THE AUSTRALASIAN

Radio World

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

VOL. 8 . . . . NO. 10 MARCH 15 1944

- How to make modern musical instruments using electronics.
- First article of the series on utility circuit designs.
- Will the walkie-talkie be used after the war.
- Short-wave Review is guide to overseas reception.

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117 Reservoir Street, Sydney

★**Subscription Rates** —
6 issues **5/3**
12 issues **10/6**
24 issues **£1**
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Vol. 8 **MARCH, 1944.** **No. 10**

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EDITORIAL

In a recent issue we had a paragraph about a second-hand chassis which was advertised for £500. In the same issue we had an advertisement from one of our readers who was prepared to pay up to £150 for a really good short-wave set. These items have brought to notice several enquiries as to what can be expected from even the best of sets when it comes to receiving overseas stations on the short-wave band and long-distance stations on the broadcast band.

Quite frankly, one needs to be a keen enthusiast in order to appreciate even the best of communications receivers.

When a signal is so weak that it is below the normal noise level of the locality, it is quite useless to amplify it excessively, as the noise is also amplified.

Communications sets sometimes cover from 9 metres, right through to 600, whereas the average dual-waver only covers from 16 to 47 metres and the broadcast band. But to the ordinary listener this extra coverage of wave-lengths is not a great advantage, as practically all the short-wave broadcasts worth hearing are available between 13 and 50 metres.

Yet to the right type of enthusiast the communications set is worth every penny of its cost. The low internal noise makes medium strength stations into good entertainment, the extra selectivity allows a greater number of stations to be heard.

But it is probably the minor refinements which create the right atmosphere; the smoothness of controls, the convenience of phone jacks, of a beat frequency oscillator for signal finding as well as morse reception, and so on. After all there is little fundamental difference between a cab horse and a racing thoroughbred. They both have legs at their four corners!

—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.

WHAT IS THE FUTURE OF WALKIE-TALKIE?

FAVOURITE topic for the romancing of feature journalists seems to be the possibilities of walkie-talkie sets of the kind at present being used in the forces to maintain contact.

Vivid word-pictures are built in popular magazines and papers to describe the way in which Mr. Suburbanite will be able to let Mrs. Suburbanite know that he is bringing home the boss to dinner. He will always carry his vest-pocket walkie-talkie, and presumably, Mrs. Suburbanite will have hers in her handbag when she goes to afternoon bridge.

Really Practical

All of which is not nearly as fantastic as it might seem. The walkie-talkie has not only proved itself to be really practical in every way, but has brought about a complete change in official attitude towards it. We feel certain that this matter of official attitude is the key to the future popularity of commercial radio communication as considered as something completely apart from broadcasting, the Beam service and the marine equipments, which in the past have comprised the major use of the ether.

For technically, the walkie-talkie has always been a possibility, and has been demonstrated by enthusiasts for many years past. Right back in the dim past we have an impression of Howard Love co-operating with the late Ross Hull to give a demonstration of car-to-car radio communication about 1922. Still later, I think it was Don Knock who allowed Bob Herring to strap Eveready "B" batteries on his back so that he could stride up and down at a Manly surf carnival with a radio outfit of quite similar design to the latest walkie-talkie. These impressions may be a bit hazy, but there is little doubt that walkie-talkie technique is not by any means new and its practical applications in the past have been suppressed by the official attitude displayed towards any suggestion that the granting of permission to operate transmitters should be as "free as the ether."

Licence Position

Licences for transmission have been granted in the past only to a few lucky applicants for broadcasting licences, to experimenters who have been carefuly policed to see that they make no commercial use of the art, and more lately, to allow the installation of radio in police cars and ambulances. Applications for permission to operate radio systems to allow newspaper delivery vans to keep in touch with the publishing department, or newspaper reporters to keep in touch with editors, however, have not received official encouragement. Before going further we might explain that the official attitude is not so much a state of mind of departmental heads who have risen to the top through years of stick-in-the-mud service, as an interpretation of rules adopted at International Conferences. These worthy conferences have been most necessary to control the art of radio transmission, especially as the science has been developing so rapidly. Without such conferences there is little doubt that conditions in the ether would be chaotic.

Post-War Conferences

It is to be hoped, however, that as soon as the war has been cleaned up there will be another international radio conference to widen the scope of transmitter control.

We would not suggest that there should be any need to alter the pre-war status of the amateur experimenter, but we think that control of wave-lengths for transmissions of a local nature should be handed over completely to those local authorities. To explain: since there is not the slightest likelihood of any 7-metre Australian transmission interfering with similar transmission in America or Europe it could well be left to Australian authorities to issue as many licences as they think fit for commercial uses of all wave-lengths below 10 metres.

Transmission from 10 to 80 metres always stands a chance of skipping out into the world beyond, and so it is only reasonable that they should be subject to international control.

Considering next the band between 80 and 600 metres, there is the possibility that interference would occur in Europe unless international control is maintained. But Australia's position is somewhat different by virtue of its isolation and there is little chance of low-powered medium-wave transmitters in Australia causing any serious interference with transmitters of other nations.

An American civilian defence worker operating a modern walkie-talkie equipment.

Presuming, therefore, that the local authorities have international permission to handle the band below ten metres and wish to encourage every possible use to be made of radio transmission, then we can hope for the walkie-talkie to take its proper place in the scheme of things.

Need Ability to Handle

Cars can be dangerous things, but this has not prevented thousands of driver's licences having been issued to those who prove their ability to handle a car. Should the driver tend to get careless there is always the traffic cop on hand to remind him him of his responsibility. In like manner we could have walkie-talkie licences issued quite freely, with adequate Radio Inspectors to keep check on interference. The radio industry will be ready and waiting to supply the sets as their technicalities are not any more difficult than encountered in everyday radio engineering. Only in exceptional circumstances could the walkie-talkie be expected to be a worthwhile proposition, but there is almost unlimited scope for a small transmitter to fit in a car. Imagine every doctor keeping in contact with his surgery whilst on his visiting round, every carrier keeping in touch with his office to get last-minute pick-up instructions, and every outback settler connected by radio to the nearest township.

NEW RECORDER

A new electronic wire recorder is bringing news programmes and the "Army Hour" to U.S. fighting men in North Africa. The programmes are recorded on hair-like steel wire which is wound on spools. These spools are flown by transport plane to Algiers, where the programmes are played back to soldiers who otherwise would not be able to hear them. A combination unit weighing less than fifty pounds has built-in recording, play-back and instantaneous-erasure features. A field set operated by batteries weighs about nine pounds and can be carried on the back.

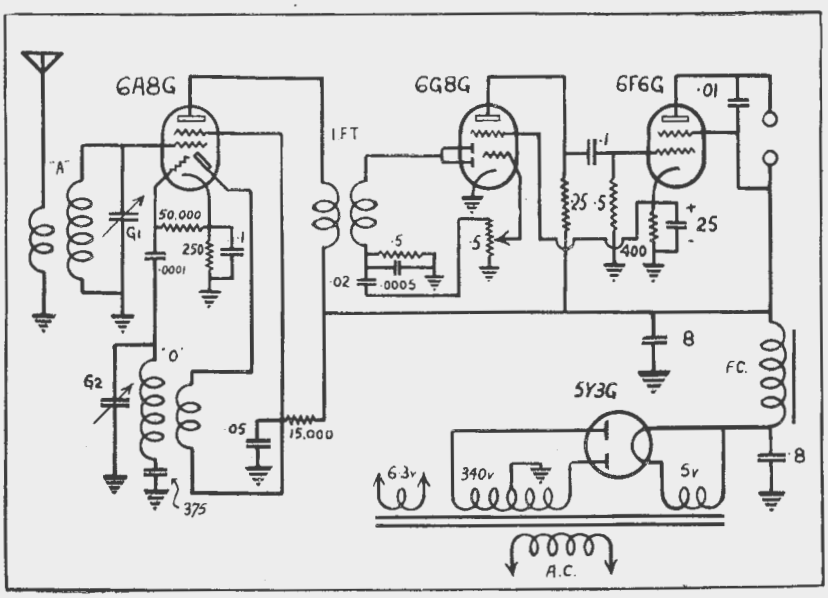
DESIGN FOR A UTILITY CIRCUIT

By

CHARLES H. MUTTON

EVEN a casual survey around the the trade today makes one realise how much, indeed, we are at total war. One predominant factor, and a guiding one, to post-war development, is the phenomenal demand, futile perhaps, for a "personal" or mantel receiver. The trend seems to be towards the small receiver in the lower-price class.

Before the war many of us will remember the scheme in Germany, to provide what was termed "The Working Man's Set." The basic idea of which attempted to bring to every home radio entertainment at a price, within reach, of even the most meagre pocket. Such a scheme could well be applied at home here in our own country.

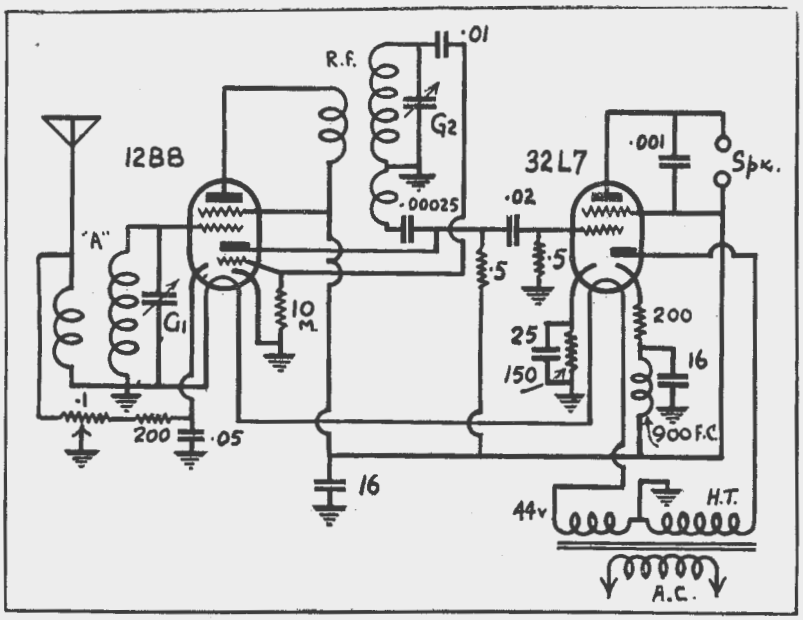


Here is one possibility for a simple superhet. Compare it with the somewhat similar one on the opposite page.

Abnormal conditions under which we live, has caused an acute shortage of radio components, so that buying commercial sets, or constructing our own receiver, has become practically impossible. So we are now forced into the only alternative, that being to look to the future and decide on a design best suited for our requirements, keeping in mind economy, portability and performance.

Experience, the world's best tutor, has shown the writer that the minimum number of tubes consistent with good results is usually four, including the rectifier.

Economy demands, to a large degree, that we keep the number of tubes to a minimum.



Using valves of American origin this type of receiver has great possibilities if these valve types ever become available in Australia.

T.R.F. versus Superhet.

General choice of the majority of radio "fans", without doubt, favours the superhet. receiver, so that with due regard to those readers who favour the T.R.F. design, I think we can pass on to a few tentative design features for "Utility Receiver."

Basically, we want the converter, I.F. amplifier, if needed, detector and the output stage. Out of a prolific number of types of tubes, the more common types will be considered; in addition, several types which are not standard, but which offer possibilities, will be discussed. Summarising the tubes complements in brief form we have, e.g.: Converters, 6A7, 6A8G, 6K8, 6J8, EK2G; Diode pentodes, 6B7's, 6B8G, 6G8C, EBF1, EBF2; Triode R.F. pentodes, 6F7, 12B8; Output tubes, 42, 6F6G, 6V6G, EL3NG, EBL1, 12A7, 32L7GT.

The above listed tubes are a fairly representative gathering of tubes used, or seen, in sets produced in Australia to date.

Having decided on what tubes to use, we now have to decide on how to use them to the best advantage. The converter stage will be standard, regardless of the hook-up, keeping in mind, however, that one uses the correct oscillator coil to suit whichever converter tube is decided up on.

At this stage our problems narrow

down to the following points in the R.F. end.

(1) For our location, taking into account selectivity problems, can we do without the I.F. amplifier and build up our gain in the audio end?

(2) Do we want the same selectivity, sensitivity as a standard five-valve job mindful that with only three tubes to work with, we can get the above result only at the expense of the additional gain, provided by an audio amplifier preceding the output stage.

(3) Will we disregard the simplicity of a diode detector and use, if possible, a dual-purpose tube, such as a 6F7 or a 12B8, to perform the dual function of (1) I.F. amplifier (pentode section, (2) Triode driver (triode section).

Many Possibilities.

The above tubes were merely mentioned, due to the fact sets have been produced here by some of our prominent manufacturers and may be readily obtainable when hostilities cease. Nevertheless, they contribute to a degree, some rather novel ideas in the way they are used.

Referring to the diagrams it will be seen that here are contained a few of the many possible arrangements used in the construction of a small superhet.

The last constitutes about the most economical design possible for a very small T.R.F. receiver. Its inclusion merely serves to illustrate to budding designers what can be done with multi-purpose tubes.

Transformerless Sets

A factor which could have a big influence on the future designs of utility sets is in regard to the elimination of the power transformer, putting the mains voltage directly onto the plate of the rectifier valve and fitting a series resistor to allow the mains to be connected to the heaters. This has been more or less standard practice for cheap American sets for many years past and has been used here with sets for both A.C. and D.C. operation. It has not, however, been allowed as a means of cheapening the production of a utility type of small mantel model for A.C. use. Under certain circumstances such a receiver could be dangerous, although it is simple enough to think out ways and means of fitting safeguards against shock. In America the low voltage of the power supply is not as dangerous as the 240 volts standard in Australia.

The design of any utility set is largely governed by the types of valves available.

During 1939 and 1940 there were a number of new types introduced in America, but these did not appear on the Australian market in any quantity and the local valve factories never found it worth their while to consider their manufacture. Possibly the story will be a different one after the war is over.

Multi-purpose Valves.

Amongst those new types were several multi-purpose valves, including combined pentode and rectifier valves, combined r.f. and detector types and so on. Most of them had high-voltage heaters of from 12 to 110 volts and were intended to be fitted in series and then heated directly from the 110 volt power supply which is standard voltage in America. Our diagram shows a possible arrangement of two of these American valves to provide a simple two-valver with performance equal to a normal four-valve t.r.f set.

Conclusion.

Basing some ideas on the few thoughts contained herein should produce some novel and interesting circuits, with gratifying results and should provide a good argument for some standardisation of design to be adopted by manufacturers for the war period and, perhaps, even after.

OUR PRIZE CONTEST

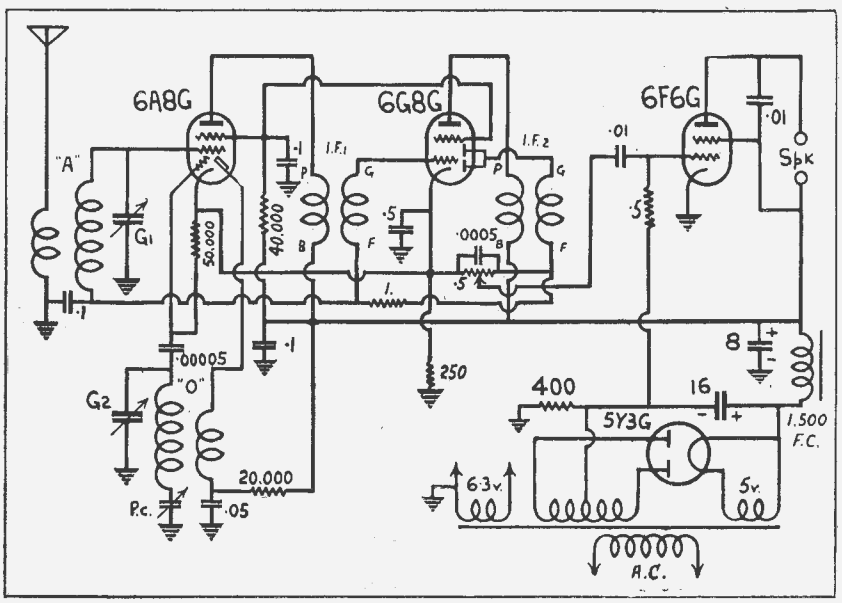
As announced in last month's issue, we are offering a prize for the best essay on the subject of utility circuit design, having in mind the value of standardising a circuit which is suitable for economical and efficient production in war-time for amenity use, or for immediate post-war production during the period when laboratory engineers are working on the designs for the new-series receivers.

Here is an example of an excellent essay, submitted by Charles H. Mutton, a radio technician employed in one of Melbourne's leading radio factories, and the original designer of the "Little Componion", which was detailed in the issue of August, 1942.

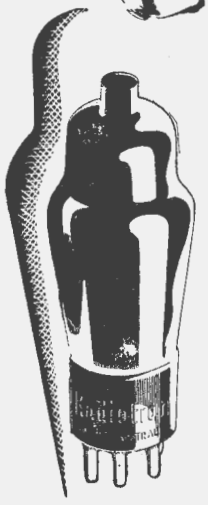
When submitting your effort be sure to write on one side of the paper only, and as clearly as possible. Do your circuit sketches on a separote sheet of paper.

Address your entries to "Australasian Radio World," 243 Elizabeth Street, Sydney.

No closing date has actually been announced, but don't delay. Send your entry in as soon as possible.



This circuit uses identical valves to those in the circuit on the opposite page, yet is completely different in its fundamentals. Which is best?



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

Radiotron

THE WORLD'S STANDARD RADIO VALVE

Buy £10 National Savings Bonds and War Savings Certificates

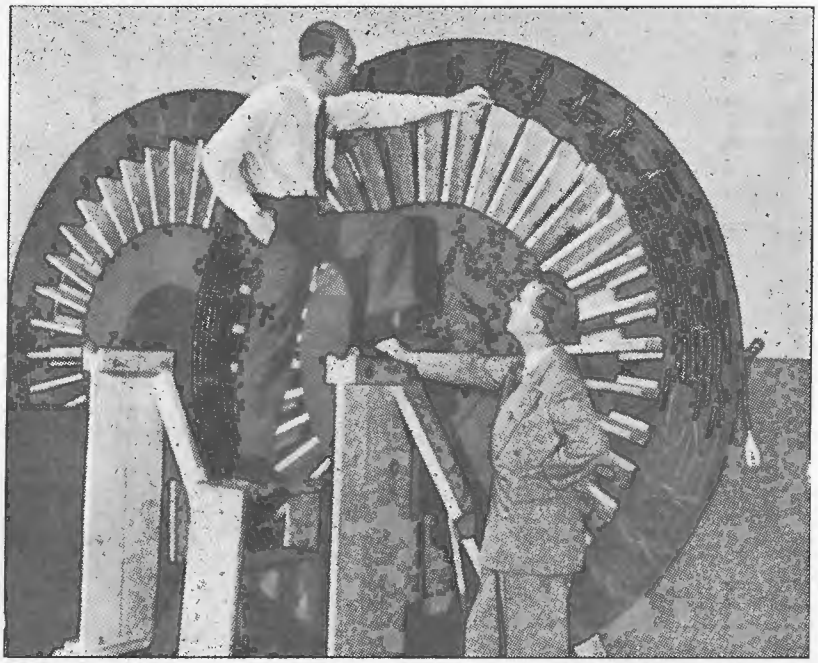
AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

A HUNDRED MILLION VOLTS !

(From our Special Correspondent in U.S.A.)

AN induction electron accelerator capable of yielding electrons and x-rays of 100,000,000 volts neared completion in the General Electric Research Laboratory. A previous equipment, capable of producing 20,000,000-volt streams of electrons, was loaned to the University of Illinois.

This accelerator does for electrons what the cyclotron does for positively charged particles, and gives the desired high acceleration without the use of high voltage. The electrons are accelerated by electromagnetic forces produced by a varying electromagnetic field. The principal part of the new machine is an electromagnet weighing 125 tons and constructed of more than 100,000 sheets of silicon steel, each 0.014 in. thick. The primary consists of two 98-in. coils (photo above) of insulated copper conductor 0.88 in. diameter. Each coil has forty turns and contains a ton of metal.



A photograph of the gigantic coils of the electron accelerator which produces 100,000,000 volts.

Staggering Figures

The magnetising current for these coils will be of 60 cycles, 1000 amp at 24,000 volts. A bank of capacitors with a capacity of 24,000 kva is placed across the coils to form a resonant circuit.

Between the pole faces of the magnet is an evacuated doughnut-shaped glass tube having an outside diameter of six feet. Inside this is a hot-cathode electron gun which injects the electrons tangentially.

The magnetic field will cause them to circle around, acquiring with each revolution the same voltage increase as though they had flowed through a single convolution of wire. This takes place during the first quarter of each cycle of the alternating current.

When fully accelerated to very nearly the speed of light, the electrons strike a target and generate a beam of highly penetrating x-rays. This beam emerges from the tube, along with scattered high-speed electrons. Even the electrons are capable of penetrating two inches of steel. The entire machine is being housed in a special building with concrete walls three feet thick around the machine-room to provide protection from the high-voltage x-rays and electrons.

Unknown Radiations

While high-voltage x-rays will be produced, it is likely that the electron accelerator will also prove effective with other radiations, and its radiation may well have important uses which cannot be foreseen.

With the use of million-volt x-rays in industrial radiography it is possible to examine steel castings as thick as eight inches.

Questions have been asked concerning the possibility of radiographing much thicker steel pieces, including armour plate. The induction electron accelerator, making available x-rays of voltages up to 100,000,000 should give the answer.

Pulsating Transmission To Cure Static

When you go to the movies you get the impression that there is a continuous image thrown on the screen. Actually there is merely a series of scenes projected one after the other at such a rate that the eye does not get time to see each one separately and so we get movies.

Apparently Continuous

Similarly we get the impression that the light from an ordinary household electric lamp is continuous, but smart people, like those who read "Radio World," know that the light is fed from alternating current, and the light is not truly continuous, as is readily proved by the practicability of the stroboscopic speed indicator which you can use to check the revolutions of the gramophone turntable.

Apparently thinking along these lines an inventor lodged a patent recently which covers the idea of using a pulsating radio transmitter of high power and a pulsating receiver tuned to this station and thereby getting a better signal to noise ratio under difficult reception conditions.

According to the inventor the total "noise energy" in the circuits of a receiver is proportional to the product of the power of the noise and time during which it persists. Accordingly if a receiver is made active only at intervals of, say, 1/5,000 of a second, repeated 500 times a second the resulting noise will be reduced by approximately ten-to-one in power. This will not, of course, improve the signal-to-noise ratio when receiving continuous signals.

Higher Peak Power

If the outgoing signal is radiated in intermittent pulses, it can be transmitted at a much higher level of instantaneous or "peak" power than is possible for sustained or continuous operation. If the intermittent activities of the transmitter and receiver are synchronised a considerable improvement in signal-to-noise ratio is achieved, and this can be still further improved by the use of directive aerials.

RADIO IN THE NEWSPAPER HEADINGS

EVERYONE must notice how much more prominently the newspapers are featuring anything to do with radio or technical developments in electronics.

Often enough the newspaper reporters make the most of the story they have to tell, and then sub-editors add striking headings so that the final impression is highly sensational. For example, a few quite modest predictions by Mr. T. W. Bearup, assistant manager of the Australian Broadcasting Commission, were published under a heading, "Staggering Radio Moves Predicted."

Sir Ernest Fisk, chairman of directors of Amalgamated Wireless, made reference to communicating with the spirits of the departed, and this has been published near and far under such headings as "Radio Can Communicate With the Dead." We have an idea that Sir Ernest is going to get plenty of awkward questions to answer. There is sure to be some "dear old thing" who will ask him what sort of set he thinks will be best on which to hear "poor Aunt Emily," who died forty years ago.

Are These Staggering?

Getting back to Mr. Bearup and his predictions, can any of us really consider that these are staggering? Here is what he visualises:—

Extensive use of ultra high frequency transmitters which will enable the use of much more simple and cheaper radio sets.

Use of radio as a leading means of creating an educated Democracy throughout the world.

Extensive use of radio as a school educational medium.

A link-up of Empire programmes and possibly regular world broadcasts.

Mr. Bearup believes that an international language such as basic English will become indispensable in propaganda and educational broadcasts.

Wireless, he thinks, will be the equivalent of a League of Nations.

In the education sphere he expects to see history, geography and kindred subjects not taught in schools from books or occasional talkie pictures, but by direct broadcasts from the land concerned.

Television Problems.

"A pupil may sit in 100 degrees in a Melbourne schoolroom and hear a first-hand and actual description of a blizzard raging in Alaska, woven into an educational talk on seasonal effects on the products of that country," Mr. Bearup said.

Although the BBC made big strides in television before the war intervened, Mr. Bearup is not optimistic about it being a principal post-war development.

"Television," he said, "is enormously expensive to put over — far outside the humble £1 listening fee range — its field is very limited, and it requires concerted attention by listeners."

What Is Death?

Getting back to Sir Ernest's statement, the actual words used by Sir Ernest were much more guarded than might be assumed from the way in which they were padded around by the neswpaper reporters and sub-editors.

Professor Laby was one of the first to challenge the statements of Sir Ernest, but rather missed the point, according to our way of thinking, and simply brought up that age-old question of whether there has, or has not been, conclusive proof of the existence of spirits of the departed.

Students of history know only too well of the many cases where new ideas in science were greeted with ridicule because they appeared absurd in the light of the amount of knowledge at that time possessed by those who doubted.

Even radio today is hard to believe. Even as you sit reading these words you can glance around your room without noticing that it is filled with the the music and words of many nations, yet you can easily prove this to be so by switching on a short-wave set with a few feet of wire for an aerial. Such a remarkable proof that our eyesight is comparatively limited must surely make us feel tolerant towards any statement about a subject on which we are very short of definite information, especially when such a statement comes from a man who has a magnificent record of accomplishment.

CLEARER THAN GLASS

Fused quartz has emerged from the laboratory and is now available from the General Electric Co. in the form of ingots, rods and tubes. Possessing unique properties making it useful for many applications, particularly those having to do with electricity, heat, chemistry and optics, fused quartz comes in two types, translucent and clear. The translucent type is made from a very pure grade of sand and gets its name from its satin appearance, caused by the imprisonment of air bubbles during manufacture. The clear type is made from crushed natural crystals and is more transparent than any glass.

ELECTRONICS IN MODERN MUSIC

MUCH has been said and heard, in latter years, of the science of electronics being applied to the art of producing musical tones or assimilating most of our better-known types of musical instruments by electronic devices.

Many and varied are the means used to accomplish this result but in all cases it is necessary, firstly, to provide a system whereby acoustical or

PART 1

By

CHARLES H. MUTTON

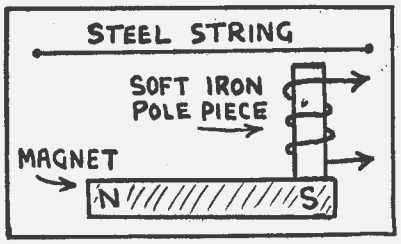
1 Plow Street, Thornbury, Victoria.

mechanical vibration is converted to electrical vibration. Having accomplished this result we then feed the electrical variations into one of the many amplifying systems. Ultimately, the resultant sound will be produced by means of the speaker system attached to our amplifier.

We will now consider the first link in the chain, i.e., the pick-up unit. Pick-up units can be classified into four main groups. (1) Magnetic; (2) Electrostatic; (3) Contact or Vibration; (4) Rotating waveforms. Not forgetting, of course, the vacuum-tube oscillator and the photo electric cell. Taking the three first-named units, we will take each in detail and consider it on its merits.

The magnetic unit consists of a permanent magnet, with its associated coil, and works much after the same principal as the familiar magnetic type of gramophone pick-up, and is usually found in fretted instruments such as the mandolin, guitar (steel and Spanish) banjo and the more legitimate instrument, the piano.

Figure 1 serves to illustrate how the magnetic unit is applied. It works on the principle that the steel string, suspended in the magnetic field of the magnet will, when struck, set up a voltage in the coil, thus transferring the vibrations of the string into electrical variations in the coil.



The magnetic principle can be used, as shown here.

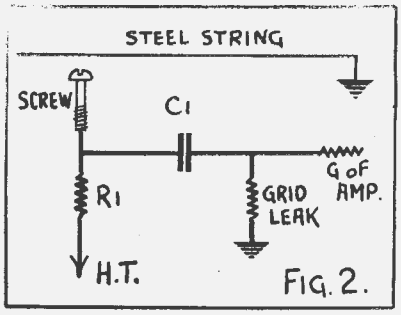
Advantages and Disadvantages

The magnetic pickup, as applied to electronic music, has only one real advantage, i.e., comparatively high output, resulting in economy in design in the amplifying system, plus the fact that its construction lends itself rather well to fretted instruments.

Its disadvantages are many: (1) susceptible to pick-up of both electrostatic and electromagnetic hum fields.

(2) Variation in magnet strength; requires frequent remagnetisation.

(3) Operates on the square-law principle, thus causing distortion of the waveform of the string vibration, as translated into electrical alternating voltage.



This diagram illustrates the electrostatic type.

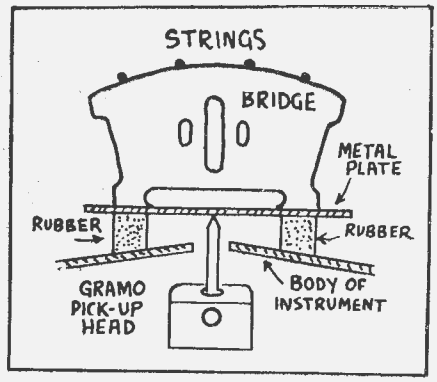
(4) The fine wire, usually about 42 s.w.g., is subject to damage and open circuits in the coil unit.

Electrostatic Type

The electrostatic type is best illustrated by figure 2. Studying this diagram, the following action takes place. The pick-up screw receives a high polarising voltage, through R1, the string being at ground potential and connected also to the ground at the amplifier unit. Upon striking or plucking the string, the vibration will cause a capacity change to take place between what is, in effect, a small electrostatic or condenser microphone. The condenser C1 serves to isolate the high voltage from the grid of the tube. The resultant variation is then fed to the amplifier.

For this type the advantages and disadvantages are:—

(1) Economical, no coils or magnets. (2) Good frequency response; (3) Linear in operation, due to the fact that capacity change is a function of the first power of distance; (4) Can be made adjustable to obtain various tones; (5) Can be used with gut strings providing they are given a small conducting surface, with any metallic paint ("Tarzan's Grip" or "Silvafros").



Any magnetic or crystal pick-up unit can be used in this way.

Its only disadvantage being that it has very little output and must be worked in conjunction with a pre-amplifier.

We next come to the third type, known as the contact or vibration type, the operation of which can be best understood by referring to figure 3.

The action and characteristics of this type of pick-up unit are similar to the more familiar gramophone pick-up, either magnetic or crystal, and needs no further explanation.

The last-named unit, the rotating disc type, will be discussed in a further article on this subject.

In conclusion, the writer hopes to be able to give constructional data on several types of pick-up units, and how to apply them to a completed instrument in a following article in this journal. Electronic music has taken a prominent place in our modern scheme of things and is here to stay!

TROPIC-PROOF

Peerless Electrical Products Co. of Los Angeles, has announced production of a new moisture-proof and dust-proof transformer. Its principal feature is glass or porcelain insulators with metal bands which are soldered into the transformer case and thus become an integral part of the case.

Is This Radiomen?

The following is reprinted from a recent issue of the U.S. Coast Guard Magazine, a service publication devoted to the interests of the U.S. Coast Guard:—

Among the stranger people on this earth are radiomen. A radioman is a person either going on or coming off watch.

Contrary to popular belief, radiomen are not crazy. A radioman has two brains: one perfectly normal brain, which is destroyed during the process of learning radio, and another which is in a constant state of turmoil and is used proficiently in his work. This latter brain is filled with dots and dashes and procedure signs.

Radiomen are like groundhogs. They seldom see the sun, coming up topside only on Saturday mornings at the request of the commanding officer. If the sun is shining and a radioman sees his shadow, he goes below and everyone knows there will be six more days.

Sitting at his typewriter a radioman receives an endless story of the world flowing through his ears, unable to get out because both ears are stopped up by headphones. The stuff flows out through his fingers and is given out as press news, weather messages, and so forth.

When conversing with a radioman, do not try to point your story by asking if he remembers "the message to Garcia," because he will jump and scream, "What's the number of it? Who sent it? If it's lost, it didn't come in on my watch!"

Radiomen live on black coffee and cigarettes. All through the long midnight watches they sit and dit and dah, so tired and weary of it all and wondering why they ever chose radio as a profession. When they go off duty they hurry home to their little "ham" radio sets and just dit and dah to their heart's content.

Girls who fall for radiomen will find they are courted with considerable sparking, and after they are married will receive much broadcasting both loud and long.

Radiomen are found on all ships and in all stations and are quite harmless if left alone, fed occasionally, and given annual leave so they may rig up new "ham" outfits at home!

NEW U.S. SHORT-WAVE TRANSMITTERS

According to a recent report from the United States it is estimated that there will be 36 short-wave broadcasting stations operating by the middle of this year, radiating programmes for overseas. The power of some of the new transmitters is likely to be about 250 kW.

PROPER METHODS OF USING VALVES

GRID emission of a thermionic nature may occur when a valve is used under conditions where grid positive current is flowing. For example, grid positive current will flow to the control grid of a valve operating under "positive drive Class B" conditions or, momentarily due to overload, in the case of a valve which is nominally working under Class A conditions. The flow of electrons to the grid in such cases as have been mentioned may result in electrons being released by impact from the grid material. This form of grid emission, arising from electron bombardment, is known as grid secondary emission and

By

J. R. HUGHES, A.M.I.E.E.

(British Radio Valve Manufacturers' Association)

will result in the grid losing electrons, probably to the anode. Thus the flow of electrons from the grid, by secondary emission, offsets the arrival of electrons to the grid from the cathode. This phenomenon is illustrated in Fig. 1.

Starting at a point in the neighbourhood of Vg = O, the grid current is zero. If the grid is made more positive, electrons are attracted to it, thus constituting a grid positive current. This current rises to a maximum at a point shown on the diagram where Vg = A, and subsequently it begins to fall because of the increasing loss of electrons from the grid arising from the resultant grid secondary emission. As the positive grid voltage is still further increased and the bombardment of the grid becomes greater, the secondary emission increases and the grid negative current will eventually attain the same numerical value as the grid positive current which is causing it. At this point Vg = B, the total external grid current is zero. Beyond this point the value of the grid negative current becomes numerically greater than the grid positive current, and thus the resulant grid current is negative. At a still higher value of positive grid voltage, a further effect becomes apparent when the potential gradient around the grid is such that the secondary electrons move back to the grid itself rather than to the anode. This, of course, results in a drop of the grid negative current and at the point Vg = C the total external grid current once more becomes zero. From here on, the grid current is increasingly positive.

It will be apparent from the above that there are three sets of conditions under which the external grid current can be zero.

If the grid valve has no DC connection to the cathode the external grid current is evidently zero. It may be, however, that the valve is operating at the point C on its grid characteristic and that the grid consequently, is at a large positive potential. Under these conditions a considerable electron current will be flowing to the grid and an equally considerable electron current flowing from the grid as a result of secondary emission. The condition is a stable one and the valve may remain in this state indefinitely. Obviously, since the grid potential is large and positive, the anode current of the valve will be considerably higher than the normal and the effect of this will be to increase the anode dissipation and thus damage the valve.

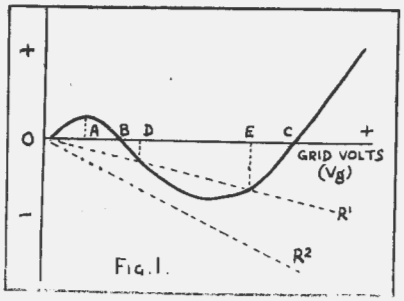
This is one very important reason for the insistence in the Code of Practice that ". . . in no circumstances should valves be operated without a DC connection between each electrode and the cathode."

Mention is also made in BS 1106 of the practice of "keying" by opening the screen circuit of a valve whilst the normal anode and grid voltages are maintained. This is another example of the operation of a valve without a DC connection between each electrode and the cathode.

Secondary Emission

The phenomenon of grid secondary emission, moreover, is of importance even if the grid has a DC connection to the cathode. Referring again to Fig. 1, it will be seen that two dotted lines are included, marked R1, and R2. These are simply the current voltage characteristics for two values of resistance, drawn on the came co-ordinates as the grid current curve. The flow of grid negative current in a valve circuit where a DC connection exists between the grid and the cathode gives rise to a voltage drop down the DC resistance of such polarity that the grid becomes positive with respect to the cathode. R1 and R2 are assumed to be two values of external grid resistance where, of course, R1 is greater than R2.

Considering first the operation of the valve with an external grid connection having a resistance R1, it will be observed that the grid current curve and the R1 characteristic intersect



Grid volts curve of a typical valve to illustrate secondary emission.

at the two points D and E. These two intersections are conditions of equilibrium which, once established, may be maintained without the application of any external EMF to the grid. At D the equilibrium is unstable, but if a positive potential having a value greater than E is applied to the valve grid and then removed, the grid voltage falls towards zero until the stable point of equilibrium E is reached. Thus a momentary application to the valve grid of a positive potential greater than E (as, for example, by a condition of overload) may result in the phenomenon known as "grid-locking."

On the other hand grid locking is impossible in the case of the same valve operating with the smaller value of external grid resistance R2 because that dotted line nowhere intersects the grid current characteristic.

This argument further emphasises the requirement that the DC connection between each electrode and the cathode should have the minimum practicable resistance. The Code of Practice in fact, states ". . . the apparent advantage of an 'open-circuited' electrode, or of a high resistance path, may be defeated by the valve's secondary emission characteristics."

Grid Rectification Biasing

The very common use of grid rectification to obtain a bias voltage, particularly in cases of valves used as oscillators or RF power amplifiers, is the subject of another precaution covered by BS.1106. This type of circuit is no doubt well known and consists of a condenser and resistance used in conjunction with a valve which is being driven into grid positive current on part of each cycle. This grid positive current produces an accumulation of electrons in the grid condenser and the mean charge potential

(Continued on next page)

PROPER VALVE USE

(Continued)

is adjusted to the desired value by an appropriate choice of condenser capacity and grid-leak resistance.

In the event that the valve drive is cut off for any reason, the flow of electrons to the condenser every cycle will cease whilst the leakage of electrons through the grid-leak resistance will continue until, finally, the potential across the condenser will fall to zero. As the biasing potential drops the anode current will rise and may very greatly exceed the rated anode current. To avoid the damage to the valve which can arise in these circumstances the Code of Practice recommends that grid rectification biasing should never be used alone. It mentions one of the possible methods of avoiding the risk described, by recommending that some of the desired bias potential should be secured in the normal manner by a resistance in the cathode lead. Thus if the grid rectification bias fails the increasing anode current will produce an increasing cathode bias and thus can save the valve from damage. For any particular application it is very desirable that the valve manufacturer's advice should be taken as to the minimum cathode bias which will ensure a reasonable security against damage.

Miscellaneous

It will be of interest to consider briefly two less known miscellaneous points which are covered by the Code of Practice.

The first reads "It is, in general, undesirable that valves should be operated in such circuit conditions that the cathode current is normally cut off." This practice, which is often adopted in equipments which are required intermittently but at short notice, may be permissible with some valves but it should not be adopted without first taking the advice of the valve manufacturer. When a valve is operated in a normal manner the cathode emission carries with it minute quantities of impurities in the cathode coating. These impurities are deposited elsewhere in the valve and have only a negligible effect upon the useful life. On the other hand, if the cathode is maintained at operating temperature but the cathode current is cut off as, for example, by cutting off the anode voltage, these minute quantities of impurities fall back on to the cathode itself with the result that the cathode surface is slowly "poisoned" and its emissivity decreased.

A further cause of cathode "poisoning" may arise from the presence in the bulb of very small quantities of residual gas. Under the operating conditions the residual gas is ionised by collision, whereas this will not be the case if the cathode current is cut off. It can be shown that un-ionised residual gas is less rapidly reabsorbed than when ionised and accordingly, in the absence of space current, residual gas may remain and result in cathode "poisoning."

The second of the two miscellaneous points referred to is concerned with contact potential.

The contact potential between any two electrodes in a valve is defined very simply in the Code of Practice as the "voltage corresponding to start of positive current to any electrode." Evidently, the assessment of the voltage at which a current starts to flow between two electrodes is dependent upon the sensitivity of the method used to detect the current and it is therefore usual in practice to define the contact potential as the potential at which the positive current reaches some small arbitrary value. The value of the contact potential is dependent upon the two surfaces under consideration and any variation in either of the

surfaces will produce a change of contact potential.

The question of contact potential is of importance in a number of cases, but particular mention might be made of the case of the cathode/grid potential in high-gain triodes. With these valves, where the contact potential may easily be of the same order as the bias voltage, it is obviously important that due regard should be paid to it.

The Code of Practice emphasises that "circuits which are critical as regards control of contact potential should be avoided . . ." This condition must be observed because, as has been stated, the contact potential is dependent in any given case upon the electrode surfaces. Contact potential therefore changes with temperature and throughout the life of the valve and cannot be regarded as a stable or constant quantity.

Mercury Vapour Rectifiers

A far smaller number of valve users is concerned with mercury vapour rectifiers than with "hard" valves of one sort or another. Partly because of this but partly because each mercury vapour application tends to be regarded as an individual engineering problem in itself, mercury vapour rectifiers are not taken quite so much for granted as are "hard" valves. Nevertheless B.S.-1106 does include a short section dealing with this subject.

The essential difference between a vacuum rectifier and a mercury vapour rectifier is that the latter contains a certain amount of mercury, partly in liquid form and partly vapour, depending upon the temperature conditions. When a potential difference is applied between the anode and the heated cathode an electron stream flows in the normal manner, and in their passage from the cathode to the anode electrons will collide with mercury vapour molecules and produce a state of ionisation. The positive ions on account of their high mass and the low potential gradient move towards the cathode at a relatively low velocity, and will neutralise the space charge existing between the cathode and the anode.

In a vacuum-valve the presence of the space charge has the effect of reducing the space current and of necessitating the use of relatively high anode potentials. To remove the space charge entirely in a vacuum rectifier would require the application of very high anode voltages which might damage the valve by excessive anode dissipation and liberation of gas. The cathode, moreover, would be rapidly destroyed by the bombardment of positive ions which would be travelling at an extremely high velocity on account of the large potential between the anode and the cathode.

(Continued on next page)

PROPER VALVE USE

(Continued)

The introduction of mercury vapour into the valve and the consequent neutralisation of the space charge without the need for very great anode potentials, permits the anode current of the mercury vapour valve to approach the total emission of the cathode, whilst avoiding the risk of cathode damage from high-velocity bombardment.

The potential difference which is necessary between the anode and the cathode in a mercury vapour rectifier in order to produce a satisfactory ionisation of the vapour is usually less than 20V. Thus, provided the anode voltage is of that order, the anode current will be unrestricted by the presence of a space charge and will only be limited by the emission available from the cathode. The principal property of the mercury vapour rectifier therefore is that it will pass a relatively large current with only a very small potential difference across it. The very low value of the rectifier's resistance and its practically constant voltage drop require the use in practice of a limiting resistance in series with the rectifier.

If it should happen that the anode voltage were applied to the rectifier, before an adequate amount of mercury had been vaporised, the flow of electrons from the cathode to the anode would result in an insufficient number of positive ions to neutralise the space charge The internal resistance would be excessively high and the voltage drop across the rectifier would accordingly be high also. Under these conditions, the velocity of such positive ions as did exist would be sufficient to cause cathode damage by bombardment, and partly for this reason a preheating time is always specified in the case of mercury vapour rectifier.

By preheating time is meant the period during which the cathode is heated before the application of the anode voltage. Mercury vapour rectifier cathodes are normally of the high current low voltage type having a considerable thermal capacity, and an appreciable time is required for the cathode to reach its operating temperature. Subsequent to this the heated cathode will cause the evaporation of a certain amount of mercury until a new state of equilibrium exists inside the bulb. If the valve has not been recently used, or if it has been disturbed so that the mercury may have splashed on to the emissive coating of the cathode, it will be necessary to take still greater care that an adequate preheating time is allowed. In the latter event, for instance, the presence of liquid mercury actually on the cathode will result in very rapid evaporation and an excessive mercury vapour pressure around the cathode. If the anode voltage were applied whilst this condition persisted, arcing would take place between the electrodes and the valve would be damaged. In this exceptional case it will generally be found that the manufacturer recommends the preheating time of between 15 and 30 minutes but for the routine starting of valves in regular use, the preheating

(Continued on page 18)

Technical Ideas From The Talkies

THERE are one or two stunts which are common practice in talkie amplifiers, yet do not appear to have been suggested for use in quality amplifiers of the type used by enthusiasts for the better reproduction of recordings and broadcast programmes.

One particular scheme which appeals to us is the arrangement of series resistors to enable the plate current of every valve in the amplifier being checked with a single meter which will then show the current as a per centage of normal rated plate current.

Quick Testing

Checking plate current with a milliammeter is a rather complicated business, as it is necessary to open the circuit and insert the meter. Such an arrangement can be done by using jacks and plugging in a multi-meter. Accidents will happen, however, and putting in a meter when set to the wrong range may mean a burnt-out meter in a fraction of a second.

The problem is neatly tackled in many talkie amplifiers by fitting resistors in every plate circuit and then proportioning each of these resistors in such a way that the voltage drop across them with normal plate current will always be the same figure, say 10 volts.

Voltmeter Strip

The idea may be easier to understand if you look at the diagram herewith, where the simplest possible arrangement is shown with just two valves, one drawing a normal plate current of 2 milliamps and the other 50 milliamps. Now, by fitting a 5,000 ohm resistor in the circuit of the valve drawing 2 milliamps we have only to measure the voltage drop across this resistor in order to find out whether plate current is normal. Leads are run out from each end of the resistors to a terminal strip on the back of the chassis, where the voltmeter can be readily applied.

For the second valve a 200 ohm resistor is fitted, as with normal plate current in this valve the voltage drop will again be 10 volts. Leads to the terminal strip are fitted in the same way. If the meter reads full scale, then it is a sure indication that the bias is correct, that the high tension voltage is normal and that the valve has correct emission.

If the meter does not read full scale then some fault is indicated. As the valves grow old the emission may drop off. On the other hand, a coupling condenser may leak, or a grid leak resistor may become open circuited. In either case the meter will immediately indicate the fault by showing a reading of more than full scale. Even in extreme cases, however, it is unlikely that there will be any chance of the meter being damaged by overload as you will always know that the reading will be around 10 volts. Of course, any other suitable voltage can be used, suitable resistor values being easily calculated by Ohm's Law.

Points to Watch.

There are several minor points to be carefully observed before you fit the scheme to your pet amplifier. Due attention must be paid to feedback circuits which may be built into the wiring if you run wires alongside of each other and then connect them to two points with widely different signal potential, as between plate of one valve and plate of the next stage of amplification.

By-passing the Resistors.

It is also necessary to arrange the proper by-passing of the resistors as otherwise they might introduce losses or even cause instability by creating couplings. In most cases it is quite a simple matter to arrange the resistors so that they actually replace decoupling resistors, thereby decreasing the hum level and ensuring improved stability at high gain.

For Push-Pull.

With push-pull valves it is highly desirable to check the current of each of the valves separately, but it often happens that a single high-tension supply is fed to the centre-tapping of the speaker transformer. It is not likely to be sound practice to have the resistors in each plate circuit, between plates and speaker transformer, as they would make it a problem to arrange their proper by-passing and there would still be the possibility of parasitic oscillation if long stray leads are connected to the plates and then run around the base for far. One possible solution is to have the resistors in the cathode circuit, one for each valve and then running together to the common bias resistor if one is fitted. With pentodes this will then give the total current reading for both screen and plate, just a point worth mentioning as it will have to be taken into account when calculating the resistance value to be used.

Checking for Distortion

In conclusion we might mention that the scheme has still another attraction; it allows a more careful eye to be kept on distortion. The plate current of each valve should be checked while the amplifier is actually in operation on a heavy recording at full volume. There should not be any flickering or fluctuation of the plate current indicated on the meter by the needle. Any such movement is an indication of distortion.

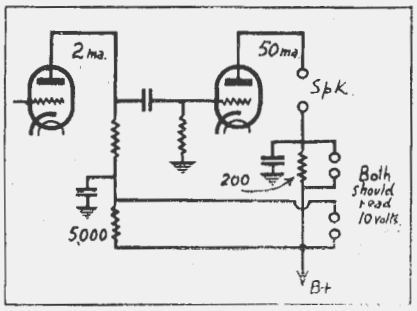


Diagram showing series resistors fitted for quick valve testing.

By using this method of detecting distortion it is often found that the early stages in an amplifier start to overload before the output valves are delivering their full power. Therefore the checking should be started right from the first valve, and then progressively to the outputs. If there is no distortion indicated in the early stages, but does occur only in the output stage, then it can be taken that the amplifier is working to the limit of its capacity. On the other hand, if there is distortion indicated in the first or second stages, this distortion will be amplified and handed on to the output stage, so that the amplifiers will not be capable of delivering the same amount of power as if the early stages were correctly designed.

LUBRICATION

Many moving parts in modern receivers are employed as conducting paths and thus in addition to good contact between the adjacent surfaces, it is essential to keep them clean and free from foreign matter. Switches, for instance, are a typical instance of a moving contact surface, and many amateurs clean these periodically by rubbing with emery or fine sandpaper. While this may be in order in some cases, the metal dust which is thereby obtained may find its way into some place where it will introduce trouble and the procedure is not therefore ideal. Special chemical cleaners are available for the purpose, and these should be used. Where lubrication is necessary colloidal graphite is a very good material to use, but it should be applied sparingly.

PROPER VALVE USE

(Continued)

time is less than this and may even be as short as a minute. In either case the length of the preheating time depends upon the size of the valve and upon the room temperature and it is safest to make sure that the recommended times for any particular type are known.

It is a common practice, and a very good practice, to make use of automatic time delay switches to take care of the necessity for a preheating time. These switches are generally thermal in principle and their release time, which is obviously determined by the rate of cooling of the bi-metal element, is far from negligible. It can happen, therefore, that the rectifier might be switched on again, soon after switching it off, before the delay switch has had time to return to the unoperated condition. If this should happen it is obvious that the anode voltage and the filament voltage will be applied to the rectifier simultaneously. The chance of this occurring is, no doubt, small, but it is a point well worth remembering.

Ionisation and Pressure

The factor of temperature is always of considerable importance in the operation of mercury vapour rectifiers. The degree of ionisation of the mercury is dependent upon the pressure, and hence upon the temperature of the gas, as is also the rate of de-ionisation. If in any mercury vapour rectifier the temperature of the condensed mercury is too low, vaporisation and subsequent ionisation will be insufficient to bring about the desired condition of low voltage drop across the valve. If, on the other hand, the temperature is too high, then de-ionisation will be retarded. It will be remembered that the process of ionisation is effected by the flow of electrons from the cathode to the anode on each half-cycle when the anode is positive with respect to the cathode, and it is, therefore, evident that ionisation is required to take place in a time short compared with the length of one half-cycle. Similarly, the vapour must de-ionise at the beginning of each succeeding half-cycle rapidly enough to ensure that de-ionisation is sufficiently complete to enable the rectifier to withstand the peak inverse voltage. If the process of de-ionisation is retarded, the internal resistance of the rectifier will be too low to withstand the peak inverse voltage and breakdown and destruction of the cathode surface will result. It is, therefore, necessary to control the operating temperatures of mercury vapour rectifiers and with large valves of this class, when normal ambient temperatures are likely to vary unduly, some form of forced air temperature control must be employed.

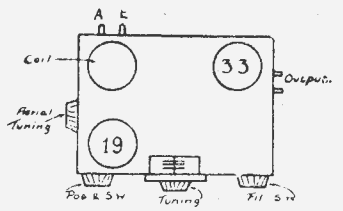
The published data covering mercury vapour rectifiers always specifies a limiting range of condensed mercury temperature, and due attention must be paid to this if reliable service is to be expected from the valve.

The very high current-carrying capacity of mercury vapour rectifiers, as compared with vacuum rectifiers, gives rise to the need for a special precaution in the case of the larger directly heated types. With these it may well happen that the anode current is of the same order as the filament-heating current. Moreover, as has already been stated, the voltage drop

(Continued on page 26)

THE THREE-TWO SPECIAL

THIS receiver is designed for the beginner to cut his or her teeth upon, and is essentially a short wave set. However, the older hands will get a kick out of building it, and also with its performance, which is exceptionally good. Two switches are incorporated in the receiver, and a study of the circuit shows just why and how they are connected. Follow this section of the circuit faithfully,



Plan of a suitable lay-out.

for reasons which are obvious. The whole may be mounted on a panel and chassis (both of metal) of almost microscopic proportions, but don't make it too small. All values, with the exception of the coil data, is given in the body of the diagram.

All wiring is sub-chassis, only one wire to the tuning condenser emerging through the chassis. An important point is that all wiring in the detector section should be kept as short as possible to ensure stability. The aerial coupling condenser plays an important part. If the capacity is too large, it will "block" the detector tube on the shorter waves. Select a 36 mmd., condenser of a low minimum capacity. On the other hand, as this set is designed for SW, should you desire to use it on broadcast also, you will have to increase the capacity by placing a fixed mica condenser (or another variable 35 mmf.) in parallel with the one incorporated in the receiver. However, a little experimenting with your own resources will rapidly clear up this minor problem.

The coil data should be strictly adhered to if you desire to gain 100 per cent. results.

10 TO 20 METRES—

Grid:—5 T of 28 g.enamel, 3-16 in., between turns.

Reaction:—7 T of 30 g. enamel, close wound.

20 TO 40 METRES—

Grid:—11 T of 28 g. enamel, 3/32 in. between turns.

Reaction:—9 T of 30 g. enamel, close wound.

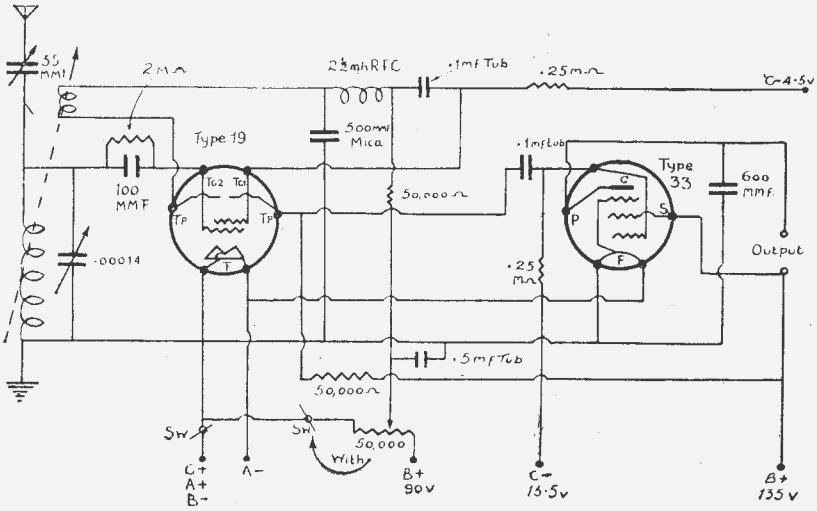
40 TO 80 METRES—

Grid:—23 T of 28 g. enamel, wound 16 T per inch.

Reaction:—11 T of 30 g. enamel, close wound.

Distance between grid and reaction coils in all instances is 1/8-in. Diameter of Former is 1¼-in.

—N.Z. "Radiogram."



Circuit of a two-valve battery set of simple design, but effective performonce.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY—

THAT FAR AWAY LAND — NEAR BY

It's funny, it does not matter where the signal comes from, there is always a thrill in "landing a new station," and just as I was waiting eagerly to "catch" 9PA, the New Guinea Radio station, I learn it is to be a low powered medium wave station. Well, the object is to give some entertainment to the boys in that Far Away Land, Near By (I think Harry W. Flannery's reference to Mexico is applicable to New Guinea) and that's all that matters.

Had a letter from Ray Simpson again this week and he says he is bewildered with the number of American stations and the many new BBC transmitters shown in Radio World since he left us. Yes, just glancing at the list in front of me there are about 130 short wave outlets for U.S.A., and almost as many for the BBC.

LIFE AT HOME

I invariably tune to GWC 19.91 m. at 10.20 p.m. on a Saturday to hear Howard Marshall in his delightful series, "Life at Home." Never cared for Mr. Marshall as a war reporter, but in this series would consider he stands alone. Let him take you into one of those country inns or a walk along a trout stream — he's great.

WHAT AMERICAN COLUMNISTS SAY

A new feature from KWIX given daily at 4.50 p.m. As its title suggests consists of articles taken from leading American newspapers. KWV still gives "What American Commentators Say" but at 6.15 p.m. instead of 6.45 p.m.

PUT THAT CLOCK BACK

Just a reminder that at 2 a.m. on Sunday, March 26, Time Marches Back.

RAY DISSINGER ACCIDENTALLY KILLED

I was very grieved to hear from Ted Whiting that he read in December issue of "The Universalite" (my copy has not yet been delivered) of the death of Ray Dissinger. It appears that a bulletin addressed to Corporal Ray Dissinger was returned marked "Accidentally Killed' Addressee Deceased.,' The date was September 9.

I had never met Ray, but from his many many letters I felt as though I knew him well.

From February 15, 1941, and up till the time he went into the U.S. Service, he was Short Wave Editor of "The Universalite", and was elected Vice-President of The Universal Radio DX Club in September, 1941. It was through his kind offices I was made their Official Representative for Oceania.

Until he left for Alaska he contributed frequently to these pages.

My heartfelt sympathy goes to his relatives.—L.J.K.

NEW STATIONS

HER-, Berne, 12.965 mc., 23.14 m.: Has replaced 16.26 m. in Tues and Sat programmes to Australia. Schedule is now 7—8.30 p.m. As usual English on Tuesday, Nat. Lang. Sats.

LENINGRAD, 9.725 mc., 30.85 m.: Mr. L. Edel rang me this one, which I first heard at 5.45 pm on February 5 with an R9 Q5 signal but spoilt by morse. Opens again at midnight.

LENINGRAD, 11.632 mc., 25.79 m.: Later on the same day Mr. Edel heard this outlet, from 10—10.30 pm. Opened at midnight in German and French. Present schedule shown in Schedule List.

MOSCOW, 10.085 mc., 29.75 m.: Still another for the U.S.S.R. Heard around 4.45 pm. French at 5 pm and at 7 were heard in Japanese.

MOSCOW, 7.46 mc., 40.21 m.: Home service from 2 am in relay with another new one, 7.36 mc., 40.76 m. Mr. Edel, who speaks Russian fluently, told of these also.

XGOY, Chungking, 6.05 mc, 49.59 m: This new outlet for the Voice of China is reported by Mr. Nolan and Mr. Edel. Opens at 10.35. News at 1 am. Very strong signal.

XGOY, Chungking, 5.995 mc., 50.04 m.: This looks like a still further transmitter for the capital of China, and news is given at 1 am.

WOOW, New York, 7.82 mc., 38.36 m.: Heard announcement on WOOC (31.09) m.) when closing at 10 am that they would re-open in 15 mins on WOOW 7.82 mc.,—L.J.K. Too noisy to hear, here.

WCDA, New York, 11.145 mc., 26.92m.: Mr. Cushen sends this one. News at 6 am, signs at 7. Often covered by morse. (It certainly is here.—L.J.K.)

Shortwave Notes and Observations

OCEANIA

Australia

VLW-6, Perth, 9.68 mc., 30.99 m.: Note, when opening at 9.30 p.m. call is VLW-6 and not VLW-5.

New Caledonia

FK8AA, Noumea, 6.20 mc., 48.39 m.: Broadcast in English on Wednesday nights from 8.30—8.50. News of the war from home for N.Z. troops in S.W. Pacific combat zone (Clack). (Am sorry, but have not heard any English from FK8AA for ages—L.J.K.)

New Zealand

..ZLT-7 Wellington, 6.715 mc., 44.68 m.: Hearing this station very well now (Hallett). Now gives news at 8.30 p.m. and signal has improved tremendously. —L.J.K.

AFRICA

Algeria

AFHQ 6.04 mc., 49.67 m.: Good with news at 7.30 a.m. (Gillett).

Mr. Cushen of N.Z. mentions a new frequency for Algiers, 11.86 mc., 25.29 m. Says, Find signal is fair at 9 p.m. with news: a summary at 9.30 and news at 9.30 and news again at 10; station signs at 10.15 but has morse interference.

I doubt is the station would be heard here at all at that time, but a similar programme was being heard with more or less difficulty an 11.885 mc., 25.24 m.—L.J.K.

Belgian Congo

RNB, Leopoldville, 15.53 mc. 19.33 m. Fair at night (Gaden). Not as good as when on 16.88 m. (Gillett).

——, Leopoldville, 15.155 mc., 19.80 m. On January 22 they played the Kissantzi from 8.45 till 9.02 p.m. and then songs till 9.15 when they signed. Announced in Dutch, French and English. Terrible C.W. spoilt them (Nolan)

RNB, 9.78 mc., 30.66 m. Signal in afternoon much better than 19.33 at night (Gaden).

Egypt

SUV, 10.05 mc., 29.84 m. Good at 6 a.m. in Arabic (Nolan).

Ethiopia

Addis Ababa, 9.62 mc., 31.17 m. Noisy at 3 a.m. with news (Gillett). Good at 2.40 a.m. (Nolan).

French Equatorial Africa

FZI, 11.97 mc., 25.06 m. Heard nicely with news at 7.45 a.m. (Gillett).

Mozambique

CR7BE, 9.88 mc., 30.38 m. Very good with news at 7 a.m. (Gillett). Opens at 2.30 a.m. on Mondays. Splendid signal (Nolan).

CENTRAL AMERICA

Costa Rica

TIPG, 9.62 mc., 31.19 m. On a few occasions fair at 11 p.m. (Gillett).

(Has been missing for some time, but will now re-insert in Schedule List.)

SOUTH

Argentine

LRX, Beunos Aires, 9.66 mc., 31.06 m. Has replaced LRU. Received veri. in form of card from "Radio El Mundo" Calle Maipu 555 Buenos Aires. (Cushen).

LRX-1, 6.12 mc., 48.94 m. Another outlet for "Radio El Mundo" heard by Mr. Cushen.

Brazil

PRL-8, 11.72 mc., 25.61 m. English announcements at 7 a.m. (Cushen).

U.S.A.

KROJ, 'Frisco, 17.76 mc., 16.89 m. Heard well from noon till 1 p.m. (Perkins).

KWU, 15.35 mc., 19.53 m. Always splendid in morning (Gaden).

KWID, 15.29 mc., 19.62 m. Heard well around 11 a.m. (Gaden). Heard closing at noon—L.J.K.

KROJ, 15.19 mc., 19.75 m. Only a fair signal at breakfast, improves later. (Gaden).

WRUS, 15.13 mc. 19.83 m. Signs at 7.30 a.m. (Cushen).

WKRD, 12.967 mc., 23.13 m. Came back on the air as from February 16. News at 8 a.m.—L.J.K.

WRCA, 11.89 mc., 25.22 m. Good in French in evening and also very fair in morning (Gaden).

KWIX, 11.87 mc., 25.27 m. Heard call at 10 a.m. Closed at 10.30 with "S.S.B." (Gaden). (Not a whisper down here.—L.J.K.)

WBOS, 11.87 mc., 25.27 m. Good strength at 8 a.m. "Hit Parade" on Sundays (Cushen). Excellent at breakfast time (Gaden). Closes 8.15 at fine strength. The carrier then just audible is KWIX—L.J.K.

WOOW, 11.87 mc., 25.27 m. Mr. Arthur Cushen supplies the information re the C.B.S. station mentioned in February issue. It is in parallel with WOOC from 1.45—5.45 a.m. Very poor signal on opening, but a great one when they sign.

WCRC, 11.83 mc., 25.36 m. Very good at breakfast time (Gaden).

KGEI, 11.79 mc., 25.43 m. Very nice around 2 p.m. (Gaden).

WRUA, 11.79 mc., 25.45 m. Very good when closing at 7.30 a.m. (Cushen).

WRUL, 11.71 mc., 25.58 m. Good in morning (Gaden). Good when closing at 5 p.m. (Cushen).

WLWO, 11.71 mc., 25.62 m. Great signal when closing at 8.15 a.m. (Cushen).

WCDA, 11.145 mc., 26.92 m. News at 6 a.m. signs 7 a.m., often covered by morse. (Cushen).

KWV, 10.84 mc., 27.68 m. Nice steady signal 5—7.45 p.m. (Gaden). Often good 8—10 (L.J.K.)

WRUS, 9.70 mc., 30.93 m. Closes at 5 p.m. fair signal (Cushen).

WRUW, 9.70 mc., 30.93 m. "Friendship Bridge" Saturdays at 8 a.m. Very good.—L.J.K.

KROJ, 9.89 mc., 30.31 Fair level most nights (Gaden).

WNBI, 9.67 mc., 31.02 m. Now heard opening at 7 p.m. Very good signal—L.J.K.

WOOC, 9.65 mc., 31.09 m. Very good at 8.45 a.m. (Nolan, Gillett). Probably the loudest signal on the air at that hour, but from 9.45—9.58 appear

to go silent except for a peculiar noise, something like a very fast metronome. At 10 a.m. when signing say, "Will re-open in 15 mins., on WOOW 6.12 mc., directed to Europe."—L.J.K.

WCRC, 9.59 mc., 31.30 m. Heard opening at 9 p.m. with news. Sign at 9.45 p.m. and move to 11.83 mc., 25.36 m. (Cushen).

WRUS, 9.57 mc., 31.35 m. Opens at 7.45 a.m. (Cushen).

KWIX, 9.57 mc., 31.35 m. Good at night, but suffers from surge and at times a metallic ring (Gaden).

WGEO, 9.53 mc., 31.48 m. Very good in morning (Gaden).

WKTS, 6.38 mc., 47.01 m. Poor here and mixed with morse in late afternoon (Cushen).

WCDA, 6.17 mc., 48.62 m. Opens at 8.15 a.m. with station identification (Gillett.)

THE EAST

China

XGOY, Chungking, 11.90 mc., 25.21 m. Good in news at 9 p.m. but modulation poor (Nolan). (Since February 12 have been on 11.87 mc., 25.27 m. and when opening at 8.55 sit right on top of VUD with his news—L.J.K.)

XGOA, 9.72 mc., 30.86 m. Weak at 1.20 a.m. (Nolan).

XGOY, 6.05 mc., 49.59 m. In English most of the night, zooms in at 1.20 a.m. (Nolan).

XGOY, 6.02 mc., 49.83 m. Mr. Cushen (N.Z.) says, Very good on about 6.02 mc., Talk in English at 12.30 a.m. News 1 a.m.

India

VWY, Kirkee, 17.94 mc., 16.72 m. Allington Kennard calls BBC at 10 p.m. (Nolan).

VUD-2, Delhi, 7.29 mc., and 6.19 both fair at 5 a.m. (Cushen) and for those who want to try lower frequencies here is a budget from Mr. Cushen:

VUD-2, 3.49 mc. Good signal through morse with news at 1.50 a.m. and heard very well in Native programme at 2.30.

VUB-2, Bombay, 3.365 mc., announces: "This is Bombay in the 89 metre band." Has news at 1.50 a.m. Quiz session heard at 2.30 and dance music from 2.45. The best Indian at 3 a.m.

VUM-2, Madras. Note new frequency 3.345 mc. Very poor signal spoilt by morse.

VUC-2, Colombo, 3.305 mc. Quite good at 2.30 a.m. in Native programme.

Colombo on 4.90 mc., very good with local news at midnight. BBC news at 2.

Great Britain.

Just a trace of two signals on 13 m. band (Gaden).

GRD, 15.45 mc., 19.43 m. The best 19 metre Daventry at 9 p.m. (Gaden).

GWD, 15.42 mc., 19.46 m. Opens 10 p.m. Sun., Tues., Thurs., and Fri., in Japanese. On Mon., Wed., and Sat., in English for Japanese (Edel).

GSN, 11.82 mc., 25.38 m. Splendid when closing at 9.15 p.m. (Gaden).

GVU, 11.78 mc., 25.47 m. Heard around 2 p.m. (Gaden).

WR--THREE

GWC, 15.07 mc., 19.91 m. "The sound of Bow Bells followed by Big Ben helps you to identify the General Overseas Service." at 10.30 p.m.

GRH, 9.825 mc., 30.53 m. No star at 5.30 p.m. but at 9 p.m. perhaps the best signal on the air (Nolan). Splendid also at noon (Gaden).

Listen at 7.59 p.m. for B—B—C. —L.J.K.

GRX, 9.69 mc., 30.96 m. Very good at 9.30 p.m. (Gaden).

GVZ, 9.64 mc., 31.12 m. Very powerful at night (Gaden), (Nolan).

GSB, 9.51, 31.55 m. Nice strength at 2 p.m. (Gaden). News from Canada at 7.30 a.m.—L.J.K.

GRI, 9.41 mc., 31.88 m. Good in South American service at 2 p.m. (Gaden). Good in Dutch at 2.45 a.m. (Nolan).

GSU, 7.26 mc., 41.32 m. Good at 7 p.m. (Gaden). Closes at 7.15—L.J.K.

GRM, 7.12 mc., 42.13 m. 5.29 p.m. B—B—C followed by Big Ben at 5.30 —L.J.K. At 7 p.m. is R7 -8 (Clack).

GRO, 6.18 mc., 48.54 m. Fair from 7.30—8 p.m., but suffers from high noise level (Clack).

U.S.S.R.

Moscow unless otherwise mentioned.

15.22 mc., 19.70. Heard well around 10 a.m. and 12.15 p.m. (Gaden). Also at 2.15 p.m. When closing at 2.37 say also on 9.545 mc., 31.43 m.—L.J.K.

News in English 10.40 p.m., Yiddish 11.23 p.m. (Edel).

12.26 mc., 24.47 m. Calls BBC at 11.30 p.m. (Gillett). Russian Home News at 6, 9 and 10 p.m., Estonian, 10.15; Lithuanian, 10.30; Latvian, 10.45 p.m. (Edel).

Radio TBILISI (Tiflis) 11.96 mc., 25.08 m. Opens at 10 p.m. in Italian and at 10.34 in Ukrainian (Edel).

(TBILISI, pronounced Tbi-lee-see, is the Georgian name for Tiflis—L.J.K.)

11.83 mc., 25.36 m. Opens at midnight in Hindustani.

Leningrad, 11.63 mc., 25.79 m. Announces as transmitting on 25.79, 30.85, 31.25 and 49.50 metres. See 25.79 for schedule. BCB DX-ers note also on 288.6 m.

10.23 mc., 29.33 m. Good most nights with news at 10.40 p.m.

7.36 mc., 40.76 m. News in Finnish at 2.30 a.m.

6.06 mc., 49.50 m Ukrainian at 1.30 a.m. (Edel).

5.89 mc., 50.90 m. Home news at 1 a.m. followed by concert (Edel).

MISCELLANEOUS

Canada

CFRX, Toronto, 6.07 mc., 49.42 m. Heard this one, R 3-4 at 11.30 p.m. calling CFRB (Clack). Heard them for first time on January 5 at midnight Good signal spoilt by GRR (Gillett).

Winnipeg Stations CJRX 11.72 mc. and CJRO 6.15 mc., are now back on the air with changed call-signs, CKRX and CKRD (Howe "Universalite").

Madagascar

Radio Tananarive, 48.68 m., opens at 2 a.m. with "Marseillaise." (Edel).

Sweden

SBT, 15.15 mc., 19.80 m. Calls BBC at 11 p.m. (Edel).

SBO, 6.06 mc., 49.46 m. Packs a punch with news at 8.15 a.m. (Nolan).

Spain

Radio Malaga, 7.14 mc., 42.00 m. Heard with 2 Gongs at 7.45 a.m. (Gillett).

Switzerland

HER-, Berne, 12.965 mc., 23.14 m. Replaces 16.26 m. on Tues. and Sats. 7—8.30 p.m., fair signal—L.J.K.

HER-, on 40.56 m. closes transmission to the Orient at 2.47 a.m. with an R5 Q4 signal (Edel).

HER-, 6.345 mc., 47.28 m. A new frequency to America. Strong signals 9.30—11 p.m. (Howe, "Universalite"). (This transmitter is best heard, here, from 5 till 7 a.m., closes 8.45—L.J.K.)

Turkey

TAQ, Ankara, 15.19 mc., 19.75 m. Good in Turkish around 11 p.m. (Nolan). (Best here between 8.30 and 9.30 p.m.—L.J.K.) From 10 till midnight gives concert with Turkish announcements—no English (Edel).

TAP, Ankara, 9.46 mc., 31.70 m. Great signal at 2.10 a.m. (Nolan); News at 4 a.m. (Edel). Note: Friday talks to England are now given at 7.30 a.m.—L.J.K.).

Vatican City

HVJ, 17.44 mc., 17.2 m. Heard man reading POW news in Italian at 1 a.m. (Nolan). As no reports were coming in for this station I removed from list in Dec., have re-inserted same.—L.J.K.

HVJ, 5.96 mc., 50.26 m. Heard an R 8 signal at 7.30 a.m. (Clack).

Mexico

XERQ, 9.61 mc., 31.21 m. Very good at 3 p.m.

WEST INDIES

Cuba

COBH, Havana, 11.805 mc., 25.41 m.: This is a new station relaying CMCX-CMCF from 1 a.m.— 10a.m. COGF, Matanzas, seems to be off the air (Howe, "Universalite"). (COBH reported, by Mr. Walker, was shown in February issue).

COBQ, 9.22 mc., 32.54 m: Now excellent of a morning, 9—10.30; gives call in English every half hour. Relays CMCQ (Walker).

(A long while since this station was reported — I will re-insert it in Schedule List—L.J.K.).

COHI, Santa Clara, 6.455 mc., 46.48 m. The RHC-Cadena Azul's outlet comes through with an R 5-6 signal at 11 p.m. (Clack).

Haiti

HHBM, Port-au-Prince, 6.165 mc., 48.66 m. This is a new frequency and operates from 10 a.m. till 1 p.m. (Howe "Universalite").

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.

Eastern Australian STANDARD Time comes into operation on March 26, at 2 a.m.

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
HER-	Berne	18.45		16.26	Tues. and Sats. Now on 23.14m
GVO	London	18.08		16.59	2—3.15 am
AFHQ	Algiers	18.02		16.64	10.20 pm
GRQ	Londan	18.02		16.64	Midnight—2.15 am.
VWY	Kirkee	17.94		16.72	Around 10.30 pm.
GRP	London	17.87		16.79	9—11.15 p.m. ; 2.45—4.15 am
EIRE	Athlone	17.84		16.82	11—12.30 am; 4.30—5 am; News 3.45 a m
WCDA	New York	17.83		16.83	12 am—5.30 am.
WCRC	New York	17.83		16.83	8.15—10.15 am
GSV	London	17.81		16.84	Not in use.
VLI-8	Sydney	17.80		16.85	8.30—9 pm
WLWO	Cincinnati	17.80		16.85	8.30—9.45 am; 12.15—5.30 am
GSG	London	17.79		16.86	9—9.30 pm; 2.15—3.45 am
WRCA	New York	17.78		16.87	12—3.45 am
OPL	L'poldville	17.79		16.88	5.55—7.15 am.
KROJ	'Frisco	17.76		16.89	Noon—1 pm; News at noon.
WRUW	Boston	17.75		16.90	2—4.15 am
GVQ	London	17.73		16.92	7.45—9.15 pm; 12.30—2.30 am
LRA-5	B'nos Aires	17.72		16.93	Sats. 7.45—7.30 am
—,	Brazzaville	17.71		16.94	7.30—8 am
GRA,	London	17.71		16.94	7 pm—3.45 am; News 7 pm
HVJ	Vatican City	17.44	N	17.20	Midnight—2 am
GVP	London	17.70		16.95	8 pm—1 am
KMI	'Frisco	17.09		17.5	2—5 am
WCW	New York	15.85		18.93	4 am—8 am
LSL-3	Beunos Aires	15.81		18.97	
—,	Moscow	15.75		19.05	10.40 pm —12.30 am
FZI	Brazzaville	15.59		19.25	10.15—11.15 pm
RNB	L'poldville	15.53		19.33	10 pm—midnight
KKR	Bolinas	15.46		19.4	News and commentary 1—1.30 pm
GRD	London	15.45	S	19.43	2.30—3.45 am; 5—8 am; 8.30—8.45 pm.
GWE,	London	15.43		19.44	7—9.15 pm;10—11 pm
GWD	London	15.42		19.46	8.30—8.45 pm; 9 pm—1 am 2.15—2.45 am.
GRE	London	15.37		19.51	6.45—8 pm; 11.15—2 am; 2.30—5 am.
ZYC-9	Rio deJ'niero	15.37		19.51	Schedule unknown
KWU	'Frisco	15.35		19.53	2—5 am; 7.30—9.15 am; 10.45 am—11.45 am
—	Moscow	15.35		19.54	9.15—11.20 pm. (English from 10.40)
WRUW/L	Boston	15.35	S	19.54	9.15 am
WGEA	Schenectady	15,33		19.57	8.30—9.45 am
KGEI	'Frisco	15.53		19.57	Closes at noon.
WGEO	Schenectady	15.33		19.57	10.15 pm—6.30 am
VLI-3	Sydney	15.32		19.58	8.30 pm—Midnight
GSP	London	15.31		19.60	4.45—6.15 am; 10.30 pm—1 am
KWID	'Frisco	15.29		19.62	4.30—Noon; 4—5.45 pm
VUD-3	Delhi	15.29		19.62	2.30—8.30 pm; News 2.30 and 6.
WCBX	New York	15.27		19.64	10 pm—7.45 am; 8—10.45 am
GSI	London	15.26		19.66	4.45—6.15 pm; 2.45—7 am
WLWK	Cincinnati	15.25		19.67	8.30—11.15 am; 11.30 pm—8.15 am.
VLG-6	Melbourne	15.23		19.69	11.45 am—12.20 pm; 1.40—1.50 pm (Sun. 1.15—1.50)
—	Moscow	15.22		19.70	8.15—8.40 am; 9.47—10.30 am; 12.15—12.40 pm; 10.40—11.20 pm
WBOS	Boston	15.21		19.72	11.15 pm—2 am; 2.15 am—3.45 pm
XGOY	Chungking	15.20		19.73	Heard testing with U.S.A. 6—8 pm
TAQ	Ankara	15.19		19.75	8.30—11.15 pm; 12.30 am—1.45 a.m.
KROJ,	'Frisco	15.19		19.75	7—11.45 am
WOOC	New York	15.19	N	19.75	1.45—5.45 am
WKRX	New York	15.19		19.75	6.30—8 am
XGOX	Chungking	15.18		19.76	Wed. only, 11—11.45 am
GSO	London	15.18		19.76	9.45—10 pm; 11.15—12.15 am; 2.30—2.45 am; 4.30—5 am
TGWA	Guatemala	15.17		19.78	4.45—5.55 am (Mon. till 9.15 am)
VLG-7	Melbourne	15.16		19.79	6—8.10 am (Sun. 6.45—8 am)
SBT	Stockholm	15.15		19.80	2—5.15 am. News 2.01 am
WNBI	New York	15.15		19.81	11 pm—8 am.
GSF	London	15.14		19.82	10 pm—1.45 am; 2—5.15 am
KGEI	'Frisco	15.13		19.83	4.15—5.15 am
WRUS	Boston	15.13		19.83	6—7.30 am.
HVJ	Vatican City	15.12		19.84	Irregular in afternoons
—	Moscow	15.11	S	19.85	8.15—8.40 am; 9.48—10.30 am; 12.15—12.40 pm
HVJ	Vatican City	15.09		19.87	See 19.84m.
GWC,	London	15.07		19.91	7—8.45 pm; 9 pm—1.45 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 11.45 pm
WKRD	New York	12.96		23.13	11 pm—10.15 am
HER-	Berne	12.96	N	23.14	Tues and Sats. 7—8.30 pm
CNR	Rabat	12.83		23.38	10.30—11 pm
HCJB	Quito	12.45		24.11	7—8 am; 10.55 pm—midnight
—	Moscow	12.26		24.47	2 pm to 3 am
TFJ	Reykjavik	12.23		24.54	4.15—4.30 pm
—	Moscow	12.19		24.61	8.45—10.23 am; 11—11.50 am
—	Moscow	12.17	S	24.65	5.45—6 pm; 8.30—9.50 pm
R. France	Algiers	12.12		24.75	3.30—5.30 am; 6—8.30 am; 8.45—9.15 am
ZNR	Aden	12.11		24.77	3.13—4.30 am
GRF	London	12.09		24.80	11 pm—2.15 am
GRV	London	12.04		24.92	6.30—9.15 pm
FZI	Brazzaville	11.97		25.06	5.45—9 am; 2—3 pm; 5—5.15 pm; 12.30—1.15 am
Radio TBILISI	Tiflis	11.96	S	25.08	From 10 pm
GVY	London	11.95		25.09	9 pm—2.45 am; News 10 pm, midnight and 2 am.
GVX	London	11.93		25.15	8 pm—1.30 am; 2.30—6 am; (Eng 8.15—8.45 pm; 12—12.30 am.
XGOY	Chungking	11.90		25.21	9—10.30 pm; 2.30—3.30 am.
VLG-9	Melbourne	11.90		25.21	Not in use
CXAIO	Montevideo	11.90		25.21	10.5 am—1.10 pm
WRCA	N.Y.	11.89		25.22	7—11.45 pm; 4—7.45 am; 8 am—2.30 pm
VPD-2	Suva	11.90		25.22	9.30—11 am
WKTM	New Yark	11.89		25.23	9.—11 am.
AFHQ	Algiers	11.88		25.24	7.57 pm
VLR-3	Melbourne	11.88		25.25	Daily 11.45 am—5.45 pm; Sun. from 12.50 pm
WOOW	New York	11.87	N	25.27	11.45 pm—5.45 am
VLI-2	Sydney	11.87		25.27	5.55—6.25 pm
WBOS	Boston	11.87		25.27	9.15—11 pm; 6—8.15 am; 8.30 am—3 pm
VUD-,	Delhi	11.87		25.27	8.45—11.30 pm; News 8.46
KWIX	'Frisco	11.87	S	25.27	7—10.30 am
HER-5	Berne	11.86		25.28	11.55—1.30 am
GSE	London	11.86		25.29	10 pm—6 am.
WGEA	Schenectady	11.84		25.33	11 pm—8.15 am
VLG-4	Melbourne	11.84		25.34	Noon—1.45 pm; 7.10—8 pm; 8.30—9 pm; 9.15—10.45 pm
GWQ	London	11.84		25.34	8 pm—1.30 am; 2.30—5.45 am
VLW-3	Perth	11.83		25.36	9.30 am—12.45 pm; 2.30—9.15 pm; (Sun. 9.45 am—9.15 pm)
—	Moscow	11.83		25.36	3—3.45 pm; 4—5 pm; 10—10.30 pm; 12—12.4 am; 1.30—4.45 am.
WCRC	N.Y.	11.83	S	25.36	6.15—9.45 am
WCDA	N.Y.	11.83	S	25.36	9.45 pm—
GSN	London	11.82		25.38	7.45—9.15 pm; 11 pm—11 am
XEBR	Hermosillo	11.82		25.38	12—4 pm
COBH	Havana	11.80		25.41	Heard at 9 am and 10.30 pm
COGF	Matanzas	11.80		25.41	Said to be off the air.
GWH	London	11.80		25.42	8 pm—1.30 am; 2.30—5.45 am
WRUL	Boston	11.79		25.45	9 pm—7.30 am.

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
VUD-6	Delhi	11.79		25.45	8.45 pm—1 am; News 8.45
KGEI	'Frisco	11.79		25.43	8 am—3.45 pm
GVU	London	11.78		25.47	5—7 am
HP5G	Panama	11.78		25.47	12.15 pm—1.30 am; 3.45—7 am
VLR-8	Melbourne	11.76		25.51	6—10 am (Sun. 6.45 am—12.45 pm)
GSD	London	11.75		25.53	6.45—8.45 pm; 2.45—7 am; 7.45—11 am.
—,	Moscow	11.75		25.53	10.30—10.55 am.
GSB	London	11.75		25.53	3—3.45 pm.
HVJ	Vatican City	11.74		25.55	Mon. & Thurs: Calls Eng. 5 pm, Thurs & Sat calls Aust 6 pm.
COCY	Havana	11.73		25.56	12. pm—5.15 pm.
GVV,	London	11.73		25.58	9.45 pm—2.15 am; 2.30—7.30 am
WRUL,	Boston	11.71	S	25.58	7—9 am; 9.15—10.15 am
CKRX	Winnipeg	11.72		25.60	4—8.45 am
OPL	L'poldville	11.72		25.60	10.55—m/n; 5.55—7.15 am.
Brit. Medit. Stn		11.72		25.60	11 pm—3 am
HER-5	Berne	11.71	S	25.61	Daily: 5—8.45 am; Tues & Sat. 7—8.30 pm
PRL-8	R. de J'niero	11.72	N	25.61	English announcements at 7 am
YSM,	San Salvador	11.71		25.62	5—6 am.
VLG-3	Melbourne	11.71		25.62	4.55—5.40 pm; 5.55—6.25 pm; 6.30—6.50 pm.
WLWO	Cincinnati	11.71		25.62	5.45—8.15 am; 9.30 pm—midnight; News 10 and 11 pm.
CXA-19	M'tevideo	11.70		25.63	10—11 pm; 8 am—2 pm
SBP	Motala	11.70		25.63	2—5.15 am; 8.20—8.40 am; 12 am—1 pm opens again at 10.05 pm
CBFY	Montreal	11.70		25.63	10.30 pm—2.30 pm
GVW	London	11.70		25.64	2.30—7 am
HP5A	Panama City	11.70		25.64	12—pm—4 am; 12.10 pm—4 pm
CE1170	Santiago	11.70		25.64	11pm—1 am
GRG	London	11.68		25.68	5—7 am; 11 pm—4 am.
—,	L'poldville	11.67		25.71	Now on 30.66 metres.
Leningrad		11.63	N	25.79	10.30—10.43 pm; 10.50—11.17 pm; 12.30—12.43 am; 12.50—1.18 am
COK	Havana	11.62		25.83	3 am—2 pm (Mon. 4—10 am)
WRUA	Boston	11.14	S	26.92	11 pm
WCDA	New York	11.14	N	26.92	6—7 am
CSW6	Lisbon	11.04		27.17	6—9.30 am.
KWV	San F'cisco	10.84		27.68	5—7.45 pm; 8—10 pm
VQ7LO	Nairobi	10.73		27.96	1.45—6 am
KES-3	Bolinas	10.62		28.25	4—9.15 pm
VLN-8	Sydney	10.52		28.51	Idle at present.
—	Moscow	10.44		28.72	7 pm—2.45 am (often news at 10.40 pm)
—	Moscow	10.23		29.33	5.15—6.50 pm; 10 pm—midnight
Moscow		10.08	N	29.75	Heard at 4.50 pm
SUV	Cairo	10.05		29.84	5.30—6 am; 9.45—10.30 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	5—6.20 am; 8—8.30 am 8.30—9.30 pm; 12.45—1.15 am
HCJB	Quito	9958		30.12	7—8 am; 10.55 pm—1 am
WRX	New York	9905		30.29	9 am—3 pm; 3.15—8 pm
WKRD	New York	9897		30.31	7.45—9.30 pm; 6—8 am.
WKRX	New York	9897		30.31	9—11.45 am.
KROJ,	'Frsco	9.89		30.31	1.15—6.45 pm; 7 pm—midnight; 2—5.15 am.
—	Moscow	9.88		30.34	Irregular, but often heard around 9.30 pm
CR7BE	L. Marques	9.88	X	30.38	5.30—7.30 am; News 6.50
EAQ	Madrid	9860		30.43	5—6 am; News 5.15
—	Moscow	9860	S	30.43	9—11.15 pm
COCM	Havana	9833		30.51	10.45 pm—4 pm
GRH	London	9825		30.53	8.15—am—1.15 pm; 4.45—9.15 pm; 1.45—2.15 am.
RNB	L'poldville	9.78	S	30.66	4—5.45 pm; 2.55—3.30 am 4.15—9.30 am
—	Moscow	9770		30.71	11—11.30 am.
WKLJ	New York	9750		30.77	6.30—9.30 am
T14NRH	Heredia	9740		30.80	11—12 pm (Wed, Fri, & Sun. 2.30—4.30 pm).
CSW-7	Lisbon	9735		30.82	See 27.17 metres.
Leningrad		9.72	N	30.85	Heard around 6.15 pm; 10—11 pm and midnight
CE-970	V'paraiso	9.73		30.82	Heard around 3 pm
XGOA	Chungking	9720		30.86	6—7 am; 10 pm—2 am; News 1 am
OAX4K	Lima	9715		30.88	9.30 am—3.20 pm
WRUW	Boston	9.70	S	30.93	5.45—9 am
FIQA	Tananarive	9700		30.93	1.30—2 am.
GRX	London	9690		30.96	News 8 pm; America calls Europe 8.15 pm.
TGWA	Guatemala	9685		30.96	12.50 pm—3.45 pm (Mon. 11 am—3.45 pm)
VLG-8	Melbourne	9.68		30.99	
XEQQ	Mexico City	9680		30.99	
VLW-6	Perth	9.68		30.99	Idle at present.
WNBI	New York	9.67	S	31.02	1 am—5.45 pm
Brit. Medit. Stn		9.67		31.02	9.30 pm—2.30 am
. . .	—				8.15—5 pm; 7 pm—11 pm—3 am; 5 am—
LRA-1	B'nos Aires	9688		30.96	2.30—5 am; 6.30—7.30 am; 7 am—1 pm
VLQ-3	Brisbane	9.66		31.05	11.45 am—5.15 pm. (Sun. 11 am—5.15 pm).
GWW	London	9.66		31.06	Heard at 11.30 pm
LRX	B'nos Aires	9.66	S	31.06	2.30—8 am
HVJ	Vatican City	9.66		31.06	3—5.30 am
WGEO	Schenectady	9.65		31.08	Not in use at present.
WOOC	New York	9.65	S	31.08	7—10 am
WCBX	New York	9.65		31.09	2.45—5 pm.
XGOY	Chungking	9.64		31.10	10.35 pm—2.40 am; News 1 and 2 am
COX	Havana	9.64		31.12	3.50—3 pm
LRI	B'nos Aires	9.64		31.12	8.57—11 pm; 4.30—5.30 am; 6 am—2 pm
GVZ	London	9.64		31.12	7—8.45 am; 4.30—8 pm; 9 pm—2.15 am; 3—6 am
GWO	London	9.62		31.17	No schedule.
—	Addis Ababa	9.62		31.17	2.40—3.30 am
TIPG	San Jose	9.62	N	31.20	Heard around 11 pm
XERQ	Mexico	9.61		31.21	Heard at 3 pm
ZYC-8	Rio de J'n'ro	9.61		31.21	10 am—1 pm
ZRL	Capetown	9.60		31.22	6.15 pm—1.30 am
HP5J	Panama City	9.60		31.23	11 pm—5.30 am; 12.30 am—2.30 pm; Sun. 12 pm—2 pm. Mon.
CE960	Santiago	9.60		31.24	10 am—3 pm.
GRY	London	9.60	S	31.25	4.30—8 am; 4—6.15 pm; 10—11 pm
—	Athlone	9.59		31.27	8.05—8.25 am; News 8.10 am
VUD-4	Delhi	9.59		31.28	9.30—12.35 am; 1.15—2 am; 3.30—5.30 am; News 11 pm 1.50 am and 5 am
WCRC	New York	9.59	N	31.30	9—9.45 pm
WLWO	Cincinnati	9.59		31.30	10 am—3 pm
WLWK	Cincinnati	9.59		31.30	Idle
VLR	Melbourne	9.58		31.32	6—11.30 pm daily
VLI-10	Sydney	9.58		31.32	Idle at present.
VLG	Melbourne	9.58		31.32	1.15—1.45 am (Eng. for India) 2—2.45 am (for Nth America
GSC	London	9.58	S	31.32	7.45 am—1.15 pm
WRUS	Boston	9.57	S	31.35	7.45—9 am; 9.15 am
KWIX	'Frisco	9.57	S	31.35	11 am—3.45 pm; 11 pm
KWID	'Frisco	9.57		31.35	Not in u se at present
—	Khabarovsk	9.56	S	31.37	8.40—9.45 rm; 7 pm—1 am
OAX4T	Lima	9.56		31.37	Midnight—1 pm
XETT	Mexico	9.55		31.39	Continuous
GWB	London	9.55		31.41	7.15—8.45 am; 5.10—5.30 pm 6.10—7 pm; 7.30—8.30 pm; 9.45—11 pm; 11.45 pm—12.15 am; 2.30—6.45 am.
WGEA	Schenectady	9.55		31.41	Not in use at present.
—	Moscow	9.54		31.43	2.15—2.40; 10.40—11.20 pm
VLG-2	Melbourne	9.54		31.45	4.10—4.40 pm; 11 pm—1 am; 2—2.45 am
AFHQ	Algiers	9.53		31.46	1.45—2 am; 3—9.30 am; News 6 am
SBU	Stockholm	9.53		31.47	8.20—8.35 am; 12 am—1 pm, News 8.20 and 12 am.
HER-4	Berne	9.53		31.47	See 25.61 metres.
WGEO	Schenectady	9.53		31.48	6.15—8.15 am; 8.30 am—10.30
GWJ	London	9.53		31.48	8—11.45 pm; m/n—1.30 am
ZRG	Joh'burg	9.52		31.50	6.30 pm—1.30 am
COCQ	Havana	9.51		31.53	11 am—2 pm; 9.20—12 pm
GSB	London	9.51		31.55	5.15 am—1.15 pm; 4—6.15 pm.
PRL-7	R de Janeiro	9.50		31.57	9 am—2 pm
XEWW	Mexico City	9.50		31.58	12.58—6.45 pm.
GWF	London	9.49		31.61	6 pm—1.30 am; 2.30—5.30 am
KRCA	'Frisco	9.49		31.61	4 pm—4 am
WCBX	New York	9.49		31.61	10.50 am—2.30 pm
—	Moscow	9.48		31.65	5—6 pm; 9.30 pm—1.45 am; 2.45—3.15 am.
TAP	Ankara	9.46		31.70	2—6.45 am; News 4 am. Talk at 7.30 am on Fridays
GRU	London	9.45		31.75	4—7.30 am; 7.45—8.45 am; 4.30—8 pm; 11.30 pm—2.45 am.
COCH	Havana	9.43		31.80	9.45 am—4.15 pm
—	Moscow	9.43		31.81	8—8.25 am; 3.15—3.45 pm; 4.30—5 pm.
GRI	London	9.41	S	31.88	3.45—9.30 am; 10 am—2.45 pm
FGA	Dakar	9.41		31.88	4—5.15 am
OAX4W	Lima	9.40		31.90	Heard closing at 4 pm
—	Moscow	9.39		31.95	10.30—12 pm; 2.30—3 am; 11 am—2 pm.
COBC	Havana	9.37		32.00	12 pm—4.15 pm.
OAX4J	Lima	9.34		32.12	10 am—5 pm; 12 pm—1 am; 4—7 am

Call Sign	Location	Mc.	M.	Time: East. Australian Daylight
LRS ..	B'nos Aires	9.32	32.19	9 am—1 pm; 11—12 pm; 5—5.30 am
COCX	Havana	9.27	32.26	11.45—4 pm.
COBQ	Havana	9.22	32.54	11 pm—12.15 pm
HC2ET	Guayaquil	9.19	32.64	11.30 pm—4.30 pm
CNIR1	Rabat	9.08	33.03	5—9.50 am; 5.30—5.50 pm; 10.30—12 pm.
VWY	Kirkee	9.04	33.16	Around 9 am.
—	Brazzaville	9.04	33.19	12.45—1 am; 5—6.15 am; 8—8.30 am; 3.30 pm—9.30 pm
COBZ	Havana	9.03	33.23	11.45 pm—3 pm
—	Moscow	8.99	33.37	6.50—7 am.
AFHQ	Algiers	8.96	33.48	3—10 am; News 5 and 6
—	Moscow	8.94	33.54	Around 9.45 pm
KES-2	'Frisco	8.93	33.58	9.15 pm—4 am
—	Dakar	8.83	33.95	6.15—7.45 am; 6.30—6.50 pm; 11.15—12 pm.
COCQ	Havana	8.83	33.98	9.20 pm—3.15 pm
COCO	Havana	8.70	34.48	8.30 pm—4.30 pm
COJK	Camaguey	8.66	34.62	3.30—4.30 am; 7.30—10 am; 12—12.30 pm:
WOO4	New York	8.66	34.64	11 am—5 pm; 5.15—8 pm.
—	Moscow	8.05	37.27	2—2.30 am; 3—5.15 am; 8.15 9.45 am
CNR1	Rabat	8.03	37.34	5—10.45 am; 4—6 pm
FXE	Beirut	8.02	37.41	Midnight—8 am.
YSD	San Salvador	7.89	38.00	11 am—2.30 pm
SUX	Cairo	7.86	38.15	4.30—5.30 am; 6.15—8.45 am
WOOW	New York	7.82 N	38.36	10.15 am—
WKRD	New York	7.82	38.36	5—7.15 pm
WKRX	New York	7.82	38.36	8—11 pm.
WRUW	Boston	7.80 S	38.44	Opens 5.15 pm
WRUA	Boston	7.57 S	39.6	7.45—9 am; 9.15—
WLWO	Cincinnati	7.57 S	39.6	3.15—5.30 pm
WKTS	New York	7.57	39.6	11 am—1 pm
—	Moscow	7.56	39.68	2—7.30 am; 9—10 am; 12.10—12.30 pm.
WDJ	New York	7.56	39.66	10.15 am—7 pm
KWY	'Frisco	7.56	39.66	11.30 pm—1.30 am
SU—	Cairo	7.50	40.00	2.30—4 am
YN2FT	Granada	7.49	40.05	11 am—2 pm
—	Moscow	7.46 N	40.21	Home Service Heard at 2 am
HER—	Berne	7.39	40.56	2.15—2.47 am
—	Moscow	7.36 N	40.76	Home Service Heard at 2 am
GRJ	London	7.32	41.01	5.30 am—2.30 pm; 3.45—6.15 pm
—	Moscow	7.30	41.10	3—10.30 am; 11—12 am; 2—4.45 pm; 5.30—6 pm
VUD-2	Delhi	7.29	41.15	8.45 pm—12.25 am; News 8.45 pm; Special news for 15 minutes at 5 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	7—7.40 pm; 10.45—12.30 pm; 1.45—1.50 pm. News 11 pm and 1.45 am.
GSU	London	7.26 S	41.32	5—7.30 am; 8.15 am—3 pm; 4.45—7.15 pm; 10.35 pm 1 am
KGEI	'Frisco	7.25	41.38	2 pm—3.45 am
GWI	London	7.25	41.38	5 am—2 pm; 3.45—8.15 pm
VUB-2	Bombay	7.24	41.44	5.15—6.10 pm; 10.25—11.45 pm. News 6, 10.25 & 11 pm
VLQ	Brisbane	7.24	41.44	6—10 am.
KWID	'Frisco	7.23 S	41.49	6 pm—4.05 am
GSW	London	7.23	41.49	6 am—2.30 pm; 3—6.15 pm
VLI-4	Sydney	7.22	41.55	12.35—1.45 am
VLQ-2	Brisbane	7.21	41.58	5.30—11.30 pm
Brit. Medit. Stn				
. . . —		7.21	41.58	5 am—
—	Moscow	7.21	41.61	8.50—10.30 am
VUC-2	Calcutta	7.21	41.61	9.30—10.30 pm
—	Madrid	7.20	41.63	7—10 am
GWL	London	7.20	41.64	No schedule.
YSY	San Salvador	7.20	41.65	11.30 am—3 pm
GRK	London	7.18	41.75	
XGOY	Chungking		41.80	9 pm—4 am; 5.30—8 am
—	Moscow	7.17	41.80	6.20—7.30 am; 8.15—10.55 am 11—11.30 pm; 2—5.30 am
GRT	London	7.15	41.96	1.45—3 pm
EAJ-9	Malaga	7.14	42.00	7—10.05 am
—	Ovideo	7.13	42.05	6—8.30 am
GRM	London	7.12	42.13	4.45—7.15 pm
EA9AA	Melilla	7.09	42.31	Heard around 8 am
GRS	London	7.06	42.46	3.30—9.45 am.
EAJ24	Cordoba	7.04	42.61	7.40—8 am
EAJ-3	Valencia	7.03	42.65	7—11 am
—	Ponto Delgada	7.02	42.74	6—7 am
WGEA	Schenectady	7.00	42.86	11 am—3 pm
FO8,AA	Papeete	6.98	42.95	Wed & Sat. 2.57—3.45 pm
—	Moscow	6.98	42.98	3 am—10.23 am; 11—11.30 am
YNOW	Managua	6.87	43.67	11 am—3.30 pm
KEL	Bolinas	6.86	43.7	8—8.25 pm
ZLT-7	Wellington	6.71 S	44.68	8.30 pm in news session only
TGWB	G'temala	6.54	45.87	10.30 am—4 pm
COHI	Santa Clara	6.45 N	46.48	10.30 pm—3.15 pm
WKTM	New York	6.38	47.01	6.15—8 pm
	Berne	6.34	47.28	5—8.45 am; News 7.53
SUP-2	Cairo	6.32	47.47	5—8 am
FK8AA	Noumea	6.20	48.39	6.15—6.27 pm; 8—9 pm
GRN	London	6.19	48.43	6.45—7.30 am; 1—3.45 pm
VUD-2	Delhi	6.19	48.47	10.30—11.15 pm; M/n—2.45 am News 11 pm; 12.45 am; Special 15 mins at 5 am
XECC	Puebla	6.19	48.47	From 3—5 pm
WGEO	Schenectady	6.19	48.47	3.15—6.15 pm
LRM	Mendoza	6.18	48.51	9.30—2 pm
GRO	London	6.18	48.54	6—11.45 am; 3.40—8.45 pm
HJCT	Bogota	6.18	48.54	10 am—3.15 pm.
WCBX	New York	6.17	48.62	3—6 pm
WCDA	New York	6.17 N	48.62	8.15 am—
—	Antananarivo	6.16	48.62	2—3 am
HER-3	Berne	6.16	48.66	See 47.28 metres
GWK	London	6.16 S	48.66	6 am—2 pm; 3.45—5.45 pm; 11 pm—12.45 am
HHBM	P-au-Prince	6.16	48.66	10 am—1 pm
HJCD	Bogota	6.16	48.70	Around 3 pm
CBRX	Vancouver	6.16	48.70	12.30 am—5.30 pm
EQB	Teheran	6.15	48.74	2.30—7.30 am; News 3.45 and 6.15
GRW	London	6.15	48.78	4—7 am; 7.45 am—2.30 pm; 3—6.15 pm
CKRD	Winnipeg	6.15	48.78	10 am—1 pm
WBOS	Boston	6.14	48.86	7.—9 pm
XGOY	Chungking	6.13	48.92	10.35 pm—2.30 am; News 1 and 2 am. Also heard around 4.45 am
VPD-2	Suva	6.13	48.94	4.55—9 pm
LRX-1	B'nos Aires	6.12 N	48.94	8 am—3 pm; 10.30 pm—2.30 am
GWA	London	6.12	48.98	7 am—1 pam; 2.45—7.30 pm
HP5H	Panama City	6.12	48.99	10 am—3 pm
XGOY ..	Chunking	6.12	49.02	10.35 pm—3.30 am
XEUZ	Mexico	6.12	49.02	Around 3—4 pm
WKTS	New York	6.12	49.02	5—7 pm
WOOW	New York	6.12 S	49.02	10.15 am—5.45 pm
WCRC	New York	6.12	49.02	Heard closing at 5.45 pm
GSL	London	6.11	49.10	8.15 am—3.45 pm; 4.45—6.45 pm; 2—2.45 am
XGOY	Chungking	6.11	49.10	News at 1 am
CBFW	Montreal	6.09	49.25	10.30 pm—2.30 pm
GWM	London	6.09	49.26	No schedule.
ZNS-2	Nasau	6.09	49.25	12—12.15 pm; 4.45—5.15 am
VUD	Delhi	6.08	49.3	9.30 pm—3.20 am
VQ7LO,	Nairobi	6.08	49.32	3—6 am; News 3.15 am.
WLWK	Cincinnati	6.08	49.34	11.30 am—3 pm; 3.15—7.30 pm
CKFX	Vancouver	6.08	49.34	12.30 pm—5.30 pm
CFRX	Toronto	6.07	49.42	10 pm—4.30 pm
—	Moscow		49.42	7.30—8.30 pm
GRR	London	6.07 S	49.42	3.45—8.30 pm; 11.30 pm—9.30 am
SBO	Stockholm	6.06	49.46	Try around 8.30 am
WCDA	New York	6.06	49.50	10.30 am—5 pm
—	Moscow	6.06	49.50	Heard around 1.30 am
GSA	London	6.05	49.59	1—3.30 am
XGOY	Chungking	6.05 N	49.59	10.35 pm (News 1 am)
XETW	Tampico	6.04	49.66	11 pm—5 pm
WRUW	Boston	6.04	49.66	3.15—7 pm
AFHQ	Algiers	6.04	49.67	3—10am; News 5 and 6 am
HP5B	Panama City	6.03	49.73	10 am—2 pm; 2.30 am—5 am
—	Moscow	6.03	49.73	10.40—11.19 pm
CJCX	Sydney (Nova Scotia)	6.01	49.92	10 pm—5.30 am; 9 am—2 pm
VUD-3	Delhi	6.01	49.92	11.25—12.45 am
GRB	London	6.01	49.92	3—4.30 pm
ZRH	Joh'burg	6.00	49.95	2.—8 am
CFCX	Montreal	6.00	49.96	11 pm—5 am; 9 am—3 pm
ZOY	Accra	6.00	49.96	9.30—10.15 pm; 3.15—6.15 am News 6 am
XEBT	Mexico City	6.00	50.00	2 am—4.30 pm
XGOY	Chungking	5.99 N	50.04	News 1 am

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

G. B. (Essendon, Vic.) makes some suggestions.

A.—Very glad to have the suggestions, although we cannot act upon them at present as the amount of paper we use is strictly limited. As soon as things return to normal we hope to make many improvements, and so your idea will be filed away for future reference.

●

G.S. (Gympie, Q.) raises the point of power supplies.

A.—It seems to be the accepted thing that all electricity undertakings will eventually be converted to a.c. and so it does not appear to be sound policy to count too far on d.c. supplies.

●

B.B. (Albury) has heard that car radios are now prohibited.

A.—No, we feel sure that you have been misinformed. In England there is some such regulation, but in Australia the only drowback is the need for a supplementary licence at half-fee.

●

J.D.F. (Hawthorn, Vic.) sends a circuit of an amplifier with resistance-capacity coupling to a pair of 6A6 type output valves. He wants to know if it will be essential to use permatune inter-mediate transformers to match up with the aerial and oscillator coils, which are permatune.

A.—The output valves are of unsuitable type and it would not be possible to use them as suggested. You will either have to change over to 6V6G or other suitable beam power valves or output triodes, or else use a special class B audio transformer with plenty of power in a driving stage. With regard to the intermediates, these can be of any style, so long as they tune to the right frequency when adjusted. In this case there is no point in matching the permatune feature, although, of course, permatune i.f. transformers are O.K. and if you can get them, or have them on hand, then by all means use them. However, the circuit suggests that you are not fully conversant with theory and we suggest that you should work on tried and tested designs before starting out on your own developments. For example, it is essential to arrange for some form of detection; you have to change signals from radio frequency, as received in the aerial and amplified in the r.f. stages, into audio frequency suitable for being amplified in the audio end and fed to the speaker. If you just amplify the r.f. signals and then feed them into the audio amplifier you cannot expect to get satisfactory audio signals in the speaker.

●

E.A.G. (Cooper's Plains, Q.) asks what DX stands for; also, what are minimum cathode ray voltages, as the makers usually specify maximum ones only.

A.—DX stands for distance, and in radio work indicates anything to do with long-distance reception. With regard to the actual minimum voltages we have no actual data, but you can take it as fairly right that the tube manufacturers and designers have done everything possible to make cathode ray tubes to operate with the lowest potentials possible, so that, as sure as you get below the rated voltages, you are sure to find a falling off in performance, especially as regards brilliance of the spot, etc. Without knowing full details we could not feel safe in recommending you to attempt to operate a cathode ray tube unless you are within 10 per cent of the rated screen voltage.

●

H.F. (North Fitzroy, Vic.) has £2 available with which to purchase a good book on the subject of modern set building, along the style of the article published in the July, 1942, issue.

A.—Afraid you will not find any book of this kind available, although the subject has been covered time and again in constructional articles appearing in back numbers issued over the past 8 years. Of course, the American "Radio Amateurs Handbook" and "Radio Handbook", have good chapters on workshop practice and set building, but they deal mostly with "ham" transmitters. All good knowledge and interesting, however, and you should start thinking about being a "ham" after the war is cleaned up. We suggest having a look around the shelves in the Public Library in Melbourne, also upstairs at McGills, in Elizabeth Street.

●

R.B. (Hawksburn, Vic.) has built a powerful short-wave set, but finds that it is too noisy.

A.—We are not at all surprised to hear that you are disappointed with the set. The two i.f. stages are giving you far too much noise, and you would have been much better off with at least one r.f. stage and one i.f. stage, or better still two r.f. stages and two i.f. stages, but with the i.f. gain cut right back to less than normal with a single stage, but with extreme selectivity. The high-audio gain which you have designed in the amplifier is also useless when it comes to the purpose you have in mind, getting overseas short-wove stations clearly. No matter how much audio gain you have, you are only amplifying the noise as well as the signal. You will do better to avoid any high degree of fidelity, too, cutting back both lows and highs and handling only the middle register from, say 400 cycles to 2,000. In your case this would mean fitting a .001mfd. by-pass to the second detector plate, and reducing the coupling condenser to .004 mfd.

PROPER VALVE USE

(Continued from page 18)

across the rectifier is so low that it may be of the same order as the filament-heating voltage. If the anode and filament voltages are connected in phase or 180 degrees out of phase, as would be the case in a normal bi-phase half-wave circuit, maximum current to the anode will coincide on each half-cycle with peak positive voltage at one or other end of the filament. This will tend to draw more emission from one end of the filament than from the other, and will also result in unequal amplitude of current in the two halves of the filament. For this reason the Code of Practice lays down that with large directly heated mercury vapour rectifiers, the anode voltage and the filament voltage should be arranged to be substantially 90 degrees out of phase. If this is inconvenient, steps may be taken to reverse the filament terminals at regular intervals, but if this is not possible, the rectifier will usually have to be operated with reduced ratings.

STUMPING THE EXPERTS

The opinions of the experts were divided; some leading jewellers and jade connoisseurs thought the small black antiquated snuff bottle from China was of black jade, and therefore rare and worth £500; others believed the bottle was merely agate and worth about £5.

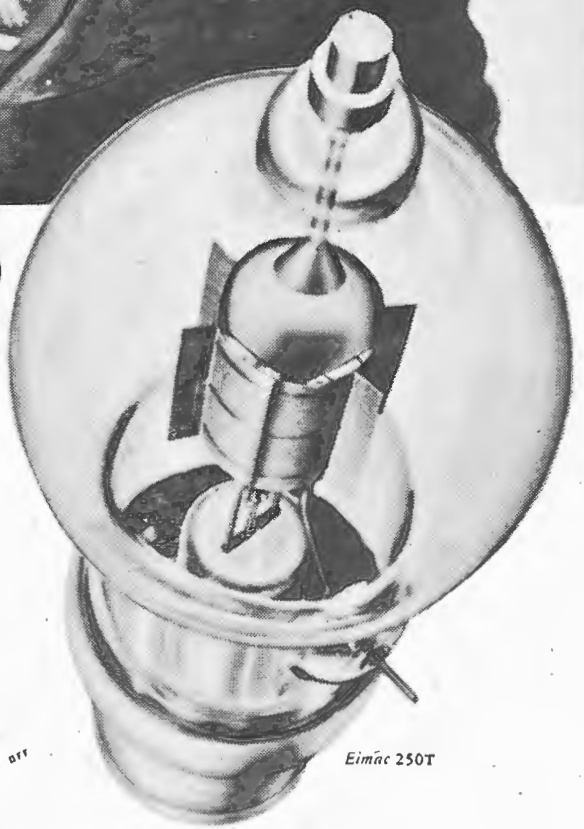
The owner referred the problem to the Field Museum in Chicago, and the Museum, in turn, handed it on to radio engineers of the G.E. Company. X-ray diffraction patterns finally showed that the bottle was really of black jade, but even more amazing, the X-ray inspection explained why the jade was black instead of the usual white or green. Certain extra lines in the diffraction pattern checked with those produced by manganous and titanium oxides. Infiltrations of these oxides into the basically white jadite rock would account for the black colour.

the amateur is still in radio

No other industry has had the benefit of such an eager and proficient group of supporters as the radio amateur.

By his own experimentations and inventions, and because of the extreme demands he made upon radio equipment, the radio amateur has been the driving force behind many of the major developments in radio. Out of the amateur testing grounds have come advanced techniques and vastly superior equipment of which Eimac valves are an outstanding example.

Eimac valves created and developed with the help of radio amateurs, possess superior performance characteristics and great stamina. They will stand momentary overloads of as much as 600% and they are unconditionally guaranteed against premature failure due to gas released internally. These are good reasons why Eimac valves are first choice among leading electronic engineers throughout the world.



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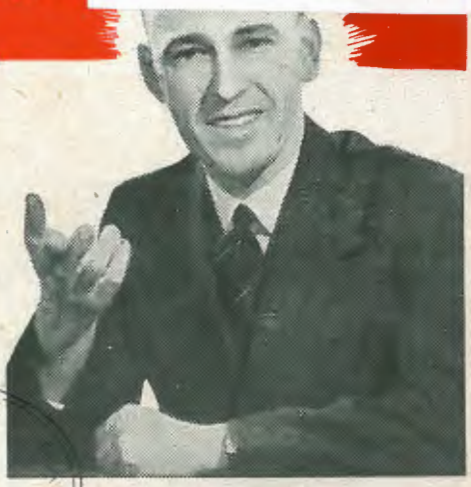
Ask yourself these 3 questions

1 Am I capable of doing more for my Country?

2 Am I capable of earning more money?

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



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

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

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

SEND FOR THIS BOOK

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

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

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

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

H.B., Western Australia.

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

C.T.S., Melbourne.

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

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

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