequency.

AS FROM OCTOBER 3, ONE HOUR SHOULD BE ADDED TO ALL THE TIMES SHOWN TO COINCIDE WITH DAYLIGHT SAVING TIME.

Call Sign	Location	Mc.		M.	Time: Eastern Australian St'dard
GRZ	London	21.64		13.86	9—11.15 pm
GSH	London	21.47		13.97	8.30—1.15 am
OPL	Leopoldville	20.04		14.97	8.55—10.15 pm
—,	L'poldville	19.20		15.63	2.45—3.30 a.m.; 4.30—4.45 om; 9.15—9.30 pm;
HBH	Berne	18.48		16.23	Tues. & Sat. 11.45 pm—1.15 am
GVO	London	18.08		16.59	7—2.15 am
GRQ	London	18.02		16.64	8.45 pm—12.30 am; 2--2.45 am
EIRE	Athlone	17.84		16.82	10—11.30 pm; 3.30—4 am; News 2.45 am.
WCDA	New York	17.83		16.83	11 pm—4.30 am
WCRC	New York	17.83		16.83	7.15—9.15 am
GSV	London	17.81		16.84	3.45—4.45 pm; 8.45 pm—1.15 am; 1.30—3.15 am
WLWO	Cincinnati	17.80	S	16.85	7.30—10.15 am; 11.15 pm—5.30 am.
GSG	London	17.79		16.86	8.45—10 pm; 1.30—2.45 am
WRCA	New York	17.78		16.87	11 pm—2.45 am
OPL	Leopoldville	17.77		16.88	8.55—10.15 pm; 4.30—6.30 am
KROJ	'Frisco	17.76		16.89	Not in use at present
WRUW	Boston	17.75		16.90	1—3.15 am
GVQ	London	17.73		16.92	5—7 pm; 11.30 pm—1 am
LRA-5	B'nos Aires	17.72		16.93	Sats. 6.45—7.30 am
—,	Brazzaville	17.71		16.94	6.30—8 am
GRA,	London	17.71		16.94	6 pm—2.45 am; News 7 pm
HVJ,	Vatican City	17.44		17.20	Mon. Wed. & Sat.: 11 pm—1 am; Tues, 11 pm—1.20 am; Fri. 11 pm—midnight.
WCW	New York	15.85		18.93	3 am—7 am
—,	Moscow	15.75		19.05	9.40—11.30 pm
WCB	Hicksville	15.58		19.28	7.15—8 am.
GRD	London	15.45		19.42	5.45—7pm; 8.45—10.30 pm
—	Accra, G. Coast	15.42		19.45	8—8.30 pm; 3—4 am.
GWE,	London	15.43		19.44	5.45—7 pm; 8 pm—1.15 am
GWD	London	15.42	N	19.46	8—8.30 pm; 9.30—9.45 pm; 11 pm—12.15 am; 1.15—1.45 am.
GRE	London	15.39		19.50	5.45—7 pm; 10.15 pm—1 am; 1.30—5 am
KWU	'Frisco	15.35		19.53	Daily except Thurs. 6.30—8.15 am (Mon 7—8 am). Daily except Mon. & Thurs. 9.45—11.30 am
WRUW/L	Boston	15.35		19.54	8 pm—3.15 am; 3.30—4.30 am
FGA	Dakar	15.34		19.55	5.15—7 am
WGEA	Schenectady	15,33		19.57	7.30—9.45 am
KGEI	'Frisco	15.53		19.57	Not in use.
WGEO	———	15,33		19.57	10.15 pm—5.30 am.
VLI-3	Sydney	15.32	S	19.58	7.30—11 pm.
GSP	London	15.31		19.60	5—7 pm; 8—10.45 pm; 11—11.30 pm; 11.45 pm—12.45 am; 2—2.30 am; 2.45—3 am
HER-6	Berne	15.30		19.60	Testing Tues. and Sat. from 6.30—8 pm.
KWID	'Frisco	15.29		19.62	3.30—11 am; 3—4.45 pm
LRU	B'nos Aires	15.29		19.62	9.15—10.15 pm
VUD-3	Delhi	15.29		19.62	1.15—2.5 pm; 3—6.15 pm; 8.30—10.15 p.m.
WCBX	New York	15.27		19.64	9 pm—6.45 am; 7—9.45 am
GSI	London	15.26		19.66	4—7 pm; 8.45 pm—1.15 am; 1.30—6.45 am
WLWK	Cincinnati	15.25	S	19.67	7.30 am—2 pm; 10.30 pm—7.15 am.
VLG-6	Melbourne	15.23		19.69	12 noon—1.15 pm.
—	Moscow	15.22		19.70	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am; 1.15—1.40 pm
WBOS	Boston	15.21		19.72	10.15 pm—1 am; 1.15 am—2.45 pm.
XGOY	Chungking	15.20		19.73	8—9.30 pm. Signal erratic but improving
TAQ	Ankara	15.19		19.75	7.30—9 pm; 11.30 pm—12.45 am
KROJ,	'Frisco	15.19		19.74	6.15—7.45 am; 8—9 am
WKRX	New York	15.19	N	19.75	5.30—7 am.
XGOY ..	Chungking	15.18		19.76	Wed. only, 10—10.45 am
GSO	London	15.18		19.76	8.45—9 pm; 10.15—11.15 pm; 1.30—1.45 am; 3.30—4 am.
TGWA	Guatemala	15.17		19.78	3.45—4.55 am; (Mon. till 8.15 am)
PRE-9	Fortaleza	15.16		19.78	7—11.05 am
VLG-7	Melbourne	15.16		19.79	6.30—8.10 am (Sun. 6.45—8 am)
SBT	Stockholm	15.15		19.80	1—4.15 am. News 1.01 am.
WNBI	New York	15.15		19.81	10 pm—7 am.
GSF	London	15.14		19.82	8.45 pm—1.15 am; 3.30—3.45 am
KGEI	'Frisco	15.13		19.83	3.15—4.15 am
HVJ	Vatican City	15.12		19.84	Mon. 10—10.15 am; 10.30—10.50 om; 11—11.20 am; Wd. 1.25-2.25 am; Fri 2-3.20 am
—	Moscow	15.11		19.85	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am; 1.15—1.40 pm; 9.30—10.20 pm
HVJ	Vatican City	15.09		19.87	Thurs. m/n. to 1 am Fri.; Fri. m/n to 1 am Sat.
GWC,	London	15.06		19.91	3—7 pm
PSE	R de Janiero	14.93		20.07	Fri. 7—7.30 am;10—10.30 am
WDO	N.Y.	14.47		20.73	11 pm—6 am
—	Malaga	14.45		20.75	11 pm—Midnight
—	Tunis	14.40		20.83	9—11 pm; 3—7 am
—	Dakar	13.34		22.48	No schedule
WKRD	New York	12.96	S	23.13	10 pm—9.15 am.
CNR	Rabat	12.83		23.38	9.30—11 pm
FIA	Douala	12.70		23.61	8.45—9.30 pm; 5.15—5.45 am
HCJB	Quito	12.45		24.11	9.45—11.45 pm; 2.30—5.30 am; 8 am—12.45 pm
—	Brazzaville	12.27		24.45	4.30—6 am.
—	Moscow	12.26		24.47	1 pm to 2 am (this is all Russian—for Home Service)
TFJ	Reykjavik	12.23		24.54	3.15—3.30 pm
—	Moscow	12.19		24.61	7.45—9.23 am; 10—10.50 am
—	Moscow	12.17	..	24.65	6—8 am; 2.40—3.45 pm; 4.45—5 pm; 7.30—8.50 pm; 11—11.15 pm; 12.30—12.45 am; 1.15—1.45 am.
R. France	Algiers	12.12		24.75	2.30—4.30 am; 5—7.30 am; 7.45—8.15 am.
ZNR	Aden	12.11		24.77	2.13—3.30 am
GRF	London	12.09		24.80	8 pm—2.45 am
GRV	London	12.04		24.92	3.45—6.45 pm; 8.45—9 pm; 10.15—11.30 pm; 11.45 pm—2.30 am; 2.45—4.45 am; News 4.15 and 6 pm.
CE1180	Santiago	11.97		25.04	9.30pm—m/n; 2.30 am—2 pm
FZI	Brazzaville	11.97		25.06	5—7.30 am; News 5.45 am; 1—2 pm; 3.55—4.40 pm; 9.15—10.30 pm; 2—3 am
ZPAS	Encarnacion	11.95		25.10	8.30—10 am
. . . —	London	11.95		25.09	7.15 pm—12.30 am; 1.30—am; (Eng. 11—11.30 pm)
. . . —	London	11.93		25.15	7 pm—12.30 am; 1.30—6 am; (Eng. 7.15—7.45 pm; 11—11.30 pm.
XGOY	Chungking	11.90	S	25.21	8—9.30 pm; midnight—2 am.
VLG-9	Melbourne	11.90		25.21	12.15—12.45 am.
CXAIO	Montevideo	11.90		25.21	9.25 am—12.10 pm
WRCA	N.Y.	11.89		25.22	6—10.45 pm; 3—6.45 am; 7 am—1.30 pm
WKTM	New York	11.89	N	25.23	8—10 om.
VLR-3	Melbourne	11.88		25.25	11.45 am—6.15 pm (Sun. 12.50 pm—6.25 pm)
H13-X	Trujillo City	11.88		25.25	8.30 am—12.15 pm.
VLI-2	Sydney	11.87		25.27	4.55—5.25 pm
WBOS	Boston	11.87		25.27	8.15—10 pm; 3—7.15 am; 7.30 am—2 pm
HER-5	Berne	11.86		25.28	10.55—11.30 pm; 6.50—7.55 am; 11.45 am—1 pm
GSE	London	11.86		25.29	1—1.15 pm; 1—1.30 am; 2.30—7 am.
WGEA	Schenectady	11.84		25.33	10 pm—7.15 am.
CXA, 14	Colonia	11.84		25.35	7 am—2 pm
VLG-4	Melbourne	11.84	S	25.34	1.30—3.10 pm; 6.25—7.25; 7.30—8 pm; 8.15—9.45 pm.
VLW-3	Perth	11.83		25.36	8.30—11.45 am; 1.30—8.45 pm (Sun. 8.45 am—8.45 pm)

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
—	Moscow	11.83 S	25.36	2—2.45 pm; 3—4 pm; 9—9.30 pm; 11—11.45 pm; 12.30—3.45 am.
WCRC	N.Y.	11.83	25.36	9.30 am—2 pm.
WCDA	N.Y.	11.83	25.36	8 pm—8.30 am
GSN	London	11.82	25.38	3—5.30 pm; 5—6.45 am
XEBR	Hermosillo	11.82	25.38	11—3 pm
COGF	Matanzas	11.80	25.41	2.30—5 am
KGEI	'Frisco	11.79	25.43	7 am—2.45 pm
WRUL	Boston	11.79	25.45	3.30—8 am; 8.15—9.25 am; 9.30 am—4 pm
GVU	London	11.78	25.47	3—5.30 pm
HP5G	Panama	11.78	25.47	11.15 pm—12.30 am; 2.45—6 am.
ZYB8	Sao Paulo	11.76	25.50	7 am—noon.
VLR-8	Melbourne	11.76	25.51	6.30—10 am (Sun. 6.45 am—12.45 pm)
GSD	London	11.75	25.53	11.15 am—2 pm; 3—7 pm; 1.15—1.30 am; 1.30—6.45 am.
—,	Moscow	11.75	25.53	9.30—9.55 am.
HVJ	Vatican City	11.74	25.55	Tues & Thurs. 5—5.30 pm; Mon. Wed. & Sat. 6—6.30 pm.; Wed. 1—1.30 am.
COCY	Havana	11.73	25.56	11 pm—4.15 pm
GVV,	London	11.73	25.58	5—7 pm; 1.30—6.30 am
WRUL,	Boston	11.73	25.58	9.15 am; 2—4 pm
KGEI	San F'cisco	11.73	25.58	7 am—12.45 pm (Think has been withdrawn).
ZPA-2	Asuncion	11.72	25.60	8.30 am—12.10 pm.
—,	Leopoldville	11.72	25.60	8.55—10.15 pm; 4—6.30 am
PRL-8	R de J'niero	11.72	25.60	5 am—1.10 pm.
—,	Lisbon	11.72	25.60	10 pm—midnight
HER-5	Berne	11.71 S	25.60	Daily 4—7.45 am; Daily except Sunday. 9.30—11 am; Tues. and Sat. 5.30—6.30 pm.
YSM,	San Salvador	11.71	25.62	4—5 am
VLG-3	Melbourne	11.71	25.62	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm.
WLWO	Cincinnati	11.71 S	25.62	5.45—7.15 am; 8—11 pm.
CXA-19	M'tevideo	11.70	25.63	9—10 pm; 8 am—1 pm
SBP	Motala	11.70	25.63	1—4.15 am; 7.20—7.40 am; 11 am—noon
CBFY	Montreal	11.70	25.63	9.30 pm—1.30 pm
. . . —	London	11.70	25.64	1.30—2 am. Italian: 2.15—6 am. Various languages.
HP5A	Panama City	11.70	25.64	11 pm—3 am; 11.10 am—3 pm
CE1170	Santiago	11.70	25.64	10 pm—midnight
GRG	London	11.68	25.68	3—7 pm; 4.30—6.45 am
—,	L'poldville	11.67	25.71	5.15—5.30 am; 2—3 pm; 6.30—6.45 pm
COK	Havana	11.62	25.83	2 am—2 pm (Mon. 3—9 am)
CSW6	Lisbon	11.04 S	27.17	7.45—8.30 am.
KWV	San F'cisco	10.84 S	27.68	6.45 pm
VQ7LO	Nairobi	10.73	27.96	12.45—5 am.
CEC	Santiago	10.67	28.12	10—10.15 am
KES-3	Bolinas	10.62	28.25	3—8 pm
VLN-8	Sydney	10.52	28.51	Idle at present.
WOA-4	New York	10.51	28.53	8—10 am; 6.45—8 pm.
—	Moscow	10.44	28.72	6 pm—1.45 am (often news at 9.40 pm).
PSH	R de Janeiro	10.22	29.35	10.30—10.48 am
HH3W	P't-au-Pr'ce	10.13	29.62	2.30—8.45 am; 9 am—1.30 pm
SUV	Cairo	10.05	29.84	4.30—5 am; 8.45—9.30 am
—	Brazzaville	9.98	30.06	4—5.20 am; 7—7.30 am
HCJB	Quito	9958	30.12	9.45—11.45 pm; 2.30—5.30 am; 8 am—12.45 pm; (Sunday 10 pm—7.30 am
WRX	New York	9905	30.29	8 am—2 pm; 2.15—7 pm.
WKRD	New York	9897	30.31	6.45—8.30 pm; 5—7 am
WKRX	New York	9897	30.31	8—10.45 am
KROJ,	'Frsco	9.89	30.31	1—5.45 pm; 6—11 pm;11.15 pm—2.45 am
LSN-2	B'nos Aires	9890	30.33	Noon—12.30 pm
EAQ	Madrid	9860	30.43	4—5 am; 9.50—11 am. News 4.15 am and 10 am.
—	Moscow	9860	30.43	8.48—9.23 am; 10—11.50 am; 2—3.45 pm
CR7BE	L. Marques	9843	30.48	3—4 am; 7.30—10 am.
COCM	Havana	9833	30.51	9.45 pm—3 pm
GRH	London	9825	30.53	3—6.30 pm
—	Moscow	9770	30.71	10—10.30 am
ZRO	Durban	9755	30.75	Midnight—7 am
WKLJ	New York	9750	30.77	6.45—8 pm 8—11 am.
T14NRH	Heredia	9740	30.80	10—11 pm (Wed. Fri. & Sun. 1.30—3.30 pm)
CSW-7	Lisbon	9735 S	30.82	4—7.30 am.
CE970	V'paraiso	9730	30.82	9.30—11 pm; 7.30 am—2.30 pm
XG0A	Chungking	9720	30.86	9 pm—1 am. News midnight
OAX4K	Lima	9715	30.88	8.30 am—2.20 pm.
WRUW	Boston	9.70	30.93	4.45—9 am; 2—4 pm
FIQA	Tananarive	9700	30.93	12.30—2 am
GRX	London	9690	30.96	3.30—6.15 pm

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
TGWA	Guatemala	9685	30.96	11.50 am—2.45 pm (Mon. 10 am—2.45 pm).
LRA-1	B'nos Aires	9688	30.96	1.30—4 am; 5.30—6.30 am; 7 am—noon
XEQQ	Mexico City	9680	30.99	Midnight—4.45 pm.
VLW-5	Perth	9.68 S	30.99	8.30 pm—1.30 am.
WNBI	New York	9.67 ..	31.02	7.15 am—4 pm.
VLQ-3	Brisbane	9.66	31.05	11.45 am—5.15 pm. (Sun. 11 am—5.15 pm)
LRX	B'nos Aires	9.66	31.06	8.30—9; 10.30 pm—1.10 pm (Sundays 3 pm).
HVJ	Vatican City	9.66 S	31.06	2—4.30 am.
HHBM	P't-au-Pr'ce	9.65	31.06	10.30—11 pm; 3—4 am; 9 am—12.30 pm.
WGEO	Schenectady	9.65	31.08	Not in use at present.
WCBX	New York	9.65	31.09	1.45—4 pm.
COX	Havana	9.64	31.12	2.50 am—2 pm.
XGOY	Chungking	9.64	31.10	11.30—2.15 am; News midnight 12.30, 1 and 2 am.
LRI	B'nos Aires	9.64	31.12	7.57—10 pm; 3.30—4.30 am; 5 am—1 pm.
. . . —	London	9.64 S	31.12	6.45—8.45 am; 3.30—7 pm.
CXA-6	Montevideo	9.62	31.17	1—9 am
—	Addis Ababa	9.62	31.17	1.40—2.30 am
VLI	Sydney	9.61	31.12	Not in use at present
XERQ	Mexico City	9.61	31.21	11.30 pm—1 am; 9 am—3 pm
ZRL	Capetown	9.60	31.22	5.15 pm—12.30 am.
HP5J	Panama City	9.60	31.23	10 pm — 4.30 am; 11.30 am—1.30 pm; Sun. 11 pm—1 pm Mon.
CE960	Santiago	9.60	31.24	9 am—2 pm.
GRY	London	9.60	31.25	7.15—8.45 am; 3—4.45 pm; 1—7 am; News 6.45 am, 4.15 pm, 2 and 4 am.
—	Athlone	9.59	31.27	7.05—7.25 am; News 7.10 am
VUD-4	Delhi	9.59	31.28	11 am —1.35 pm; 3—6 pm; 7.30—7.45 pm; 8.30—11.35 pm; 12.15—1 am; 2.30—4 am. News 11.45 am; 1.30, 5, 10 pm and 12.50 am
WLWO	Cincinnati	9.59 S	31.30	10.30 am—2 pm.
WLWK	Cincinnati	9.59	31.30	9—11 pm
VLR	Melbourne	9.58	31.32	6.45—11.30 pm (Sun. from 7 pm)
VLI-10	Sydney	9.58 N	31.32	11.35 pm—12.45 am.
VLG	Melbourne		31.32	1—1.45 am for N America (W States)
GSC	London	9.58	31.32	7.15 am—2.45 pm; 3—4.45 pm
KWIX	'Frisco	9.57	31.35	10 am—2.45pm; 3—4.45 pm; 10.30 pm—1 am.
KWID	'Frisco	9.57	31.35	5—8.15 pm.
—	Khabarovsk	9.56	31.37	5.30—7.12 am; 7 40—8.45 am; noon—1.12 pm; 1.45—2.40 pm; 6—9.30 pm; 10.30 pm—midnight
OAX4T	Lima	9.56	31.37	11 pm—midnight
XETT	Mexico	9.55	31.39	Continuous
GWA	London	9.55	31.41	5.30—7 am; 4—7 pm; 1.30—4.30 am
WGEA	Schenectady	9.55	31.41	Not in use at present.
XEFT	Vera Cruz	9.54	31.42	11 pm—4.15 pm
—	Moscow	9.54	31.43	9.40—10.20 pm; 12.15—12.30 am
VLG-2	Melbourne	9.54	31.45	10—10.45 pm for N. America 10.55—11 pm (Dutch), 11—11.35 pm (French), 11.35—midnight (Thai).
SBU	Stockholm	9.53	31.47	7.20—7.35 am; 11 am—noon, News 7.20 and 11 am.
HER-4	Berne	9.53	31.47	9.45—11.15 am. Except Sundays
WGEO	Schenectady	9.53 S	31.48	5.45—7.15 am; 7.30 am—9.30
ZRG	Joh'burg	9.52	31.50	5.30 pm—12.30 am
COCQ	Havana	9.51	31.53	10 am—1 pm; 8.20—11 pm
GSB	London	9.51 S	31.55	3—7 pm; midnight—1.15 am, 4.15—7 am; 7.45—8.45 am, 9 am—12.45 pm.
PRL-7	R de Janeiro	9.50	31.57	8 am—1 pm
XEWW	Mexico City	9.50	31.58	11.58—5.45 pm
OAX5C	Ica	9.50	31.58	Think off the air.
. . . —	London	9.49	31.61	5.30 pm—12.30 am; 1.30—8.45 am
KRCA	'Frisco	9.49	31.61	3 pm—3 am
WCBX	New York	9.49	31.61	9.50 am—1.30 pm
—	Moscow	9.48	31.65	4—5 pm; 8.30 pm—12.45 am; 1.45—2.15 am.
CR6RA	Loanda	9.47	31.69	9.30—10.45 pm; 5.30—7 am
TAP	Ankara	9.46 S	31.70	1—5.45 am; News 3 am;
GRU	London	9.45 S	31.75	3—4.45 pm; 1—1.15 am.
COCH	Havana	9.43	31.80	8.45 am—3.15 pm
—	Moscow	9.43	31.81	7—7.25 am; 2.15—2.45 pm; 3.30—4 pm
GRI	London	9.41	31.86	2.45—8.30 am; 5—7.45 pm
FGA	Dakar	9.41	31.88	3—4.15 am.
—	Moscow	9.39	31.95	9.30—11 pm; 1.30—3 am; 10 am—1 pm
COBC	Havana	9.37	32.00	11 pm—3.15 pm

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
OAX4J	Lima	9.34	32.12	9 am—4 pm; 11 pm—midnight 3—6 am
LRS ..	B'nos Aires	9.32	32.19	8 am—noon, 10—11 pm; 4—4.30 am
COCX	Havana	9.27	32.26	10.45 pm—3 pm
HC2ET	Guayaquil	9.19	32.64	10.30 pm—3.30 pm
CNIR1	Rabat	9.08	33.03	4—8.50 am; 4.30—4.50 pm; 9.30—11 pm
COBZ	Havana	9.03	33.23	10.45 pm—2 pm
—	Kuibyshev	8.99	33.37	5.50—6 am
AFHQ	Algiers	8.96	33.48	2—3.15 am; 6—9.15 am
KES-2	'Frisco	8.93	33.58	8.15 pm—3 am
—	Dakar	8.83	33.95	5.15—6.45 am; 5.30—5.50 pm; 10.15—11 pm.
COCQ	Havana	8.83	33.98	8.20 pm—2.15 pm
COCO	Havana	8.70	34.48	7.30 pm—3.30 pm
COJK	Camaguey	8.66	34.62	2.30—3.30 am; 6.30—9 am; 11—11.30 am;
WOO4	New York	8.66	34.64	10 am—4 pm; 4.15—7 pm
—	Kuibyshev	8.05	37.27	1—1.30 am; 2—4.15 am; 7.15—8.45 am
CNRI	Rabat	8.03	37.34	4—9.45 am; 3—6 pm
FXE	Beirut	8.02	37.41	11 pm—7 am
FIA6	Douala	8.00	37.50	4.45—5.45 am; 8.45—9.30 pm
PSL	R de Janeiro	7.93	37.81	Sundays 9—10 am
YSD	San Salvador	7.89	38.00	10 am—1.30 pm
SUX	Cairo	7.86	38.15	3.30—4.30 am; 5.15—7.45 am
WKRD	New York	7.82 S	38.36	9.30—11.15 am
WKRX	New York	7.82	38.36	7—10 pm
WRUL	Boston	7.80 N	38.44	4.15 pm
YNDG	Leon	7.66	39.16	9 am—1 pm
YNLAT	Granada	7.61	39.40	9.30 am—1.15 pm
WLWO	Cincinnati	7.57	39.6	2.15—4.30 pm
WDJ	New York	7.56	39.66	9.15 am—6 pm
KWY	'Frisco	7.56	39.66	6.45—9.05 pm: 10.30 pm—12.30 am
WKTS	New York	7.57	39.6	10 am—noon
—	Moscow	7.56	39.68	1—6.30 am; 8—9 am; 11.10—11.30 am
YN2FT	Granada	7.49	40.05	10 am—1 pm
GRJ	London	7.32	40.98	5—7 am; 2.15 pm—5.15 pm
. . . —,	London	7.31 N	41.01	5.30—8.45 am; 2.30—6.30 pm
—	Moscow	7.30	41.10	2—9.30 am; 10—11 am; 1—3.45 pm; 4.30—5 pm
ZOY	Accra	7.29	41.13	2.15—5.15 am
VUD-2	Delhi	7.29	41.15	8.30—11.25 pm
VLI-9	Sydney	7.28 S	41.21	1—1.45 am (for Nth America—West)
VUM-2	Madras	7.26	41.32	6—6.40 pm; 9.45—11.30 pm; 12.45—12.50 am. News 10 pm and 12.45 am
GSU	London	7.26	41.32	4.30—10.30 am; 1.45—6.30 pm; (Eng. 6.1'5—6.30 pm)
KGEI	'Frisco	7.25	41.38	1 pm—2.45 am.
VUB-2	Bombay	7.24	41.44	4.15—5.10 pm; 9.25—10.45 pm. News 5, 9.25 and 10 pm
VLQ	Brisbane	7.24	41.44	6—10 am.
KWID	'Frisco	7.23	41.49	8.30 pm—3.05 am
GSW	London	7.23	41.49	5.15—8.45 am; 1.45—4.45 pm
VLI-4	Sydney	7.22	41.55	Not in use
VUC-2	Calcutta	7.21	41.61	5—5.55 pm; 8.30—9.20 pm
VLQ-2	Brisbane	7.21	41.58	5.30—11.30 pm
—	Moscow	7.21	41.61	7.50—9.30 am
—	Madrid	7.20	41.63	6—9 am
YSY	San Salvador	7.20	41.65	10.30 am—2 pm
CM21	Havana	7.19	41.72	8 am—2 pm; midnight—3 am
GRK	London	7.18	41.75	
XGOY	Chungking		41.80	8 pm—3 am; 4.30—7 am
—	Moscow	7.17	41.80	5.20—6.30 am; 7.15—9.55 am; 10—10.30 pm; 1—4.30 am
GRT	London	7.15	41.96	9.15 am—2 pm; 3—4.45 pm
EAJ-9	Malaga	7.14	42.00	6—9.05 am
HC4FA	Porto Viejo	7.14	42.02	7 am—1 pm
—	Ovideo	7.13	42.05	5—7.30 am
GRM	London	7.12	42.13	10.45 am—2.45 pm; 3—6.30 pm
EA9AA	Melilla	7.09	42.31	Heard around 7 am
GRS	London	7.06	42.41	4—8.45 am; 11.45 am—2 pm
EAJ24	Cordoba	7.04	42.61	6.40—8 am
EAJ-3	Valencia	7.03	42.65	6—10 am
—	Ponto Delgada	7.02	42.74	5—6 am

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
EAJ47	Valladolid	7.00	42.82	6.30—7.15 am.
WGEA	Schenectady	7.00	42.86	10 am—2 pm
FO8,AA	Papeete	6.98	42.95	Wed. & Sat. 1.57—2.45 pm
—	Moscow	6.98	42.98	2 am—9.23 am; 10—10.30 am
YNOW	Managua	6.87	43.67	10 am—2.30 pm
HIH	San Pedro	6.77	44.28	10—11.30 am; Mon. 8.20—9.40 am
YNDS	Managua	6.76	44.28	3—6 am; 8 am—2.30 pm; 10 pm—midnight
—	Oran	6.73	44.56	6.30—7 am
ZLT-7	Wellington	6.71	44.68	8 pm in news session only.
TGWB	G'temala	6.54	45.87	9.30 am—3 pm
Latin-American and other stations seldom, or unlikely to be heard, have been omitted.				
WKTM	New York	6.38	47.01	5.15—7 pm
SUP-2	Cairo	6.32	47.47	4—7 am
FK8AA	Noumea	6.20 F	48.39	5.15—5.27 pm; 7—8 pm.
GRN	London	6.19	48.43	5.45—6.30 am; 9.30 am—2.45 pm; 5.20—5.35 pm; 2.15—2.30 am; 3.30—3.45 am
VUD-2	Delhi	6.19	48.47	9.30—10.15 pm; 11 pm—1.35 am; News 10 and 11.45 pm
XECC	Puebla	6.19	48.47	From 2—4 pm
WGEA	Schenectady	6.19	48.47	2.15—4.10 pm
LRM	Mendoza	6.18	48.51	8.30 am—1 pm
GRO	London	6.18	48.54	5—10.45 am; 2.40—7.45 pm
WCBX	New York	6.17	48.62	5.18—7 pm; News 6.18 pm
HER-3	Berne	6.16	48.66	4—7.45 am
HJCD	Bogota	6.16	48.70	Around 2 pm
CBRX	Vancouver	6.16	48.70	11.30 pm—4.30 pm
CS2WD	Lisbon	6.15	48.74	5.30—8 am
EQB	Teheran	6.15	48.74	2—6 am; News 2.45 and 5.15 am.
WBOS	.. .. Boston	6.14	48.86	6—8 pm
CXA4	Montevideo	6.12	48.98	Around 2 pm
. . . —	London	6.12	48.98	6 am—noon; 1.45—6.30 pm
HP5H	Panama City	6.12	48.99	9 am—2 pm
YV3RN	B'quisimeto	6.12	49.02	Around 1.30 pm
XGOY ..	Chunking	6.12	49.02	9.35 pm—2.30 am
XEUZ	Mexico	6.11	49.02	Around 2—3 pm
WKTS	New York	6.12	49.02	4—7 pm
GSL	London	6.11	49.10	9.30 am—4.45 pm; News 11—6 am; 12.45 and 2.30 pm
CBFW	Montreal	6.09	49.25	9.30 pm—1.30 pm
ZNS-2	Nasau	6.09	49.25	11—11.15 pm; 3.45—4.15 am
WLWK	Cincinnati	6.08 S	49.34	2.15—6.15 pm.
CKFX	Vancouver	6.08	49.34	11.30 pm—4.30 pm
CFRX	Toronto	6.07	49.42	9 pm—3.30 pm
—	Moscow		49.42	6.30—7.30 pm
GRR	London	6.07	49.42	3.45 am—noon; 1.45—5.45 pm
SBO	Stockholm	6.06	49.46	Try around 7.30 am
VQ7LO	Nairobi	6.06	49.50	2—5 am
WCDA	New York	6.06	49.50	9.30 am—4 pm
GSA	London	6.05	49.59	8.45—10.45 am; 1.45—6.30 pm News 5.30 pm
XETW	Tampico	6.04	49.66	10 pm—4 pm
WRUW	Boston	6.04	49.66	2.15—6 pm.
HP5B	Panama City	6.03	49.73	9 am—1 pm; 1.30 am—5 am
—	Moscow	6.03	49.73	9.40—10.19 pm
CJCX	Sydney (Nova Scotia)	6.01	49.92	9 pm—4.30 am; 8 am—1 pm
VUD-3	Delhi	6.01	49.92	10.25—11.35 pm
GRB	London	6.01	49.92	8.45—10.45 am; 1.45—6.30 pm
ZRH	Joh'burg	6.00	49.95	1—7 am
CFCX	Montreal	6.00	49.96	10 pm—1.15 pm
HP5	Colon	6.00	49.96	10 pm—4 am; 8 am—2 pm
ZOY	Accra	6.00	49.96	8.30—9.15 pm; 2.15—5.15 am. News 5 am.
XEBT	Mexico City	6.00	50.00	1 am—3.30 pm
WKRD	New York	5.98 S	50.12	2.45—6.30 pm.
VONH	St. John's	5.97	50.25	10.30 pm—4.30 am; 7—11.35 am; News 7.30 am
HVJ	Vatican City	5.96 S	50.26	4.30—6.45 am.
ZRD	Durban	5.94 N	50.47	9.30—10.10 pm; 1—7 am.
—	Khabarovsk	5.93	50.54	8 pm—midnight
—	Moscow	5.89	50.90	8 pm—6 am
—	Lisbon	5.85 N	51.19	3.45—8 am.
VUB-2	Bombay	4.88 N	61.48	11—11.15 pm; midnight—12.15 am; News 11 pm
VUC-2	Calcutta	4.84 N	61.98	10—10.10 pm; 11—11.10 pm; midnight—1 am.

NEW STATIONS

WKTM, New York, 11,890 k.c., 25.23 metres: Appears to have replaced WOA-4 and is heard at good strength from 8 till 10 a.m. English news at 8 and 9 o'clock.

GIVE IT A NAME

Trials apparently having been satisfactory, two further BBC transmitters have been named, viz., GWA 9.55 m.c., 31.41m. and GWD, 15.42 m.c., 19.46m. See Schedules for transmission times.

STOP PRESS

The Federal Government has decided Daylight Saving will come into operation as from 2 a.m. on Sunday, October 3, when clocks will be advanced one hour. It will remain in force until March 26, 1944.

VERIFICATIONS RECEIVED

VLQ-2 with new card, (Cushen), KRCA with new card (Cushen): VLQ-2, VLI-4, VLN-8, VLG-9, WBOS 48.86, HER-5, 25.28m. and KRCA (Cushen). Received card from KWID for 15,290 k.c., transmission, L.J.K.

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

J.D.C. (Cronulla): What are the connections for the R.C.S. coil "R.F. with Reaction?"

A.—This coil has entirely different connections to the standard R.F. coil. The six pins are numbered as follows:—

1. Anode of R.F. valve.
2. Anode of detector valve.
3. Reaction condenser (.0001 mfd.).
4. Grid of det. (via grid condenser).
5. Earth return of grid coil.
6. High-tension positive.

Nos. 1 and 6 are primary, Nos. 2 and 3 are reaction coils, and Nos. 4 and 5 are secondary.

●

R.P. (Bathurst): What is the shortest wavelength of any electromagnetic radiation?

A.—The shortest wavelengths are those of "cosmic rays" from space. This high-frequency energy probably comes from the building up of matter from simpler types, or from its annihilation. The wavelength is approximately 3 × 10/16 cm.

Radio rays with wavelengths of less than one centimetre have been produced by electrical means. These ultra high frequency radio waves resemble light rather than broadcast band radiation in their properties.

C.R.O.

(Continued from page 8)

beam and consequently the brightness of the spot may be controlled by varying the cathode heater current, by varying the anode voltage or by varying the voltage between the cathode and a control grid placed between it and the anode.

Graphite Coating.

Some of the electrons from the cathode ray beam are not absorbed in the fluorescent coating. Sometimes other electrons (secondary electrons) are knocked out of the coating by the impinging beam. All these electrons tend to form a negatively-charged cloud which repels the cathode ray beam. To prevent this a thin film of graphite (a conductor) around the inside of the tube and is connected to each cathode, the earth, the focussing electrode or one of the deflector plates.

M.P. (Paddington): What is an electron gun?

A.—It is not a Buck Rogers' device, but consists of a hot cathode emitting electrons. These electrons are focussed into a beam by means of charged electrodes. Electron guns are part of cathode-ray oscilloscope tubes and television tubes. The cathode may be a coated filament wound in a helix and covered by a shield which has a single perforation. Electrons are attracted through the perforation by positively charged electrodes. The diverging beam so produced is passed through a negatively charged annulus which repels the electrons in the beam so that the beam is now a converging one and is brought to a focus on the screen of the tube.

●

C.J. (Albert Park, Vic.): Is the manufacture of radio sets still permitted?

A.—Definitely NOT. Radio parts can still be bought in shops, but the parts are supplied to these shops only for replacement or repair purposes. Even if a radio dealer has all the parts in stock, he is not supposed to build a set or an amplifier. In the meantime, we suggest you confine your efforts to experimentation or repairing and reconditioning. It is not illegal to purchase a radio or amplifier already built.

●

F.S. (Auckland, N.Z.) sends postal notes for a subscription.

A.—Sorry, but New Zealand postal notes are not negotiable in Australia, and so are valueless to us. On application at your local post office you can get a special money order which can be cashed in Australia quite normally. Although your regulations prohibit the export of money, special arrangements have been made for subscriptions to technical journals and "Australasian Radio World" is covered by this privilege. Subscription rate is 10/6 per annum, no extra charge being made to cover the extra postage costs to New Zealand.

●

J.L.K. (Mayfield) sends a circuit he is using, also some comments.

A.—Sorry, but we can't make head or tail of the circuit, which appears to be either something very startling or else full of mistakes in the drawing. We suspect the latter trouble, as in three cases your resistors are actually in parallel and not fed with any current. We are always pleased to have comments, but at the moment we are not particularly keen on any big changes in policy or style. Figures prove that we are ticking along very nicely in spite of difficult conditions. We do, however, have great plans for post-war development, anticipating that "ham" radio, and radio experimenting generally will boom to an extraordinary degree.

●

H.M.D. (Mildura) seems to be a bit hazy about power transformer ratings.

A.—The trouble seems to be that you disregard the wattage when making your considerations. You don't get anything more from a transformer than you put into it, but you can get a higher voltage. At the higher voltage, however, the current drain must be kept lower, so that the output wattage is always lower than the input wattage. If you exceed the normal current drain by unsuitable loading you will find that the secondary voltage will drop under load, also that the primary current will rise, and the whole transformer will heat up, eventually burning out if the overloading is excessive.

ANSWER TO RADIO PUZZLE

To operate a midget 110-volt A.C./D.C. set from 23 volts, a series resistor is required. This series resistor may consists of one 100-volt 30 watt lamp, or two 200-volt 60 watt lamps in parallel.

The formula for power is $P = E^2 \div R$, therefore $R = E^2 \div P$, so a 200-volt, 60 watt lamp has twice the resistance of a 100-volt, 30-watt lamp. Hence two are required in parallel. Here is another: How many values of resistance can be made up if you have three 250 ohm resistors? We'll give you the answer next month.

WIRING TIP

A hint, which I hope you will never take, comes from America, where an electrician overcame a cable-laying trouble in a novel way. He required to pass the cable across a house, between the roof and ceiling, but the available space was too small for him to take it through himself. So he procured a cat and tied a long piece of string to its tail. (Even that wants doing! You just try it.)

He then inserted the cat into the hole, which he blocked up sufficiently to prevent the animal from "backing out" of the job. All he had to do after that was to wait at the opposite hole till the cat emerged, when he untied the string and fastened his cable to it, so that he could pull it through from the opposite side.

What a brain!

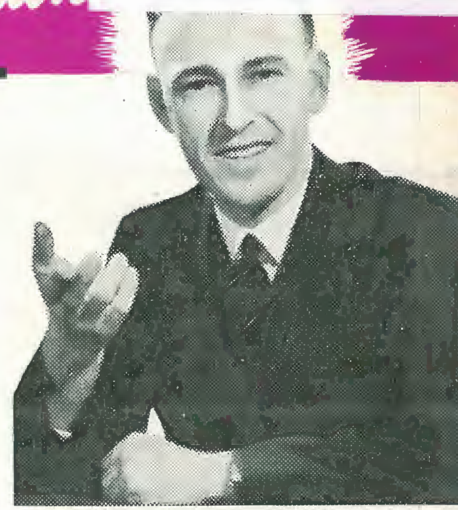
—N.Z. Radiogram.

Ask yourself these 3 questions

1 Am I capable of doing more for my Country?

2 Am I capable of earning more money?

3 Am I willing to use my spare time to build myself a future?



L. B. Graham, A.INST.R.E. (Aust.) Fellow of the Television Society (Eng.) Principal of the Australian Radio College—the foremost institution of its kind in the Southern Hemisphere.

IF THE ANSWER IS YES! There's room for YOU in RADIO

Almost every day you read in your papers, and hear over the Radio, urgent appeals for men with Radio knowledge. This is a war of technicians — trained specialists, such as Radio men, are needed in thousands to fill vital positions in our armed forces. Does it not impress you, that the Peace to follow will, more than ever, demand trained specialists, particularly radio engineers?

Radio is a young industry which has shown remarkable progress in the past few years. The future possibilities of Radio are unlimited, they spell security for a man who is trained.

YOU CAN START RIGHT AWAY

Of the many industries crying out for skilled men, none is more important to the Nation that Radio. We offer you the opportunity to enter Radio either in industry, or in the fighting forces.

Here are three good reasons why you will benefit if you become Radio Trained:—1. You will enter today's most progressive industry. 2. You will be pulling your weight in the war effort. 3. You will have a splendid career ahead of you when the war is over.

COSTS LITTLE

Think of this — for a few pence per day — actually less than many fellows spend on tobacco — you can prepare yourself for a man-sized job in Radio.

PREVIOUS KNOWLEDGE UNNECESSARY

You don't need a knowledge of Radio or Electricity. We'll give you all you need of both — you'll start at the beginning, building up knowledge just as carefully and systematically as you would lay brick after brick in its place when building a wall. ★ A.R.C. Training fully covers Radio ServiceMen Licensing requirements — is suitable for entry to Radio Location work and Radio Maintenance work in the Forces.

SEND FOR THIS BOOK

First thing to do if you want to secure the facts about Radio is to send in for "Careers in Radio and Televisian," a lavishly illustrated book, published by the College and available to approved enquirers. Send in coupon for your copy now. It's free and post free!

FREE

LOOK WHAT A.R.C. HAS DONE FOR THESE MEN

"I'm blessing the day I started learning radio at the A.R.C. As things stand at present, I have earned enough to cover all my expenditures; these include (1) the Course paid for; (2) two meters value pre-war (£26)—worth a lot more now; (3) four radios to learn on and experiment with, plus a fair amount of stock on hand value roughly £15, and best of all, worth more than all, a decent future."

H.B., Western Australia.

I am writing to let you know that I, who took your service engineering course, am now in camp with the 1st Corps, HQ Sigs of the 2nd A.I.F. I am in as a radio maintenance man and instrument (radio) mechanic. Because of the training I received from you, I am able to take my place as engineer in a wireless station or mobile van radio station. Because of the training I have had I am able to pass tests set by the instructors where many fail, and it will probably mean two or three stripes for me as N.C.O. in charge of full transmitting equipment.

C.T.S., Melbourne.

To L. B. GRAHAM,
Principal of Australian Radio College.

Dear Sir—
Please send me, without obligation on my part, the free book, "Careers in Radio and Television."

NAME ....
ADDRESS ....
.... A.R.W.

AUSTRALIAN RADIO COLLEGE Pty. Ltd.

Cnr. BROADWAY & CITY ROAD,
SYDNEY — Phone: M 6391 — M 6392

Printed by the Bridge Printery, 117 Reservoir St., Sydney, N.S.W., for the proprietor of the "Australasian Radio World," 117 Reservoir St., Sydney