THE AUSTRALASIAN Radio World

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VOL. 8 ..... NO. 11 APRIL 15 1944

★ **Definition of communications set lists its ideal features.**

★ **Constructional details for making an electric guitar.**

★ **Utility circuit designs reveal interesting suggestions.**

★ **Short-wave section gives guide to reception of overseas stations.**

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For all Correspondence

★ **City Office** —
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EDITORIAL

We would not like to suggest that any of our readers could be unreasonable, but it is very apparent that a few of them are inclined to be completely carried away by their enthusiasm.

They seem to get so carried away, in fact, that they completely overlook the problems of the times and expect to find that "Radio World" has an unlimited staff of technicians with plenty of time to spare to go into the most elaborate details of component design in order to maintain the queries service.

Now, in case you are not aware, practically every radio magazine in the world has been forced to abandon its query service; we have stuck to ours so far in the hope that what little time we can afford will be duly appreciated.

There are one or two points we would like to suggest, as they will make it possible for us to give better results for the time made available. Firstly, please write plainly, on one side of the paper, as briefly as possible, yet giving all the necessary facts, and attaching diagrams on a separate sheet of paper, so that they can be studied at the same time as the letter itself.

Try and put yourself in our position and remember that the amount of time devoted to each query cannot possibly exceed ten minutes. Therefore it is quite useless to expect to have special power or output transformers designed to order. It is equally useless to ask to have a special set designed to use the junk or odd valves which you have on hand.

—A. G. HULL.

IN WAR— NO LESS THAN PEACE

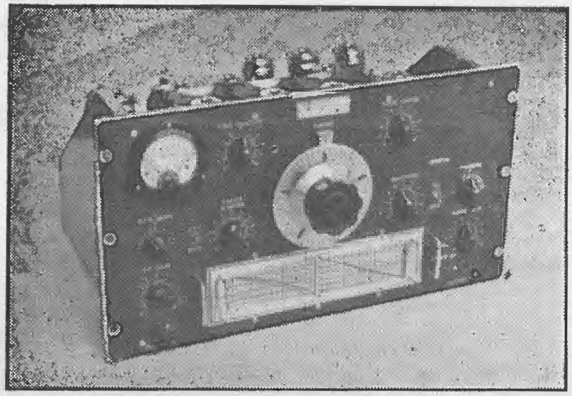
R.C.S. have not — and never will —lose sight of the fact that amateur construction and experiment is important in war no less than peace. Many servicemen now operating in forward areas recognise with confidence the familiar R.C.S. brand with which they experimented in their civilian days. Many enthusiastic young constructors of today are the wireless operators and signalmen of the near future.

R.C.S. are proud to acknowledge their debt to that band of never-tiring "hams" and constructors whose constant acceptance of R.C.S. improvements has enabled the company to reach their present unexcelled standard of radio component manufacture.

R.C.S. RADIO PTY. LTD., SYDNEY, N.S.W.

IDEALS IN DX SETS

SEVERAL times recently we have had occasion to mention "Communications Receivers" in our columns, and we have had several letters from readers asking for further details of these sets, or for a definition which will explain the difference between a good all-wave receiver and a communications receiver. Needless to add these readers are of the new crop; readers who followed up our articles a few years ago are well acquainted with the term and remember the circuits for receivers of this type which were featured from time to time.



An Australian-made communications set of the type which should be popular when the war is over.

Characteristics

A communications receiver is something in the way of a special set which in appearance, must never be contained in a console cabinet, but rather in a metal case or mounted on a rack and panel. It must never have an ordinary type of dial, but rather something in the way of one or more over-grown knobs, with plenty of figures on it. In fact, the front panel of the ideal communications receiver must have as many knobs as possible, each one labelled with its purpose in incomprehensible abbreviations, and scaled from one to ten or one to a hundred.

Technically.

To return to serious vein, however, and to go into the subject more reverently, the aim for performance is the maximum effective sensitivity and selectivity. Power output and quality of reproduction are of secondary importance, or more correctly, are purposely designed to incorporate features which would be considered inferior for commercial receivers for the broadcast band.

Sensitivity

High-gain throughout the set is necessary to give the super-sensitivity desired, but at the same time, consideration must be given to the way in which the gain is obtained, as sensitivity is useless unless the inherent noise level of receiver is kept as low as possible. With an ideal receiver it should be possible to short out the earth and aerial terminals and then turn the controls to "flat out" without getting excessive noise or hiss in the speaker. In practice the easiest way to keep the noise level down is to get as much r.f. gain as possible ahead of the converter stage, but to keep down the i.f. and audio gain. The efficiency of the converter stage is also vitally important, and it is quite a problem to get a converter which will operate reliably from below 10 metres to over 2,000 metres, yet have a low noise level and a minimum of frequency drift.

Selectivity

Extreme selectivity is not only desirable to separate stations on adjacent frequencies, but also to help in the matter of noise level, for the narrower the band of frequencies actually being received the lower will be the noise from static, etc., other things being equal. Similarly, in the audio end it is desirable to go to the opposite to broadcast set practice, restricting the tonal range to the middle register only, thereby cutting down the reproduction of the sharp crack of static or the heavy rumble of background noise. Maximum power output should be kept low, for otherwise an unexpected overload from a powerful station or a heavy burst of static may be reproduced with too much power. Highly desirable would be some power overload device to limit the maximum power output, although we doubt if this has ever been actually worked out in practice.

Number of Valves

The number of valves required will vary from about eight to a dozen, usually arranged as two r.f. stages to give greatest r.f. gain, thereby giving sensitivity without noise and also an absence of second-spot or image-frequency trouble, which can be confusing, as well as affecting effective selectivity on account of interference between the some spot and the desired station. Conversion is often obtained with a separate oscillator, making two valves required for this stage, but sometimes a pentagrid converter can be made to give satisfaction over the wide range of wave-lengths covered. Two more valves are required for the i.f. stage, mainly to get improved selectivity, no attempt being made to get the full stage gain from each i.f. valve, as this would only result in intolerable noise. Two more are usually sufficient for the audio end, or possibly an extra one to allow a thoroughly efficient a.v.c. action to be obtained. Then there is a beat frequency oscillator valve and the usual rectifier. That makes about ten valves, doesn't it?—and a nice basis to work on!

The Bands Covered

As we said earlier, the good communications set should cover from below ten metres to up past 2,000, although in practice the average listener will find little to interest him except between 13 and 40 and 175 and 550. The full coverage is usually obtained with from five to seven bands, each band being covered by a set of plug-in coils or by a coil switching or coil turret arrangement.

Scarce and Dear

Of course there is a lot more to it as well, but the above remarks give a fair coverage of the subject of these communications receivers which have been so popular in America, yet evaded by scared local factories. As a result, they are scarce and dear with plenty of buyers wanting to buy them at £100 a piece and more. Doubtless one of the big features of post-war radio will be the way in which this market will be catered for to the great benefit of listening enthusiasts who want effective reception of distant stations.

STANDARD FEATURES FOR UTILITY

AN ENTRY IN OUR UTILITY CIRCUIT CONTEST

By

CHARLES ASTON

21 William Street, Double Bay

THE main considerations in a receiver of the utility type is that it should be constructed with a minimum of standardised replacement parts, and no trick circuits, but one the manufacturers will be able to build with the least possible drain on man-power, and one that will not require too much time for the serviceman to check when a breakdown occurs; so a straight superhet. is the ideal.

To my mind a utility receiver is one that will give suitable and satisfactory operation to the greatest number of buyers. If a receiver is required for a two-roomed flat, then half a watt to the speaker would be quite sufficient, and three valves with a rectifier would fill the bill; a converter, I.F. amplifier and a duo-diode pentode feeding the speaker. If it were for a larger flat or average house, a converter, duo-diode pentode followed by a power valve would probably be satisfactory on local stations or a three valve T.R.F., but neither would be very useful in awkward locations, or for short-wave reception, so the four-valve class is definitely out for a utility receiver.

Must be Dual Wave.

A receiver must be dual-wave for the prospective user to feel happy and the average dual-wave receiver owner, these days, does use the short-wave band more than in pre-war days. A dual-waver means A.V.C., and A.V.C. means a duo-diode triode or pentode.

The 6K8G was chosen as the converter valve, as it seems to be easier to get going than the 6J8G, and does not require to feed into a transformer with a high impedance primary as a 6J8G which has a very high plate resistance and it also operates better on the broadcast band. A.V.C. may be applied with equal success to these valves and it does not tend to detune the oscillator as with the 6A8G. Of course, the 6J8G gives much better performance on short waves such as better signal to noise ratio.

Spares Available.

The next valve an I.F. amplifier, one of the super control amplifier type, and as the 6U7G is made locally, and there appears to be plenty of spares about even in these hard days. This valve has the ability to handle the usual signal voltages without cross-modulation or modulation distortion, which makes it adaptable for use as an I.F. amplifier with A.V.C. voltage applied.

As said before, a valve with diodes in would have to be used to provide detection, A.V.C. voltage and an A.F. amplifier a 6B8G was chosen as it has proved itself well in the past.

For an output power valve a 6V6G is used with a simple inverse feedback system, consisting of one 1.5 meg. resistor connected between the plates of the 6V6G and 6B8G, this value results in a compromise between reduction of distortion and loss of gain.

Separate Bias Resistors

Separate cathode resistors and by-pass condensers are used with each valve, as I am sure manufacturers do not want to be locating instability in some of the receivers.

The performance of the completed receiver is wholly dependant on the design and construction of the coils and I.F. transformers, which means that the tracking and coupling must be correct and must remain so over a period of time, especially in the short-wave portion. Only high-grade formers and components should be used, otherwise heat and humidity will adversely affect the tracking; however, now the coil manufacturers should have had plenty of experience in building these types for the forces, and I presume that they would be considerably better than those available for replacement purposes. Of course, the forces must have the best at the expense of us, owing to man-power shortages.

It will be noticed that the circuit is a standard circuit that practically anyone could design with the aid of a couple of text books, but the principle has been proved over a number of years now, and for a utility receiver a good reliable simple circuit is the ideal, and excellent results are assured on both the broadcast and short-wave bands. The fidelity is good enough not to grate on the nerves of the ears. The sensitivity and selectivity is more than enough for the average listener. All of these points could not be retained if the number of valves were reduced, and so would not be satisfactory as a utility receiver.

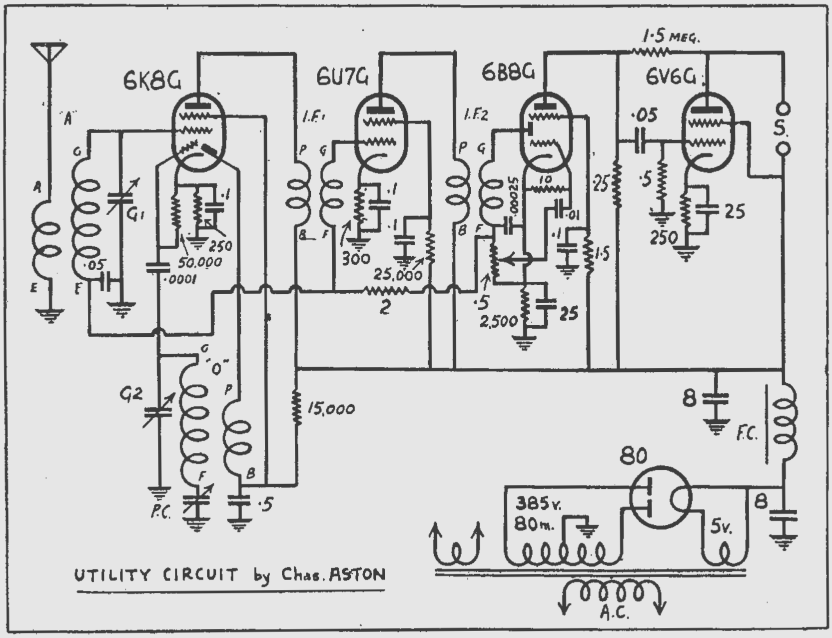
It will be noticed that no regeneration is used, if it was successful for broadcast listening the manufacturers would have retained it from the good old days of dials and howls, and I think all receivers are well rid of it. It also requires special coils or I.F. transformers which should be avoided for this type of set.

No New Valves

As for developing new types of valves and putting them into production in Australia, well, it seems very unlikely to me. For one thing, they could only be used as replacements in the new receivers, so the demand for them would be fairly limited in Australia, with its small population.

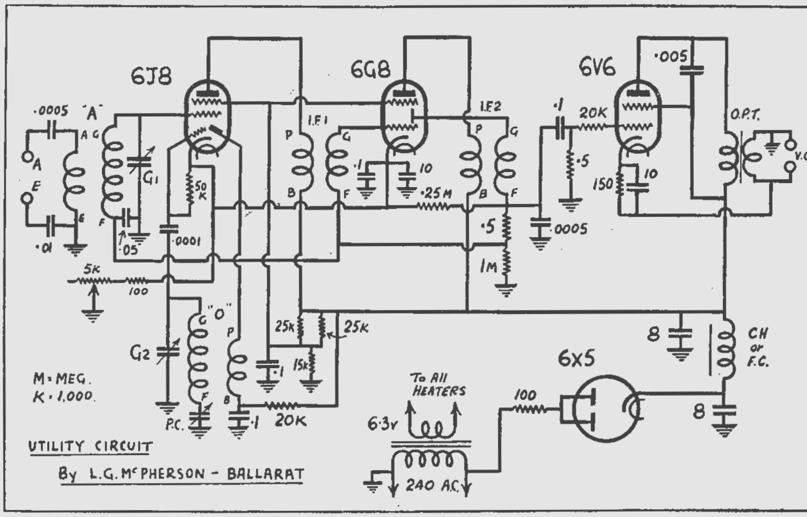
When I first thought of a utility re-

(Continued on page 19.)



UTILITY CIRCUIT by Chas. ASTON

AVOIDING THE H.T. TRANSFORMER



The "Utility Set" entry I am submitting is really not unusual, but the power supply circuit is interesting.

You might say on inspection of circuit, Why not use a standard AC-DC hook-up? My reasons are:—

1. Due to the faulty high mains voltage in use in Australia, a very critical voltage regulator tube is necessary in series filament arrangements. These tubes will break easily when bumped about (as small mantel radios invariably are).
2. Voltage regulators cannot be mounted near the field of a speaker as this will also break them down.
3. Too much heat dissipation, which will buckle small mantel cabinets.
4. Tubes in series with a barreter seem to develop hum which no amount of filtering seems to entirely eliminate.

In a Utility radio cost, of course, is of paramount importance.

The use of a 240 to 6-volt transformer would save an appreciable amount in production cost.

The drain of the 4 tubes in diagram is under 2 amps. so that a transformer stepping 240 down to 6.3 volts at 2 amps. is used. Tbis can be quite small and in a receiver I built it took up hardly any space.

A 240 to 12 volt transformer could be used, of course, with filaments of tubes in series parallel, with correct parallel resistors to match up the drain of the tubes in series.

If it was possible to obtain a combined half-wave rectifier and output pentode this receiver could be built using only 3 tubes.

ANOTHER ENTRY IN OUR UTILITY CIRCUIT CONTEST

By

L. G. McPHERSON,

14 Drummond Street South, Ballarat, Victoria

The inverse feedback on the 6V6 is quite effective, and costs nothing to instal, as the resistor and cathode bypass is necessary in any case.

Correct phase, of course, must be found or else positive feedback is the result with increased gain and poor tone.

The volume control simply varies the bias of the first two tubes. I have found this to be only effective control.

Varying the diode load is absolutely useless in a circuit of this kind where the 6G8 is used as shown.

Theoretically, the A.V.C. should stop overload of the diode, and as the 6G8 is not really reflexed no after volume control effect should be apparent. But somehow or other diode load controls distort on local stations, on the type of circuit shown.

The A.V.C. is quite simple and only two-thirds of that available is used. This stops lack of gain on distant stations and eliminates complicated delayed A.V.C. circuits.

Of course, the A.V.C. doesn't act much on locals, due to the bias volume control, but this doesn't matter as it is only necessary on distant stations, as no fading, etc., is apparent on local stations.

In all other respects receiver circuit is normal. A high gain antenna coil and permatune I.F. transformers are necessary as lack of alignment in a small receiver, such as this, spoils everything.

There seems to be no danger in using a 6 x 5 in this fashion.

Weather to cathode rating is about 400 volts. This circuit places a potential difference far less than that.

Output current rating is about 75 mA. This is much more than can be drawn from the average small power pack, therefore there is no need to over-bias output tube to cut down drain.

The field of a dynamic speaker can easily be excited. Field resistance can be kept down to about 1000 ohms, and plenty of H.T. is available, about 200 volts or so. This seems to be adequate for first-class results.

If desired, a small filter choke could be used and a permag. speaker. A high-tension voltage of about 230 volts is then apparent.

I use a similar hook-up to that shown (without output tube) feeding into an amplifier with about 10 watts output.

Even at full gain I have not experienced the slightest trouble with hum or noise and I can recommend the circuit for anyone who wants an A.C. tuner, with self-contained power supply.

How About YOUR Entry?

On these pages are two entries received in our Utility Circuit Contest, full details of which were published in the lost two issues.

Entries in this contest will be received only until April 20, so there is just nice time for you to rush along your entry.

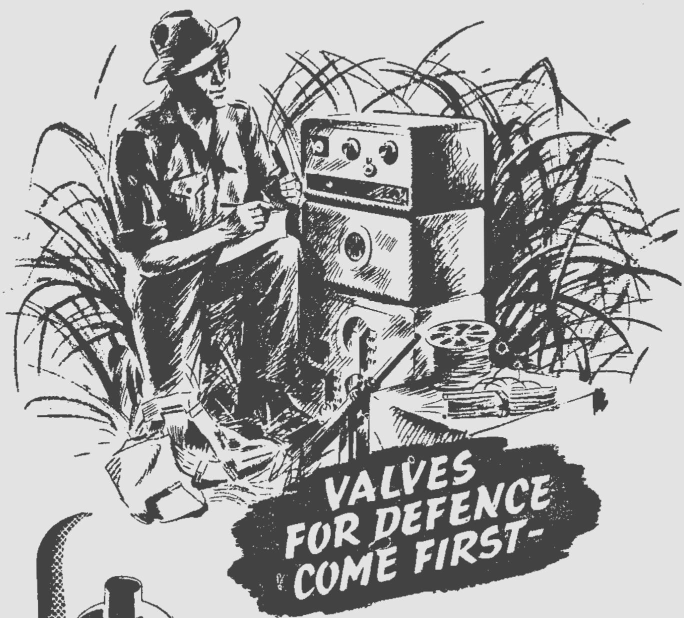
All entries published will be paid for, as well as the prize for the best.

The idea is to write an essay on the subject of circuit design for a utility receiver, one suitable for easy manufacture and service, cheap and reliable and using as few components as possible, yet giving satisfactory performance under a wide variety of operating conditions.

Circuit diagrams can be roughed out on a separate sheet of paper, and essays should be written clearly, using only one side of the paper.

Address your entries to "Australasian Radio World," 243 Elizabeth Street, Sydney, and make sure they arrive before April 20.

Results will be published in full in the June issue.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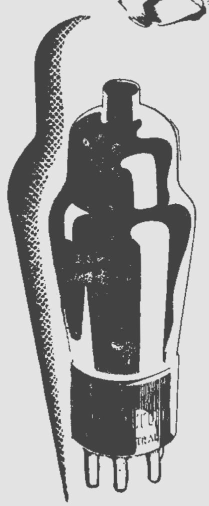
FOR DEFENCE
COME FIRST-



ELECTRONICS IN MODERN MUSIC

PART 2

By

CHARLES H. MUTTON

Plow Street, Thornbury, (Vic.)

HAVING discussed in our last issue a broad outline of the more common ways of reproducing musical tones by means of the electron art, we can now settle down to produce some practical results.

To those readers who are interested in this particular phase of electronics, the writer assumes that they are already in possession of a musical instrument of some kind or other. Guitar (steel or Spanish), banjo-mandolin, or banjo, seem to be a fairly representative gathering of the more popular choice, with the guitar probably holding pride of place.

Looking at things from an economical point of view, the writer feels that those already in possession of an ordinary instrument would like to first try their hand at converting what they already have invested in, without interfering or disfiguring what otherwise would be quite a nice looking banjo, guitar, or what have you?

The Steel Guitar

Keeping those thoughts in view, supposing we take the always popular steel guitar, as a basis for our experiments.

This instrument and its kindred types rely solely on what is termed the sounding board or post, for the reproduction of sound from the plucked string. The placement of this sound post determines to a large degree the amplification and tonal quality of the finished job.

Herein lies the main difference between musical instruments of the non-electronic and electronic types. In the case of the former we rely on: (1) The seasoning of the wood. (2) Type of construction. (3) Quality of material used. (4) The sound board. Whereas in the latter we are not in the least bit interested in any one of these factors. We rely solely on the ability of our reproducing equipment consisting of the amplifier and speaker, to faithfully reproduce the original vibration of the string.

Amplifier Should be Good

It would be well to stress at this point that any amplifier or radio receiver which is used in conjunction with an electronic musical instrument must be beyond reproach in the matter of distortion. More of which will be discussed later.

The most simple way to convert an ordinary guitar to the electric type, is to utilise the familiar crystal cartridge from a crystal pick-up. By attaching this cartridge to the sound board of the guitar, and allowing the needle to rest lightly on the bridge to which the strings are attached, the vibrations of the sound board will be converted from mechanical to electrical variations. These variations are then fed into an amplifier and subsequently boosted up greatly in volume, depending on the position of the volume control in the amplifier. If an existing radio receiver is at hand which is fitted with pick-up terminals, the output of the crystal cartridge can be fed into these terminals, and some surprisingly good results will be obtained.

In order to obtain a clear idea of how this is actually done in practice, a glance at Fig. 1 should clear any doubts up which the reader may have in mind.

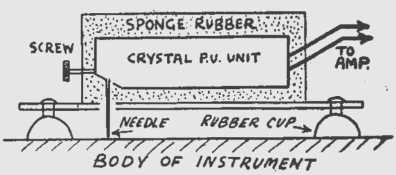
The materials needed are a piece of sheet steel and a couple of rubber suction caps, often seen on automobile windscreens and shop windows, for the purpose of attaching various articles to the face of the glass, without damaging same.

Mounting the Unit

The steel is then cut to the required shape as shown, two holes are drilled in either end and in these holes are inserted the suction cups. The sides of the steel plate are bent up as shown, thus forming a U-shaped receptacle in which the crystal cartridge is inserted. The inside of this receptacle is lined either with felt or sponge rubber, making sure that when we insert the cartridge it is quite a tight fit. In the bottom of the plate a hole is drilled, in order to allow the usual needle to protrude right through from the underneath side in such a manner as to have unrestricted movement in all directions.

The chief reason for resorting to the suction cap method of attachment is to enable the pick up unit to

Fig. 1



be detached easily, without in any way affecting either the appearance or the tonal quality of the original instrument, a feature highly desirable, if the said instrument is an expensive one, and highly polished.

Saving the Polish

Should the budding maestro not wish the needle to mark the wood, a very small piece of sponge rubber can be fitted over the needle point, so that the vibrations are transmitted via the rubber to the needle. This will also form a measure of protection for the delicate crystal element.

Should any trouble be experienced with acoustic feedback due to mechanical resonances between the sound board and the pick up unit, a piece of silk or other material shoved into the sound hole should obviate the trouble. Playing too close to the speaker can also cause the same thing. The remedy is obvious.

A magnetic pick-up head could also

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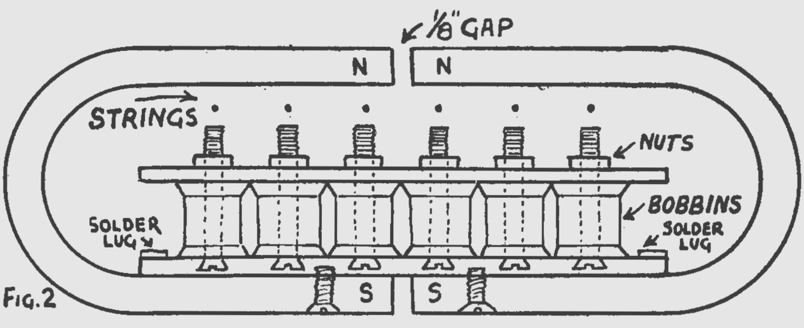
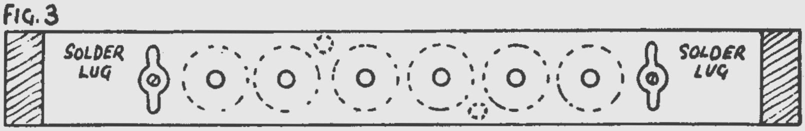


Fig. 2

Fig. 3



ELECTRONIC MUSIC

(Continued)

be used with encouraging results, but due to its awkward size and increased weight, it cannot be said that it lends itself as well as the crystal type does for this class of work.

Electric Guitar

Catering for the more ambitious constructor who may wish to make a straight-out electric guitar, the magnetic unit usually contained in such instruments can be constructed in the following manner: Obtain two horseshoe magnets from two old Phillip's cone type magnetic speakers. Some of our readers will recall the type referred to, as being very popular around 1932, now to be found mostly in the junk box or adorning the shelves and windows of the local second-hand shop.

The magnets in question are ideal, containing a high percentage of chromium, and are already drilled to suit our purpose.

The pick-up coil for each string consists of a bobbin taken from a discarded pair of earphones. Six bobbins will be needed in all, so that two pairs of earphones are required; this will then leave two bobbins for spares in case of accidents.

Perhaps the simplest way to convey to the reader the way in which the unit is assembled together would be to illustrate the set up by means of diagrams, which the writer feels sure should provide all the information needed.

Referring to Fig. 2 it will be noticed that the magnets are so placed that like poles are together, North to North and South to South. This ensures that the magnetic field will be strongly concentrated around the six enclosed coils. Remembering the old rule that like poles repel and unlike poles attract, should enable the constructor to position the magnets correctly.

Coil Mountings

The six cells are mounted on a piece of bakelite or some such insulating material, so that their centres are approximately 7/16-inch apart. After marking the holes in the bakelite, they should be countersunk and drilled to receive the countersunk head $\frac{1}{8}$-in. diameter screws which serve to hold the coils securely to the bakelite base plate. The depth of the countersinking should be such that when the coils are mounted and the screws tightened up, the heads should not touch the magnet. This ensures that the screws are merely floating, so to speak, in the magnetic field. Two extra holes are drilled in the bakelite, corresponding to the two holes which are already drilled in the magnet. These serve to fasten the whole coil assembly to the magnets. A piece of punching bakelite 1/16-inch thick forms a top cover for the coils and is drilled the same way as the bottom supporting piece, to receive the ends of the six protruding screws, which are securely held down with 1/8-inch hexagon nuts as shown in the diagram.

The six coils are joined in series, connecting the inside of one to the outside of the other, so that we finish up with the start being an inside connection and the finish an outside connection. The total resistance should be in the neighbourhood of 6000 ohms.

Coil Assembly

Fig. 4 shows the magneto and coil assembly supported on a piece of 1/8-inch by $\frac{3}{4}$-inch soft iron, which is shaped as shown, and is in effect a cradle support for the complete unit. It will be noticed that this cradle support has two knurled-head bolts, one at each end, which are screwed into tapped holes in the piece of soft iron which forms the support for the magnets. It will be readily understood from the diagrams that these two screws form an adjustment, which enables the distance between the cores of the coils,

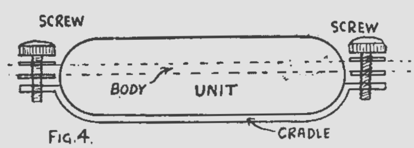


FIG.4.

and the strings of the instrument to be altered at will. Generally speaking, the distance from the cores to the magnet is usually about $\frac{1}{4}$-inch and having at the same time, each string over its own pick-up screw and centred approximateely between the top of the screw and the magnet.

Having covered most of the details in connection with the magnetic pick-up unit for a stringed instrument, a few remarks about the body would not go amiss.

Unlike non-electronic instruments, the body of an electronic instrument is composed of a solid block of wood. The wood chosen should be such that it will not warp under the strain of the strings when they are fully tightened. The writer found kauri pine quite satisfactory in this respect. It will need to be about 2 inches thick in order to accommodate the pick-up unit, and if desired, a self contained volume control, the latter being optional.

The taste of the individual varies to such a large degree that a description of the body of the instrument is deemed unnecessary, but will be left to the discretion of the constructor. As far as practical results are concerned, the body can be a perfectly straight piece of wood, without any shaping whatever.

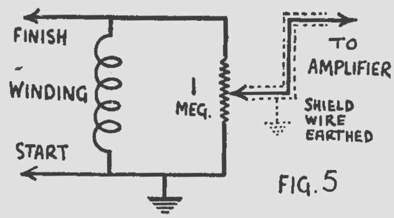


FIG. 5

The main points to watch are as follows: (1) The height of the strings above the finger board to be 5/16-inch.

(2) The strings must not contact the cores or the magnet when plucked.

(3) The pick-up unit to be mounted approximately 2-inches from the bridge, to which the strings are anchored.

(4) The fret markings can be painted on the wood for simplicity, but must be positioned correctly, and are best marked from another instrument, making absolutely sure that the 12th fret is absolutely dead half-way between the neck and the bridge of the instrument.

(5) Earth all exposed parts, such as strings, bridge and magnets to the metallic or braided covering of the wire which connects the pick-up unit to the amplifier system. Microphone cable, if available, is ideal for this purpose. If not, ordinary shielded hook-up will suffice. Fig. 5 shows the method of connecting.

Compensation

There remains one little point which should be explained, which may not be apparent to the would-be enthusiast, e.g. the strength of the magnetic field diminishes as we get away from the poles, which means that the voltage induced into the centre coils will be greater than that induced into the two coils on the extreme outsides. Now, as far as the bass string is concerned, being less taut, it has a much greater swing inamplitude when vibrating than the treble or highest E string. This fact will compensate to a large degree for the lack of magnetic field at this position.

In the case of the treble string, which has the least vibration of all, we find that the output will be down. In order to remedy this, we can either make the core in this particular coil a fraction longer than the others, or adjust the knurled head bolts so that the unit tilts at a slight angle, thus bringing the cores at the outside near the treble strings nearer their respective strings.

(Continued on page 26)

SIMPLE VOLUME EXPANDER CIRCUITS

MANY systems for volume expansion and compression have been suggested, but they usually require the use of three or more valves, and are relatively complicated and expensive. Some simplified arrangements have recently been disclosed by RCA making use of heptodes and triode hexodes and details are given below.

Referring to Fig. 1, the valve 1 is a heptode, and may be of the 6A7 or 6A8 type, and the signals to be controlled are applied to the inner grid 4.

The cathode 2, input grid 4 and anode 3 co-operate to provide an audio amplifier, and the amplitude audio voltage is developed across the potentiometer resistor 5. One end of the resistor is earthed, while its opposite end is connected to the plate electrode 3 by an audio coupling capacity 6. The plate electrode 3 is connected to any desired source of positive potential through a plate resistor 7. The potentiometer is provided with an adjustable slider 8, and the audio voltage developed across resistor 5 may be regulated as to magnitude by adjustment of the slider 8 along the resistor 5.

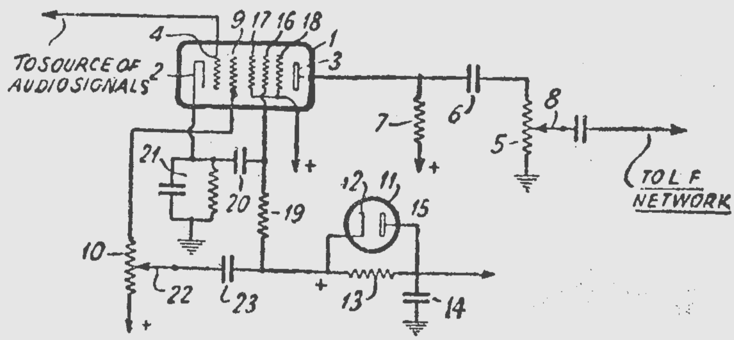


Fig. 1.—An expander circuit incorporating a heptode valve.

Gain Control of Amplifier

In order to effect expansion of the volume range it is essential to increase the gain of the audio amplifier as the intensity of the audio input energy increases.

The gain control of the audio amplifier is provided by a portion of the audio input energy to the audio amplifier. It is desirable to amplify the control energy prior to its rectification. Hence the second control electrode 9 is employed as a plate, or anode, electrode, and the load resistor 10 is arranged in circuit with anode 9. Resistor 10 is connected to a source of positive potential. It will therefore be seen that the audio energy impressed on electrode 4 develops audio output voltage, both across the output resistor 7 and the output resistor 10, both electrodes 9 and 3 functioning as audio amplifier output electrodes.

The audio voltage developed across output resistor 10 is impressed upon a rectifier 11, and the latter may be of the diode type. The cathode 12 of the diode is connected to earth through a path which includes the diode load resistor 13 and the condenser 14. The diode anode 15 is connected to the junction of condenser 14 and load resistor 13, the junction point, additionally, being connected to a source of negative direct current potential so as to provide an initial negative bias for the gain control electrode 16 of valve 1.

Accelerating Fields

Gain control electrode 16 is the fourth control electrode of the valve, and is disposed between the screen-grid electrodes 17 and 18; the latter two grids are connected to a source of positive potential. It will be understood that the grids 17 and 18 provide an accelerating field for the electrons between grids 9 and 16, and between grid 16 and the plate electrode 3. The gain control 16 is connected to the cathode end of a diode load resistor 13 by means of a resistor 19, which functions to filter out the audio pulsations in the gain-control voltage.

Audio By-Passing

The condenser 20 by-passes audio frequency currents from the gird end of resistor 19 to the cathode 2. The cathode itself is maintained at a positive potential above earth by means of the usual self-biasing resistor network 21 and, therefore, the control grid 4 is at a normal negative bias. The magnitude of the audio voltage impressed on the control rectifier 11 is adjusted by means of the variable tap 22 adapted to slide along resistor 10, the audio coupling condenser 23 connecting the tap 22 to the cathode end of resistor 13.

To explain the functioning of the arrangement shown in Fig. 1, let it be assumed that the audio signal is applied to grid 4. The amplified audio signal voltage is developed across the output circuit of valve 1. The gain of the audio amplifier is controlled by grid 16 in a polarity sense such that the gain of the audio amplifier increases as the audio signal input intensity increases. This follows from the fact that when the audio signal voltage applied to grid 4 increases, then the audio voltage developed across resistor 10 increases, thereby increasing the magnitude of the audio voltage impressed upon the rectifier 11, in this way the voltage across load resistor 13 increases. Since the grid 16 is connected to the cathode, or positive, end of resistor 13, an increase in direct current voltage developed across resistor 13 causes the reduction of the initial negative bias on gain control grid 16. The result of this reduction of negative bias is to increase

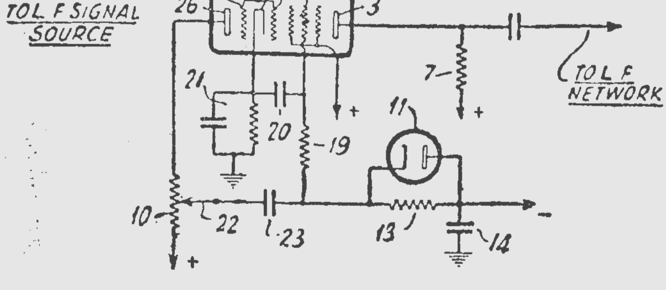


Fig. 2.—Similar arrangement to the Fig. 1 scheme but with a triode-hexode valve.

Continued on next page)

VOLUME EXPANDER

(Continued)

the gain of the audio amplifier. The amount of increase in gain and thereby the amount of volume expansion may be controlled by adjustments of tap 22.

Constant-Pitch Winding of Grids

While it has been explained that valve 1 is of the 6A7 or 6A8 type, it is desirable to have the fourth grid 16 of a constant-pitch winding. It is pointed out that in a 6A7 or 6A8 type of valve the second grid 9 actually consists of the rod supports usually employed for supporting the grid winding. With this type of construction the rod supports have a minimum of influence on the main electron stream flowing to the audio amplifier output electrode 3. It will therefore be appreciated that the valve 1 not only provides normal audio amplification, but also supplies amplification of that portion of the audio input energy which is to be used for rectification at valve 11 in order to provide the expansion control voltage for grid 16.

Instead of the heptode, shown in Fig. 1, a triode hextode may be used as shown in Fig. 2. Thus, the cathode 2 provides an electron stream flowing through the control grid 25 to the output electrode 26, and audio signal energy is impressed on grid 25. The output resistor 10 is included in circuit with the output electrode 26. In other words, cathode 2, grid 2 and plate 26 correspond respectively, in Fig. 1, to cathode 2, grid 4 and output electrode 9. The audio amplifier section of valve 1 comprises the cathode 2, the grid 4 and the output plate 2. The gain control electrode 16 is located between the positive screen grids, as in the case of valve 1 in Fig. 1.

The remainder of the circuit elements correspond to those shown in Fig. 1. Both signal grids, 25 and 4 are connected to the source of audio input energy, and both of these grids are maintained at a normal negative bias by the self-biassing network 21. It is not thought necessary to describe the detailed construction of the combined triode-hexode type valve shown in Fig. 2; it being found merely necessary to point out that cathode 2 provides a pair of independent electro streams to a triode section and an independent hexode section. The advantage of this arrangement is that the control energy amplifier section has minimum influence on the functioning of the gain audio amplifier section. It is to be clearly understood that in either of Figs. 1 or 2 automatic compression will be secured by merely interchanging the connections to the cathode 12 and anode 15 of diode 11. For example, if the anode 15 is connected to resistor 13 in place of cathode 12, then with an increase of audio input energy intensity there will result a decrease in the gain of the audio amplifier.

Gain Control Voltage

It is not essential that independent rectifiers be employed for providing the gain control voltage. In Figs. 3 and 4 are shown circuit arrangements wherein the combined triode-hexode 1 may be utilised for providing the rectification action as well as the automatic compression or expansion. In Fig. 3 there is shown an automatic compressor circuit. In this case the plate electrode 26 is connected to the same positive potential lead connected to the positive screen grids 17 and 18. The cathode 2 is connected to ground by means of a pair of series resistors 30 and 31, resistor 30 being shunted by an

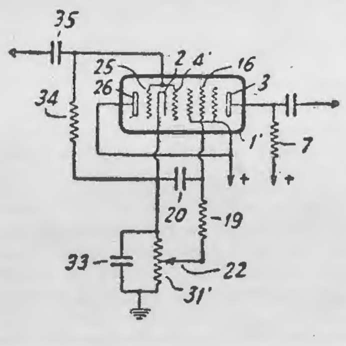


Fig. 4.—Similar arrangement to Fig. 3, but with grid rectification instead of anode rectification.

audio bypass condenser 32, and resistor 31 being shunted by an audio bypass condenser 33. The blocking condenser 35 connects the audio input circuit to the control grids 25 and 4 which, in turn, are connected to the junction of resistors 30 and 31 by means of grid leak 34. The gain control grid 16 is connected to the resistor 31 through the series path, including the filter resistor 19 and adjustable tap 22.

The condenser 20, connected between the grid end of resistor 19 and the cathode end of resistor 30, functions as a portion of the filter network 19-20. It will be seen that in the arrangement of Fig. 3 no diode rectifier is necessary, since plate rectification occurring in the triode section of tube 1 is utilised. The resulting cathode current change through resistor 31 is employed to increase the grid bias of grid 16 as the audio input energy increases. In other words, as the audio input voltage impressed on grids 25 and 4 increases there will be a greater flow of space current through resistor 21, and, therefore, the grid 16 will be biased, increasingly in a negative polarity sense. This results in the reduction of the gain of the hexode section of tube 1 such as is desired for automatic compression.

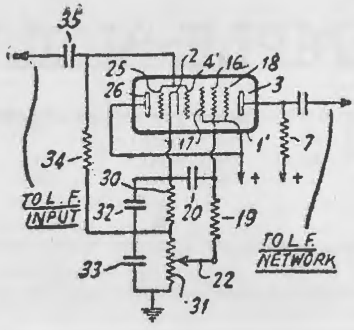


Fig. 3.—Complete action, including rectification, is provided in this circuit.

High Amplification Factor

It is desirable to design valve 1 so that the triode section is normally biased close to cut-off, while with the same bias on grid 4 of the hexode portion of the valve this latter portion is operating on a substantially linear portion of its characteristic. This is readily accomplished by utilising a higher mu, or amplification factor for the triode section than for the grid 4 to grid 17 portion of the hexode. In the 6K8 type of valve, for example, such a difference in amplification factor exists by virtue of the difference in spacing between grid 25 and plate 26 from the spacing of grids 4 and 17. If the triode section mu is not sufficiently higher than the mu of grid 4 to grid 17 of the hexode, satisfactory operation can still be obtained by lowering the positive voltage applied to the triode section plate 26 below that of the grid 17.

The circuit arrangement shown in Fig. 4 differs from that of Fig. 3, in that grid rectification is utilised in place of anode rectification in the triode section. The signal grids 25-4 are connected to the audio signal source through the grid condenser 35 as in Fig. 3. The grid leak 34, however, in distinction to Fig. 2, is connected to cathode, thus permitting grid rectification. Resistor 31 connects cathode 2 to earth, the resistor being by-passed for audio frequencies by condenser 35. In this form of circuit the cathode 2, signal grid 25 and plate 26 provide a grid-leak detector circuit. Upon a signal intensity increase, the flow of space current through cathode resistor 31 decreases due to the well-known action of the grid-leak and condenser 24-35. As a result, the bias of grid 16 decreases; the gain of audio amplifier section 2-4-16-3 thereby is increased. Expansion of the audio volume range results. If the hexode section has a sufficiently low mu so as not to be cut off for the strongest signals, distortion effects will be negligible. The triode section mu should be high, as in the case of the arrangement of Fig. 3.

—"Broadcaster," (W.A.)

REVIVING DRY BATTERIES ELECTRICALLY

Writing from 73 Burns Bay Road, Lane Cove, Mr. David W. Hain offers a scheme for recharging batteries.

He says: Some time ago I read in "Radio World", Vol 6. No. 9. the article on "Rebuilding Radio Batteries", and found it very interesting. With your permission I would like to make the following comments and suggestions.

You said that you bought the powdered carbon from your chemist. According to my chemist, this carbon is prepared from a special pine tree, and from experience I have found it to have a much higher resistance than has coke dust.

You also said that you mixed solution number two until it made up a paste of similar consistency to the paste taken from the run-down battery.

I think this was a mistake, being too moist, as in a run-down cell this paste is more moist than in a new cell, due to the action of the manganese dioxide on the hydrogen liberated there during discharge, with the formation of water.

($MnO_2 + H_2 = MnO + H_2O$)

In my opinion the most satisfactory method of rejuvenating run-down cells is to "recharge" them. The following is the method I have adopted.

In an ordinary A.C. receiver the centre-tap of the transformer high tension is disconnected from whatever it is connected (usually chassis or a bias resistor) and it is then connected to the negative terminal of the cell or cells (up to 60 cells can be treated simultaneously in series). The point in the circuit from which the centre-tap was removed is connected to the negative terminal of the cell or cells. When no battery is being charged the two leads are joined, thus restoring the original circuit of the receiver. Thus the circuit below is typical.

My theory as to how it works is this:—

A new cell consists essentially of a piece of zinc in a solution (paste) of NH_4Cl and a rod of carbon in a bag of $MnO_2 + C + NH_4Cl$, all suspended in the same solution as the zinc.

On use the cell becomes essentially a thinner piece of zinc in a solution of $ZnCl_2 + NH_4OH$ and a piece of carbon in a bag of MnO and unaltered powdered carbon and some water and some NH_4Cl.

If a current is passed through this cell, electrolosis will set up. If the zinc is connected to the negative of the supply it is called the cathode and the carbon rod and the powdered carbon in contact with it will be the anode.

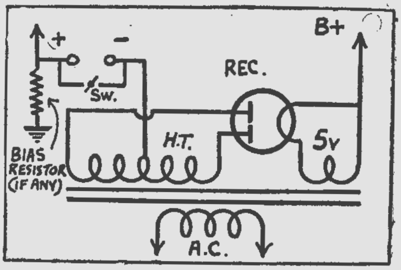
Suppose the current is now applied, the actions will be as follows:—

(1) **At the cathode.** Of the Zn/Cl_2 the Zn ions are attracted to the zinc, where, on contact with it they lose their negative charge to form metallic zinc, rebuilding the zinc to the original size.

The chlorine ions react with the NH_4OH as below:—

$2NH_4OH + 2Cl — 2NH_4Cl + 2OH$

Thus, around the cathode everything is as in a new cell, but for the lack of water (used during the cell's discharge when the NH_3 formed, combined with it to form NH_4OH), and for the addition of 2OH.



At the Anode the water is dissociated into H/OH thus the positively charged carbon rod attracts the OH ions and treats them as below:—

$2OH + 2 = H_2O + O$

The atomic oxygen thus produced combines with the MnO to give MnO_2

$MnO + O = MnO_2$.

Now with this action going on around the anode, you will notice that there are two H+ ions left over. These migrate to the two OH— ions around the cathode to reform the original water, which, during discharge was used by the NH_3 being evolved.

A possible alternative to the action just described, around anode would be this:—

$2NH_4Cl$ on solution is ionised to $2NH_4+$ and 2Cl— ions. The 2Cl— ions on contact with the negative charged carbon rod give chlorine gas which acts on water present to give hypochlorous acid and hydrochlorin acid.

($H_2O + Cl_2 = HClO + HCl$.

The HClO then acts on the MnO

$MnO + HClO = MnO_2 + HCl$.

(The hydrochloric acid formed is too weak to act on any MnO_2.)

We now have our MnO_2 as in a new cell and also 2H+/Cl— and also 2 NH_4+ ions around the anode. These combine to give our original NH_4Cl and 2H+ ions left over ($2HCl + 2NH_4 — 2NH_4Cl + 2H+$). These H+ ions, as before migrate to the OH— ions around the cathode. Therefore, theoretically at least, the cell is restored to its new condition.

It seems that the only limitation to the life of dry cells so treated would be their normal shelf life, that is, until their moisture has dried out.

In practice I have had great success with this method, as I have obtained more than twice normal life out of some sets of portable "B" batteries, and many times the normal life from torch batteries. Unfortunately, however, large cells such as radio "A" batteries do not respond as well as the smaller types.

MUSIC versus NOISE

ONE of the worst destroyers of efficiency in fine and intricate work is the noise factor, which acts upon production as a "war of nerves." By noise is meant annoying sounds which irritate the operative and with this may be included any perceptible vibrations. By their very irregularity they become distractors. Insulation of their sources by means of canite, rubber or the use of felt underlays for the bases of machines, all tend to lessen mental irritation and hence the wear and tear upon nerves. Experiments have shown that though work may be carried on under stress conditions of noise, mental strain and fatigue is undoubtedly increased by it. The degree of susceptibility, however, is always an individual matter, some neurotic persons being unable to put up with even a small amount, while others soon become noise-adapted.

Music, on the other hand, "hath charms." Researches into applications of music in industry were first carried out in Britain some three or four years ago. The general findings were, first, that music increased output by from 6 to 12 per cent., and, second, that only a small percentage of firms that tried out musical programmes during parts of the working day ever reverted to the "no-music" work day.

"Factory Management" has recently investigated the problem in some very large U.S.A. firms. Again the increase has been found to lie between 6 and 12 per cent. In no case was there any tendency to revert to the "no-music" work day.

—From an address by Dr. A. H. Martin, Honorary Director, Australian Institute of Industrial Psychology, and Lecturer in Psychology, University of Sydney.

PENTODES AND SIMILAR POWER VALVES

PENTODES have come into such widespread use during more recent years that it has become customary to expect to find this type of valve in the output stage of almost any type of receiver. What advantages do pentodes confer, and what disadvantages?

The principal advantage is in connection with the stage gain, especially when high-tension voltage is limited. It is possible, with a pentode, to obtain two or three times as much gain as with a normal small output triode used in the same general circuit arrangement. In the case of battery-operated sets, a single pentode will provide up to about half a watt of audio output; and this for the consumption of under 10 mA at 120 volts. To obtain a similar output with any triode valve would necessitate the use of a valve taking double the current, and operating at a much higher plate potential. This is true whether the valve is used as a class A amplifier or a pair of valves is used in a push-pull stage. Conditions are more favourable if class B is employed, but in that case the extra cost of components must be borne in mind.

At a Cost

Most good things in this world have to be paid for, so one might well ask what disadvantages attach to the use of pentodes. The first is that the pentode gives rise to distortion of uneven harmonics — particularly the third. A triode also tends to produce a certain degree of harmonic distortion, but this occurs at even harmonics, and applies principally to the second harmonic.

The essential difference is that even harmonics are far less offensive to the ear than are odd harmonics. Hence the widely-held belief that the pentode does not give quality of reproduction equal to that of the triode. There is another important point in this connection; both types of valve give increased harmonic distortion as they approach the limit of their power-handling capacity. But whereas the rise in distortion with a triode is roughly proportional to the rise in output (within the working limits of any particular valve) the distortion increases more rapidly with a pentode as the output is varied from about one-fifth to the maximum.

Tone Compensation

In general, a pentode tends to emphasise the upper audio register. Because of that it is normally found desirable to apply some form of tone control or tone compensation. This can be done without much difficulty, but the result is to reduce to a certain extent the gain provided by the valve. On the other hand, there are cases in which a little extra amplification of the higher audio frequencies is desirable; it may then prove satisfactory to employ a pentode without any appreciable degree of tone compensation. This applies in the main to 'straight" circuits, where the utmost degree of selectivity has been provided, with the result that there is a noticeable attenuation of the upper register.

Another tendency of the pentode — due largely to its higher amplification factor and higher impedances involved — is toward self-oscillation at audio frequency. This can be overcome by the application of negative feedback, which will call for due consideration.

Beam Tetrodes

So far reference has been made only to triode and pentode valves. What of the beam tetrode? This resembles a pentode in many respects, and gives a similar degree of gain. The connections to it are the same as to a pentode, the only "mechanical" difference being the omission of the cathode-connected suppressor grid. This type of valve, however, has one marked advantage over the pentode in that it introduces less third-harmonic distortion. It does, on the other hand, produce appreciable second-harmonic distortion. In general, and for many purposes it may eventually be the cause of the pentode becoming obsolete.

Pentode Circuits

Now let us turn to some of the more practical aspects of pentode-circuit design. Fig. 1 shows the circuit of a pentode output stage, resistance-capacity coupled to a preceding L.F. or detector stage. It works quite well in such a circuit, and has the advantage of very low "Miller Effect" grid-cathode capacity. This is due in the main to the screen effect between grid and anode of the suppressor and auxiliary grids. The values of the grid condenser and leak can be determined as previously explained in the case of triodes. The bias resistor and condenser can also be found by the application of Ohm's Law.

The values of the auxiliary-grid decoupling resistor and condenser are not usually very critical, but the effect of changes should be considered. It should first be borne in mind that changes of auxiliary-grid voltage have more effect on anode current, and hence on gain and maximum output, than have changes in anode voltage. In fact, the anode current will be found to remain constant over a fair range of anode voltages, provided that the auxiliary-grid voltage remains unchanged. The reason is simply that the auxiliary grid is closer to the cathode than is the anode, and therefore has more controlling effect.

Component Values

A value of 2,000 ohms for the resistor is generally as good as any for all-round results, but values between 1,000 and 5,000 ohms can be used. Clearly, the value of this resistor affects the voltage applied to this grid, and therefore a higher value will result in lower gain and lower maximum output. It is because of this that in many simple and inexpensive battery sets the auxiliary grid is often connected directly to the H.T. supply line. That method of connection is not desirable from other points of view, and often emphasises the distortion. The inclusion of the resistor has a stabilising effect on the valve and tends to "iron out" the effect of differences in characteristics of different samples of valves of the same type.

The by-pass condenser is necessary in conjunction with the resistor to avoid the building up of audio-frequency voltages across the resistor; these would cause variations in voltage applied to

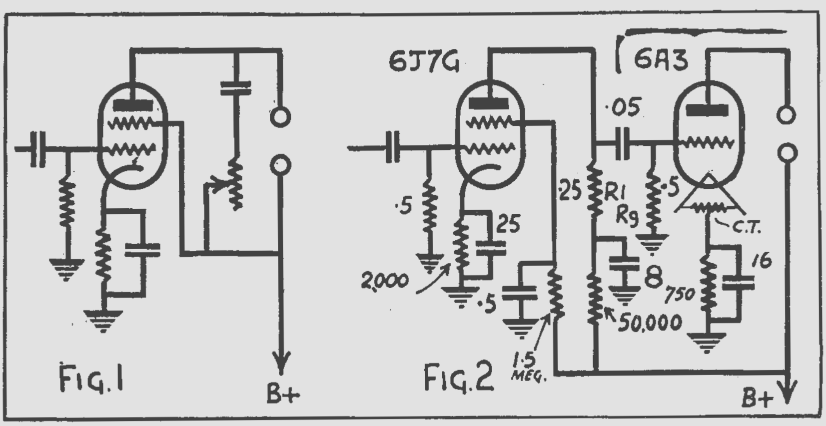


FIG.1 FIG.2

the auxiliary grid and add to the distortion, whilst causing a loss in output. A capacity of 2 mfd., is often recommended for the by-pass condenser, but a much lower value is normally just as satisfactory, and obviously more economical. It also reduces the likelihood of hum. If a few tests are made it will nearly always be found that a capacity of .5 mfd. is fully satisfactory with resistances up to 2,000 ohms; and it is seldom desirable to go above this resistance unless it is desired to limit the gain and the valve is by no means fully loaded.

Tone Filters

A simple form of tone filter or tone control is shown in Fig. 1. This takes the form of a fixed condenser in series with a resistor between the anode of the valve and earth. Value of .1 mfd. and 25,000 ohms are suitable when a variable control is required. If a fixed compensating filter is sufficient — as is generally the case — .05 mfd. and 10,000 ohms will suit most pentodes. Reducing the capacity of the condenser or increasing the value of the resistor will bring about a rise in the average pitch of reproduction.

Speaker Feed

We now come to the final link in the chain: the speaker, or speaker transformer. This is very important, and introduces what is probably the greatest difficulty. If we are to have any pretence of matching, the impedance of the transformer primary must be high. But unfortunately the impedance increases with frequency. Thus, although it may be well chosen for average audio frequencies, it may then be near resonance at the third harmonic of lower frequencies. In consequence, the third harmonic would be brought into increased prominence, and reproduction may be distinctly unpleasant. With normal methods of coupling that is a difficulty which must be tolerated. At the same time, the network which we have described as a tone compensator will virtually smooth out the variations in speaker-transformer impedance and thereby provide some relief from the trouble mentioned.

Pentode as Voltage Amplifier

It is not customary to feed the output from a pentode into a triode, but this may be done. Alternatively, it may be fed into a push-pull stage. This arrangement would normally be used only when it was required to obtain a fairly large output and when it was wished to avoid the use of two intermediate voltage-amplifier stages. Nevertheless, the pentode can be used to good purpose, and it does give a high degree of voltage amplification for a very economical consumption of H.T. and L.T. current.

Fig. 2 shows a circuit of a two-stage amplifier in which a pentode is resistance-capacity coupled with a triode power-output valve. The choice of auxiliary-grid resistor and condenser is governed by the factors already dealt

(Continued on next page)

PENTODES
(Continued)

with, so we have to consider only the values of anode resistor and grid condenser and leak. Matching is out of the question because of the high internal resistance of a pentode. The higher the value of Rl the greater the stage gain (provided that the available H.T. voltage is sufficient) and the greater the attentuation of the higher audio frequencies. Suitable values normally lie between about 100,000 ohms and 500,000 ohms, and a resistor of 250,000 ohms will be found suitable with almost any pentode. If the bias resistor is of the normal value, determined as for a triode, it is possible to use a comparatively low H.T. voltage without the anode potential falling too seriously. This is because of the low resulting anode current. And since the valve is used purely and simply as a voltage amplifier, and if the applied grid voltage is low, a very satisfactory signal voltage can be fed to the triode by using the normal H.T. voltage of 120 or 250, for battery and mains valves respectively.

The grid leak, marked Rg, should have a resistance equal to about twice that of the anode load resistor, whilst the value of the grid condenser may be about .05 mfd. Due to the constant impedance of the anode load, frequency distortion will not be a serious factor. Because of the high shunt impedance, the "Miller Effect" capacity of the triode will come into prominence This may be more of an advantage than a disadvantage, since it will tend to give a "cut" of the higher frequencies.

The Output Tetrode

So far little reference has been made to the output tetrode, although it has been stated that this valve has most of the advantages of the pentode, without the most important disadvantages of producing third-harmonic distortion. The method of using it is practically identical with that applying to a pentode; in fact, it would be possible to substitute a tetrode for a pentode in almost any circuit, without doing any more than adjust the grid-bias voltage to suit the new valve. It is not, therefore, necessary to deal here with any particular tetrode circuits.

High-mu Triodes

So-called high-mu triodes have been in use for a number of years in the outpute stage. In general, it is the battery-set high-mu triode which is most widely employed. It has a high value of mutual conductance (the figure may approach 4 mA./volt for a two-volt valve) and a comparatively high internal resistance — in the region of 5,000 ohms for a battery valve. This type of valve is more sensitive than the normal small power valve; that is, the output provided for any given small input is greater than is the case with other types of triode. In this respect it can be said to fall between the normal triode and the pentode. The chief disadvantage is that it is capable of handling only a small input, whilst the available output is normally limited to around 200 milliwatts.

Correctly employed, it is very convenient when in search of good reproduction with a small battery set designed for economy in prime cost and battery-current consumption. The setting of the bias voltage should be arranged with the utmost care, for which reason it is highly desirable that automatic bias should be employed. The value of the bias resistance is determined by the normal application of Ohm's Law, but it should be remembered that the current passed through the resistor is the total cathode current taken by all the valves in the set.

—"Practical Wireless."

"MYSTERY" CRYSTAL SET

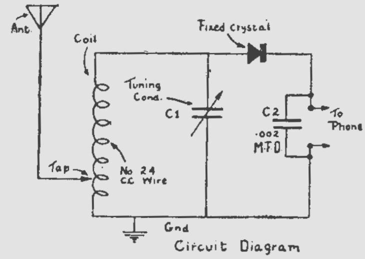
Here are particulars of a Crystal Set to be fitted into one side of a pair of phones. The other ear-piece is used in the ordinary way.

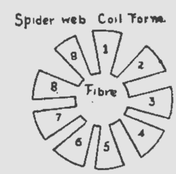
Strip the phone and drill hole in centre of shell bottom for the shaft of the porcelain base Trimmer Condenser C1. Wind thin spider web coil with as many turns of No. 24 wire as possible, beginning at the centre and ending about ¼-inch from the outer end of the spider arms.

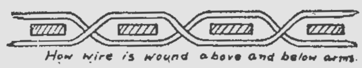
Before mounting the parts in shell, connect them for a test on a small board, and check coil turns, tapping for the aerial tap lead at a point for best reception. Then solder. Ater assembling in shell, the aerial and earth leads should be several feet long and terminate in small spring clips to fasten to any convenient aerial and earth.

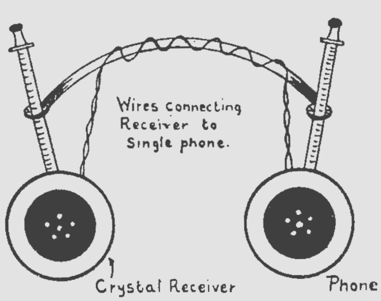
The fixed Crystal should be a small round flat type. with machine screw terminals. Short bushings and machine screws are used to mount Tuning Condenser and Knob. The crystal detector may be hard to obtain, but all good Radiomen should be able to rig something up.

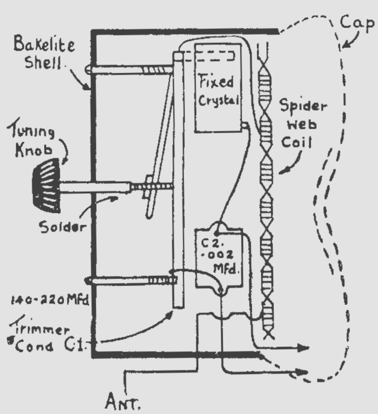
—N.Z. "Radiogram."











CROONERS NEED DISTORTION!

According to "Diallist" of the English "Wireless World," an eminent critic, Mr. James Agate, has offered an explanation of the reason why they use microphones when performing on the stage before an audience.

"I'd always thought that it was because their bleating voices were too feeble to fill and auditorium of any size," says Diallist, "but Mr. Agate has come to a different conclusion. Most of them, he says, become known to the great mass of the people by their broadcasting. Those who hear them use receiving sets either inherently incapable of good quality, or so "toned down" that the reproduction is queerly distorted. Having heard crooners and other alleged singers under these conditions, they conclude that this is what their efforts really sound like. If they went to theatres and heard their favourites performing without distortion introduced, wilfully or incidentally, by microphone, amplifier and loudspeaker, they would feel that something was lacking and would be disappointed. In other words, they have come to prefer the distorted sounds associated with "canned" music to the real thing.

METRES AND MEGACYCLES

MANY attempts have been made at different times to induce the constructor and experimenter to adopt the frequency designation instead of describing a transmission in terms of wavelengths in metres, but these have met with little success so far as the broadcasting bands are concerned. This is perhaps unfortunate in many respects, since the frequency notation has much to recommend it, and wavelengths have invariably to be converted to frequencies in order to make calculations of inductance, etc. The position on the short-waves, however, is different, for almost every short-wave enthusiast speaks in terms of megacycles and all amateur transmitters announce the frequency of their transmissions in preference to giving the wavelength.

Because of this the beginner on short waves often finds difficulty in calibrating his receiver by making use of the many available transmissions. Actually, the conversion from megacycles (millions of cycles, or thousands of kilocycles) to wavelengths is perfectly simple, since 1 megacycle is equivalent to 300 metres, 2 megacycles to 150 metres, 3 megacycles to 100 metres, 4 megacycles to 75 metres, 10 megacycles to 30 metres, 15 megacycles to 20 metres, 60 megacycles to 5 metres, and so on. The short-wave experimenter will find it very helpful to cultivate the habit of thinking in terms of megacycles instead of in metres, for this will save a good deal of trouble in applying the simple conversion calculation.

It might at first seem that matters would be complicated by using the megacycle notation, since it is not easy to convert, say 14.6 megacycles to metres — this works out at approximately 20.548 metres, and is found by dividing 14.6 into 300 — but the point to remember is that the transmission was not doubt arranged for 14.6 kilocycles, and not for its metre equivalent. The custom of using the megacycle notation for short-wave transmissions is growing rapidly, and will, undoubtedly, become universal by the time the ultra-short-wave television transmissions come into operation again. It will therefore be worth while to get accustomed to it now.

—from "Practical Wireless," Eng.

RADIO AT WAR

Approximately 90 per cent of the U.S. Army Signal Corps' allocation of $5,000,000,000 for communication equipment for the year is to be spent on radio apparatus.

EUROPE'S 213,000,000 LISTENERS

Comparative Figures of Radio Density

A synoptic table compiled by the International Broadcasting Office of the Union Internationale de Radiodiffusion, Geneva, shows the increase in the number of listeners in the European Zone during 1942. It should, perhaps, be pointed out that the European Zone is bounded on the north and west by the natural limits of Europe, on the east by the meridian 40 deg. E., and on the south by the parallel 30 deg. N. One section of the graph shows the number of listeners and the other the radio density.

Sweden retains first place so far as radio density is concerned with 254.13 receivers per 1,000 inhabitants. Second place is retained by Denmark with 243.1 per 1,000. Their respective figures at the end of 1941 were 243.4 and 233.9.

Great Britain again holds third place with a density of 197.76 as compared with 186.7 the previous year. In 1941 fourth place was held by Germany, which is now relegated to the sixth with Iceland and Switzerland in the fourth and fifth places, having 184.78 and 170.9 per 1,000 respectively. In both these countries there has been an increase — 14 and 11 per 1,000 respectively.

Germany's figure shows a decrease from 177.48 to 164.95 per 1,000. This is not, sad to relate, necessarily due to fewer Germans wishing to listen to Goebbels' outpourings, but the fact that this year's figure includes the low-density areas in Bohemia-Moravia and the occupied territories of Poland and the U.S.S.R.

In the section of the graph showing the number of receivers in each country, Germany, with which is included the territories mentioned above, leads with a total of 16,113,466. Figures not being available for the U.S.S.R., Britain holds second place with 9,139,426, and France third with 5,404,600.

The total number of receivers in Europe at the end of 1942, allowing the 1941 figures for the U.S.S.R., Norway and Egypt, for which later figures are not available, is estimated at 53,238,000, an increase of nearly 1,500,000 on the previous year's figure. Allowing for an average of four listeners to each receiver Europe had nearly 213,000,000 listeners in 1942.

The figure for Australia is 193.7 licences per thousand of population.

—o—

MARCONI'S YACHT

According to broadcasts from Paris, all the apparatus has been removed from Marconi's famous yacht "Elettra," and the vessel taken to a place of safety. It will be remembered that it was on this yacht that Marconi carried out some of his most useful experiments in the realm of ultra-short waves.

TRIUMPH FOR ELECTRONICS

Measuring the thickness of strips of steel at a temperature of 2,000 degrees, within one or two per cent, while the strip is moving half a mile a minute, might appear to be a difficult task. But to radio engineers it is comparatively child's play. And so some American radio engineers of the G.E. Company have produced an electronic thickness gauge for use in steel mills. The measurements are made without touching the steel.

In large strip mills, huge ingots of red-hot metal are passed successively through a series of wringer-like rollers, each squeezing it a little thinner. As it gets thinner the speed increases. At the end of its passage through the rollers, the steel may have a speed of 2,000 feet per minute or more. To regulate the thickness of the finished sheets it has been the practice to measure them with micrometers, and then make adjustments. You can imagine how slow this method has been, and how often sheets have had to be discarded on account of having improper thickness. While it is possible to have such sheets remelted and used over again, the loss of time is now saved by the electronic gauge.

The method used is simple enough. An x-ray tube is fitted on one side of the moving metal. The beam penetrates the metal and an ionisation chamber on the other side measures the intensity of the rays received. This will read inversely proportional to the thickness. The ionisation current is amplified and read on a meter graduated in terms of thickness. With steel strips about an eighth of an inch thick it is possible to get accuracy to within a thousandth part of an inch.

UTILITY

(Continued from page 6)

ceiver my mind turned first to a broadcast job using a 6K8G converter, 6U7G I.F. amplifier, 6U7G cumulative detector, 6U7G connected as triode output. I have been using a 6U7G connected as a triode in the output of a seven-valve super. on to an 8/20 permagnet., the fidelity and output were surprising, and when turned flat out could be heard well all over the house.

For the Utility Receiver a full-size chassis would be the best from both the manufacturing and servicing point of view; this, of course, would depend on the cabinets available and the materials to build them with.

An equivalent battery circuit could be designed for country users and it could be the same as this one, but altered to suit battery valves.

The speaker would depend upon the size of the cabinet, but an 8-inch could be used with the size of the cabinet permitting.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

DOUBLE OR QUITS.

Before this issue reaches our readers, Great Britain will have gone on to double-summer-time (2 hours ahead of Greenwich Meridian Time) and in Australia we will have gone back to Standard time.

These changes will very likely coincide with the swing over from Night to Daylight reception and indeed there is already an indication that the noontime stations are trying to make themselves heard.

HOWARD THAT'S NOT CRICKET

Just as I tell the world how much I enjoy Howard Marshall in his "life at home" given over, until Feb. 26th, through GWC at 11.20 GMT (then 10.20 pm Sydney) he was replaced on March 4th by Major Lionel Marson in "War Office calling the Army." As excellent or necessary as this new session may be I regret that no space or time, so far, has been found for Howard Marshall.

The irony of the whole thing is that we were reminded on 26th Feb. that we could hear Mr. Marshall every Saturday at 11.20 GMT.

SOME DAY, MONDAY OR ALWAYS

KWIX with all the fidgets of the Cubans and South American s/w stations has certainly given us the run around over the past month or so. But as the anxiety is to get a better channel for programmes to the Allied Forces we must not complain but rather assist by reports as to how the various trials come through.

On February 29th. they moved to 11.9 mc. in programme directed to Australia from 4-10.58 pm (EADST) and at time of writing are still on that frequency from 3-9.58 pm. Some nights programme can be followed right through but generally from 8.30, while Japanese session is on, and again at 9.15, when "This is America at War, America calling the French speaking World" a "jam" is put on.

Station closes at 9.58 and comes back on 9.57 mc. at 10 in "Victory for the Philippines." The morning session I am told is still on 11.87 mc. but it is impossible to even hear WBOS, on the same frequency, now at 7.30. Dr. Gaden says he has heard the frequency given several times as 11.9 mc. but even that part of the dial is a blank here.

HELP WANTED

S/Sgt. R. K. Clack writes under date February 20th.: "I have a mystery station on about 7220 kc. The station is an Indian which opens at 8 pm with a programme in Hindustani. The signal is only R3-4 and sandwiched as it is between the strong signals of KWID and VLQ-2 it is very hard to copy. Even the bandspread tuning on the receiver does not enable its separation from the other two transmitters.

——?South Africa 9.92 mc. 30.24 met: Mr. Lindsay Walker of Applecross, W.A., submits this one heard opening with fair strength at midnight. Sometimes relays BBC. Advertisements are also heard but he has no idea of call-sign and suspects location is South Africa.

NEW STATIONS

XGOY, Chungking, 6.04 mc., 49.66 m.: This new outlet for the Chinese International Station in the war-time capital announces this freuency when opening at 9.35 pm. Often heard calling U.S.A. Stations WEEW, WMCA, and WNEW. However, the last night or two appears to have gone back to 48.92 m. Mr. Edel drew our attention to above.

ZOY, Accra, 7.05 mc., 42.54m.: Carries the same programme as the other Gold Coast station in Accra, ZOY, 49.96 m. Announces You are listening to Gold Coast Station ZOY in 42 metre band." (Mr. Nolan forwarded particulars of this one.)

CR7- Lourenco Marques, 5.86 mc., 51.19m.: Mr. Nolan of Perth forwards information re this. Opens around 2.45 am at very good strength. Closes at 6.30. News in English at 3.15. Woman announcer says, "Radio Station Lourenco Marques broadcasting on 51, 85 and 395 metres." Uses more English than CR7BE (30.38 m.) which opens at 4.25 and carries a different programme.

VPO11, Barbados Is. British West Indies, 11.475 m.c., 26.14 m.: First heard on Thursday, March 23, just as they were closing at 8.05 a.m.
Heard again at 7.06 am on Saturday, March 25 till 8.15 a.m. "This is VPO11, Barbados British West Indies transmitting on 11.475 mc., calling the United Kingdom." Then followed talk about conference of Caribbean Sea Islands being held in presumably Bridgtown, Barbados. On opening signal was R8 Q4 dropping to R6 Q3 on closing. Very pleased with catch and believe it is first time this country heard in Australia.
—L.J.K.

GENERAL FORCES PROGRAMME

Listeners doubtlessly noticed the BBC brought in on February 27th the "General Forces Programme." This is broadcast in the United Kingdom also, and during the hours of 3.30 pm-8 am replaces the "General Overseas Service." The all important point in the alteration is that it means the Forces will be sharing their listening with those at home.

ALL-WAVE ALL-WORLD DX CLUB

Application for Membership

ALL-WAVE DX CLUB ALL-WORLD

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

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

Name ....

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

....

My set is a ....

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

(Signed) ....

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

Shortwave Notes and Observations

OCEANIA

Fiji

VPD-2, Suva 6.13 mc. 48.94 met.: Back on the air again but Sundays only from 4.55 till 7.30. N.Z. Hour concludes at 5.59 and A.B.C. News is given at 6 o'clock. (Edel.)

NEW CALEDONIA

Radio Noumea 48.39 met. R8-9 signal every night (Clack). Splendid signal here and now gives News in English for New Zealand Forces on Monday nights from 7.30 o'clock.—L.J.K.

AFRICA

Algeria

AFHQ 6.04 ms. 49.67 met. English French, etc., at 6 a.m. Call. "United Nations Radio." (De 'Lisle)

Belgian Congo

RNB Leopoldville 15.53 mc. 19.33 m. Little weaker than its neighbour but continues later and gradually builds up to R7. (Walker.)

RNB 9.785 30.66. Fair in afternoon but is a crackerjack from 1.30 a.m. (Matthews.) Heard at terrific strength in French and Flemish till 4.45 p.m. and at 9 a.m. (De 'Lisle.) Very strong in afternoon. (Gaden.)

French Equatorial Africa

FZI Brazzaville 15.59 mc. 19.25 m. Still heard till closing at 10.45 p.m. Pity they don't use English occasionally. (Walker.) French till U.S.A. Special service at 10 p.m. Closes at 10.45. (De 'Lisle.) Not as good at night as morning signal on 25.06. (Gaden.)

FZI 11.97 mc. 25.06 m.: R8 at 3 a.m. with News in French; News in English, commentary and Swing music till Italian at 7.30 a.m. (De 'Lisle.) Fine in morning. (Gaden.) Good at 6.45 a.m. in News. (Hallett.)

GOLD COAST

ZOY Accra 7.05 mc. 42.54 m. Announces at 5 a.m. "You are listening to Gold Coast Station ZOY in 42 metre Band. Closes around 6 a.m. Same programme as 49.96. Nolan.)

ZOY Accra 49.96 m.: Takes BBC news at 4 a.m. Domestic news 4.15—great sig. (De 'Lisle.) "The Empire at War" at 4.20 a.m. Musical programme 4.45. Good strength. (Nolan.)

KENYA

VQ7LO Nairobi 27.96 m.: Quite good between 1 and 2 a.m. (Edel.) (Nolan.)

VQ7LO Nairobi 49.32 m.: Makes announcement in English at 2 a.m. Music till 2.15 then local news (same programme as 27.96. (Nolan.)

MOZAMBIQUE

CR7BE Lourenco Marques. 9.88 mmc. 30.38 m.: Very interesting transmission at colossal strength from 3 till 5 a.m. Calls frequently in French and English.

CR7 5.86 mc. 51.19 m.: See "New Stations." (De 'Lisle.)

SOUTH AFRICA

ZRG Johannesburg 9.52 mc 31.5 m.: First time I have heard this one. Opened at 11 p.m. when man says "This is The Broadcasting Corporation of South Africa." Language following I think must be Afrikaans. Sig. 87 improving to R8 at M/N when 6 time pips are given and a woman announces in German. Closes at 12.45. (Walker, Matthews.)

——**?South Africa 9.92 mc. 30.24 m.:** See "New Stations."

AMERICA

Central

Costa Rica

TIPG San Jose, 9.62 mc. 31.20 m.: Good around 10 p.m. (Matthews.) Heard at mid-day. (Gaden.)

Guatemala

TGWA 30.96 m.: Heard after lunch. (Gaden.)

Panama

HP5G 25.47 m. and HP5A 25.64 m.: Believe I am hearing them after 12.30 p.m. (Gaden.)

U.S.A.

KWU 19.53 m.: My old friend reopens at 9.45 a.m. and puts in a very fine signal till closing at 11.30 a.m.; worth listening to in English news and views from 11 till closing. (Gaden.) Wish we could hear it down here, it is beamed up your way my friend.—L.J.K.

KROJ 19.75 m. Splendid at present in morning but not as srong as KWU. (Gaden.)

KWID 19.62 m.: Wonderful signal till closing at 11 a.m. (Gaden.)

WLWK 19.67 m.: Usually knocks spots off KWID in morning; closes at 7.15—all too soon, figure signal would be good for fair bit longer. (Gaden.)

WKRD 23.13 m.: Excellent with news at 7 a.m. often reaching R8 Q4. —L.J.K.

KWIX 11.9 25.21 m.: Moved to here from 9.57 mc. on Feb. 29th. and putting in a fair signal at intervals from 3 till 9.58 p.m.—L.J.K. Heard 'Frisco here the other night. (Clifton.) Swell signal in early evening although some times badly QRM'd. (Nolan.)

KWIX 25.27 m.: Badly heterodyned by WBOS and hard to follow. (Matthews, Perth.)

Fair here, but should be better up North, can separate from WBOS although both give 11.87 mc. Think WBOS is actually on 11.875 mc. Think WBOS is actually on 11.875 mc. (Gaden.) Can't help you Keith as both as inaudible here now.—L.J.K.

WOOD 25.27 m.: Italian at 11 p.m. French 11.30 p.m. (Edel.)

WGEA 25.33 m.: Think is a point or so stronger than WGEO at 6 a.m. (Gaden.)

Coming through nicely at 10 p.m.—L.J.K.

WCRC 25.36 m.: German at 11 p.m., Italian 11.15. At 11.30 can only just separate from Moscow. (Edel.) Goes great guns around b/f time. (Gaden.)

KGEI 25.43 Heard in afternoon. (Gaden.) In a few weeks maybe down here.—L.J.K.

WLWO 25.6 m.: Now clases at 10 p.m. re-opening at 10.15 on 17.80 mc. 16.8 m.—L.J.K.

KROJ 30.31 m.: Now putting in an excellent signal, most nights from 6-11.—L.J.K.

WKLJ 30.77 m.: Splendid in morning. (Gaden.)

WNBI 31.02 m.: Opens at 6 p.m. with news in English. At 6.05 gives wave bands of News in English for 24 hours. (Edel.) Probably the best on 30/31 band. (Gaden.)

WOOC 31.09 m.: Very good in morning, heard news at 9 o'clock. (Gaden.)

WGEO 31.48 m.: Not quite as good as WOOC or WKLJ. (Gaden.)

KES-2 33.59 mm.: Fair at 9 p.m. with news. (Edel.)

WOOW 7.82 mc. 38.36 m.: Being heard at 8.30 a.m. (Whiting.)

WKRD 38.36 m.: Good with news at 4 p.m. (Cushen.)

WRUL 38.44 m.: Opens at 4.15 p.m. (Cushen.)

WRUA 39.66: Opens at 6.45 a.m. (Cushen.)

KGEI 41.38 m.: Fair just after 4 p.m. (Gaden.) Best here from 8 p.m. —L.J.K.

"Old Faithful" is only putting in an R4 sig. through "jamming." (Clack.)

(The interfering station is GWI which has a "jam" on it.—L.J.K. later.)

KWID 41.49 m.: Now opens at 5 p.m.—L.J.K.

WCDA 48.62 m.: Heard in Armed Forces Radio Service at 4 p.m., seems to be WCBX now. (Cushen.)

WRUA 48.86 m.: Fair sig. when closing at 4 p.m. (Cushen.)

WBOS 48.86 m.: At 11 a.m., 1 p.m. and 6 p.m. announces wave-bands of news in English for full 24 hours.—L.J.K.

WOOW 49.02 m.: Fairly good when closing at 4.45 p.m. (Cushen.)

WRUW 49.66 m.: Closes at 4 p.m. with fair sig., re-opens at 4.15. (Cushen.)

SOUTH AMERICA

Argentine

LRM Mendoza 6.18 mc. 48.51 m.: Gives 5 musical chimes at 8.30 p.m. (Whiting, Edel.)

Brazil

PRL-7 Rio de Janiero 9.72 mc 30.86 m.: I am hearing Cuban type of programme at 9 a.m. which may be PRL-7. (Matthews.)

(Quite likely as they recently moved from 9.505 mc.—L.J.K.

ZYC-8, Rio de Janiero, 9.61 mc. 31.22 m.: I was very interested in your reference to this and logged them early this month. Very good just before 3 p.m. till CRY blots them out. (Cushen.)

Chile

CE960, Santiago, 31.24 m.: Hearing it just after lunch. (Gaden.)

Ecuador

HCJB, Quito 30.12 m.: Only fair when opening at 9 p.m. (De 'Lisle.)

Paraguay

ZPA-5, Encarnacion, 11.95 mc. 25.10 m.: Good signal at 10.30 a.m. (Cushen.)

THE EAST

China

XGOY, Chungking, 25.27 m.: Seemed to have settled here although male announcer gives frequency as 11.9 mc. just as news begins at 8.03 p.m. It is definitely on 11.87 mc. and overpowers Delhi.—L.J.K. Hum has gone but badly heterodyned by VUD. (Clifton.)

XGOY, 49.10 m.: Calls U.S.A. at 10 p.m. (De 'Lisle.)

XGOY, 6.04 mc., 49.66 m.: Opens at 9.35 p.m. in Chinese. Announces frequency as 6040 kc. News at M/N and in parallel with GXOA (30.6 m.). (Edel.)

XGOA, 50.04 m.: News in English at 1 a.m. (Edel.)

INDIA

VUD-, 25.27 m.: French and Hindustani at 10.30 p.m. (De 'Lisle.)

VUD-6, 25.45 m.: Heard concluding 15 minute session in English at 11.45 p.m. (Hallett.)

VUD-2, 41.15 m.: From 9 p.m. in English. Swing records 2 a.m. (De 'Lisle.)

VUD-2, 48.47 m.: From 10 p.m. English used. (De 'Lisle). Opens at m/n in Hindustani. (Edel.)

VUD-, 49.3 m.: Good at 10 p.m. and 3 a.m. (Whiting.) Talk in English at 11 p.m., calls U.S.A. at m/n. (Edel.)

Colombo Radio

Call on 4.90 mc. is not VUC. Do not know short-wave call, but B/C is ZOH. (Cushen.)

Heard Colombo testing on 9615 kc., 31.21m. Signal at 3 a.m. (Hallett.)

GREAT BRITAIN

Note:—Pacific Service commencing March 26th is from 3-7 p.m.

Transmitters are:—GRH and GVZ. 3-7 p.m.; GRM, 3-6.15 p.m.; GSU, 3-5.30 p.m.; GRV, 4.30-7.00 p.m.; GWD, 5.00-7.00 p.m.; GVQ, 5.30-7.00 p.m.; GSN, 5.45-7.00 p.m.

GRP, 16.79 m.: Never a real champ., not up to the form of GSG and GSV of old but possible at night. (Gaden.) A very disappointing sig. down here too.—L.J.K.

GVQ, 16.92 m.:

And here is Dr. Gaden's report on BBC.:

GRD, 19.43 m.: Good at night. GWD, 19.46, very good, GWC, 19.91, quite good at night. GSN, 25.38, Sorry taken off at 8.15 p.m. GRH, 30.53, Very good in Pacific Service. (Now getting fair at 6.30 a.m.—L.J.K.). GVZ, 31.12, Good.

U.S.S.R.

Moscow, 19.7, Heard well round 7.30, 9 and 11.15 a.m., also 1.30 p.m. (Gaden.)

Leningrad on 25.79 and 30.85, putting in good signal around 9.30 p.m. (Gaden.)

RW15, Khabarovsk, 31.37 m.: With KWIX off the air on 31.35 can hear this one very well. (Clifton.)

And here is Mr. Edel's Russian Budget:

24.47 m.: 3-9 p.m.. Home programme, 9.20 news, calls BBC 10.30, Hindustani 11 p.m., news 1 a.m.

24.65: Home programme, 7-9 p.m., news in Russian 9 and 11 p.m., English, 9.40, Chinese, 10.25.

Tiflis, 25.08, From 8.45-11.45 p.m. in various languages.

25.11: News from 9.40 p.m.

25.36 in relay with 24.47 from 11 p.m. in Hindustani.

28.72: German 3.15-4 p.m., 4.15-4.30, 4.45-5 p.m. Czech. 5-5.15.

29.33: In Czech. 5-6 p.m.

29.68: In relay with 28.72 in German at 4.15 p.m.

29.75 opens at 4 p.m. in French, 4.30 German, 5 Czech., 5.30 Portugese, 5.45 Spanish, signs at 5.48 p.m.

31.65, Spanish at 3.30 p.m.

MISCELLANEOUS

Arabia

ZNR, Aden 12.11 mc., 24.7 m. Only fair at 2.30 am (Nolan).

Azores

——,Ponta Delgada, 42.74 m.: Has been coming through lately around 7 am. but signal poor. (Clifton).

British Mediterranean Station, 7.21 mc., 41.58 m.: When signing off at 6 am, "You are listening to the British Mediterranean Station. Good night." (Nolan).

Canada

CBFY, Montreal, 25.36 m.: News at 11 pm Sig. R4 Q3 (Edel).

(Signal should improve quickly — L.J.K.).

Heard CJCX 49.92 m and CHNX 48.93 m. at good strength around 10 pm (Graham).

CFRX, Toronto, 49.42m.: Hear with R4-5 sig. on Feb. 25 relaying CFRB (Edel

Very good strength at 10 pm (Graham).

Supposed to be big things moving in Canada for much improved service so watch out for some new and powerful stations testing.—L.J.K.).

Mexico

XEQQ, 30.99 m.: Thought I heard them the other day at 2 pm (Gaden).

XETT, 31.39 m.: Being heard around 5 pm (Whiting).

XEFT, Vera Cruz, 31.42 m.: Mr. Walker of W.A. says he thinks this is the station he hears from 9.30—10 am with an R5 sig. Quite possible this is correct and as schedule is from midnight to 4.15 p.m. I have re-inserted in list.—L.J.K.

XEWW, 31.5 m.: Good from 11 pm and also in morning (Matthews).

Not a patch on its old form on afternoon (Gaden).

Portugal

CSW-7, Lisbon, 30.82 m.: Good at 10.30 am (Matthews).

Sweden

SBT, 19.80 m.: Heard in Swedish from 9.30 for 20 minutes (Edel).

SBP, 25.63 m.: Heard in Swedish at 12.15 am (Edel).

Allied and Neutral Countries Short-Wave Schedules

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

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

NOTE.—S indicates change of schedules other than those affected by change of Time System

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
GSH	London	21.47	N	13.97	8.45 pm—1.15 am.
HER-	Berne	18.45		16.26	Tues. and Sats. Now on 23.14m
GVO	London	18.08		16.59	1—2.15 am.
AFHQ	Algiers	18.02		16.64	9.20 pm
GRQ	London	18.02		16.64	11—1.15 pm
VWY	Kirkee	17.94		16.72	Around 9.30 pm
GRP	London	17.87	S	16.79	8 pm—1.15 am; 1.45—3.15 am
EIRE	Athlone	17.84		16.82	10—11.20 am; 3.30—4 am; News 2.45 am
WCDA	New York	17.83		16.83	11 am—4.30 am
WCRC	New York	17.83		16.83	7.15—9.15 am
GSV	London	17.81	S	16.84	1.30—4.45 am
VLI-8	Sydney	17.80		16.85	7.30—8 pm
WLWO	Cincinnati	17.80	S	16.85	7.30—8.45 am; 10.15 pm—4.30 am
GSG	London	17.79		16.86	8—8.30 pm; 1.15—2.45 am
WRCA	New York	17.78		16.87	11—2.45 am
OPL	L'poldville	17.79		16.88	4.55—6.15 am
KROJ	'Frisco	17.76		16.89	11—Noon; News at 11 am.
WRUW	Boston	17.75		16.90	1—3.15 am
GVQ	London	17.73	S	16.92	5.30—7 pm: 2—2.15 am
LRA-5	B'nos Aires	17.72		16.93	Sats 6.45—6.30 am
—,	Brazzaville	17.71		16.94	6.30—7 am
GRA,	London	17.71		16.94	6 pm—2.45 am; News 6 pm
HVJ	Vatican City	17.44	N	17.20	11 pm—1 am
GVP	London	17.70		16.95	7 pm—12
KMI	'Frisco	17.09		17.5	1—4 am
WCW	New York	15.85		18.93	3 am—7 am
LSL-3	Beunos Aires	15.81		18.97	
—,	Moscow	15.75		19.05	9.40 pm—11.30 pm
FZI	Brazzaville	15.59		19.25	9.15—10.15 pm
RNB	L'poldville	15.53		19.33	9 pm—11 pm
KKR	Bolinas	15.46		19.4	News and commentary 12—12.30 pm
GRD	London	15.45	S	19.43	4.30—5.15 pm; 1.15—5 am
GWE,	London	15.43	S	19.44	9.15 pm—1 am; 3—8 am
GWD	London	15.42	S	19.46	5—7 pm; 2—2.15 am
GRE	London	15.37		19.51	5.45—7 pm; 10.15—1 am; 1.30—4 am
ZYC-9	Rio deJ'niero	15.37		19.51	Schedule unknown.
KWU	'Frisco	15.35	S	19.53	1—4 am; 6.30—8.15 am; 9.45—11.30 am
—	Moscow	15.35		19.54	8.15—10.20 pm. (English from 9.40)
WRUW/L	Boston	15.35	S	19.54	8.15 am
WGEA	Schenectady	15,33		19.57	7.30—8.45 am
KGEI	'Frisco	15.53		19.57	Closes at 11 am
WGEO	Schenectady	15.33		19.57	9.15 pm—5.30 am
VLI-3	Sydney	15.32		19.58	7.30 pm—11 pm
GSP	London	15.31	S	19.60	7.15 am—12.15 pm; 3.45—5.15 pm; 9.15—10 pm; 10.30 pm—1 am; 2—2.15 am
KWID	'Frisco	15.29		19.62	3.30—11 am; 3—4.45 pm
VUD-3	Delhi	15.29		19.62	1.30—7.30 pm; News 1.30 and 5.
WCBX	New York	15.27		19.64	9 pm—6.45 am; 7—9.45 am
GSI	London	15.26	S	19.66	1.30—7 am
WLWK	Cincinnati	15.25		19.67	7.30—10.15 am; 10.30 pm—7.15 am.
VLG-6	Melbourne	15.23		19.69	10.45 am—11.20 am; 12.40—12.50 pm (Sun. 12.15—12.50)
—	Moscow	15.22		19.70	7.15—7.40 am; 8.47—9.30 am; 11.15—11.40 am; 9.40—10.20 pm
WBOS	Boston	15.21		19.72	10.15 pm—1 am; 1.15 am—2.45 pm
XGOY	Chungking	15.20		19.73	Heard testing with U.S.A. 5—7 pm
TAQ	Ankara	15.19		19.75	7.30—10.15 pm; 11.30 pm — 12.45 am.
KROJ,	'Frisco	15.19		19.75	6—10.45 am

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
WOOC	New York	15.19	N	19.75	12.45—4.45 am
WKRX	New York	15.19		19.75	5.30—7 am
XGOX	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)
VLG-7	Melbourne	15.16		19.79	5—7.10 am (Sun. 5.45—7 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	S	19.82	3—5.15 pm; 8 pm—6 am
KGEI	'Frisco	15.13		19.83	3.15—4.15 am
WRUS	Boston	15.13		19.83	5—6.30 am
HVJ	Vatican City	15.12		19.84	Irregular in afternoons
—	Moscow	15.11	S	19.85	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am
HVJ	Vatican City	15.09		19.87	See 19.84 m.
GWC,	London	15.07	S	19.91	3.45—5.15 pm; 8 pm—1.15 am; 4—8 am
GWG	London	15.06		19.92	No schedule.
WWV	Washington	15.00		20.00	See 10 m.c.
—	Moscow	13.42		22.35	Around 10.45 pm
WKRD	New York	12.96		23.13	10 pm—9.15 am
HER-	Berne	12.96	N	23.14	Tues and Sats6—7.30 pm
CNR	Rabat	12.83		23.38	9.30—10 pm
HCJB	Quito	12.45		24.11	6—7 am; 9.55 pm—11 pm
—	Moscow	12.26	S	24.47	Home prog. 3—9 pm; News 9.20, calls BBC 10.30 pm
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	S	24.65	4.45—5 pm; 7.30—8.50 pm
R. France	Algiers	12.12		24.75	2.30—4.30 pm; 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	10 pm—1.15 am
GRV	London	12.04	S	24.92	4.30—7 pm; 12.45—1.15 am
FZI	Brazzaville	11.97		25.06	4.45—8 am; 1—2 pm; 4—4.15 pm; 11.30—12.15 am
Radio TBILISI	Tiflis	11.96	S	25.08	From 9 pm
—	Moscow	11.94	N	25.10	9.40—10.54 pm in English
ZPA-5	Enc'nac'n	11.95	N	25.10	Heard around 10.30 am
GVY	London	11.95		25.09	8 p m—1.45 am; New 9 pm, 11 pm and 1 am.
GVX	London	11.93	S	25.15	
XGOY	Chungking	11.90	X	25.21	Moved to 25.27m.
VLG-9	Melbourne	11.90		25.21	Not in use
KWIX	'Frisco	11.9	N	25.21	3—9.58 pm
CXAIO	Montevideo	11.90		25.21	9.5 am—12.10 pm
WRCA	N.Y.	11.89	S	25.22	6—10 pm; 3—6.45 am; 7 am—1.30 pm
VPD-2	Suva	11.90		25.22	8.30—10 am
WKTM	New York	11.89		25.23	8—10 am
AFHQ	Algiers	11.88		25.24	6.57 pm
VLR-3	Melbourne	11.88		25.25	Daily 10.45 am—4.45 pm; Sun. from 11.50 am
WOOW	New York	11.87	N	25.27	10.45 pm—4.45 am
VLI-2	Sydney	11.87		25.27	4.55—5.25 pm
WBOS	Boston	11.87		25.27	8.15—10 pm; 5—7.15 am; 7.30 am—2 pm.
VUD-,	Delhi	11.87		25.27	7.45—10.30 pm; News 7.46
KWIX	'Frisco	11.87	S	25.27	6—9.30 am
XGOY	Chungking	11.87	F	25.27	7.55—9.30 pm
HER-5	Berne	11.86		25.28	10.55—12.30 am
GSE	London	11.86	S	25.29	9.15 pm—7 am
WGEA	Schenectady	11.84		25.33	10 pm—7.15 am
VLG-4	Melbourne	11.84	S	25.34	3.10—3.40 pm; 6.10—7 pm; 7.30—8 pm; 8.15 9.45 pm
GWQ	London	11.84		25.34	7 pm—12.30 am 1.30—4.45 am
VLW-3	Perth	11.83		25.36	8.30 am—11.45 pm; 1.30—8.15 pm; (Sun. 8.45 om—8.15 pm)
—	Moscow	11.83		25.36	Opens at 11 pm in Hindustani
WCRC	N.Y.	11.83	S	25.36	5.15—8.45 am
WCDA	N.Y.	11.83	S	25.36	8.45 pm—
GSN	London	11.82	S	25.38	4—6 am; 5.45—7 pm; 10 pm—10 am
XEBR	Hermosillo	11.82		25.38	11—3 pm
COBH	Havana	11.80		25.41	Heard at 8 am and 9.30 pm
COGF	Matanzas	11.80		25.41	Said to be off the air.
GWH	London	11.80		25.42	7 pm—12.30 am; 1.30—4.45am
WRUL	Boston	11.79		25.45	8 pm—6.30 am.

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
VUD-6	Delhi	11.79		25.45	7.45 pm—12; News 7.45
KGEI	'Frisco	11.79		25.43	7 am2.45 pm
GVU	London	11.78	S	25.47	2—5.15 pm; 9—10 pm; 12.45—2.30 am.
HP5G	Panama	11.78		25.47	11.15 pm—12.30 am; 2.45—6 am
VLR-8	Melbourne	11.76		25.51	5—9 am (Sun. 5.45 am—11.45 am
GSD	London	11.75		25.53	7—9.45 am; 3—5.15 pm; 8—midnight; 12.30—1.15 am
—,	Moscow	11.75		25.53	9.30—9.55 am
GSB	London	11.75		25.53	2—2.45 pm
HVJ	Vatican City	11.74		25.55	Mon. & Thurs: Calls Eng. 4 pm Thurs & Sat calls Aust. 5 pm
COCY	Havana	11.73		25.56	11 am—4.15 pm
GVV,	London	11.73		25.58	8.45 pm—1.15 am; 1.30—6.30 am
WRUL,	Boston	11.71	S	25.58	6—8 am; 8.15—9.15 am
CKRX	Winnipeg	11.72		25.60	3—7.45 am
OPL	L'poldville	11.72		25.60	9.55—11 pm; 4.55—6.15 am.
Brit. Medit. Stn		11.72		25.60	10 pm—2 am
HER-5	Berne	11.71	S	25.61	Daily: 4—7.45 am; Tues & Sat 6—7.30 pm
PRL-8	R. de J'niero	11.72	N	25.61	English announcements at 6 am
YSM,	San Salvador	11.71		25.62	4—5 am
VLG-3	Melbourne	11.71		25.62	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm
WLWO	Cincinnati	11.71	S	25.62	4.45—7.15 am; 8.30—10 pm
CXA-19	M'tevideo	11.70		25.63	9—10 pm; 7 am—1 pm
SBP	Motala	11.70		25.63	1—4.15 am; 7.20—8.40 am; 11 am—12, opens again at 9.05 pm
CBFY	Montreal	11.70		25.63	9.30 pm—1.30 pm
GVW	London	11.70	S	25.64	1.30—7 am
HP5A	Panama City	11.70		25.64	11 pm—3 am; 11.10 am—3 pm
CE1170	Santiago	11.70		25.64	10 pm—12
GRG	London	11.68	S	25.68	5.15—9.45 am; 3.30—5.15 pm; midnight—3.45 am
—,	L'poldville	11.67		25.71	Now on 30.66 metres.
Leningrad		11.63	N	25.79	9.30—9.43 pm; 9.50—10.17 pm; 11.30—11.43 pm; 11.50 12.18 am
COK	Havana	11.62		25.83	2 am—1 pm (Mon. 3—9 am)
WRUA	Boston	11.14	S	26.92	10 pm
WCDA	New York	11.14	N	26.92	5—6 am
CSW6	Lisbon	11.04		27.17	5—8.30 am
KWV	San F'cisco	10.84		27.68	4—6.45 pm; 7—9 pm
VQ7LO	Nairobi	10.73		27.96	12.45—5 am
KES-3	Bolinas	10.62		28.25	3—8.15 pm
VLN-8	Sydney	10.52		28.51	Idle at present
—	Moscow	10.44	S	28.72	3—6 pm and again at 9.15 pm
—	Moscow	10.23		29.33	4.15—5.50 pm; 9 pm—11 pm
—	Moscow	10.10	N	29.68	4.45—5.45 pm
Moscow		10.08	N	29.75	Heard at 3.50 pm
SUV	Cairo	10.05		29.84	4.30—5 am; 8.45—9.30 am
WWV	Washington	10.00		30.00	National Bureau of Standards frequency check, in speech on hour and half hour.
—	Brazzaville	9.98		30.06	4—5.20 am; 7—7.30 am 7.30—8.30 pm; 11.45—12.15 am
HCJB	Quito	9958		30.12	6—7 am; 9.55 pm—12
WRX	New York	9905		30.29	8 am—2 pm; 2.15—7 pm
WKRD	New York	9897		30.31	6.45—8.30 pm; 5—7 am.
WKRX	New York	9897		30.31	8—10.45 am
KROJ,	'Frsco	9.89		30.31	12.15—5.45 pm; 6 pm—11 pm 1.15—4.15 am
—	Moscow	9.88	S	30.34	11 pm—1 am Home prog.
CR7BE	L. Marques	9.88	X	30.38	4.30—6.30 am; News 5.50
EAQ	Madrid	9860		30.43	4—6 am; News 4.15
—	Moscow	9860	S	30.43	8—10.15 pm
COCM	Havana	9833		30.51	9.45 pm—3 pm
GRH	London	9825	S	30.53	7.15 am—12.15 pm; 3—7 pm 12.45—1.15 am; 5—7 am
RNB	L'poldville	9.78	S	30.66	3—4.45 pm; 1.55—2.30 am 3.15—8.30 am
—	Moscow	9770		30.71	10—10.30 am.
WKLJ	New York	9750		30.77	5.30—8.30 am; heard at 8.30 pm
T14NRH	Heredia	9740		30.80	10—11 pm (Wed. Fri. & Sun. 1.30—3.30 pm)
CSW-7	Lisbon	9735		30.82	See 27.17 metres.
Leningrad		9.72	N	30.85	Heard around 5.15 pm; 9—10 pm and 11 pm
CE-970	V'paraiso	9.73		30.82	Heard around 2 pm
XGOA	Chungking	9720		30.86	5—6 am; 9 pm—1 am; News 12 am
PRL-7	R de J'niero	9.72	F	30.86	8 am—1 pm
OAX4K	Lima	9715		30.88	8.30 am—2.20 pm
WRUW	Boston	9.70	S	30.93	4.45—8 am
FIQA	Tananarive	9700		30.93	12.30—1 am
GRX	London	9690	S	30.96	8 am—2.45 pm; News 7 pm; America calls Europe 7.15 pm
TGWA	Guatemala	9685		30.96	11.50 am—2.45 pm (Mon. 10 am—2.45 pm)

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
LRA-1	B'nos Aires	9688		30.96	1.30—4 am; 5.30—6.30 am—Noon.
XEQQ	Mexico City	9.68		30.99	Midnight—4.45 pm
VLW-6	Perth	9.68		30.99	8.30 pm—1.30 am
WNBI	New York	9.67		31.02	7.15 am—4 pm; 6 pm—11 pm
Brit. Medit Stn.		9.67		30.02	10 pm—2 am; 4—7 am
VLQ-3	Brisbane	9.66		31.05	10.45 am—4.15 pm. (Sun. 10 am—4.15 pm).
GWW	London	9.66		31.06	Heard at 10.30 pm
LRX	B'nos Aires	9.66	S	31.06	1.30—7 am
HVJ	Vatican City	9.66		31.06	2—4.30 am
WGEO	Schenectady	9.65		31.08	Not in use at present
WOOC	New York	9.65	S	31.08	6—9 am
WCBX	New York	9.65		31.09	1.45—4 pm
XGOY	Chungking	9.64		31.10	9.35 pm—1.40 am; News 12 and 1 am
COX	Havana	9.64		31.12	2.50—2 pm
LRI	B'nos Aires	9.64		31.12	7.57—10 pm! 3.30—4.30 am; 5 am—1 pm
GVZ	London	9.64	S	31.12	6—7.45 am; 3—7 pm; 8 pm 1.15 am; 2—5 am
GWO	London	9.62	S	31.17	3.45—5.15 pm
—	Addis Ababa	9.62		31.17	1.40—2.30 am
TIPG	San Jose	9.62	N	31.20	Heard around 10 pm
XERQ	Mexico	9.61		31.21	Heard at 2 pm
ZYC-8	Rio de J'n'ro	9.61		31.21	9 am—12
ZRL	Capetown	9.60		31.22	5.15 pm—12.30 am.
HP5J	Panama City	9.60		31.23	10 pm—4.30 am; 11.30 pm—1.30 pm; Sun. 11 am—1 pm Mon.
CE960	Santiago	9.60		31.24	9 am—2 pm
GRY	London	9.60	S	31.25	5—7 am
—	Athlone	9.59		31.27	7.05—7.25 am; News 7.10 am
VUD-4	Delhi	9.59		31.28	8.30—11.35 pm; 12.15—1 am; 2.30—4.30 am; News 10 pm; 12.50 am and 4 am
WCRC	New York	9.59	N	31.30	8—8.45 pm
WLWO	Cincinnati	9.59		31.30	9 am—2 pm
WLWK	Cincinnati	9.59		31.30	Idle
VLR	Melbourne	9.58		31.32	5—10.30 pm daily
VLI-10	Sydney	9.58		31.32	Idle at present
VLG	Melbourne	9.58		31.32	12.15—12.45 am (Eng. for India) 1—1.45 am (for Nth America)
GSC	London	9.58	S	31.32	7.15 am—2.45 pm
WRUS	Boston	9.57	S	31.35	6.45—8 am; 8.15 am
KWIX	'Frisco	9.57	S	31.35	10 am—2.45 pm; 10 pm
KWID	'Frisco	9.57		31.35	Not in use at present
—	Khabarovsk	9.56	S	31.37	7.40—8.45 pm; 6 pm—12
OAX4T	Lima	9.56		31.37	11 pm—Midnight
XETT	Mexico	9.55		31.39	Continuous
GWB	London	9.55		31.41	6.15—7.45 am; 4.10—4.30 pm 5.10—6 pm; 6.30—7.30 pm; 8.45—10 pm; 10.45 pm—11.15 am; 1.30—5.45 am.
WGEA	Schenectady	9.55		31.41	Not in use at present
XEFT	Vera Cruz	9.54	X	31.42	Midnight—4.15 pm
—	Moscow	9.54		31.43	1.15—1.40; 9.30—10.20 pm
VLG-2	Melbourne	9.54	S	31.45	10 pm—Midnight
AFHQ	Algiers	9.53		31.46	12.45—1 am; 2—8.30 am; News 5 am
SBU	Stockholm	9.53		31.47	7.20—7.35 am; 11 pm—12. News 7.20 and 11 am
HER-4	Berne	9.53		31.47	See 25.61 metres
WGEO	Schenectady	9.53		31.48	5.15—7.15 am; 7.30 am—9.30
GWJ	London	9.53		31.48	7—10.45 pm; 11 pm—12.30 am
ZRG	Joh'burg	9.52	X	31.50	11 pm—12.45 am
COCQ	Havana	9.51		31.53	10 am—1 pm; 8.20—11 am
GSB	London	9.51	S	31.55	7.15 am—1.30 pm; 2—2.30 pm; 3.45—5.15 pm;9.15 pm —2.15 am; 3—7 am
PRL-7	R de Janeiro	9.50	F	31.57	Moved to 30.86 metres
XEWW	Mexico City	9.50		31.58	11.58—5.45 pm
GWF	London	9.49		31.61	5 pm—12.30 am; 1.30—4.30 am
KRCA	'Frisco	9.49		31.61	3 pm—3 am
WCBX	New York	9.49		31.61	9.50 am—1.30 pm
—	Moscow	9.48		31.65	4—5 pm; 8.30 pm—12.45 am; 1.45—2.15 am
TAP	.. .. Ankara	9.46		31.70	1—5.45 am; News 3 am. Talk at 6.30 am on Fridays
GRU	London	9.45	S	31.75	1.30—3.30 am; 5.15—6.30 am
COCH	Havana	9.43		31.80	8.45 am—3.15 pm
—	Moscow	9.43		31.81	7—7.25 am; 2.15—2.45 pm; 3.30—4 pm
GRI	London	9.41	S	31.88	2.45—8.30 am; 9 am—1.45 pm
FGA	Dakar	9.41		31.88	3—4.15 am
OAX4W	Lima	9.40		31.90	Heard closing at 3 pm
—	Moscow	9.39		31.95	9.30—11 am; 1.30—2 am; 10 am—1 pm
COBC	Havana	9.37		32.00	11 am—3.15 pm
OAX4J	Lima	9.34		32.12	9 am—4 pm; 11 pm—12 am; 3—6 am

Call Sign	Location	Mc.	M.	Time: East. Australian Stand'd
LRS	B'nos Aires	9.32	32.19	8 am—12; 10—11am; 4—4.30 am
COCX	Havana	9.27	32.26	10.45—3 pm
COBQ	Havana	9.22	32.54	10 pm—11.15 am
HC2ET	Guayaquil	9.19	32.64	10.30 pm—3.30 pm
CNIR1	Rabat	9.08	33.03	4—8.50 am; 4.30—4.50 pm; 9.30—11 am
VWY	Kirkee	9.04	33.16	Around 8 am
—	Brazzaville	9.04	33.19	11.45—12; 4—5.15 am; 7—7.30 am; 7.30 pm—8.30 pm
COBZ	Havana	9.03	33.23	10.45 pm—2 pm
—	Moscow	8.99	33.37	5.50—6 am
AFHQ	Algiers	8.96	33.48	2—9 am; News 4 and 5
—	Moscow	8.94	33.54	Around 8.45 pm
KES-2	'Frisco	8.93	33.58	8.15 pm—4 am
—	Dakar	8.83	33.95	5.15—6.45 am; 5.30—5.50 pm; 10.15—11 am.
COCQ	Havana	8.83	33.98	8.20 pm—2.15 pm
COCO	Havana	8.70	34.48	7.30 pm—3.30 pm
COJK	Camaguey	8.66	34.62	2.30—3.30 am; 6.30—9 am; 11—11.30 am
WOO4	New York	8.66	34.64	10 am—4 pm; 4.15—7 pm
—	Moscow	8.05	37.27	1—1.30 am; 2—4.15 am; 7.15 8.45 am
CNRI	Rabat	8.03	37.34	4—9.45 am; 3—5 pm
FXE	Beirut	8.02	37.41	11 pm—7 am
YSD	San Salvador	7.89	38.00	10 am—1.30 pm
SUX	Cairo	7.86	38.15	3.30—4.30 am; 5.15—7.45 am
WOOW	New York	7.82 N	38.36	9.15 am—
WKRD	New York	7.82	38.36	4—6.15 pm
WKRX	New York	7.82	38.36	7—10 pm
WRUW	Boston	7.80 S	38.44	Opens 4.15 pm
WRUA	Boston	7.57 S	39.6	6.45—8 am; 8.15—
WLWO	Cincinnati	7.57 S	39.6	2.15—4.30 pm
WKTS	New York	7.57	39.6	2.15—4.30 pm
WKLJ	New York	7.57 N	39.66	
—	Moscow	7.56	39.68	1—6.30 am; 8—9 am; 11.10—11.30 pm
WDJ	New York	7.56	39.66	9.15 am—6 pm
KWY	'Frisco	7.56	39.66	10.30 pm—12.30 am
SU—	Cairo	7.50	40.00	1.30—3 am
YN2FT	Granada	7.49	40.05	10 am—1 pm
—	Moscow	7.46 N	40.21	Home Service heard at 1 am
HER-—	Berne	7.39	40.56	1.15 1.47 am
—	Moscow	7.36 N	40.76	Home Service heard at 1 am
GRJ	London	7.32 S	41.01	9 am—1.30 pm; 2—5.15 pm
—	Moscow	7.30	41.10	2—9.30 am; 10—11 am; 1—3.45 pm; 4.30—5 pm
VUD-2	Delhi	7.29	41.15	7.45 pm—11.25 pm; News 7.45 pm; Special news for 15 minutes at 4 am
VLI-9	Sydney	7.28	41.21	Idle at present
GWN	London	7.28	41.21	No schedule
VUM-2	Madras	7.26	41.32	6—6.40 pm; 9.45—11.30 am; 12.45—12.50 pm. News 10 pm and 12.45 am.
GSU	London	7.26 S	41.32	4—6.30 am; 10.15 am—2.45 pm; 3—5.30 pm; 9.35—Midnight.
KGEI	'Frisco	7.25	41.38	1 pm—2.45 am.
GWI	London	7.25	41.38	4 am—1 pm; 2.45—7.15 pm
VUB-2	Bombay	7.24	41.44	4.15—5.10 pm; 9.25—10.45 pm.News 5, 9.25 & 10 pm
VLQ	Brisbane	7.24	41.44	5—9 am
KWID	'Frisco	7.23 S	41.49	5 pm—3.05 am
GSW	London	7.32 S	41.49	3—5.515 pm
VLI-4	Sydney	7.22	41.55	11.35—12.45 am
VLQ-2	Brisbane	7.21	41.58	4.30—10.30 pm
Brit. Medit. Stn				
. . . —		7.21	41.58	4 am—
—	Moscow	7.21	41.61	7.50—9.30 am
VUC-2	Calcutta	7.21	41.61	8.30—9.30 pm
—	Madrid	7.20	41.63	6—9 am
GWL	London	7.20	41.64	No schedule
YSY	San Salvador	7.20	41.65	10.30 am—2 pm
GRK	London	7.18	41.75	
XGOY	Chungking		41.80	8 pm—3 am; 4.30—7 am
—	Moscow	7.17	41.80	5.20—6.30 am; 7.15—9.55 am 10—10.30 pm; 1—4.30 am
GRT	London	7.15	41.96	12.45—2 pm
EAJ-9	Malaga	7.14	42.00	6—9.05 am
—	Ovideo	7.13	42.05	5—7.30 am
GRM	London	7.12 S	42.13	3—6.15 pm
EA9AA	Melilla	7.09	42.31	Heard around 7 am
GRS	London	7.06 S	42.46	2—5.15 pm; 2.30—9.45 am
ZOY	Acrca	7.05 N	42.54	Heard around 5 am
EAJ24	Cordoba	7.04	42.61	6.40—7 am
EAJ-3	Valencia	7.03	42.65	6—10 am

Call Sign	Location	Mc.	M.	Time: East. Australian Stand'd
—	Ponto Delgada	7.02	42.74	5—6 am
WGEA	Schenectady	7.00	42.86	10 am—2 pm
FO8,AA	Papeete	6.98	42.95	Wed. & Sats 1.57—2.45 pm
—	Moscow	6.98	42.98	2 am—9.23 am; 10—10.30 am
YNOW	Managua	6.87	43.67	10 am—2.30 pm
KEL	Bolinas	6.86	43.7	7—7.25 pm
ZLT-7	Wellington	6.71 S	44.68	7.30 pm in news session only
TGWB	G'temala	6.54	45.87	9.30 am—3 pm
COHI	Santa Clara	6.45 N	46.48	9.30 pm—2.15 pm
WKTM	New York	6.38	47.01	5.15—7 pm
	Berne	6.34	47.28	4—7.45 am; News 6.53
SUP-2	Cairo	6.32	47.47	4—7 am
FK8AA	Noumea	6.20	48.39	5.15—5.27 pm; 7—8 pm
GRN	London	6.19	48.43	5.45—6.30 am; 12—2.45 pm
VUD-2	Delhi	6.19	48.47	9.30—10.15 pm; 11—2.45 am News 10 pm; 11.45 am; Special 15 mins at 4 am
XECC	Puebla	6.19	48.47	From 2—4 pm
WGEO	Schenectady	$.19	48.47	2.15—5.15 pm
LRM	Mendoza	6.18	48.51	8.30—1 pm
GRO	London	6.18	48.54	5—10.45 am; 2.40—7.45 pm
HJCT	Bogota	6.18	48.54	9 am—2.15 pm
WCBX	New York	6.17	48.62	2—5 pm
WCDA	New York	6.17 N	48.62	7.15 am—
—	Antananarivo	6.16	48.62	1—2 am
HER-3	Berne	6.16	48.66	See 47.28 metres
GWK	London	6.16 S	48.66	5 am—1 pm; 2.45—4.45 pm; 10 pm—11.45 pm
HHBM	P-au-Prince	6.16	48.66	9 am—12 pm
HJCD	Bogota	6.16	48.70	Around 2 pm
CBRX	Vancouver	6.16	48.70	11.30 am—4.30 pm
EQB	Teheran	6.15	48.74	1.30—6.30 am; News 2.45 and 5.15
GRW	London	6.15 S	48.78	9 am—1.30 pm; 10 pm—3.15 am.
CKRD	Winnipeg	6.15	48.78	9 am—12 pm
WBOS	Boston	6.14	48.86	6—8 pm
XGOY	Chungking	6.13	48.92	9.35 pm—1.30 am; News 12 and 1 am. Also heard around 3.45 am
CHNX	Halifax	6.13 N	48.93	Heard around 10 pm
VPD-2	Suva	6.13 S	48.94	Sundays only: 4.55—7.30 pm. News 6 pm
LRX-1	B'nos Aires	6.12 N	48.94	7 am—2 pm; 9.30 pm—1.30 am
GWA	London	6.12	48.98	6 am—12 pm; 145—6.30 pm
HP5H	Panama City	6.12	48.99	9 am—2 pm
XGOY	Chunking	6.12	49.02	9.35 pm—2.30 am
XEUZ	Mexico	6.12	49.02	Around 2—3 pm
WKTS	New York	6.12	49.02	4—6 pm
WOOW	New York	6.12 S	49.02	9.15 am—4.45 pm
WCRC	New York	6.12	49.02	Heard closing at 4.45 pm
GSL	London	6.11 S	49.10	10 am—2.45 pm
XGOY	Chungking	6.11	49.10	News at 12
CBFW	Montreal	6.09	49.25	9.30 pm—1.30 pm
GWM	London	6.09	49.26	No schedule.
ZNS-2	Nasau	6.09	49.25	11—11.15 pm; 3.45—4.15 am
VUD	Delhi	6.08	49.3	8.30 pm—2.30 am
VQ7LO,	Nairobi	6.08	49.32	2—5 am; News 2.15 am
WLWK	Cincinnati	6.08	49.34	10.30 am—2 pm; 2.15—6.30 pm
CKFX	Vancouver	6.08	49.34	11.30 pm—4.30 pm
CFRX	Toronto	6.07	49.42	9 pm—3.30 pm
—	Moscow		49.42	6.30—7.30 pm
GRR	London	6.07 S	49.42	2.45—7.30 pm; 10.30 pm—8.30 am
SBO	Stockholm	6.06	49.46	Try around 7.30 om
WCDA	New York	6.06	49.50	9.30 am—5 pm
—	Moscow	6.06	49.50	Heard around 12.30 am
GSA	London	6.05	49.59	12—2.30 am
		6.05 N	49.59	
XGOY	Chungking			9.35 pm (News 12 pm)
XETW	Tampico	6.04	49.66	10 pm—4 pm
WRUW	Boston	6.04	49.66	2.15—6 pm
AFHQ	Algiers	6.04	49.67	2—9 am; News 4 and 5 am
		6.03	49.73	9 am—1 pm; 1.30 am—4 am
HP5B	Panama City			
—	Moscow	6.03	49.73	9.40—10.19 pm
CJCX	Sydney (Nova Scotia)	6.01	49.92	9 pm—4.30 am; 8 am—1 pm
VUD-3	Delhi	6.01	49.92	10.25—11.45 am
GRB	London	6.01	49.92	2—3.30 pm
ZRH	Joh'burg	6.00	49.95	1—7 am
CFCX	Montreal	6.00	49.96	10 pm—4 am; 8 am—2 pm
ZOY	Accra	6.00	49.96	8.30—9.15 pm; 2.15—5.15 am News 5 am
XEBT	Mexico City	6.00	50.00	1 am—3.30 pm
XGOY	Chungking	5.99 N	50.04	News 12 am
CR7-	L' Marques	5.86 N	51.19	2.45—6.30 am

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

F.C.W. (Arncliffe) points out a couple of errors which have been made in recent issues.

A.—Yes, we noticed these; but, fortunately, they are not really serious. If we knew of any way of avoiding them we would act accordingly, but you can imagine what o job it is to run a paper by remote control in your spare time after putting in 56 hours per week on vital work. Such are the horrors of war, but not as bad as it might be.

●

B.F.F. (Greenmount) osks about buying 6-volt wet battery for his vibrator set.

A.—Car batteries are controlled, or "frozen", as it is sometimes called, and even radio batteries of similar type are also under some form of control, although not as strict as with the cor batteries. If your old battery is definitely useless, you should not have the slightest trouble to get a release for a new one, the only difficulty being a certain amount of form-filling, but we thought everybody had become adept at that art. Form No. 100 should be filled in and the battery dealer should be able to supply you immediately, without waiting for any further clearance or reference to any Department.

●

C.M. (Blackheath) asks about the storage of radio components which he has on hand, but will not be using for many months to come.

A.—We doubt if there is anything more that you can do beyond putting them in a dry spot with as little change in temperature as possible. Extremes of heat, cold and humidity are to be avoided. The valves and resistors should not give the slightest trouble. Parts we would worry about most are the paper and electrolytic condensers, which will need testing before being put into operation.

●

W.R. (Albury) enquires about the Wireless Institute.

A.—Yes, the Wireless Institute is still going strong, and one of their latest moves is to offer prizes of three £1 War Savings Certificates for essays on Post-War Amateur Radio. Entries should be sent to the Federal Secretary, at 21 Tunstall Avenue, Kingsford, N.S.W. A letter addressed to the Secretary here would also bring you an answer to all the other queries you mention.

●

S.L.K. (Ivanhoe) enquires about the A.R.R.L. "Radio Amateur's Handbook."

A.—So far as we know, the twentieth edition is the current one on sale, although we have actually received a copy of the twenty-first (1944) edition direct from the States. The subject of transmission on wave-lengths below 1 metre (400 and 700 mc) is dealt with quite fully, and makes mighty interesting reading. There would appear to be unlimited scope for post war experimenting on these wave-lengths. Heard a suggestion recently that hams might be restricted to 20, 10 and under 5 metre bands, but we doubt if there is any substantial grounds for the suggestion.

●

M.J. (Toowoomba) enquires about tropic-proofing.

A.—It is generally reckoned that cadmium plating is more effective on steel than brass. Brass is usually plated with nickel. A good protective surface for steel can be obtained by dipping it in hot lanoline.

●

S.P.L. (Brisbane) enquires about back numbers.

A.—We have fairly good stocks of the issues of 1941, and January and February, 1942, but after that there are hardly any until February, March, April and May of 1943, of which we have a few. Otherwise the 1943 issues are hopeless, and in future we doubt if it will ever be possible to get back numbers, as we have orders for as many copies as we can print.

●

T.N.B. (Marrickville wants greater power from an amplifier working from a vibrator.

A.—You cannot possibly expect to get greater audio power output than you draw from the battery in the first place. If the vibrator only draws obout an ampere, you are only taking cix watts from the battery, so you will be lucky to get the 30 mills at 150 volts which you suggest, as this is equal to 4½ watts, and, again, you will be lucky if you can get 3 or 3½ watts of audio power from this amount of high-tension power. We feel sure you will appreciate the position better if you think of power in this way.

●

W.M. (Katoomba) enquires whether our contest is for amateurs only.

....A.—No, there are no rules to prevent radio dealers or mechanics from competing, in fact we have every desire to get the opinions of radio service men and engineers. After all, they are the very men who should know what they are talking about, when they have had so much experience with other designers' mistakes! No need to be shy about the journalism, as we will run over the article and check up on the spelling and punctuation.

●

S.F. (Wonthaggi raises a technical point.

A.—In practice there is very little difference between mutual inductance and the degree of coupling between two coils. Both points deal with the matter of transfer from one coil to the other. Tight coupling will give the greatest amount of mutual inductance.

AN ECHO FROM THE PAST

Received a letter from Alan Graham who for nearly four years has been on service over-seas, Middle East and New Guinea. Members of AWDXAW Club will remember Mr. Graham conducted these pages until early 1940. He has just been spending a four weeks well earned rest at his home in Victoria and put in many hours on a new set his brother had recently built.

He was surprised to find how well the 49 metre band came in and thrilled to log three Canadians around 10 pm. He was amazed at the number of "Vofa" stations and thinks Moscow must rival the BBC in the number of frequencies used. He says, "things were so good, it was simply a matter of reading your short-wave notes and then tuning the station in at schedule times."

He concludes with best wishes for the "A.R.W." more especially the short-wave section in which he has a "fatherly" interest. He has returned to his base and I am sure we with him trust it will not be long before he can home again . . . this time permanently and take up his old love . . . the UHF bands in which he was so successful.

MUSIC

(Continued from page 10)

In this way we can obtain equal voltage output from each individual string and its associated coil.

In conclusion it might be said that this arrangement is only one of possibly a dozen methods of constructing a pick-up unit of this typ,e but nevertheless one which the writer believes will serve to illustrate in a simple manner how one can, with patience, and a little ingenuity, construct out of junk parts, a unit which will provide endless hours of enjoyment.

Various types of amplifiers, suitable for use with electronic musical instruments will be featured in a forthcoming issue. Next month we will deal with the design and operation of the electric organ.

Their *hobby* is radio too...

These are the leaders of science and communications. They are professionals in what has become a most vital element of modern civilization ... radio communications and the science of electronics. Some of them wear the uniforms of top ranking military officers because we are engaged in war. Others remain civilians as doctors of science ... the leaders of radio, electronic and electrical industries which are amazing the world through their achievements. Achievements which not only aid in war but which are creating the new era of industry to follow. They are the great men of today ... they will be still greater tomorrow ... and they are radio amateurs.

Eimac valves are leaders too. First choice of these leading engineers ... first in the new developments in radio. They are first with radio amateurs too, which is no coincidence.

Follow the leaders to

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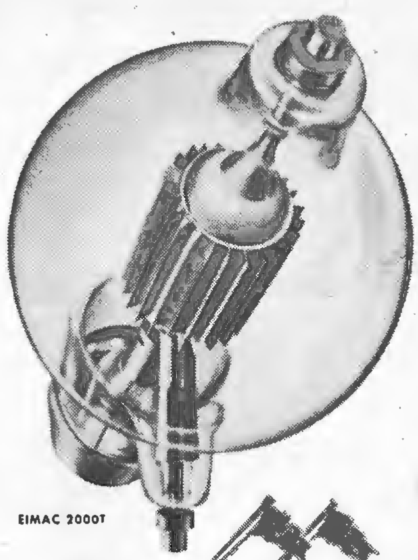
VALVES



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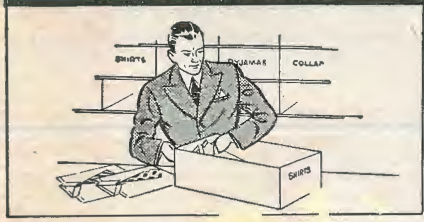
How John Stepped

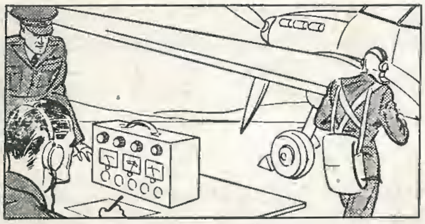


Not so very long a[illegible] was a young shop assistant named J[illegible]hn, who [illegible]ted to do his best in the War effort. [illegible] untrained, he did not know what do about it.

Until he heard about A.R.C. Radio Engineering training, and wrote for details of the course. He quickly saw the advantages of learning Radio Engineering, and started the A.R.C. course in his spare time.

John quickly learned enough to take a position at Radio Defence work, which was found for him by the College. This meant more money ond good opportunities for advancement.

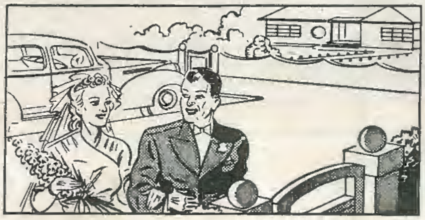
Had he wished at that time, he could have joined a Radio Unit in the Army at communications work, radio maintenance, or some other form of military radio work.



Or in the R.A.A.F. as a Radio Operator in air crew, or on the ground staff. Radio maintenance work, and radio location work, were also open to him.

Still on Defence Work, he carries on with his spare-time Radio training with the Australian Radio College. All the time making himself more and more proficient at Radio work.

Soon, by reason of his training, he is promoted to take control of his section of the work. This means another rise and prospects of even more promotion.



This extra money meons wedding bells for John, and a home of his own. He can see the fulfilment of his highest ambitions quickly toking shape.

When his Radio Training is completed he will be ready to take up an executive Radio position. This may come during or after the end of the Wor. What is most important—HIS FUTURE IS ASSURED.

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