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VOL. 8 ..... NO. 3 AUGUST 15 1943

Amplifier 5

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Summary of common faults indicates causes of inefficiency.

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ALL-WAVE ALL-WORLD DX NEWS

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EDITORIAL

Recently I have accepted invitations to hear amplifiers and receivers which proud owners have considered to be the pinnacle of perfection.

In nearly every case I have been sadly disappointed, and without regard to the rules of etiquette and hospitality I have felt it my duty to insist on the production of a meter to prove the most blatant faults, such as putting three watts of energising power into a speaker field coil and then feeding it with ten watts of audio.

One of the amazing features of the human body is the way in which the senses will accommodate themselves to changed circumstances. They say that after working in a tannery, or other place where there is an obnoxious smell, the nose soon becomes accustomed to that smell and it no longer seems unpleasant.

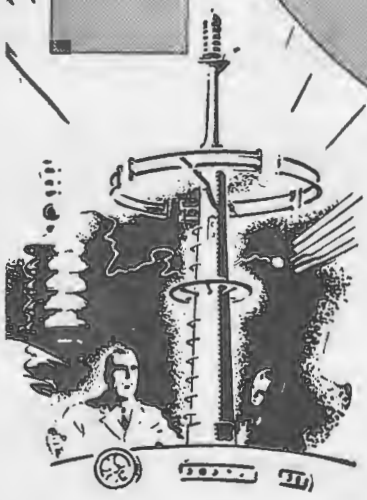
The ears have a similar characteristic. If you listen long enough to distorted reproduction you can eventually fool yourself into imagining that it doesn't sound too bad.

The ear, being such an unreliable judge of distortion, we suggest that wherever possible a periodic check should be made with meters.

Unfortunately it is not so easy to thoroughly check distortion with simple meters, but much can be done by indirect methods. If an amplifier is correctly designed and the valves and other components are in good condition, then it is unlikely that distortion will be present.

We specially suggest the testing of valves, and checking such points as the actual wattage in the speaker field, the plate current of each valve, and measurement of the effective bias voltage between each grid and cathode.

Watch R.C.S.



Radio developments, accelerated by increased war production and research have been "put in the ice" in the R.C.S, Laboratories until the end of the war. The directors of R.C.S. Radio feel confident that constructors and manufacturers who cannot obtain R.C.S. precision products fully appreciate the position and wish R.C.S. well in their all-out effort to supply the imperative needs of the Army, Navy and Air Force. The greatly increased R.C.S. production has been made possible by enlarged laboratory and factory space and new scientific equipment, all of which will be at the service of the manufacturers and constructors after the war.

Watch R.C.S.!—for the new improvements in materials and construction developed by R.C.S. technicians bid fair to revolutionise parts manufacture and will enhance the already high reputation of R.C.S. products.

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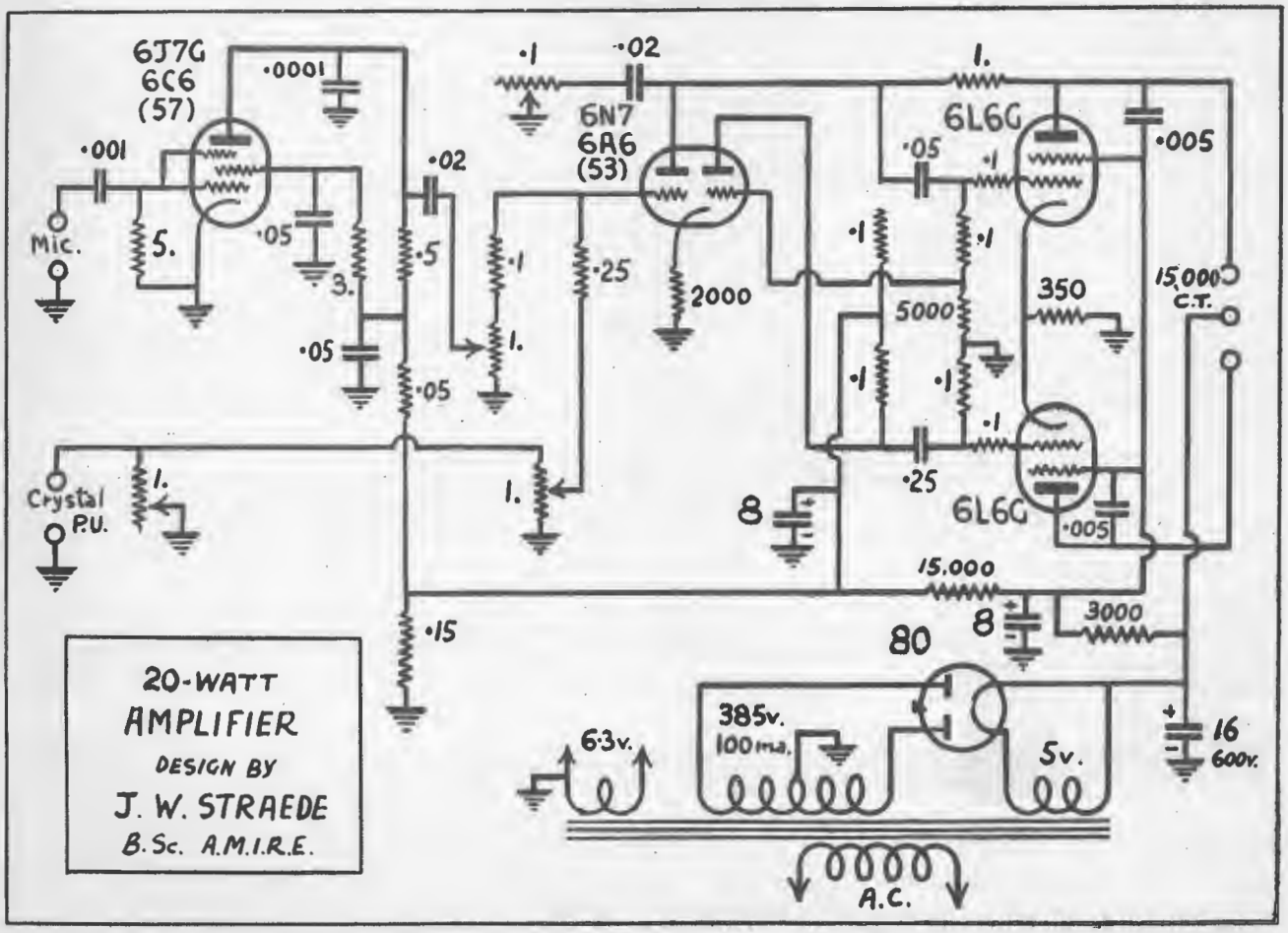
DESIGN FOR A 20-WATT AMPLIFIER

A description of a straightforward design in which quality and efficiency have been the aim rather than extreme output.

A photograph of the original amplifier.

A PAIR of 6L6G valves can be made to give a usable output of approximately 47 watts (60 watts under old ratings) but the required conditions are very difficult to obtain. Power is expended in the driver valve, separate rectifiers are required for anode, screen and bias voltages. The class AB2 transformer required is not so easy to design, or as inexpensive to construct as the simple resistance-capacity coupling circuit.

The amplifier shown in the photograph uses a total of five tubes, one being a metal 2-in-1. This metal tube, a 6N7, may be replaced by its glass equivalent, the 6N7G, or 6A6, by its 2.5 volt equivalent the 53, by similar twin triodes such as the 79, 6Y7G or by a pair of pentodes or triodes. The first tube is used for microphone only and may be dispensed with if only a pick-up is to be employed.



20-WATT AMPLIFIER
(Continued)

The circuit is quite simple and uses fewer parts than most amplifiers — for example, there is no power choke, this being compensated for by inverse feedback (which reduces hum under certain conditions) and by extra filtering for the screens of the output tubes. Hum due to incomplete filtering is small compared to ragged high-pitched "induction hum."

Another item conspicuous by its absence is the cathode bypass condenser. The first tube uses grid leak bias, which is quite satisfactory for a himu triode or a pentode, and has the advantages of improving the bass response, not that that is really necessary for most microphone work. The second tube is really two valves in push-pull and the A.C. voltages across the bias resistor cancel out. The lack of the bypass condenser here, as well as in the output stage, helps to improve the balance.

Microphone Input

A rather peculiar feature is the connection of the microphone input to the suppressor grid as well as to the usual control grid. This has three advantages: First, the negative bias due to grid-leak bias is small and by making the suppressor slightly negative, improved operation is obtained. Secondly, the suppressor acts as an additional control grid, thereby increasing the amplification. Thirdly, the suppressor lug on the valve socket makes a convenient anchorage for the shielded wire going to the grid cap.

Effective Feedback

Inverse feedback is obtained from one of the output anodes. The feedback voltage is applied to the first anode of the 6N7 phase-inverter so that it is effectively applied to both output tubes. Not very much feedback was found necessary. If required, and if gain allows, more can be used by decreasing the feedback resistor from 1 to ½, or ¼ megohm.

It is rather difficult to specify the value of the bias resistor for the output tubes. It is, you will notice, rather on the large size. In our original amplifier, we aimed at using a standard 100 ma. power transformer and the actual current drawn depends largely on the regulation of the transformer. We found that for most power transformers and a type 80 rectifier, the bias resistor could be reduced to about 310 ohms (300 if you're game to overload the transformer by about 10 per cent). On the other hand, if a 5Z3 rectifier is used, or if the power transformer has good regulation, the resistor must be at least 340 ohms, so the circuit shows 350 ohms just to be on the safe side.

There are two tone-controls — one is a straight out high-cut control of the usual type. It consists of a .02 mfd. condenser and a .1 megohm variable resistor in series between the first 6N7 anode and the chassis. The other is a variable shunt across the pick-up input and its action depends on the type of pick-up. For a crystal pick-up, reduction of load resistor decreases the response on the lower frequencies, whilst for a magnetic pick-up, the reduction of load resistor decreases the response on the extreme highs (very handy for hiding scratch and needle-hiss).

Chassis Dimensions

The chassis, which measures 15 by 6½ by 2¼, takes all the components without cramping, the main reason for the length being the number of controls, inputs and output along the front. The top and front is of sheet metal, whilst the ends, back and coverplate underneath, are of wood.

There are few snags in construction if good parts are used and care is taken with insulation. Condensers across the output (these are mounted right on the 6L6G valve sockets) and generous "grid stoppers" prevent any possibility of parasitics. All "earths" for any one valve should be made at one point. Dont' forget to earth one side of the filament, the side is usually not critical, although sometimes one side gives less hum when earthed. Coupling condensers and condensers across the output, should be mica insulation types or of 600 volt rating (working).

Selection of Speaker

It is not much good building a 20-watt amplifier and then feeding it into a 10-watt permag. speaker. You may or may not, damage the speaker, but you certainly won't be getting the best out of your amplifier. Use either a good quality heavy-magnet permag. such as the Amplion 12P64, or Rola 12/42, or a pair of speakers in parallel. If you are using a pair of speakers, choose an unlike pair so that what one speaker misses, the other will reproduce. Suggested combinations are an Amplion 12P30 with Rola 5/7 or 5/8 (18,000 C.T. trans. for the former, 50,000 for the latter) or a Rola 12/20 with an Amplion 7P20. For the latter pair, put the voice coils in parallel and use a single 25,000 C.T. speaker transformer of the "K12" type.

A Test Panel For Vibrator Testing

By
JOHN BRISTOE
Radio Manager,
Denham's Radio Service
Maryborough Queensland.

TO the writer's knowledge there is no type of vibrator tester available to the serviceman or experimenter. His only way of testing is to check the vibrator in a set, by ear (and the right set is not always available) or with another vibrator. Either means give only a very crude test.

Tested in Practice

The instrument given below has been in operation for some time in my workshop and has proved of very great assistance, but due to shortage of some parts (particularly the 5 pin special socket with one thick pin as used in a number of sets today) I have refrained from publishing it. However, I have since managed to procure a limited number of these.

The Meters Used

Meters are also scarce, particularly the 0/1 mil type. However, the meters used in this tester need not be 0/1 mil. It requires the following:

1. Moving iron A.C. Voltmeter. Any type reading not more than 50 volts full scale will do, but for preference, use one that is 25 volts full scale. If a meter with a smaller scale is used a resistor can be fitted in series with it to make it suitable for the higher voltage reading required.

2. The second meter is simply a milliammeter that has to read 20 mils at least. A 50 mil type is ideal.

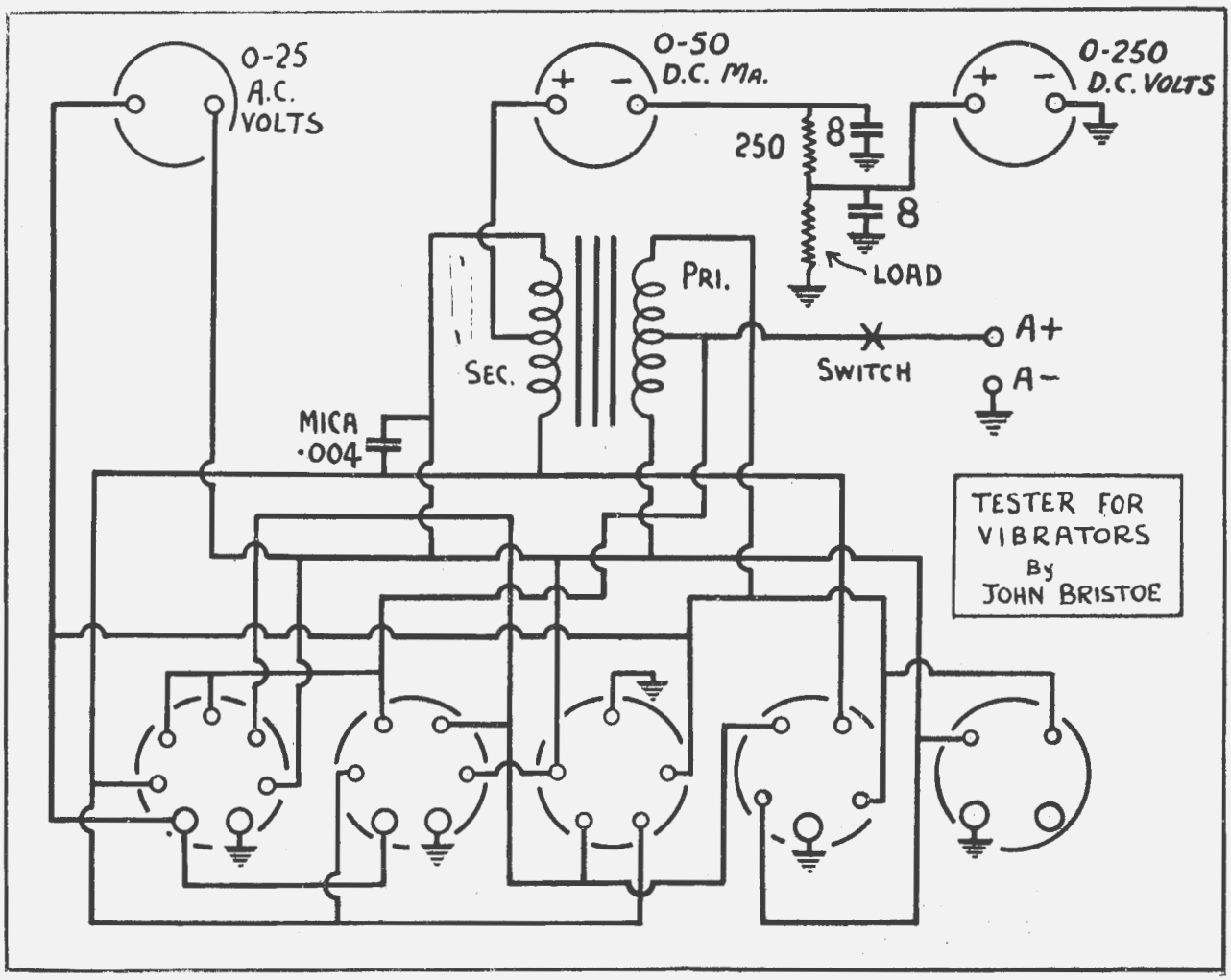
3. The third meter is a D.C. milliammeter of practically any type that can be used as a voltmeter with 250 volts full scale.

I used an 0/250 millmeter with the shunts removed. By using a suitable resistor in series to make it read 250 volts, the original scale worked in nicely.

As almost 90 per cent of the vibrators in use are 6 volt, the transformer used in the tester is a 6 volt type.

This is suitable for testing all 6 volt and 4 volt types, although the 4 volt types will show different readings. However, a switching arrangement can be incorporated to switch in any

(Continued on page 8)



VIBRATOR TESTER
(Continued)

type of transformer by just turning a knob.

Voltage Switch

In one instrument built I incorporated a 2, 4, 6, 12 and 32 volt transformer in the circuit and switched whichever was required into the circuit with a 5 position contact switch. Of course, it is necessary to test the vibrator on whatever voltage it is intended to work, i.e., when testing a 6 volt vibrator the battery clips are on a 6 volt battery, or on 4 volts for a 4 volt vibrator, etc.

Lay-out

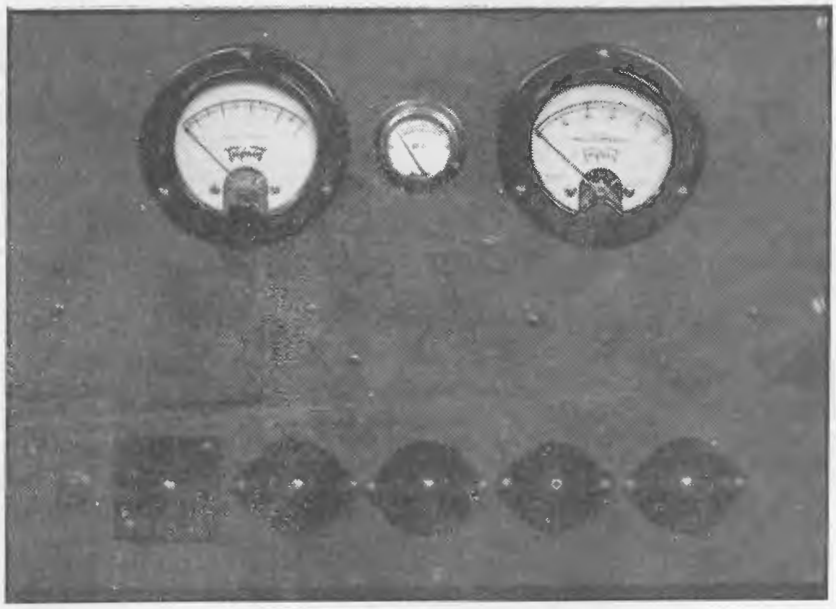
As can be seen from the layout, there are different sockets on the panel, as follows: small 7 pin standard, 6 pin standard, 5 pin, special 5 pin, standard 4 pin. The 7 pin types are rare in this part of the country, but there are a few so it is incorporated.

This tester was designed with the idea of testing the usual types of synchronous vibrators used in practically all home receivers.

There are a few sets that use non-synchronous vibrators and a separate rectifier, either metal or valve type. These are mostly in car radios, and can be checked with the A.C. voltmeter only as they will give no indication at all on the milliammeter or D.C. voltmeter.

The load resistor is actually a voltage divider of reliable make that will stand at least 20 mils without getting too warm.

The load resistor shown across the H.T. should be varied until the milliammeter shows 20 mils total drain. This being satisfactory for the usual types of vibrators.



A photograph of the vibrator tester.

Calibration

When you have finished building the unit, get a good synchronous vibrator and plug it in, then switch on. If any of the meter pointers go too far over, switch off immediately and check for shorts, or make sure that they are adjusted to indicate the required loads.

My original unit has a variable resistor in series with both the A.C. voltmeter and D.C. voltmeter, and in both cases they are adjusted to read exactly half scale when a good vibrator is plugged in.

The milliammeter is, of course, left alone as a correct milliamp reading must be shown.

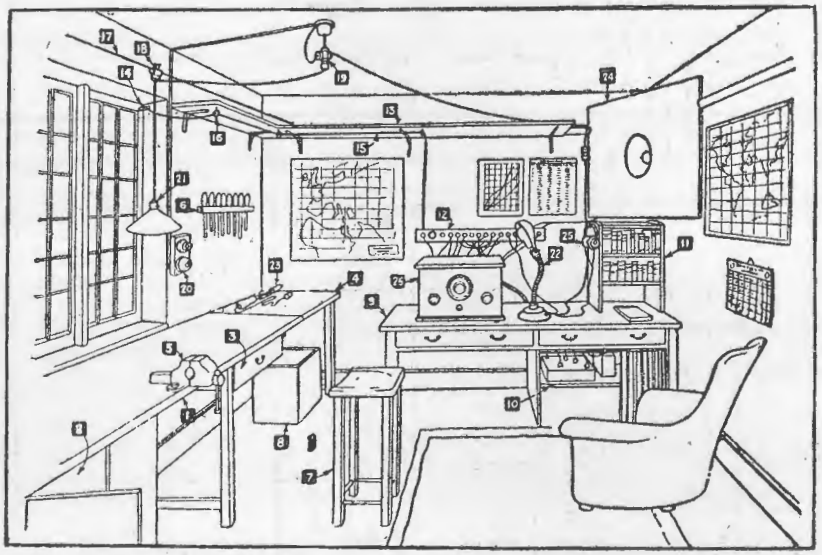
The unit can be built into a metal, wood or masonite case. The metal case is preferable, particularly if it can be earthed, as unless it is shielded, when a vibarator is being tested it is liable to cause of certain amount of local interference to any radios nearby. Do not overlook this point, or you may have complaints from neighbours.

Other Uses

Apart from testing vibrators, this unit is very useful for repairing and adjusting vibrators, a proceeding rendered necessary by the scarcity of new units.

When adjusting a vibrator it can be plugged into the tester and left there while being adjusted.

Any serviceman with a number of vibrator sets to service will find this unit invaluable. In normal times when vibrators are plentiful, it is a "silent salesman" for new vibrators as a customer can see his old vibrator tested in the same manner as a valve.



AN IDEAL RADIO DEN

According to "Practical Wireléss" (England) here is an ideal lay-out for a radio den.

No. 1.—Work bench. 2.—A useful cupboord. 3.—Tool drower. 4.—Sheet of zinc. 5—Vice. 6.—Tool rack. 7.—Bench stool. 8.—Scrop box. 9.— Testing bench. 10.—Battery compartment. 11.—Bookshelf. 12.—Universal terminal strip. 13.—Shelf. 14.—Lead-in tube. 15.—Aerial lead-in. 16.—Insulated hook. 17.—Stout galvanised wire. 18.—Sliding Clip. 19.—Three-way adaptor. 20.—Wall-plug and switch. No. 21.—Light plug and switch. 22—Adjustable lamp. 23.—Electric soldering iron. 24.—Loud-speaker. 25.—Headphones. 26—A set under test.

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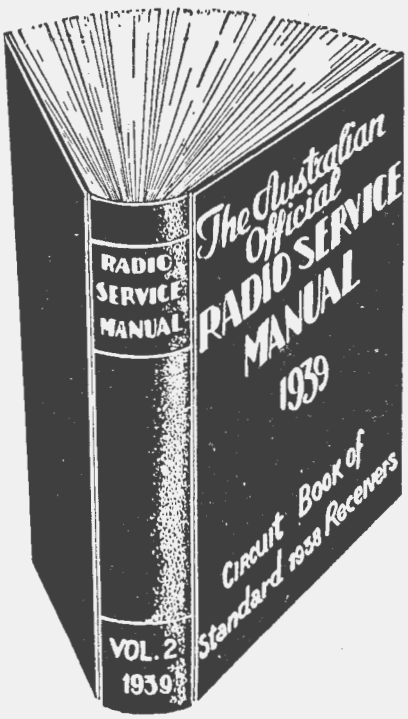

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COMMON ERRORS Of AMPLIFIER PRACTICE

THE most common mistakes made are in the overloading of some part or parts, either because proper components are unobtainable, or because the designer-builder does not know the correct ratings of standard parts.

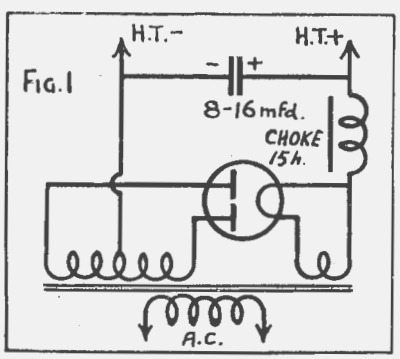
Valves are frequently overloaded as regards anode and screen dissipation and a reduced life results.

Where the maximum anode and/or screen voltages (as recommended by the makers of the valve) are exceeded (to improve regulation, to use a standard 385-volt P.T., etc.) it is advisable to increase the grid bias bringing the anode and screen currents to a value lower than normal, so that the anode **power**, product of anode voltage and anode current, is well within the limit. It is usually much safer to increase the anode voltage than the screen voltage.

Power transformers are often overloaded, either through inability to calculate the total current taken, or through sheer carelessness. It is not generally known that some of the cheaper transformers have a definite "life" and do not last forever. Increasing the current drain by 10 per cent, increases the heat produced in the windings by over 20 per cent, and the life is reduced due to insulation breakdown. Choke-input filter systems allow a slightly higher drain than condenser-input filters, the voltage being sacrificed to obtain increased output current. Large P.T.'s are sometimes rated in terms of choke-input. Thus, a transformer rated to give 250 ma. from a choke-input filter can only be relied on to give about 190 ma. from a condenser-input filter.

Speaker Overloads

I have often seen a well-built "13-watt" amplifier such as the Radiotron A504 coupled to a light-weight permag. speaker capable of handling only 8 watts without distortion. This overloading of the speaker results in a reduced cone-life, besides wasting the amplifier power. Speaker distortion is insidious — it creeps in so gradually as the volume is increased that often it is not noticed until the amplifier has been operating for a while. Sometimes the distortion is first noticed on a deep bass note that acquires an "edge", showing the addition of high-pitched harmonics.



Rectifier feeding into choke instead of condenser gives lowered high tension voltage.

Speaker transformers are also overloaded, sometimes as regards current, more often as regards power. There is a limit to the current carrying capacity of the primary winding and it must be remembered that at full output, the primary carries two currents: D.C. from the H.T. supply to the anodes and A.C. from the amplification of the signal. (Theorists might call the resulting current pulsating D.C., but it's R.M.S. value, and ability to burn out the wire is greater than the steady D.C. value). Excessive D.C. current may not burn out the wire but may cause distortion due to the iron core becoming magnetically saturated. It is a good idea to keep the D.C. (the steady anode current) as low as possible.

Tubes	Plate Volts	Bias Res.	Load P-P.	Output (watts)	Plate Curr.
45	275	780	7800	4	78
45	275	835	4000	6	67
2A3	250	375	5000	7	120
2A3	300	785	5000	10	80
50	450	770	9000	9.1	108
50	450	1050	5000	13	83

FIG. 2

Chart showing operation of valves in push-pull.

Speaker	Field Watts	Current for 1000ohm field	Current for 2500ohm field
K8	8	89	57
K12	9	95	60
12E12	8	89	57
12E22	10	100	63
188	7	84	54
180	8	89	57
182	8	89	57

FIG.3

Suggested field energising for various types of speakers.

The power-handling ability of a speaker transformer depends to a large extent on its core size, but the rating is different from power-transformer design as distortion must be avoided. The ordinary threequarter by seven-eighth core will carry up to about 8 or 10 watts, but for higher powers a larger core is essential.

Most speaker manufacturers make special transformers, a little larger than standard, and these are what the amplifier builder requires.

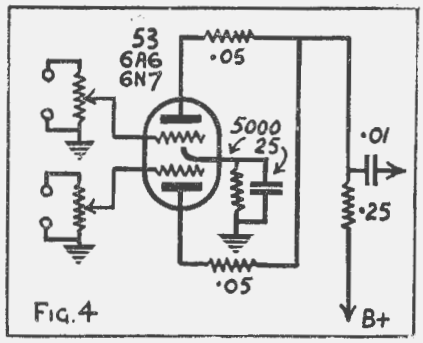


FIG.4

An input mixing circuit using a twin triode.

Output Valve Bias

Many home-builders lose power, overload components, etc., by having insufficient negative grid bias on the output tubes. A bias resistor equal in resistance to half the value for a single tube is **not** enough.

A slight increase in resistance beyond this half-value is generally accompanied by an increase in the maximum usable power.

A pair of 50's with 450 volts anode-filament gives less than 10 watts with a 765 ohm bias resistor, but 13 watts when the resistor is increased to 1065 ohms.

Some high-mutual conductance triodes, e.g., 2A3, 6A3, are easily damaged by insufficient bias. These 2A3 and 6A3 tubes, when used in push-pull may quite well have their resistor increased from 375 (half of 750) ohms to 550, 600, 700 or even 850 ohms, i.e., using a **larger** resistor for two valves! And without losing power!

Similarly with 6V6G tubes in push-pull. For a single tube at 250 volts, the bias resistor required is around 250 ohms. For push-pull operation, the resistor is not 250 divided by 2, but 165 to 175 ohms and an increase to 200 or 250 ohms causes only a very very slight drop in power. With 300 volts on plate and screen, the resistor should be 225 to 300 ohms.

It is not generally known that the addition of inverse feedback to under-biassed valves causes a reduction in power (assuming sine-wave input) whereas the application of negative (inverse) feedback to over-biassed tubes produces an increase in the output power.

Speaker Fields

Manufacturers of speakers specify a certain power to be "used" in the

(Continued on next page)

ERRORS
(Continued)

field coil of the speaker. The power is actually dissipated in the form of heat and too much power in the field coil means too much heat and risk of burning out the wire and/or insulation.

Too little power means that insufficient current flows in the field coil and the electromagnet is insufficiently magnetised, resulting in loss of efficiency (and loss of volume) a lack of the upper high frequencies and a pronounced peak in the bass response. Some makers will provide extra-heavy field coils so that plenty of power can be dissipated in them, resulting in a strong magnetic field across the voice coil. This makes for increased sensitivity and an extremely smooth response. Sometimes the field coil of a 12-inch speaker can be fitted to a 10 or 8 inch speaker, if the humbucking coil (usually useless to home-builders) is removed. The amount of power that can be dissipated with safety depends mainly on the **weight** of the field coil, the ventilation (presence or absence of a "pot" cover), shape of the field coil and heat-conducting path. With permag. speakers, the strength of the magnetic field depends on the magnet. Generally heavier magnets make the better speakers.

Electronic Mixing

When two inputs (say for microphone and pick-up) are to be operated simultaneously with separate volume controls, the adjustment of one control should not interfere with the other input. To prevent this a separate input valve is sometimes provided for each input and volume control to feed into. The anodes of the two valves supply their signals to the grid of the next tube.

This system is called electronic mixing and gives good results providing suitable precautions are taken to prevent distortion.

When a twin triode, e.g., 6N7, 79, 6SC7, is used as the two input valves, their anodes should not be directly connected, as this results in too low an anode load. Each valve, with the anode resistor in parallel, acts as the anode load for the other. The effective anode load is therefore less than the plate-resistance instead of being three or four times it.

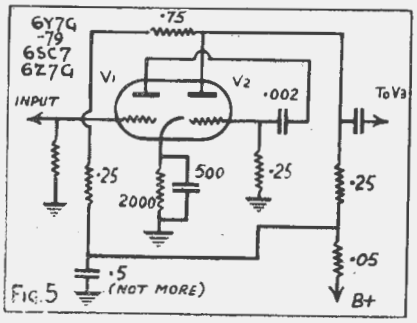
To prevent this, isolating resistors can be inserted at various places, resulting in a negligible drop in gain, but a definite decrease in harmonic distortion, especially for high-level signals.

Pentodes do not suffer from distortion when used with low values of load, and so do not require isolating resistors. However, 2-in-1 pentodes

are not widely manufactured, and the need to employ two tubes makes them little used as electronic mixers. Multiple tubes such as the 6J8G and multi-grid tubes such as the 6A7, may be used as single-tube electronic mixers, the pentode section acting as the output.

Hi-mu Triodes

Sometimes a pair of hi-mu triodes, or the elements of twin triode, are used in cascade as voltage amplifiers. Such an arrangement sounds very nice to people who dislike "pentode tone" but is not so good for really high-fidelity reproduction. Due to the valve capacities (grid-plate capacities are high intriodes owing to the lack of



A twin-triode amplifier with inverse feedback. (Note: the plate of V1 should extend up to connect to the junction of the .25 and .75 resistors.)

earthed screen) there is a distinct attenuation of frequencies above 5,000 hertz even when grid and anode resistors are reduced to the minimum.

It is easier to get pentodes working in cascade because the screening effects of screen-grid and suppressor reduces feedback of highs and more gain can be obtained with fewer stages. This latter means less phase reversal at high and low frequencies and the possibility of more negative feedback if required.

When twin-triodes are used in cascade with a common cathode, either the cathode should be earthed and filtered, decoupled, bias from a back-bias arrangement should be used or else the common cathode resistor should be bypassed by a huge condenser (say, 12 p.v. 1000 mfd.) to prevent oscillation or regeneration at low frequencies. Sometimes it is necessary to couple the two anodes by a 1 megohm resistor to prevent low-frequency oscillation (motor boating). A better arrangement is to couple the two grids by a 10 megohm resistor as this takes some inverse feedback to the input, reducing slightly the resonances of the pick-up or microphone.

Phase Inverters

It is common practice to omit the bypass condenser across the common bias resistors for valves in push-pull. This may or may not be a good thing. Although the A.C. voltages across the bias resistors are out of phase, this does not mean they cancel out as their wave-forms are not symmetrical. Generally speaking, class A AB systems do not require a bypass condenser, whereas class B (B1 or B2) do need a condenser. Theoretically, the condenser helps to stabilise the bias but this is of negligible importance unless the bypass condenser is of extremely large capacity (5000 mfd. or more).

Twin Triodes

Twin triodes used as phase inverters are in a different category. Here, no bypass condnser should be used and the bias resistor should be large, thus providing an appreciable degree of self-balancing. If there are three all-push-pull stages one after the other, the removal of the drive from one of the input tubes has very little effect on the final result owing to self-balancing action of the three bias resistors (providing, of course, that they are not bypassed). Even with only two push-pull stages, the removal of drive from one input has very little effect.

Another point not commonly appreciated is the effect of frequency response on phase-inverter operation.

The signal fed to the "second" output tube passes through one more stage than that fed to the "first" output valve (the one usually drawn uppermost in circuit diagrams). The extra stage is the phase inverter and this stage should have an excellent frequency response, otherwise the circuit would not be properly balanced as regards the "lows" and extreme "highs." A large coupling condenser (two or three times that of the corresponding direct stage) is required. An example: If the signal is fed via a .02 mfd. condenser to the "first" output valve, then the coupling condenser between the phase inverter anode and the grid of the "second" output tube should be .05 or .1 mfd.

Condenser Breakdowns

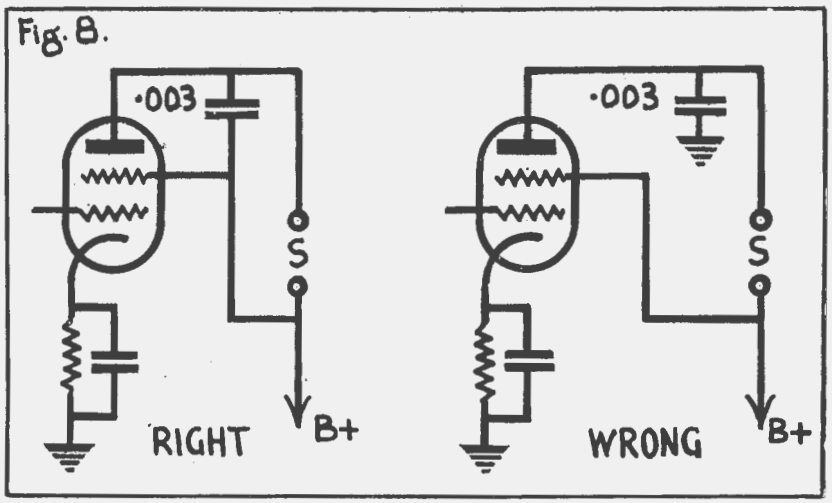
Nothing is more exasperating than the breakdown of an amplifier when used for some public function, especially when the cost of repairs is over a fiver!

A common cause of breakdowns is the exceeding of safe voltage ratings for condensers. The use of two electrolytics in series on the "high" side of the input filter is a good idea. No bleed resistors or shunt resistors are necessary to equalise the voltages if the electros. are of the wet or semi-dry type. Every amplifier should have a bleed resistor, even if it draws only a couple of milli-amperes, as that lessens the potential difference across the electrolytics and other condensers while the valves are warming up.

A Point to Watch

Condensers are often connected between the anodes of the output valves and the chassis to reduce the high-note response and/or prevent oscillation or parasitics. This is very foolish, as the peak voltage between anode and chassis is equal to the sum of the bias voltage, anode to cathode D.C. voltage, and peak A.C. output voltage (up to about nine-tenths of the D.C. voltage for a pentode or beam tube). The total is quite impressive, and is too much for a condenser of 400 volt rating. A better plan is to connect the condenser between the output anode and the H.T. supply (or

(Continued on next page)



In order to ovoid possibility of breakdowns, condensers should be fitted across lowest permissible potential.

ERRORS
(Continued)

the screen-grid of the output tube). This reduces the D.C. voltage to almost zero, leaving only the A.C. voltage, the peak value of which seldom exceeds 350 volts (assuming 400 volt H.T. supply).

A tone-control should never be connected across the output of an amplifier. Supposing you attempt to shunt 25 per cent of the power of a 20-watt amplifier through a small element in a carbon potentiometer. The potentiometer element soon burns out.

Coupling Condensers

It is foolish to use condensers of 600 volt rating for bypassing bias resistors, the voltage across which is usually only a few volts, but at the same time the voltage rating of coupling condensers should be as high as possible, because the leakage through such a condenser is usually inversely proportional to the voltage rating. Leakage through the coupling condenser reduces the grid bias of the following tube, causing it to draw excessive plate and screen currents.

Coupling condensers should be of at least 600 volt rating and not too large in capacity, as the leakage through a paper condenser is usually directly proportional to the capacity. The following grid resistor should not be too high as a high value of grid resistor increases the effect of condenser leakage on the grid bias voltage. A leakage current of only one micro-ampere (one milionth of an ampere) will reduce the bias by one volt if a grid resistor of one megohm is used. Too large a coupling condenser paves the way for motor-boating (low frequency valves and/or speaker at the output valves and/or speaker at the bass resonant frequency is reduced by using smaller coupling condensers in the earlier stages, in fact in any stages over which inverse feedback is not applied.

A.C. Mains

Condensers are sometimes connected from one or both sides of the A.C. in put to the chassis. The object of this is to remove a particularly obstinate form of hum, often rather high-pitched. The same device is used in radio receiver design to reduce modulation hum (i.e. hum present only when set is tuned to a station). The practise is not the best and is not used so much nowadays, as modern power transformers are usually provided with an effective electrostatic screen. Sometimes the earthing of one side of the filament and the bypassing to earth of the other side will suffice. Another method often of value is to connect a small condenser, say .00025 to .001 mfd. from each rectifier plate to the chassis. Such condensers should be either mica, 750-volt rating, or paper, 600-volt rating, or higher.

If a condenser **must** be connected from the main to the chassis, then its capacity must be as small as possible, certainly less than .01 mfd. and preferably less than .001 mfd. and its voltage rating must be 600 volts working, or higher. Mica insulation is advisable.

R.F. Pick-up

When an amplifier is used near a broadcasting station, sufficient R.F. may be picked up to cause overloading of a stage, distortion or even damage to a crystal microphone. This can be prevented by inserting a suitable resistance, say 20,000 ohms in series with the grid of the first tube and connecting a small condenser, say .0001mfd. between the same grid and the chassis. The anode of the first, and possibly the second tube, might require to be earthed via a small condenser, .0001 to .00025mfd. in capacity and of suitable working voltage (say 600 volts). It is also a good idea to connect a fairly large condenser from each side of the secondary of the speaker transformer to the chassis. Earthing the frame of the speaker is also helpful. For voice coils of from 2 to 20 ohms, there is no change in tone or volume if .05 condensers are used. Such bypassing also reduces the possibility of oscillation due to feedback of high frequencies from speaker cable to input valve.

Volume Control

Where an amplifier has a single input and is used only with a microphone, the volume control should not be at the input, as then **noise** in volume control is given the full amplification which is most undesirable.

After the first valve is the best position for the microphone volume control.

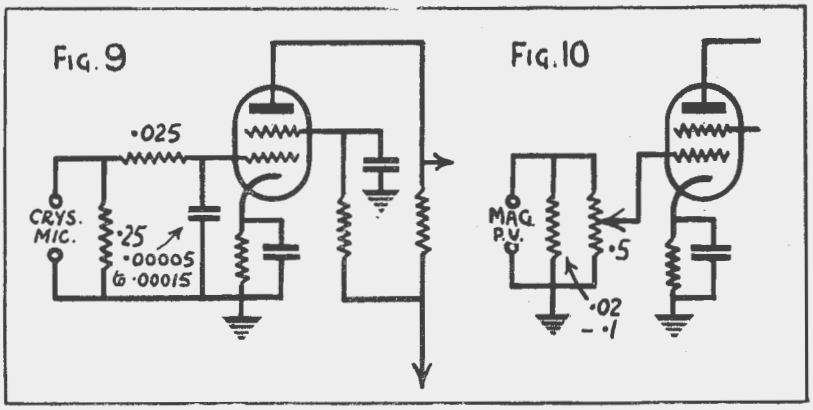
A pick-up, on the other hand, can quite easily overload the input stage, so its volume control must be connected between the pick-up and the valve to which it delivers its signal. An exception to this is when the pick-up has negative feedback applied directly to it in certain tone-compensation and equalising systems.

Whilst on the subject of volume controls, these are often of the wrong value. The ½-megohm potentiometer generally employed is too large for most magnetic pick-ups which require input impedances of from 20,000 to 100,000 ohms. High resistance potentiometers seem to become noisy sooner than those of lower resistance. Possibly the conductive part of the element is thinner and wears more rapidly.

The input resistor, after a microphone designed for speech, depends on the type of microphone. For a ribbon (velocity) microphone, the input resistor should be large, to prevent loss of "highs" and is there only to stop the grid floating while the microphone is being plugged in. A crystal microphone used for speech required a **fairly low** value of resistor, say, 250,000ohms, to prevent undue bass response, which would result in boominess.

Valve Sockets

Some output valves and rectifiers draw very large filament currents as much as 3 or 4 amperes, and sockets designed for ordinary radio receivers are not capable of carrying this current without overheating and charring of the insulation. Ceramic sockets will withstand higher voltages and larger current. Careful soldering of **thick** filament leads to the valve socket lugs sometimes improves the current-carrying capacity of the valve holder as the thick leads conduct away part of the heat (assuming they're thick enough and are not hot themselves).



Prevention of R.F. pick-up.

Reduction of vol. control impedance for magnetic P.U.

THE MEASUREMENT OF RESISTANCE

By

J. W. STRAEDE, B.Sc.

MAYBE it's a speaker field, or just a resistor with colour chipped off. How do you measure its resistance?

Resistance is **invariably** measured by the voltage drop across it when a certain current flows. Invariably. The basic principle is Ohm's Law, one form of which states that the voltage drop across a resistance is equal to the product of the current in amperes and **the resistance in ohms.**

Simple Method

This leads to a very simple, but not very accurate method. A 1½-volt dry cell is connected in series with a milliammeter and the resistance to be measured. The meter reads the current flowing and the voltage drop is assumed to be nearly all of the 1½ volts. Suppose the meter reads 25 ma., or .025 ampere. Then E equals 1 × R and R equals E/I where E is voltage drop, I equals current in amperes and R equals resistance in ohms.

R equals EI/

= 1½ divided by .025

= 1½ × 40 = **60 ohms.**

Not Accurate

This method is not very accurate because the voltage drop across the unknown resistance is not 1½ volts. Part of the voltage (electrical pressure) is used up across the cell itself and across the meter. Besides, if the resistance happens to be too small, then too much current will flow and burn out the meter, or at least bend its pointer.

The accuracy may be considerably improved by using a separate meter, a voltmeter, to measure the actual voltage drop across the resistance, but again inaccuracy must occur, because a small part of the current goes through the voltmeter instead of through the unknown resistance.

In ordinary "multi-meters" and "volt-ohm-meters," only one meter, a milliammeter is used. To make up for the drop in voltage across the meter and cell or battery, a large resistor is inserted in series with them and adjusted until the total resistance of battery (or cell) meter and resistor is equal to some fixed value, usually such that the meter gives full scale deflection with zero external resistance. As the resistance to be measured increases, the meter reads less and less. (The meter is said to be backward reading.) Finally the deflection of the meter needle is too small to be measured, thus setting an upper limit to the resistance that can be measured. The resistance of the battery or cell changes with age so that there is another reason why an adjustable resistor is required in the multi-meter.

Low Ohms

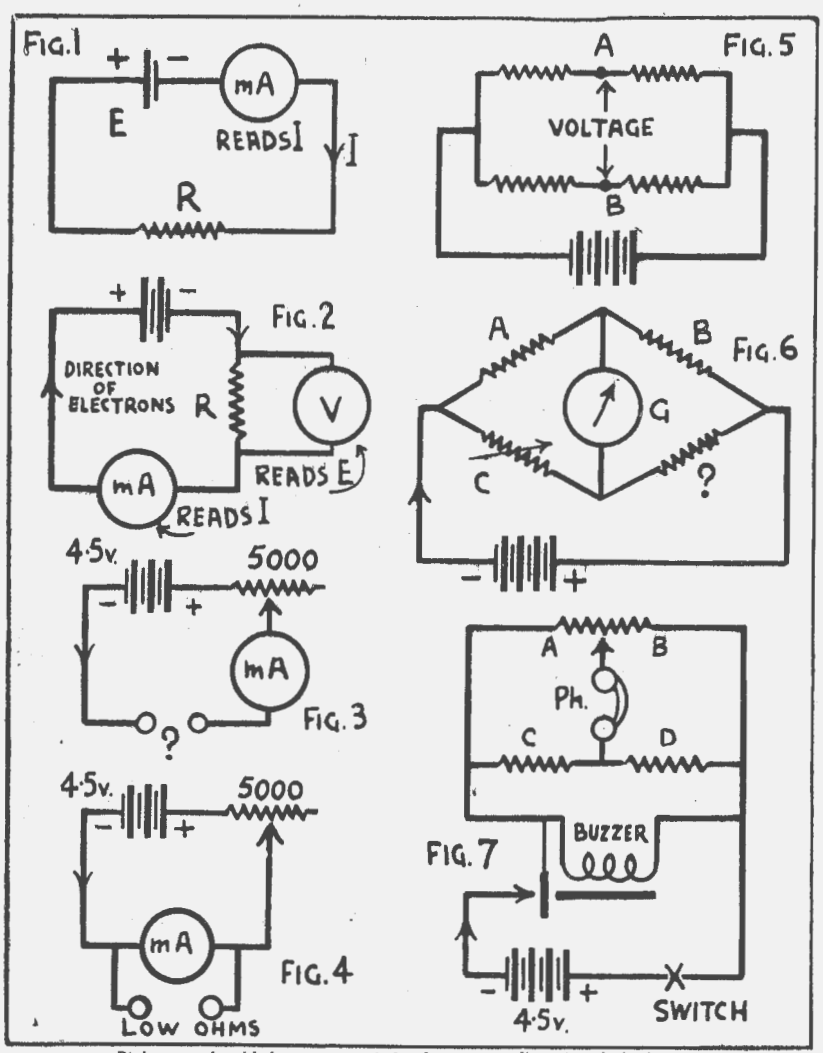
For low resistances the unknown resistance may be connected in parallel with the meter, thus bypassing some of the current. As the resistance to be measured is made less so more current is bypassed and the meter reads less. The higher the meter reading, the greater the resistance. Such "low-ohm" meters are therefore "forward-reading."

All the methods considered so far depend on the accuracy of calibration of the meter(s). Small commercial meters may be calibrated to within 2 per cent, but even 1 per cent is sometimes too much variation, so more accurate methods must be considered.

Bridge Methods

Resistance may be compared with the resistance of some "standard" (which may have been measured by a University to, say, one part in 100,000). A simple method is the "Wheatstone Bridge" invented by a man named Christie. If four resistors are connected in series parallel to a battery, then a voltage may be found between the resistor junctions not directly connected to the battery. If all the resistors are equal in value, or if they have values according to a certain rule, then this voltage disappears.

(Continued on page 16)



Pick-ups should have correct loading according to their type.

RESISTANCE
(Continued)

The disappearance of the voltage may be found by a sensitive galvanometer. The rule for this disappearance of voltage, or "balancing" of the Wheatstone Bridge is:—

A/B equals C/D

where A and B are the resistances in one arm of the bridge and C and D are the resistances in the other arm.

In practice, A and B are made equal, or in some convenient ratio such as 1:10 or 100:1. They are, therefore, called the "ratio arms." C is an adjustable resistance which is calibrated i.e., has a scale giving its values, whilst D is the unknown resistance to be measured. C is adjusted until the galvanometer G reads zero.

Then D equals value of C, multiplied by B and divided by A;

or D equals C × B/A

This "bridge" method is most accurate as the galvanometer does not have to be calibrated.

A.C. Circuit

If the circuit is supplied with A.C. instead of D.C. then an A.C. meter, a loudspeaker, or even a pair of phones may be used in place of the galvanometer. In fact, an excellent "bridge" may be wired up using a buzzer and cell in a soundproof box as the current supply and an earphone in place of the galvanometer. A and B may consist of a length of resistance wire and C can be a good quality resistor that has been accurately checked by some friend with a meter, or a specially accurate one obtained from the factory. Next month we hope to give constructional details of a "Metre Bridge," so called because the piece of wire for A and B is exactly a metre long.

Because A.C. will "pass through" a condenser (actually what really happens is that the condenser permits the current to keep flowing back and forwards, an A.C. operated bridge can be used to compare capacities of condensers. Inductances may also be compared.

RADIO DE-ICER

Details of a new electronic device which signals and measures ice forming aeroplanes in flight and automatically operates the plane's de-icers, were made public recently. The ice indicator provides the pilot with information on the thickness and rate of accumulation of ice on exposed plane surfaces, and, for the first time in flying history, permits de-icing equipment to be turned on at the exact moment it becomes most efficient. The indicator itself is composed of three separate units and utilises electronic principles for its operation. A pick-up plate or sensing element is mounted on the wing with the plane so as not to disturb the airfoil. It contains parts which actuate the mechanism by noting the accumulation of ice. The disc is connected to an amplifier inside the wing, which, in turn, is connected to a power-supply unit. The latter does the actual work of turning on the de-icers and registering the accumulation on an instrument board motor. The entire equipment weighs less than five pounds.

Radio Jobber News.

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THE BIG SPARK

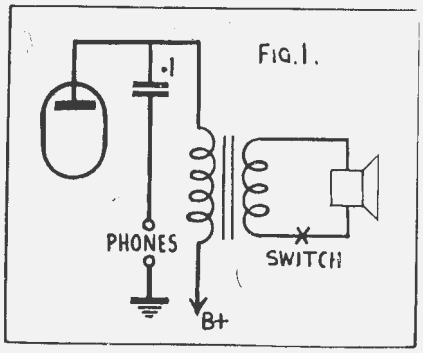
Lightning, which sometimes causes damage, does far more good than harm. In its passage through the air oxygen and nitrogen are combined by the electric arc action to form oxides which unite with the rain drops to form nitric acid. In this manner the soil is enriched to the extent of 100 million tons of nitric acid annually—more than is produced by the combined output of all the world's fertiliser plants.

HEADPHONES For QUALITY REPRODUCTION

It often happens that it is desired to use headphones with an A.C. set for one reason or another, and to do this there are several possible means of connection, depending upon the use for which they are required. As an example, when required for listening to Morse, fidelity is not important, but for ordinary broadcast programmes fidelity is of importance.

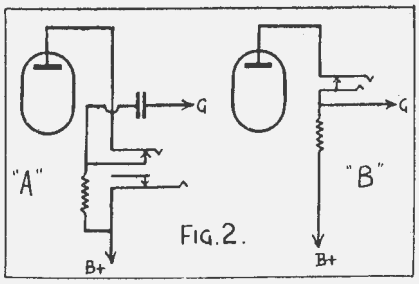
Let us consider the different methods of connection in order of merit.

One of the commonest methods is to attach the phones through a fairly large condenser (.1 or .25) between the plate of output tube and earth, as in Fig. 1. In this case the speaker is usually left going, although it can be turned off by switch X.



The simplest way to fit phones.

This system gives poor fidelity because the reaction of the condenser changes with the different frequencies; i.e., at 50 cycles its impedance will be approximately 20 times that at 1,000 cycles. As a result there is a considerably low frequency loss. If only speech or Morse is to be received this does not particularly, matter, however.



Two ways of fitting a plug-in jack.

Where less power is required, the phones may be inserted before the output stage by means of a closed circuit jack, as in Fig. 2. For local stations and quite a lot of distant ones there will be plenty of power available for headphones, and the quality will be quite good. Either a double or single circuit jack may be used, as shown, although the former will give slightly better results. The connections for both types are clearly shown in the diagrams.

A point to notice is that the insertion of the plug will automatically connect the phones and cut out the speaker, even though the output valve is left running. Under no circumstances should it be pulled out, as damage to the set may result if this is done.

A third method which will give excellent results is shown in Fig. 3. A speaker transformer matched to the output tube (as it always should be) is connected in the usual way, but instead of terminating in a voice coil a resistor of the same value is placed across the secondary. A pair of phones with an impedance of at least 10 times that of the resistor are connected across it as shown. Naturally a slight mismatch will occur, but it is negligible. The only disadvantage is that nine-tenths of the power is lost in the resistor, but with A.C. sets there is usually plenty to spare.

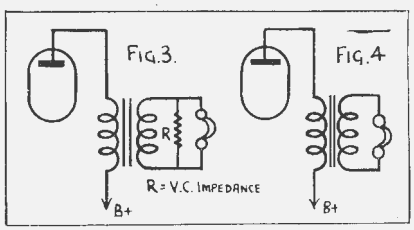
The fourth and best method is to use an output transformer with a primary to match the output tube and a secondary to match the impedance of the phones. In this way best quality reproduction will be obtained. See Fig. 4.

If the set has push-pull output all the above can easily be applied except that in the first case two condensers are used, one from each plate, as shown in Fig. 5.

It will be noticed that most of the above systems are permanent adaptions for phone work. If it is desired to operate the speaker when phones are not wanted, suitable switching devices can be fixed without any trouble.

In conclusion, it is hardly necessary to add that a good pair of headphones should be used, not only for the sake of quality, but cheap phones will definitely deteriorate often after only a few months, whereas others will last almost indefinitely.

—The N.Z. Radiogram.



Best results are obtained by using a suitable transformer.

"HANDLE WITH CARE"

This notice appears on equipment in use in Canadian broadcasting stations as a reminder to the users that much of the apparatus cannot be replaced. One notice adds, "the cord on this mike is mostly copper and rubber. Can you think of any other two materials as precious as these are today? Please be careful to avoid kinking, twisting, or crushing any microphone cord."

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AMERICAN FM STATIONS

A recent survey of FM stations in the United States revealed that there are at present 37 commercial stations and eight experimental transmitters in use. Some of them are radiating a 24-hour service. In addition to these transmitters there are a further 17 "under construction," the building of many of them, however, is delayed because of the shortage of equipment.

(In case you don't know, FM stands for frequency modulation, a form of transmission in which Australia is sadly behind.)

From Detector To Speaker

The need for audio amplifcation between detector and speaker is explained in this article– which also outlines the theory and construction of the audio transformer.

AT the conclusion of last month's instalment describing the operation of a typical three-valve battery receiver, we left the signal in its audio frequency form after it had passed through the detector and had been stripped of remaining r.f. by means of an r.f. choke and by-pass condenser.

The signal is now in exactly the same form as it was after leaving the microphone at the transmitting station, and before it was impressed on the radio frequency carrier wave. By the process of detection the signal has been transformed from a radio frequency signal oscillating at the rate of say a million times a second, to an audio frequency signal varying from perhaps 50 to 15,000 times per second.

Audio Valves Needed for Speaker Operation

This signal is still comparatively weak, though it could operate a pair of headphones connected in the plate circuit of the detector valve, thus transforming the electrical impulses into the sounds that originally impinged on the microphone diaphragm. However, to provide sufficient power for loud-speaker operation, further amplification is necessary, and this is provided by adding an additional valve or valves. Just as the amplifying stage ahead of the detector was called the r.f. amplifier, because amplification there takes place at radio frequencies, so the amplifying valve or valves following the detector comprise the audio frequency amplifier.

One common way of effecting amplification is by using an audio frequency transformer immediately following the detector, and coupled to the succeeding valve in the chain. This can be the last valve in the set, as in the circuit under discussion, or it can be followed by still another valve to give still greater amplification. Thus, in the circuit shown, the transformer "T" couples the detector valve "V2" to the output valve "V3."

How an Audio Transformer is Made

An audio frequency transformer consists of two windings of wire on an iron core, special iron alloys being generally used in order to intensify the magnetic effect. If a solid iron core were used, losses due largely to eddy currents would be extremely high, and so laminations are employed to build up the core. As well, the core must be of sufficient size to avoid saturation at the maximum value of primary current passed.

The two windings are called the primary and secondary. The primary winding, which generally consists of something like 3,000 turns, is wound over the laminated iron core. Next, a layer of insulation is put on, and the secondary winding is wound alongside (or over the top of) the primary, as illustrated in fig. 2.

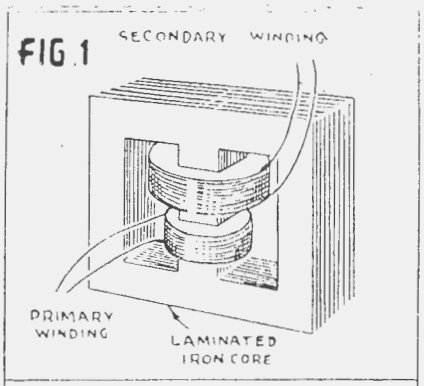
The ratio of the number of secondary turns to the number of primary turns varies from 3½:1 to 10:1, the former ratio being very commonly used. This means, for example, that if the primary consists of 3,000 turns, the secondary has 9,000 turns, and neglecting losses, the signal applied across the primary would be amplified three times.

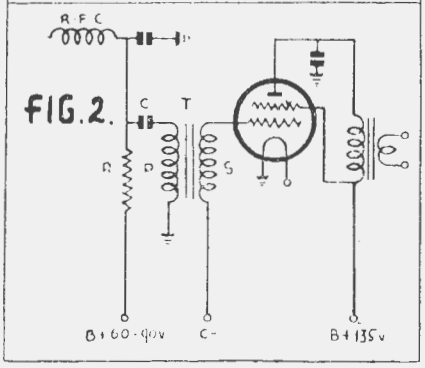
It should be noted that voltage only, and not power, is increased by this process. Coincident with the step-up in voltage there will be a corresponding step-down in current (amperes). Assuming that the transformer is 100 per cent. efficient, the power generated in the secondary measured in watts (volts by amperes), will remain the same as that developed in the primary.

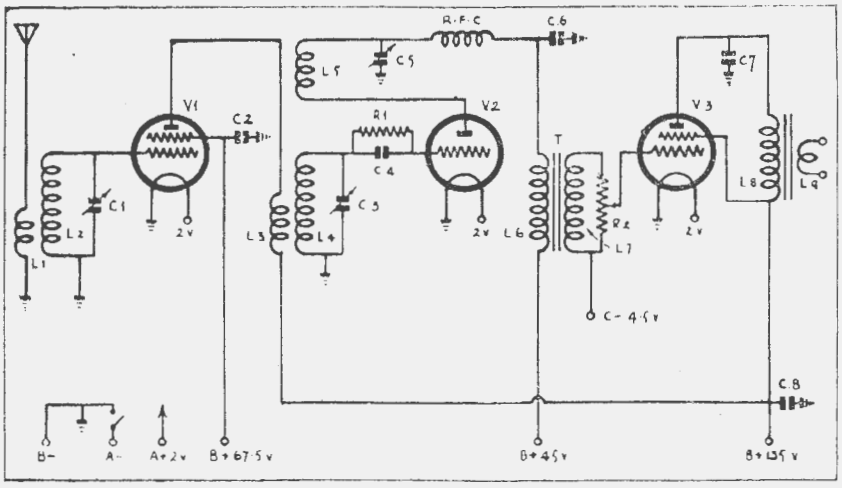
However, the normal audio amplifying valve is a voltage-operated device—current is of no importance. Hence the object is to produce the largest possible voltage variations between the grid and filament of the valve. Though an audio transformer cannot amplify by itself, it greatly increases the output of the valve following it by virtue of the voltage step-up it gives the signal developed across the primary.

From the above it might be assumed that the ratio of an audio transformer could be increased indefinitely, resulting in an enormous increase in amplification. Unfortunately, however, there are two practical restrictions.

The ratio of a transformer is determined by the number of turns of







STEP BY STEP
(Continued)

wire on the two windings, and to increase this ratio there are two alternatives, the first of which is to decrease the number of primary turns. However, this is impracticable, as for efficient operation the inductance of the primary must be kept above a certain value. One practical result of decreasing this inductance unduly is that bass response suffers seriously.

The other alternative — to increase the secondary turns indefinitely — is equally impracticable, as the result is an increase in the self-capacity of this winding. Appreciable capacity here is very undesirable, as it bypasses the higher frequencies.

It was mentioned earlier that the laminated core of an audio transformer must be of sufficient size to avoid saturation at the currents normally passed. Saturation is reached when further current increases fail to increase the flux density.

One way to avoid this saturation effect is illustrated in fig. 2, which indicates how parallel feed can be employed to divert the steady d.c. component of the plate current around the primary of the transformer. The resistance "R" has a value of the order of 30,000 ohms, depending on the plate resistance of the detector valve. The coupling condenser "C" should have an impedance sufficiently low so that the entire range of audio frequencies required in the output can be passed through it without difficulty. The value of .5 mfd. is suitable for most purposes.

POPULARITY OF RADIOTRON DESIGNER'S HANDBOOK

The Radiotron Designer's Handbook, edited by Mr. F. Langford-Smith and published by Amalgamated Wireless Company Pty. Limited, which was first issued in 1940, has been circulated very widely in Australia, the United Kingdom and the United States of America. This Handbook has been used more widely than any other reference book on radio engineering, and has been accepted as the standard book of reference on this subject in all three countries.

The total sales to date exceed 125,000 copies in spite of the fact that the number printed in Australia and England has been limited on account of the paper shortage. A very large number of orders are still outstanding and it will be some time before all these can be met.

It is remarkable that such a good response should have been given to a book of Australian origin, when so many other books have been published in the English language, but it is an indication that Australia is not lagging behind these other countries in technical knowledge and ability.

How To Get The Best From A Small Short-Wave Set

By
PHILIP. A. G. HOWELL

THIS article is not a full description of how a short-wave receiver ought to be built, but rather aims at presenting and making clear some points of major importance, especially to the beginners who have been discouraged because their first short-wave sets did not perform as they had hoped.

If good results are to be expected the following things are of the greatest importance and must be attended to; otherwise money expended will be money wasted.

The first consideration is ease of handling. Fine tuning is the essence of DX, and this cannot be accomplished with sets having cramped controls or dials which do not run smoothly. Never mind what the appearance of the set is like unless you have plenty of money to spend; a plain knob is better if it turns the control smoothly than a jerky dial no matter how good it looks. The tuning control should be placed in the middle of the panel and on DX receivers this is the bandspreading condenser. The bandsetter or large condenser which tunes the whole range of the coil is then mounted to the right so that it may be adjusted quickly. The regeneration control, which it is usually necessary to handle frequently, is set off to the left of the bandspreader. Each control should be mounted at least 3 to 4 inches apart.

It should now be seen that the above will determine the circuit lay-out. Take first the breadboard or baseboard set. The wood should be fairly soft, preferably varnished, and above all things clean. If the regeneration control is in the plate or screen circuit the associated plate circuit and screen grid components will go with their wiring over to the left of the board, while those of the grid circuit are placed on the right. The tube sockets should be screwed down so that the leads from the elements run straight to their respective circuits. If total stability and absence of hand capacity is absolutely necessary, the front panel must be of metal, while if possible a grounded shield should be screwed across the base in such a manner that it isolates the detector grid and plate circuits. Sheets cut from biscuit tin or kerosene tin are better than nothing if suitably braced, for the shields must not be loose or flap. It is as well to keep the tube on the plate circuit side of the shield and the coil on the grid circuit side, provided the leads from the reaction coil can be well spaced away from the grid circuit parts. But do not make the only to common mistake of canning the tube and coil like sardines, as losses are the only natural result. Correct spacing and no shielding are always better than too much shielding. The antenna trimming condenser should be mounted at the top corner of the panel on the grid circuit side.

For a receiver built on a chassis the lay-out is much easier. All grid circuit wiring is kept above the deck and all plate wiring underneath, each stage being separated by a metal shield. The parts can be set with the bandspreader in the middle antenna trimmer on the left and bandsetter on the right, above the chassis, while the regeneration control is mounted below and to the left of the bandspreader through the chassis, while the on/off switch offsets it on the right. When using a condenser in the grid line to control regeneration it will be mounted in place of the antenna trimmer, which will go up to the left top corner of the panel. Even when using grid control it is advisable to leave the potentiometer in the screen lead or plate lead in the case of triodes, to act as a variable resistance to regulate the voltage of different wavebands.

How to construct satisfactory coils is a thing which comes only with experience, but nevertheless there are some points worth noting which are not customarily described. Coils should be wound as close to the base of the former as is practicable — that is, usually about ¼-inch, keeping leads as short as possible, taking care to see that the reaction coil leads are not tangled with the grid winding leads. It is advisable to make the grid winding of as heavy a gauge wire as can be handled, and the converse applies for the reaction coil. Also it should be kept in mind that as the voltage is lowered on the plate of the tube, so the number of reaction coil turns are increased. Never wind a coil, dope it and try it out afterwards. It should be wound and the reaction coil made so that it can be moved within limits (only fine gauge wire will permit this). Then it can be plugged in and the windings adjusted for maximum performance. It may then be doped with a light and clear dope.

Finally, good headphones and antenna are essential. All sawiyng in the line and lead should be reduced to a minimum to stop capacity effects.

So remember these points and improve your reception.

—N.Z. Radiogram

Raising The Dead With Radio !

We cut the coupon. In due course we received the lavishly illustrated catalogue packed with information on this and that and mentioning things which we are sure do not exist (e.g. gramophone motors, speaker with 112 ounce magnets).

There were beautiful tables of bias loads, tables of reactances and last, but not least, a table giving the power required for a sound-system to do various jobs.

Looking through the last table we found the various uses for a 10-watt amplifier (we, in Australia, would probably make do with a 5-watt), the uses of a 25-watt amplifier, then a 35-watt, and so on.

The last column in the table dealt with application of a super-super "75 to 120 watts" sound system. (What a job—only a mere 18 tubes). One of the applications listed was **"Funeral Parlours."**

Now why is 75 watts (or 120) required in a Funeral Parlour? Is it to drown the laments of the dear departed's relatives, or to provide soothing music to help him on his journey to the next world.

Having recently listened to a mere 30-watt job being played "full bore" we decided that the 75-watts could do one job only and that was the raising of the dead. After all, 15-watts will drown almost any amount of wailing, 20-watts will fill a picture theatre with music, 25-watts will quieten our son-an-heir (now aged 22 months) and 50-watts will load up five long-horn P.A. speakers.

Hearing 75-watts the poor tortured soul returns to earth to beg forgiveness, change its will or do whatever else is required by the operators of the super-super sound system.

Anyway, a certain model aeroplane club got into trouble for disturbing a church service half-a-mile away with a vibrator amplifier of about 3 (three) watts.

—J.W.S.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY—

TOMMY HANDLEY'S BOOK SHOP

Got a laugh from Tommy Handley when he put over a good one in the above sketch on Friday, July 23, at 9.45 a.m. (session commences at 9.30 and through GRG, 25.68 is fine).

Lady said she wanted a book on rural matters. Tommy replied, "Yes, Madam, have you heard the story of the four bulls?" "No," said the lady. "Well," said Tommy, "there were four bulls. One said he would like to fight and he would join the Army; the second said he wanted to go to sea, so he joined the Navy; the third said he wanted to fly, so he joined the R.A.F." "But what about the fourth?" enquired the lady. "Oh," said Tommy, "he said: 'Listen, boys, I'll just stick around and be a cowboy'."

Am inclined to think,, by the time this issue is being read, daylight reception will have passed its peak. There is every indication that from 10.30 or 11 a.m. till near 1 p.m. signals fade badly and stations of an evening that were doubtful in the early part of the night are showing up pretty well. Sometimes these showings forecast an early Spring. Those of us who are compelled to rise early will welcome the warmer weather, so I hope my opinion of conditions is not just wishful thinking.

SOME DAY WAITING WILL END

Enquiries for Radio gear necessary to adapt Country sets to City requirements, suggests Doctor Gaden will soon be back at the receiver.

FROM THE SHAKY ISLES

The Pacific Panther, Arthur Cushen, as usual has a new one. This time PRL . . ., "Radio National", Rio de Janiero. On 9.72 mc., is heard from as early as 8 a.m. in Spanish transmission and still going strong at 10 a.m. No English heard, but usual bells of PRL8 used often, and many references to Propaganda Department and Radio National.

Mr. Cushen also tells of further successes in competitions and refers to having won the best of the year verifications at the local DX Club with WRRN, a 250-watter on broadcast in Warren, Ohio and ZOY on Shortwave. Result, 2 cups, 11 certificates and a pair of fireside ornaments.

SAN FRANCISCO STATIONS BEAMED TO AUSTRALIA

KROJ, 15,190 kc, 19.75 m.: 6.15—7.45 a.m. Eastern Australian Standard.

—,9897 kc., 30.31 m.: 6—11 p.m. Eastern Australian Standard.

KWV, 10,840 kc., 27.68m.: 4—6.30 p.m. Eastern Australian Standard.

KWID, 9570 kc, 31.35 m: 5—8.15 p.m. Eastern Australian Standard.

Here a few of the regular and popular features:

News, every hour on the hour. All stations.

Sports Today, 6.05 p.m. All stations.

Re-creation Top Base Ball Games, Daily, 6.15—7 p.m., KWID.

United Nations on the March. Daily, 4.05, KROJ, KWV.

Name Bands. Daily, 8.05—9 p.m. KROJ.

What American Commentators Say. Daily, except Sundays, 5.45 p.m. KWID.

Command Performance. Sunday, 4.15 p.m. KWV, 7.30 KWID.

G. I. Jive, Tues., Wed., Thurs., Sat., Sun., 4.45 p.m., KWV.

Hi Neighbour, Tues, Wed., Thru., Fri., Sat., 7.15 p.m., KWID, KROJ.

Sidney Roger Commentary, Tues., Wed., Thurs., Fri., Sat., 8.05 p.m. KWID.

Orchestras

Fred Waring: Tues., Wed., Thur., Fri., 5.45 p.m., KWV.; 10.15 p.m. KROJ.

Freddie Martin: Sun. 7.15 p.m., KWID, KROJ; Mon., 5.45 p.m., KWV.

Tues., 9.05 p.m., KROJ; Sat., 4.15 p.m. KWV.

Andre Kostelanetz: Sun. 10.30 p.m., KROJ; Thur, 4.15 p.m., KWV.

Harry James: Mon., 6.45 a.m., KROJ; 6.30 p.m. KROJ, KWID.

Tommy Dorsey: Mon.: 7.15 a.m., KROJ.

Russ Morgan: Sat., 9.05 p.m., KROJ.

Shortwave Notes and Observations

AUSTRALIA

VLQ-2, Brisbane, 7.215 m.c., 41.58 m.: This new one is R8-9 at 9 p.m. and only a slight surge. (Perkins).

VLQ 7.24 m.c., 41.44 m.: Is O.K. in a.m. but surge is still there (Perkins).

AMERICA—NORTH

KROJ, 16.89 m. has been replaced by 19.75 m .(L.J.K.)

KWID on 19.62 m. has greatly extended its schedule. Opening at 7 a.m. it continue the programme for the Americas till 2.45 p.m. Then, after 15 minutes, comes back directed to the East till 4.45 p.m. As can be imagined, they get into trouble with VUD-3, but can be copied for most of the session.

At 5 p.m. KWID moves to 31.35 m. and still puts in the best signal of the day (L.J.K.).

WGEA was picked up on July 12 at 6.08 p.m. with an R-7,Q-4signal, but it quickly dropped to R-3, Q-3 and at 6.53 was fading badly. When announcing at 6.8 p.m. said "The Voice of America is reaching you over stations in the 31, 38, 49, and 47 metre bands (L.J.K.).

KROJ, on 9.89 m.c., 30.31 m. has improved a lot in its evening session to Australia. The added feature, "Name Bands", heard from 8.05 till 9 p.m. should prove popular (L.J.K.).

KKQ, Bolinas, 11.95 m.c., 25.11 m. has the Philco programme of "Our Secret Weapon", all about the enemy propaganda, at 1.15 p.m. and "Lucky Strike" Hit Parade at 1.30 p.m. on Saturdays. (Cushen).

WKLJ, 30. 77 m. heard calling AFHQ at 9.15—9.30 a.m., after which the usual "Voice of America" programmes are heard (Cushen).

KROJ, 9.89 m.c., 30.31 m. varies a lot there. Occassionally it is good throughout, but very seldom. Most nights it weakens after 10 p.m. and by closing time is hardly audible (Matthews, W.A.).

KES-3, 28.25 m. is R-4 at 6.30 p.m., never much here and now relays KGEI (Perkins).

WLWO 39.6 m. now R-4 around 6 pm and seems irregular (Perkins). WLWO when closing at 6.30 p.m. say, ". . . We leave the air at this time to change frequency. We will return in fifteen minutes on 25.6 metres, a frequency of 11.710 kc. Tune for news in English on the hour." (L.J.K.).

WLWO, 11,710 kc., 25.62 m. I could not find the signal loud enough to copy at 6.45 p.m. (L.J.K.). Mr. Perkins of Malanda says he hears WLWO on 25.62 m. at 6 a.m., but there is no sign of them down here at that time.

KWY, 39.6 m. is a "beaut" from 6.40 p.m. (Perkins).

WBOS, Boston, 48.86 m is R-4 at 7 p.m. (Perkins). (Mr. Perkins letter was written a little while ago; WBOS now closes at 6 p.m. (L.J.K.).

KWID, 31.35 metres present a recreation of Top Line Basball games from 6.15 till 7 p.m. nightly (L.J.K.).

WRUL on 25.58 m. when closing at 4 p.m. says: "We will return at 415 p.m. on 7805 kc., and on WRUW on 6040 kc." (L.J.K.).

AFRICA

ABYSSINIA

—, Addis Abab, 9.62 mc., 31.17 m. now on the air from 1.40 till 2.30 a.m. Gives relay of BBC news at 2 a.m.

ALGERIA

Radio France 12.12 mc., 24.75 m. and AFHQ 8.9½ mc., 33.48 m. can be heard in parallel at 2 a.m. Announcing at that hour as Radio France, "This is United Nations Radio coming to you from North Africa." 2.15 German, 2.30 Englsih announcement, 2.31 French, and at 2.45 when Italian commenced there was terrific jamming (L.J.K.).

EGYPT

SUV, Cairo 10.055 mc., 29.84 m. in parallel with SUX, Cairo, 7.865 mc. 38.15 m. is putting in a louder signal at 2.30 a.m. Both sign off at 3 a.m. with bell. (L.J.K.)

SUX, 38.15 m. is fairly good at 4.10 a.m., but at the same hour SUP-2 47.47 m. is much better.

FRENCH EQUATORIAL AFRICA

FZI, Brazzaville, 11.975 mc., 25.06 m: Said to be operating from 9.15 till 10.30 p.m. but morse at that hour would make it impossible for me to follow even if on. I am told they are also on the air from 2 till 3 a.m. This time presents difficulties for me, but would be pleased to know if any readers have heard FZI at this hour.

The afternoon session can be heard through the more, but that is unfortunately always prevalent. At 3.55 p.m. the Kissantzi for two minutes precedes the announcement, "Ici Brazzaville".

FRENCH MOROCCO

CNR1, Rabat, 37.34 m. is good at 4.20 a.m. (Gillett).

KENYA COLONY

Local news in English is heard at 2.15 a.m. on VQ7LO, Nairobi, 6.06 m.c., 49.50 m. folowed by dance music (L.J.K.).

One of the outstanding signals of the month was VQ7LO, Nairobi on 27.96 m. when closing at 5 a.m. on July 2. Reports were asked for and to be sent to Box 777, Nairobi, Kenya Colony. They announced that all letters would be acknowledged (Gillett).

THE EAST

CHINA

XGOY is still unlucky in the attempts to give us a special broadcast on 19.73 m. Night after night I tune in at 8 o'clock, but noise invariably kills any signal that may be there. Later in the night XGOY is more fortunate when directed to America and at midnight can be tuned in on 31.10 m. and through XGOA on 30.86 m. when news is given. News is also heard through XGOY at 12.30, 1 and 2 a.m. when sometimes it is heard as well on 40 metres. (L.J.K.).

NEW STATIONS

KROJ, 'Frisco, 15.19 mc., 19.75m: This one was briefly mentioned in June issue. I am now able to give some further particulars regarding same. The programme heard at 8.01 a.m. is beamed to Alaska and closes at 9 a.m. The station now opens at 6.15 a.m. and till 7.45 a.m. is beamed to Australia. It has replaced the 17.76 mc., outlet which was found unsatisfactory. Unforunately, on 19.75 metres it is sometimes 7 a.m. before it is at all pleasant to listen to, but here's hoping it will imprave.

WLWK, Cincinnati, 9.59 mc., 31.30 m.: First hear on Saturday, July 10, at 9 p.m. when announcement was made in English. Then ran off into Spanish giving call sign and station particulars again at 10.30. Closed at 11 p.m. Excellent signal when opening, but got mixed up with VUD-4 after 9.30, but still strong enough to be copied.

This is the first time I have heard The Crosley Corporation depart from WLWO.

VLQ-2, Brisbane, 7.215 mc., 41.58m.: Not sure when actually opened, but first heard on July 8. Excellent signal. Schedule: 5.30—11.30 p.m. daily.

WRUL, Boston, 11.73 m.c., 25.58 m.: This is not actually a new one, but it is so long since we have heard this outlet of the World Radio University it is being included in this category, as it will be new to a lot of our readers. I am not quite sure of schedule, but I have heard them closing at 9.15 a.m. and opening again at 2 p.m. where they stay till 4 p.m. On both occasions they were in parallel with WRUW 9.70 kc., 30.93 m.

WOA-4, New York, 10.515 kc., 28.53m.: Another "Vaice of America" heard from 8 till 10 a.m. News is given at 8 and 9 a.m. Signal is fair, but like its Californian cousin, KES-3, is in a noisy part of the band which someone has found excellent for Morse.

GREAT BRITAIN

One of the best stations on the air before breakfast is ——, London, on approximately 31.41 metres. Excellent when giving BBC news at 6.45 (L.J.K.).

Will be glad when London gives us some more call-signs. Am particularly anxious to know the one for the station on approximately 31.60 m. Very active in the mornings; at 8 o'clock news is read and at 8.15 "Yankee Doodle" is followed by ...— several times and then "Hier ist London."

GSF, 19.82 m. heard well at 11.35 p.m. (Gillett) and here is a list of BBC transmitters classed as heard well at 6.45 a.m. by Mr. Gillett of Adelaide: GRY, 31.25; GRJ, 40.98; GSU, 41.32; GSW, 41.49; GRK, 41.75; GRT, 41.96; GRM, 42.13; GRS, 42.46; GRN, 48.43; GRO, 48.54; GRB, 49.92. Others classed in the same category are: GVU, 25.47 and GSN, 25.38 at 4.20 a.m.; at 4 a.m. GRX 30.96; GRU, 31.75 and GRI, 31.86. At 2.20 p.m. GRX is good, while GRU at 3.35 p.m. is also good. Mr. Gillett continues his report on the London stations with: The following are very good at the times stated: GRF, 24.8 and GRO, 24.92 at 8.45 a.m.; GSE, 25.29 at 4.45 a.m.; GSD, 25.53, 11.20 p.m. and 7.45 a.m.; GSC 31.32 at 2.20 p.m.; GRG, 25.68 at 7.45 a.m.; GSB, 31.55 at 3.35 p.m. and 6.35 a.m.; GSA, 49.49 at 6.05 a.m. and GRH, 30.53, practically all day.

RUSSIA

Morning news at 7.15 is heard well on 15.23 m.c., 19.7 m. and on some days is almost as good on 15.11 m.c., 19.85 m.

On 9.545 mc. 31.43 m, Moscow gives gives news in English at 12.15 a.m. which at 12.30 is followed by Russian.

Moscow is also often heard from 5.45 p.m. on 15.503 mc., 19.35 m. giving letters to the front and a concert at 6.10 p.m.

The Home service transmitter of Moscow on 12.26 mc., 24.47 m., wtih an R-6 signal, can be heard at midnight.

And just to round off Russian transmitters, you can hear an R-6 signal from the one on 9.48 m.c., 31.65 m., at 1 a.m. in Dutch, 1.15 various languages and at 1.31 in Hungarian. (L.J.K.).

MISCELLANEOUS

Listeners will be pleased to hear that the Canadian Broadcasting Corporation are building a new Short-Wave Station, and it is expected to go on the air very soon. Reception from Canada has never been exceptionally good and at present we are more or less left to CBFY, Montreal, for news from that part of the world, which is given at 9.30, 10 and 11 p.m.

ICELAND

TFJ, Reykjavik, 12.23 mc., 24.54 m, is now weakening off, was very poor on the only occasion I heard them at 3.20 p.m. (Gillett).

SPAIN

EAQ, Madrid, 30.43 metres are quite good at 3.23 a.m. when lady announcer said, "This is the Spanish Broadcasting Network." (Gillett).

SWITZERLAND

HER-3, Berne, 48.66 m. gives a five minutes programme in English each morning, commencing at 6.55 entitled 'The Day at Home and Abroad." (Gillett.)

SYRIA

FXE, Beirut, 37.41 m. presents news in English at 2.35 a.m. which is preceded by a portion of "The White Cliffs of Dover." (Gillett).

TURKEY

Another station using many languages is TAP, Ankara, 9.464 mc., 31.70 m. At 1.15 a.m. Yugoslavian, 1.30 Arabic, 1.45 French, 2 a.m. Portuguese. If you wait till 2.15 you will hear news in English (L.J.K.).

TAP, Ankara, 31.7 m. is great strength with news at 3 a.m. (Gillett).

VATICAN CITY

HVJ, 50.26 m. is heard very well at 5.15 a.m. and on 31.06 m. closes with ringing of Church Bells at 3.30 a.m. (Gillett).

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." The great number of stations on the air makes it necessary to print schedules in sections. The 31 and 49 metre bands are shown in July issue.

Please make the following alterations to Bands shown in July issue:—
VLQ, Brisbane, 7.24 S 41.44, 6—10 am (Sun. 6.45—10.45).
VLQ-3, Brisbane, 9.66 S 31.05, 11.45 am—5.15 pm (Sun. 11 am—5.15pm)
—, Addis Abab, 9.62 S 31.17, 1.40—2.30 am.
And make the following additions:—
WGEA, Schenectady, 9.55 31.41 , 3—8 pm (Omitted from July issue)
WLWK, Cincinnati, 9.59 N 31.30. .. See particulars under "New Stations".
VLQ-2, Brisbane, 7.21 N 41.58. See particulars under "New Stations."
WRUL, Boston, 7.80 38.44 (Omitted from July issue)
Symbols: N—New stations; S—Change of Schedule; F—Change of frequency.

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 N	15.63	2.45—3.30 o.m.; 4.30—4.45 am; 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	2—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.
WRCR	New York	17.83	16.83	8 pm—7.15 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	16.85	11pm—2.30 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 om
OPL	Leopoldville	17.77	16.88	8.55—10.15 pm; 4.30—6.30 am
KROJ	'Frisco	17.76 N	16.89	Not in use at present
WRUW	Boston	17.75	16.90	1—3.15 om
—,	London	17.73 N	16.92	11.30 pm—1.30 am
LRA-5	B'nos Aires	17.72	16.93	Sots. 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	15.42 N	19.44	5.45--7 pm; 8 pm—1.15 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 om; 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
WGEO	——	15.33	19.57	10.15 pm—5.30 am.
VLI-3	Sydney	15.32	19.58	3.10—3.40 pm; 8.15—9.45 pm
GSP	London	15.31	19.60	3.45—7.45 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. ond Sat. from 6.30—8 pm.
KWID	'Frisco	15.29 S	19.62	7 am—2.45 pm; 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	8 pm—6.45 am; 7—9.45 am.
GSI	London	15.26	19.66	8.45 pm—1.15 am; 1.30—6.45 am
WLWO	C'cinnati	15.25	19.67	2.45—5.30 am
VLG-6	Melbourne	15.23	19.69	11.45 am—1.30 pm; (Sun. 12 noon—1.50 pm); 1.55—2.30 pm; 3.10—3.40 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
KROJ,	'Frisco	15.19 N	19.75	6.15—7.45 am; 8—9 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
HVJ	Vatican City	15.12	19.84	Mon. 10—10.15 am; 10.30—10.50 am; 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 F	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	23.13	8.45 pm —2.45 am; 3—4.45 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 S	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
XGOY	Chungking	11.90	25.21	Not in use at present.
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
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—7.35 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	25.35	7.25 pm; 7.30—8 pm; 8.15—9.45 pm
VLW-3	Perth	11.83 S	25.36	8.30—11.45 am; 1.30—8.45 pm (Sun. 8.45 am—8.45 pm)
—	Moscow	11.83	25.36	8.30—9.30 pm; 10.30—11 pm; 12.30—12.50 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

Call Sign	Location	Mc.		M.	Time: Eastern Australian St'dard
XEBR	Hermosillo	11.82		25.38	11—3 pm
COGF	Matanzas	11.80		25.41	2.30—5 am
KGEI	'Frisco	11.79	N	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	N	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	3—7 pm; 1.30—6.45 am; 11.15 am—2 pm
—	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	N	25.58	5—7 pm; 1.30—6.30 am
WRUL,	Boston	11.73	N	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
—	Geneva	11.71		25.60	9.45—11.15 am
YSM,	San Salvador	11.71		25.62	4—5 am
VLG-3	Melbourne	11.71	S	25.62	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm.
WLWO	Cincinnati	11.71		25.62	5.45—7.15 am
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
CBYF	Montreal	11.70		25.63	9.30 pm—1.30 pm
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	N	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		27.17	4—8.30 am; 8.45—10.45 am.
KWV	San F'cisco	10.84		27.68	4—6.30 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.

Call Sign	Location	Mc.		M.	Time: Eastern Australian St'dard
WOA-4	New York	10.51	N	28.53	8—11 am; 6.45—8 pm
—	Moscow	10.44		28.72	6 pm—1.45 am (often news at 9.40 pm).
PSH	R de Janiero	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
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
—	Brazzaville	9.98	F	30.06	4—5.20 am; 7—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	N	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; 6.15—9 am.
WKLJ	New York	9.75	S	30.77	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm
T14NRH	Heredia	9740		30.80	10—11 pm (Wed. Fri. & Sun. 1.30—3.30 pm)
CSW-7	Lisbon	9735		30.82	11 am—noon (not heard here lately).
CE970	V'paraiso	9730		30.82	9.30—11 pm; 7.30 am—2.30 pm
XGOA	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	S	30.93	4.45—8 am; 8.15—9.25 am; 9 pm—1.30 am
FIQA	Tananarive	9700		30.93	12.30—2 am
GRX	London	9690		30.96	3.30—6.15 pm
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-6	Perth	9.68	S	30.99	8—10 am

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

S.D.E. (Yandarra) has built the Trade Builder Mantel set, but does not get reception on shortwaves.

A.—The fact that you get reception on the broadcast band indicates that your set is probably correctly wired, so the foult is most likely to be in your coils, or wave-change switch.

Unfortunately, there were a few rother poor coils released by one firm which put up a kit of parts (the firm does **not** advertise with us!). Usually the trouble was due to a short in the trimmers, the mica insulation being knocked out of position during assembly of the coil unit. If you can raise one or more interstate stations at night with an indoor aerial, you can be certain that it is not the fault of your building, and the best thing to do is to take the set along to on expert serviceman with a signal tracer. Careful inspection of trimmers and switch contacts may help you to locate the fault.

●

L.H. (Burnley) finds that earthing his set reduces the volume slightly and asks the cause and cure.

A.—Your are probably using an indoor aerial. When the set is not earthed, the mains lead to the set and the short aerial act as a dipole aerial. When the set is earthed, the mains leod no longer acts as an aerial, reducing the effective pick-up. The cure is to use a longer aerial, or else refrain from earthing the set. Earthing is advisable, however, on the score of safety — sometimes there is sufficient leakage to give on unpleasant tingle when the chassis of an unearthed set is touched by the hand.

●

A.G.C. says: "I thought the formula for a bias resistor was R = E ÷ I. The valve data books gives the bias for a 6C6 as 3 volts, its anode current as 2 ma., so shouldn't the resistor be 1500 ohms? Yet 4,000 ohms is shown on one circuit diagram."

A.—The formula is certainly quite correct, although we'd like to point out that it includes screen current as well as anode, or plate current. The actual bias voltage required depends upon the screen voltage, the anode load resistor and whether the volve is used as an amplifier, detector or oscillator. When used as an anode-detector, large bias voltages are required, thus making the current low, so a large bias resistor (often as high as 50,000 ohms) is required.

A,R.D. (Rose Bay) wants more "Ideas in Circuits."

A.—Sorry, but there's a limit to the ideas that can be evolved. Just at the moment, the "Ideas" are marking time until we can present three or four each month, including in each month's collection, something original, which hos never been published before. Many of the original ideas so far printed have been evolved by our technical editor, Mr. Straede, or by students working under his direction. Later we hope to give you a collection of "crazy circuits" that have oppeared throughout the ages, and you should get plenty of ideos from them!

M.H.W. (Preston, N.S.W.) wants the connections for a 6H7M valve (a Canadian 2-in-1 type).

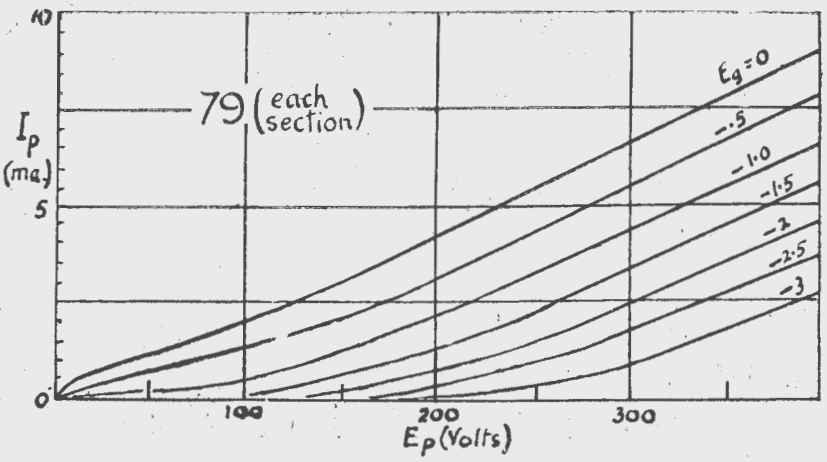
A.—Here it is. The valve consists of an output pentode similar to the 38 and hoving base connections as for a 6F6G, together with a medium-mu triode. The cap is the triode and control grid, the No. 6 pin is the triode anode. The pins (read clockwise) are: 1, shield; 2, heater; 3, pentode anode; 4, pentode screen; 5, pentode control grid; 6 triode anode; 7, heoter; 8, common cathode. Correct operating conditions for 250 volts operation are: bias resistor 600 ohms, pentode load 11,000 ohms. The triode is intended as a grid-leak detector, the grid-leak (1 to 3 meg.) being returned to the cathode and not connected across the grid condenser. The valve can be plugged in, in place of a 6F6G output valve and will work reasonably well, the triode section is then not used.

UNPUBLISHED VALVE DATA—No. 1

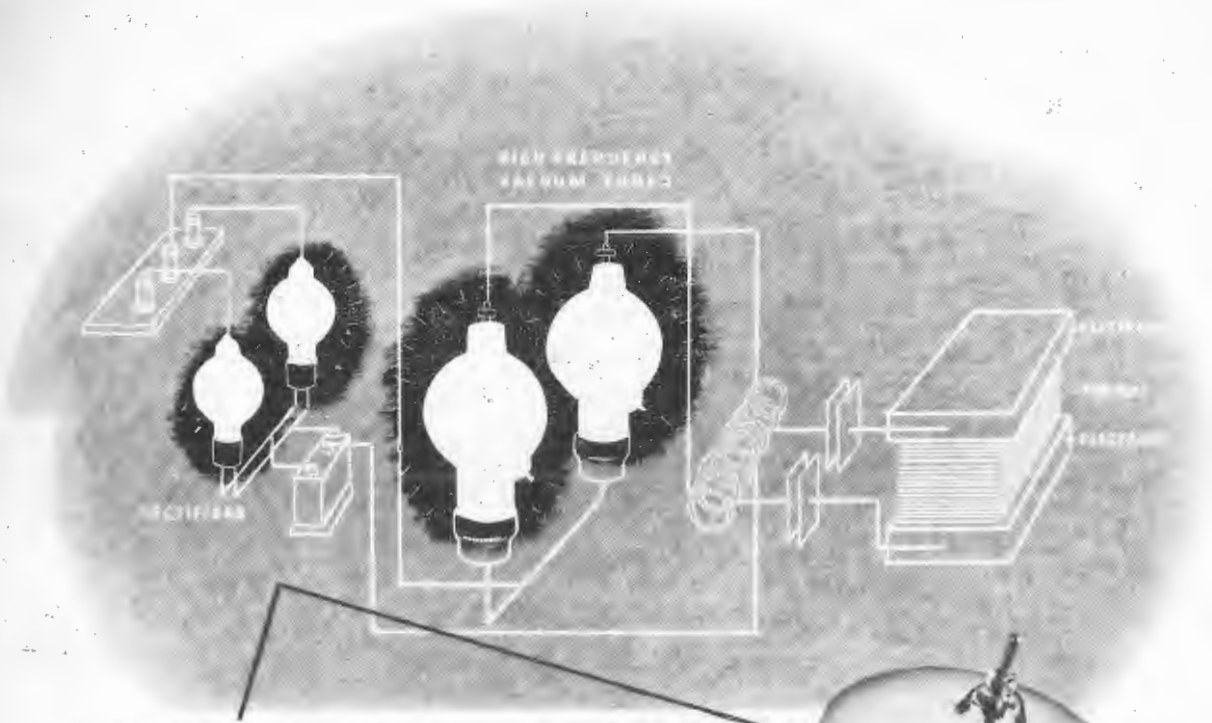
The excellent valve data charts which are published from time to time by valve manufacturers and distributors carry all the data usually required for the proper application of the valves in question. But there are times when the keen radio man finds a way of using a valve to suit his own particular requirements, although this particular form of application may not have been considered by the maker, let alone covered in the published data charts.

From time to time we come across data covering the unorthodox application of valves, and we feel sure that this data will be appreciated by our readers, as in most cases it has never been published in any popular radio magazines in Australia.

Take, for example, the 79 twin triode, which was originally introduced as an ouput valve for Class B amplifiers. It has since found application in dozens of different schemes, such as crystal oscillator and r.f. amplifier in transmitters, as a twin valve for efficient little one-valvers, and as phase-changer in amplifiers. The two triodes contained in its envelope are of comparatively high gain, with an amplification factor of about 80, a mutual conductance of 2 milliamps per volt, and a plate resistance of about 40,000 ohms. The actual characteristics depend on the grid bias, plate voltages and other factors, but the above, considered in relation to the curves shown above, will give a fair idea of what can be expected. The high gain and fairly high plate resistance make the valve ideal for resistance coupling, and for pre-amplifier stages ahead of a low-output microphone or photo-electric cell.



Characteristic curves for the triode sections of the 79 type valve.



ELECTRONIC BRIEFS: Electrostatic Heating

High frequency electrostatic heating is simply the use of electricity to create friction between the molecules of a substance. The generation of heat in non-metallic substances by molecular friction is accomplished by the application of high frequency current, which is converted from a standard power supply. The equipment used employs the basic electronic circuit used in radio transmitters. The output of the power amplifier is connected direct to the material to be heated exactly as the output of a transmitter is connected to antenna and ground. The energy is sufficient to cause the molecules within the material to distort and rub against one another very rapidly. The friction thus caused creates heat within the material.

As with all things in the field of electronics, Elecrostatic heating is wholly dependent upon the vacuum valves employed. Eimac valves are first choice of the world's leading engineers, first in the key sockets.of the important new developments in electronics. You'll get long life, dependability and superior performance with Eimac valves in the key sockets. Today Eimac valves are proving their superiority in the most gruelling test—WAR.

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G.H.T., Queensland.

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.

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

Dear Sir—

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.....A.R.W.

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