THE AUSTRALASIAN

Radio World

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VOL. 8 . . . . . NO. 12 MAY 15 1944

Novel detector design featured in utility circuit contest entry.

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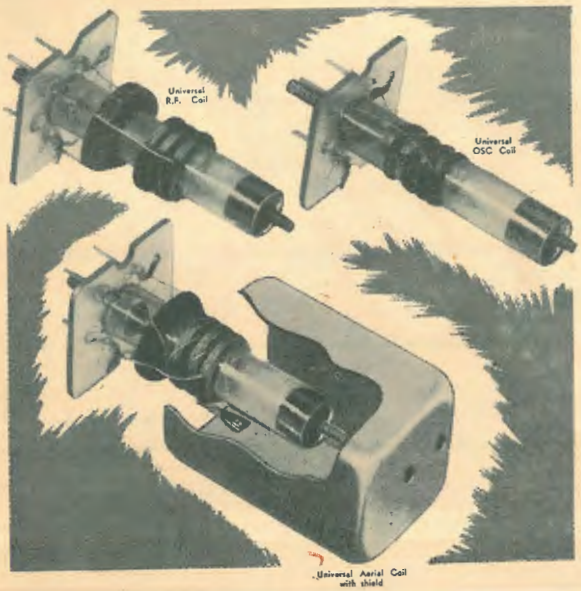

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CONTENTS

EDITORIAL

In last month's issue we had an article about communications receivers and forecast their popularity in the post-war era.

This suggestion has been challenged by an entrant in our Utility Circuit Contest Mr. P. Stevens, of "Westdale," Fletchers Avenue, Bondi, who says, "Weak or distant stations, marred by static and fading are seldom patronized except by the DX enthusiasts, and the same thing applies to overseas short-wave stations. The thrill of listening to the "truth" on Tokyo or Berlin radio through a more or less dense cloud of interference will end together with the war, and as the continuous sideband fading on short-waves makes the tonal quality rather poor, receivers should be built for broadcast only."

Chatting with factory set designers about this subject has shown that there are quite a few who readily agree with the opinion expressed by Mr. Stevens, and there seems to be quite a chance that the preference for dual-wavers will fade like it has for other "selling features" such as clock dials and push-button tuning.

We have not been able to conduct a "Gallup Poll" on lines extensive enough to be considered representative, but it is fairly obvious that not five per cent of the listening time of the average dual-wave receiver is spent on the short-wave band.

Yet on the other hand we read of thousands upon thousands of pounds being spent on the erection of bigger and still bigger short-wave transmitters, and doubtless they expect to have vast audiences.

—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.

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THE TROPIC - PROOFING ERA

WHEN I recall reactions to complaints from Pacific Island users of radio receivers in pre-war days, that after a month or so of use, dead dials were in evidence; I recall also how casually we radio engineers dismissed such complants as being individual or possibly isolated. Experience bred by the need for making Service radio equipment to stand up against the ravages of jungle atmospheres, as well as the Jap, has broadened the radio engineer's outlook on what is still a formidable problem, but one which is rapidly being solved. Every item of equipment, even down to flat headed nails in packing cases, now conforms to requirements of "Tropic Proofing", and with radio equipment, those requirements are particularly exacting.

Exasperating but essential

To the manufacturer they have appeared exasperating, but evidence and advice by those with experience in steamy forward areas are having a profound effect. Radio manufacturers now know that insistence for 100 per cent. tropic proofed apparatus on the part of Service authorities is no mere whim or fancy but imperative if that apparatus is to do its work for any length of time.

Early in the Pacific campaign there was an instance of radio communication being practically wiped out—not by the Jap, but by ingress of water into vital portions of transmitters. It was an operation from landing craft and the gear—non-tropic proofed and in commonplace packing cases, was perforce dumped into the sea and hauled ashore by ropes. Results were

By

DON. B. KNOCK,

Captain, A.I.F. (M.I.R.E. Aust.)

inevitable. Transformers "went out" and condensers, resistors, and insulation were useless. Exigencies of a landing operation under enemy fire had called for the need to get equipment ashore and into action swiftly. but sea-water action was swifter still.

So much for drastic handling of equipment. To-day it is designed to function normally when, unprotected by outer packing, it is subject even to complete immersion for hours. Packing also is no longer just timber and nails, but specially treated timber—rot and water-proofed. Inside the case equipment is double sealed in special waterproof wrappings. The case itself is carefully designed to withstand hard usage. Nothing short of a direct hit by shell or bomb will be likely to damage the precious contents.

To-day the tropic proofed construction of Service radio (and all signals equipment) is the culmination of hard experience and intense study. Manufacturing engineers, Service designers, inspectors, and packing authorities have graduated through a period of headaches to the point where all the answers are known. Some of those answers are obviously simple, others more involved.

Consider tubular pig-tailed condensers. The pre "Tropic" type appears to the layman to be well constructed and free from ordinary troubles. It is—for **ordinary** purposes. But for abnormally high humid conditions it is beset with snags. Waxing of the outer casing is not enough, the ordinary paraffin type wax has far too low a melting point for hot conditions, and flows easily. Then comes the damp weather, and moisture creeps along the pig-nails, gets inside and it is not long before trouble develops. Tubulars are therefore sealed completely at the ends in a special non-cracking bitumn compound, or in a polstyrene type of cement.

Re-sealing pigtails

That is o.k. for the component before wiring into circuit, but further care is taken to ensure that the hot soldering iron leaves no opening via the pig-tails. Re-sealing is checked again after soldering. The same applies to resistors of all types. Further, care is taken that resistors and condensers do not touch the surface of the metal chassis as could easily be the case in some portions of apparatus. Metal chasses sweat in high humidity and a leakage path exists along the length of any condenser or resistor in physical contact with the metal. Moulded mica condensers are a component one would normally dismiss as moisture free; far from it; the pigtails again provide an ingress. Mica condensers are therefore heated, specially varnished, then waxed. Carbon potentiometers are dipped completely in a special high melting point wax. All small R.F. coils are treated similarly.

Composition "Bakelite" strip as used for resistor and condenser anchorages is a source of prolific trouble. Unless the edges of such strips are sealed off by special varnish—moisture penetrates inside and the material may become almost a conductor. The same applies to non-ceramic R.F. coil formers, insulation in tuning condensers, etc. And talking of ceramics! No doubt the general impression here would be "Ah—there is a material unaffected by moisture". You think so? A simple test with a high reading Megohmeter shows the fallacy.

Captain Knock

Place a piece of ceramic, such as a padding condenser block, between the test prods and blow on the ceramic. Over goes the meter—hard! Why? Moisture from the breath! Coat the ceramic with, say, a polystyrene varnish, and repeat the test. Surface leakage is nil and the meter stays around 000 megohms. The answer is that the varnish breaks the moisture along the surface into minute globules and there is no chain of continuity for leakage. The forgoing are but a few of the anti-moisture precautions for components but there is another snag—that of fungus growth.

The jungle air

Jungle country air is charged with fungi spores and these hungry items simply love to make a meal from the braided cotton insulation on flex wiring. Braiding therefore comes in for fungicide treatment where used, and the same applies to "spaghetti" sleeving of the pre-war variety. Present day sleeving, however, is a different story. It is the result of chemical research and is based on polyvinylchloride—a product with very high in-

(Continued on page 14)

NOVEL DETECTOR IN CONTEST ENTRY

A MOST interesting detector circuit came to light in an entry in our Circuit Contest, submitted by Mr. K. E. Hicks, of 71 Francis Street, Bondi. This is what he said:

"Here is my idea of a uitility receiver. It was designed with simplicity one of the first considerations.

Mass of circuits tried

"When considering the idea of a utility receiver a mass of circuits enters the mind, with the well-tried super-het in the foreground. But a super-het requires an i.f. stage to obtain any real gain, and must therefore have four tuned circuits.

"My circuit requires only two tuned circuits.

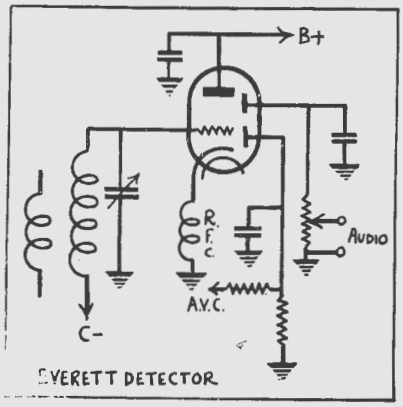
"The heart of the set is the detector. It is an r.f. amplifier, diode detector and a.f. amplifier all in one. It is a comparatively new circuit, having been developed by Everett recently. It is remarkably selective and the fidelity surpasses any other type of detector. A.V.C. can be incorporated by using the other diode plate, but I doubt yhether a.v.c. is really necessary in Australia.

Reflexing used

"After detection by the diode, the a.f. signal is reflexed through the 2B7 and the voltage gain is sufficient to drive almost any power amplifier. For simplicity I think that it would be advisable to do away with the power transformer and to use a half-wave rectifier. This really adds very little in the way of hum. It was with the consideration of the power supply in mind that I chose the 38 as the output valve. This valve has the only advantage over any other that the heater current drawn is 0.3 amp. This allows the heater to be connected in series with the other filaments without the necessity of any shunt resistors.

"The screens of the 6J7 and 2B7 are supplied by three resistors arranged in a voltage dividing network in the diagram, but a single voltage divider could be substituted for these to advantage.

"I considered using a combined amplifier-rectifier such as the 12A7 or



Schematic of the novel detector.

25A7G, but these valves are expensive and do not give very much power output (0.55 watt for the 12A7 and 0.77 watt for the 25A7G).

"In the power supply filter I have indicated a choke for smoothing out ripple. The total current drain is only 36 ma. and I think that the voltage drop would be too great to be tolerated with most dynamic speaker field coils.

"I can assure you that this set will log all the local stations and pull in many of the interstate stations as well.

"It contains a total of 37 parts, including the valves—just 8 more than Hitler's and what a difference in performance!

"I used iron-core coils when I obtained the abovementioned results."

Further details obtained

On receipt of this entry we did our best to de-cipher the detector circuit, but without success, and so we wrote to Mr. Hicks, asking him for an explanation of the operation of the detector, also some confirmation of his claim that the fidelity surpasses that of any other type of detector.

In reply to this request Mr. Hicks wrote:

"The operation is as follows: The grid is biased negatively with respect to the cathode and at such a voltage that the valve acts as a normal class-A amplifier. This prevents any rectication in the amplifying part of the valve.

"The modulated r.f. voltage is applied to the grid and the plate current variations correspond with the grid voltage excursions. A corresponding current flows through the cathode impedance and a corresponding modulated voltage is developed across this impedance. The cathode potential voltage varies in sympathy with the signal applied to the grid. When the cathode is swung negative with respect to the diode a current flows from the cathode to the diode and a voltage is developed across the diode load resistor. This voltage is the A.F. component of the modulated signal.

Explaining the fidelity

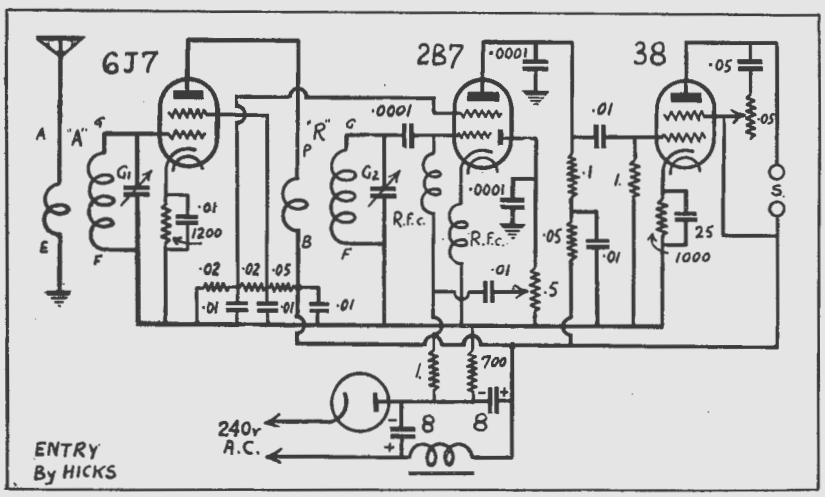
"The most popular type of detector at the present is the diode detector. This type gives reasonably good fidelity, but during the time the diode is positive electrons flow to it and a current flows through the tuned circuit and therefore the tuned circuit is loaded since it must deliver power. In Everett's detector there is an infinite impedance input and the reflected load into the plate of the preceding r.f. stage is higher, since no power is drawn from the tuned circuit under normal operating conditions. This causes a greater overall gain and allows less distortion, and hence considerably increased selectivity and fidelity.

Compared to leaky-grid

"In grid leak detectors the grid becomes positive during the positive half-cycles and the tuned circuit here is also loaded.

"In the anode bend detector the grid is biased so that it never becomes positive and fidelity is quite good, but it is still open to improvement.

"In the so-called infinite impedance



Design for a utility set with reflexed Everett detector.

detector the fidelity is excellent and the action is almost identical with Everett's detector. Therefore I retract the statement that 'the fidelity surpasses any other type of detector' and substitute 'most other types of detectors.' The only disadvantage of the infinite impedance detector is that it does not give a ready source of A.V.C. voltage.

"In the circuit I sent you, after detection the a.f. voltage is reflexed through the tube and the pentode portion made to act as an a.f. voltage amplifier as well. The detector was primarily designed for the second detector in a superhet, and as such the reflexing causes no difficulty because the whole of the tuning condenser is at the C-potential. However, when used in a t-r-f. receiver difficulty is encountered in getting the a.f. into the grid without adding too much capacitance parallel with the tuned circuit and in avoiding by-passing the a.f. to earth. This is a mistake I made when drawing the circuit I sent you.

"It may be advsable to insert an r.f.c. where I have indicated it, but in my own set this was unnecessary.

"I was looking for some other method of overcoming this when I sent you the circuit, and wrote the letter under the wrong diagram. This is probably what puzzled you because in that circuit the A.F. is by-passed to earth.

"When using this detector in a superhet, an i.f. transformer designed to work into a high impedance—not a diode transformer—should be used.

"In the set in which I tried the detector I used a 2B7, but I think a tube with a low-mu triode section such as the 6R7 might be better if the reflexed circuit were being used, because a rather larger straight-line portion is available.

"I trust this clears your puzzlement with regard to the operation of the detector. Incidentally Everett is Fred eric C. Everett, Transmitting Engineer, at Station WTAM. I am not in correspondence with him, and I am not sure just where WTAM is situated."

And so we have to thank Mr. Hicks for bringing up a most interesting detector circuit, although, frankly, we still fail to fully appreciate its theory. It is very evident, however, that Mr. Hicks is finding it successful, and therefore it can be taken as providing a fertile subject for practical experimenting. If any of our other readers have had experience with this type of detector we will be pleased to hear of their findings.

A Serviceman's Lament

Dear Sir,—I am writing this letter to comment on your competition for a standard post-war radio design. The idea is excellent but I think the opinions of service men could also be called for in the matter of construction, layout, sizes of chassis, standardisation of material, wiring colours and quality of components.

No need for novelty

After all, there is no need for any radio designer to wander away from the usual straight-forward design. How many radio manufacturers have very nearly lost their name in the radio field by adopting ideas into circuits which although by theory and on paper looked to be an advantage and turned out to be a failure when operated in the field for any time. If you were to travel through the districts of N.S.W. or any State and contact dealers who do all their own service and gather information, honestly given, of the improvements they could suggest to the makers of the particular set they are agent for. Yet these ideas are not asked for nor even accepted by the designers, because it comes from the common serviceman.

That is why I think that after the winning design is submitted to the "Radio World" readers, then ideas for construction and ability to be easily serviced could be asked for.

One type not enough

Also, I don't think that one type of set could be suitable for reception all over even N.S.W. because the distances are too great in many places from radio stations for excellent results.

My opinion is we need both 5 and 6 valve AC chassis and 6 valve battery chassis.

I have earned my living as a radio mechanic for the past 12 years and am still a radio service mechanic.

I have not submitted any circuits because I don't think it calls for new designs and for me to supply circuits would only be to praise some of the straight-forward designs you have adopted from time to time in "Radio World"; also I don't intend to copy somebody else's brain work.

Yours faithfully,

A. CLEVERLY.

Fraser St., Lithgow.

[The above letter is published in full as received from its author, a serviceman of wide experience. We publish it because it undoubtedly represents the honest opinion of one of our readers, yet we cannot agree with all the points mentioned. For example we know that every set designer of our acquaintance has always made a practise of contacting servicemen to get their opinions. As regards our contest, we are sorry that Mr. Cleverly did not submit an entry along the lines he suggested, dealing with suggested improvements and ideas rather than circuit sematics. However, there is no need to wait for contests, and if Mr. Cleverly or any other serviceman cares to contribute articles on those lines, they will be published if considered suitable, and will be paid for at journalists' award rates or better.—Editor.]

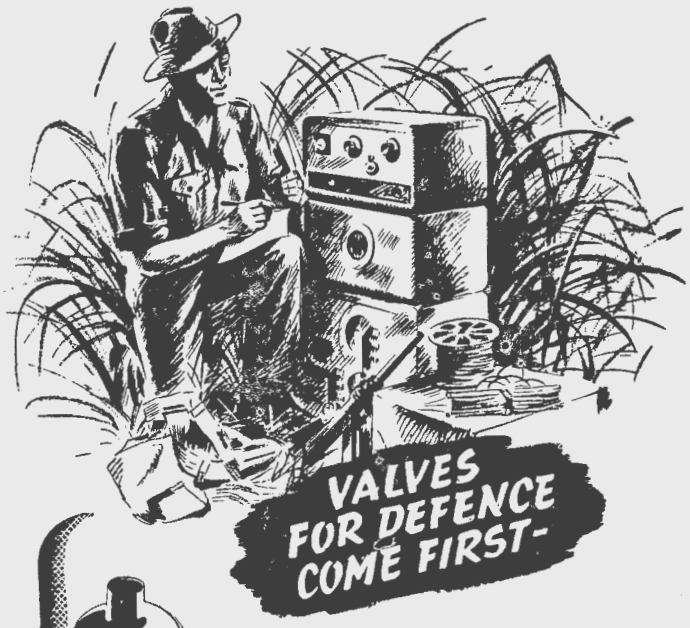
POST-WAR AMATEUR LICENSING

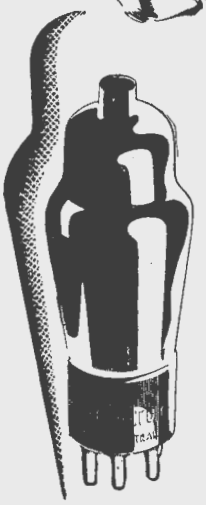
It is learned from the annual report of the Radio Society of Great Britain that, following upon a suggestion made by the G.P.O., the Council of the Society is investigating the possibility of the City and Guilds Institute, London, establishing a special technical examination for post-war applicants for experimental transmitting licences.

This proposal is additional to that already agreed to by the G.P.O. suggesting that ex-Servicemen wishing to obtain a licence shall be exempted from examination in radio theory and/or Morse, provided they can produce evidence that during the war they served in an approved radio trade or category.

OUR CIRCUIT CONTEST

As our regular readers will be aware, our Utility Circuit Contest closed on April 20. Only about one hundred entries were received, as might be expected as most radio designers and engineers are mighty busy these days, but those entries received were of a particularly high standard and it is going to be a most difficult job to decide the winner. Full results are due for announcement in next month's issue. A typical example of the interesting matter unearthed by this contest is the novel detector circuit arrangement featured on these pages. Many other ingenious designs were submitted and full details of these will be published from time to time in future issues.





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THE MULTI-VIBRATOR AND ITS USES

By
CHARLES H. MUTTON
Plow Street, Thornbury (Victoria)

MANY servicemen and experimenters fail to realize what a useful piece of equipment the multivibrator can be when its principle is thoroughly understood.

Perhaps the most simple definition of a multivibrator would be to say, that a multivibrator consists of a two stage resistance coupled amplifier, in which the output voltage of the second tube is applied to the input of the first tube as illustrated in Fig. 1.

To be technical, the output of tube 2 remains in phase with the input voltage of the first tube. In other words the phase shift occurring in both tubes is 360 deg. When this condition exists, we have our old friend an oscillator, more commonly known perhaps as a relaxation oscillator.

Inductances unnecessary

Glancing at the circuit will reveal the complete lack of inductances, a point well in its favour regarding simplicity and cost. In fact, I know of no other type of oscillator which is so simple to get into operation with so little trouble.

The frequency of oscillation is governed mainly by the grid-resistor and grid capacity but is also dependent on tube characteristics and operating voltages. Our experiment becomes very attractive when we know that by the use of a simple formula

$$f = \frac{1}{RI \times CI + R2 \times C2}$$

Where R1 and C1 equal the plate resistor and grid condenser of the first tube and R2 and C2 equal the plate resistor and grid condenser of the second tube and the resistance is in megohms and the capacities are in microfarads. The result is then in fractional parts of one second.

Wide range of frequencies

The multivibrator will oscillate from as low as one cycle per second up to several hundred thousand cycles per second.

By injecting a stable source of alternating voltage into the input of a multivibrator, will tend to cause the mutlivibrator to lock into step with the applied voltage, at a frequency which is a submultiple or multiple of the injected frequency.

A simple way to obtain a variable frequency range with the circuits shown is to make either the grid or plate resistors variable. The circuit constants shown in Figs. 2A and 2B will oscillate at approximately 500 c.p.s.

Many and varied uses

The uses to which a multivibrator can be put are as follows. A frequency multiplier, frequency divider, modulator for signal generators, code practice oscillator, A.F. test oscillator or a flat top wave scource for measuring the frequency characteristics of A.F. amplifiers. The multivibrator is important enough to consider, in view of its prominent use also in sweep circuits of cathode ray oscilloscopes and its application to television.

The output from a multivibrator however is very distorted and much removed from a sine wave, which is what we require, in order to produce in the output a waveform which is extremely rich in harmonics.

Besides its fundamental frequency, the multivibrator produces a large number of equally spaced harmonics, in our case the fundamental is approximately 500 cycles and produces a signal every 500 cycles up to 20 megacycles.

The high frequency harmonics will be picked up by any radio receiver, but are too close to be separated. Hence they form a continuous signal right across the whole of each waveband. After being rectified, the audio frequency consists of the fundamental 500 cycle tone plus its audible harmonics

Single valve enough

In the circuits 2A and 2B it will be noticed that only one tube is used, which is quite permissable seeing that in such tubes as the 6C8G or 6F8G there are two entirely separate triodes each having its own cathode grid and plate.

In the AC version either a 6C8 or 6F8 may be used ,the total plate current for the two triode sections being approximately 15MA for the 6F8 and about 10 for the 6C8G. In the battery version a single 45-volt battery will suffice for the H.T. supply, the drain from which will he about 3MA and a filament drain of 100 MA could be supplied by strapping two or three torch cells in parallel.

The AC version was built up and

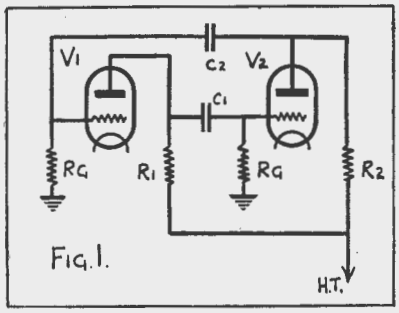

Fig. 1.

tried out in conjunction with a modern five band communication receiver, which covered a continuous frequency range from 140 kc to 10 meters. The results obtained were quite good up to about 15 meters, after which the output fell off rapidly but justified its construction, in that it was found to be extremely handy in adjusting all the R.F. end trimmers and obtaining maximum padder setting, without having to do any of the usual dial rocking. A procedure not necessary with a multivibrator, a signal is always present, regardless of what frequency the receiver happens to be tuned.

It must be understood clearly at

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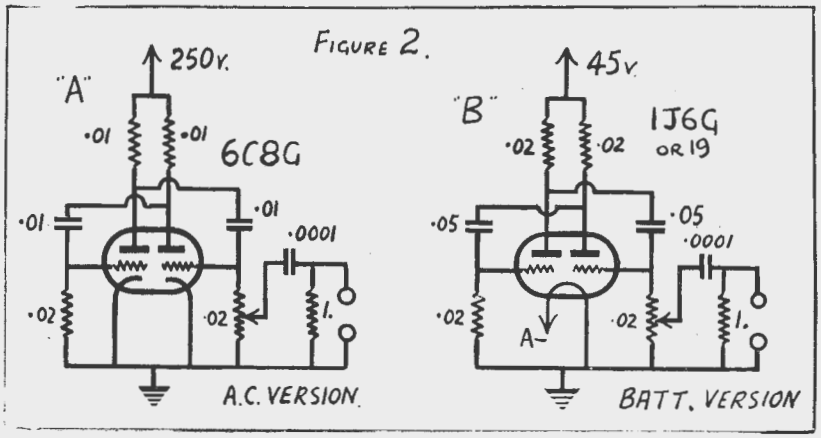
FIGURE 2.



MULTIVIBRATORS

(Continued)

this point, that the multivibrator cannot be used for aligning IF transformers or calibrating dials in terms of frequency, but is extremely useful for aligning the tuned circuits especially on the short wave bands.

After having set the oscillator trimmer to a satisfactory position at the high frequency end of the band, the output lead of the multivibrator can be connected directly to the aerial terminal of the receiver .or merely loosely coupled by just hanging it near the aerial terminal should suffice, and then proceed to align the aerial and RF trimmers for maximum output in the speaker. Dead spots and variations in sensitivity across the band can be easily detected by listening to the output as we tune from one end of the band to the other.

Output control

The output of the multivibrator is controlled by the 50000 ohm potentiometer in the output circuit. In the experiments conducted, the writer found that in an unshielded condition it was possible to pick up quite an appreciable signal from the instrument at a distance of 12 feet from a receiver which had a high order of sensitivity, and in order to completely attenuate the signal, it was found necessary to completely shield the whole chassis top and bottom, and shield the output lead.

For signal tracing

In connection with the often discussed methods of signal tracing in its varied forms, applied to the servicing industry, here is perhaps the most simple signal tracer one could possibly imagine. Without recourse to tuning condensers, inductances, manipulation of dials, switches, etc., we here have a constant signal which can be applied to RF, IF and audio circuits alike, which will find out 75 per cent. of the troubles in radio receivers that can be found with its more complicated brother the tuned vacuum tube voltmeter. If desired, anyone desiring to find actual figures or gain per stage measurements using the multivibrator, could easily do so, by the simple expedient of feeding the multivibrator into a receiver and by incorporating in the same instrument a vacuum tube voltmeter, measurements could be taken right through from the aerial terminal to the output circuit.

The vacuum tube yoltmeter circuit as used in those very fine articles on signal tracing a la Bristoe, in past issues would suit nicely. Incidentally the vacuum tube voltmeter circuit in question using a 76 type triode tube is identical to the vacuum tube voltmeter circuit used in the famous American Rider Chanalyst, so that including it in any of the reader's test instruments will assure him that he is right up to the minute in current American service practice.

Talking recently with a group of Allied servicemen, connected with both the Navy and the Air Force, revealed that our erstwhile cousins use the Rider Chanalyst very extensively in connection with their service problems. In the course of conversation I heard a remark which rather amazed me, and which put our own servicemen in quite a good light.

It appears that an HRO communications receiver went haywire and our brother serviceman from over the water said that due to not having a signal tracer on hand he was not able to determine the trouble, stating that all that was available was a Weston 20,000 ohm per volt analyser. My private thoughts were "hats off to our own boys who find all manner of faults with the lowly 0-1 milliameter.

I feel sure after that little interlude that the short time required to build up this little instrument will repay all who do so. In so doing they will also gain an insight into a type of oscillator which will be used to a large extent in sweep circuits of television receivers, when we finally get around to saying "well television is here."

A RADIOMAN'S NIGHTMARE

There were oscillations in the wire,
And static in the set.
The H.F. choke was set on fire
The valves became all wet.

And superheterodyne began,
To whistle in the 'phones
Like autodyne the screening can
Gave rattles of its bones.

The A.C. undamped waveform was
A sinusoidal curve.
The angle didn't care a cos
For asymptote or swerve.

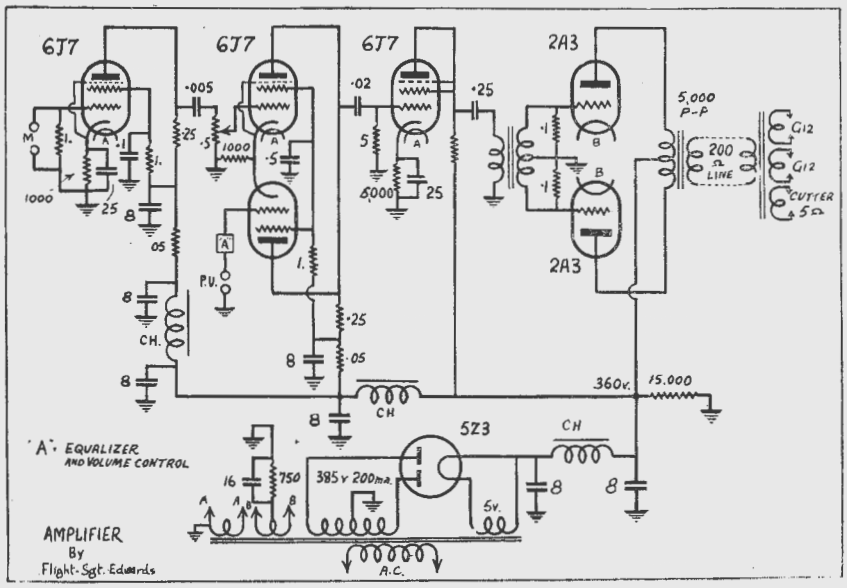
The high-mu valve was getting thin
Its screen grid lost some weight.
The anode-cap threw off its tin,
The A.V.C. was late.

The pentodes then began a dance
Some farads gave a yell.
An ohm or two began to prance,
The henries made for Hell.

One glance was good enough for me,
I staggered back in fright:
And when I'd had a cup of tea
I fled into the night.

AN AMPLIFIER BEYOND REPROACH?

BEING either rash or brave, Flight-Sergt. Edwards of the R.A.A.F., has written us a letter which is bound to arouse considerable comment as he deals with a most delicate subject in a most ruthless manner. As we feel certain that the letter will interest a large number of our readers we are reproducing it in full, but with considerable emphasis that the opinions expressed are those of the author and do not necessarily coincide with our editorial policy. If any of our amplifier enthusiasts feel moved to write in reply we will be pleased to make space available.



The letter

Writing from Mt. Gambier, South Australia, Flight-Sergeant Edwards says:

"On looking through a recent issue of "A.R.W." I saw an audio outfit designed and described by H. Smith.

"The immediate points about it, which one cannot condone, are

"(1) A stage between splitter and output.

"(2) Resistance coupling to the output.

"(3) Too many of everything.

"I am not being facetious. These points are technically unsound, as far as accepted practice goes.

"Personally, I have been building audio gear for about seven or eight years, and have run the whole gamut of whims re 'R/C v. Transformer Coupling' and 'Beam v. Triode Output', and so on. I've used 50's, 6w6's, 807's, 45's, 243's, 42's, 6v6's F443N's, and a host of 'bottles', coupled up in all possible ways, with and without inverse feedback.

"And here is my conception of the amplifier, beyond reproach. I use it for acetate recording, mostly.

Valve line-up

"Looking from the front, then. A conventional super-gain pentode, with the bias deliberately low, for the velocity mike preamplifier.

"Next, a mixer, of the 'parallel-plates-separate grids' style.

"Here again, this is the recognised mixer—assuming, of course, that the constructor can't afford attentuation systems . . .

"Thus, perfect mixing, about 120 gain, and good response due mainly, one feels, to the omission of the cathode by-pass.

"On to a conventional 6J7 triode tied. Note that A.W.A. Radiotronics circuits with 6J7's triode tied invariably have the suppressor taken back to the cathode. However, **I can find no characteristics of a 6J7 so used** in any tube manual or chart.

"Therefore I use the plate, screen and suppressor all tied, and then we read that it can be treated as a 6C5, as regards gain, bias, load and general application.

"But the place where the amplifier is really good, one feels, is in the driving system for the 2A3's.

"Here we have a shunt-fed Airzone audio transformer (remember their widely discussed 'super' model!) with a loaded secondary.

"This combines (a) good bass response due to absence of core saturation. (b) Flat response due to the levelling effect of the secondary resistive load. (c) Low-Z driving source for the 2A3's—specifically recommended by R.C.A. themselves.

Weighty O.P. tranny

"The final link in the chain is a brace of cotton multi-matching output transformers, made to specifications some years ago. Briefly, they are P/P plates to 200-v line, and 200-v line to multi-voice-coils. They are excellent units, weighing a lot but having all the virtues of good transformers.

"I cannot find a fault in the amplifier. Self bias is used, BUT the 2A3's were factory matched, so that lets me out!

"The amplifier simply has no frequency curve. It is as flat as a board over the useful audible spectrum.

"The characteristics have been analysed with a 'scope, and a host of meters. I will not take up space by treating them exhaustively. Anyone can have them if interested. Inverse feedback drops the distortion from about 4 per cent. total at full output (a shade over 11 watts!) to about 2 per cent. T.H.D., **but the ear can't tell it.** And I mean NO ear—we've tried lots of critics.

Pick-up filter

"The crystal pickup (copper torsion type) has a rather extensive filter between it and the mixer grid.

"Thus the high gain is justifiable for this channel. The microphone is (at the moment) a 'Torpedo' velocity, built by Veall's.

"The performance of the entire unit is, one feels, above reproach. The design is sound, being culled from some dozen recognised textbooks.

"I consider it the answer to all small audio amplifier problems. It is built on a chassis of aluminium (old!) measuring 24in. x 12in. x 3in.

"Naturally, it has meters all over it, not shown. How do you like it, Mr. Editor?

"You have my permission to reproduce the circuit, and whole or part of the dope on it.

"I think some audio enthusiasts would welcome it.

"Yours faithfully,

"G. P. EDWARDS."

HIS MAJESTY'S SERVICE?

Here's a true story about a student at this school that may brighten your day:

After two week of theory this student radar operator-striker "knew it all." He then walked over to a multimeter, andw ith a baffled look, asked, "What does O.H.M.S. stand for?"

—From "Q.S.T."

RADIO AIDS TO U.S. NAVIGATION

THE growing importance of communications and aircraft navigational aids to airways operation is illustrated by the fact that ten years ago the expenditure for radio and allied communications equipment and maintenance on federal airways was only 20 per cent. of the total, whereas now it represents more than 60 per cent. of the cost of all airways maintenance and operation.

Mis-guided information

There seems to exist in the minds of some much misguided information relating to the types of radio equipment carried by commercial aircraft and the use to which such equipment is put. It is the purpose of this article to attempt an explanation of the various radio units used by the commercial airlines and to show how these radio aids are necessary to avigation.

Average equipment

The author assumes that the reader will draw a close parallel between these aids and the radio equipment used by our military aircraft. It must be remembered, however, that military aircraft carry much additional radio equipment which is used for combat and is not necessary for avigation.

The average commercial transport plane carries the following different units of radio equipment:

One communications receiver.
One radio-range receiver.
One automatic direction-finder receiver.
Two marker receivers.
One v.h.f. range receiver.
One v.h.f. communications receiver.
One glide-path receiver.
One communications transmitter.
One interphone system.

The primary purpose of all radio equipment used in aircraft is the safety of life and property. The secondary purpose is the exchange of messages for proper continuance of the flight. These include messages for the Civil Aeronautics Administration (CAA), which is charged with supervising the proper operation of our aircraft transportation systems, as well as messages involving interests of the commercial airline company operating any particular flight.

Air-line ground stations

All airlines have their own ground radio stations which contact their airplanes, both while on the ground and in flight, for the purpose of exchanging messages for the safe conduct of the flight. Planes in flight may communicate with the company ground stations to obtain information relative to their movements, or they may contact CAA radio-range stations or airport-control towers directly for this information. However, it is the usual practice, whenever possible, to contact the company ground stations, which in turn work with the CAA installations. This procedure provides the company with full information regarding the plane in flight and also gives the company dispatcher more control over the flight, especialy during an emergency.

Aircraft Transmitters

Aircraft transmitters vary in power output from a few watts to as much as 250 watts. The power ratings of military aircraft radio transmitters also vary, depending upon the type of work for which the airplane is designed. Generally speaking, pursuit aircraft have low-power transmitters while medium and heavy bombers have larger installations. There are two reasons for this: first, the smaller airplanes do not have the need for extremely long-distance contacts; and second, they have neither the space nor the personnel sufficient for the operation of such units. As a rule, bombers have regular crew members responsible for the proper operation of the radio equipment. The operators may be called upon to make long-distance contacts.

Commercial aircraft transmitters are usually of the crystal-controlled type. However, since it may be necessary to establish contact on any one of a hundred or more possible frequencies, some military transmitters are equipped with variable-frequency oscillators. Some transmitters are of the multi-channel type. Any one of ten frequencies may be obtained simply by the manipulation of a regular telephone-type dial. In this case transmitter frequencies are crystal controlled. Transmitters as well as receivers usually are made up of individual units, not too heavy in weight, to make servicing easier. Thus different units may be replaced without the necessity for removing a complete transmitter or receiver. Commercial transport planes usually have a crew of three: pilot, co-pilot and stewardess. In general, most of the radio operating is done by the co-pilot.

Aircraft Receivers

Most communications receivers also are equipped with dial switching systems for frequency changes. The same switching device which switches the transmitter also switches the receiver, the oscillator of which is crystal controlled. The receiver is pre-tuned and set exactly to the proper receiving frequency. The receiver signal-to-noise ratio must be very high, since QRM and QRN combine to make very heavy competition. The received signals are not very strong at times and, since the contact may be very important, sensitivity must be good at all times. Because signal strength varies a great deal the audio output must be fairly

constant, since the pilot cannot take time to adjust the gain control frequently. The airplane may be within 100 feet of the transmitter at one moment and 200 miles away within the next hour. A very complete automatic volume control has the disadvantage that the sensitivity is maximum, and therefore the noise greatest, when no signal is being received. However, satisfactory compensation is provided by the use of a good noise limiter or suppressor operated by the carrier of the station being received.

Audio output is very low compared with that provided in ground-station installations. There is no great need for high power from the receiver, however, since it is used only to feed two pairs of headphones. The frequency response is cut down so that it is limited to a more or less flat range of 250 to 2,500 cycles. This is permissible because the higher and lower frequencies do not add materially to the intelligibility of the signal, while restriction of the audio range cuts out a certain amount of noise.

Frequencies

Operating frequencies used for commercial radio circuits extend from approximately 6 Mc. to about 3 Mc. The 6-Mc. band was chosen because of its reliability for medium distance contacts during the day. Because conditions of severe skip may be encountered during night operation at this frequency, the lower frequencies are used in periods of darkness. A long-distance aeronautical band at a still higher frequency recently has been put into use over some circuts. This band lies at approximately 9 Mc. It is not used for short-distance contacts, being unsatisfactory for this purpose because of skip characteristics.

Airplane Antennas

The efficiencies of most aircraft antennas approach those obtained with ground installations. Earlier antennas for aircraft use consisted of a long trailing wire. A heavy weight is attached at the free end of the wire to keep the antenna in a more or less vertical position. While this system is still used for long-distance or low-frequency work, it has many disadvantages. The long wire must be reeled in manually before landing, and if the pilot forgets to do this he loses his antenna—and usually more!

Next came the short vertical mast with top loading provided by guy wires. The use of this type is still popular in some of our military basic trainers. Now, however, a long wire attached to a feed-through insulator in the top of the fuselage and running to the top of the fin is used for transmitting and receiving in more than 90 per cent. of the aircraft in operation. Most airplanes have sufficient room for two such antennas.

—From the introduction to an article on the subject in the February "Q.S.T."

TECHNICAL DATA ON VALVE CATHODES

Released by
AMALGAMATED WIRELESS VALVE CO. PTY. LTD.
47 York Street, Sydney

IN electron valves, a cathode is an electrode which is the primary source of electron or ion emission. There are two broad classes of cathodes, i.e., hot and cold. "Hot cathodes" are defined as cathodes which are heated or otherwise operate at elevated temperature (frequently incandescent) in order to function as emitters. In contrast, "cold cathodes" are defined as cathodes which do not rely on heat or on elevated temperature in order to function as emitters.

Hot Cathodes

Hot cathodes commonly in use in electron valves are classified as directly heated, indirectly heated, and ionic-heated.

A **directly heated cathode,** or filament-cathode, is a wire or ribbon which is heated by the passage of current through it. It is further classified by identifying the filament material or the electron-emitting material. Such materials in regular use are pure tungsten, thoriated tungsten, and metals coated with alkaline-earth oxides. Each of these materials has distinctive advantages which are utilised in the design of valves for particular applications.

Pure Tungsten Filaments are used in certain valves, especially those for high-voltage transmitting service. Since these filaments must operate at a high temperature of about 2500 degrees C (a dazzling white) to emit sufficient electrons, a relatively large amount of filament power is required. The operating life of these filaments is determined by the rate of tungsten evaporation. Their failure, therefore occurs through decreased emission or burn-out.

Operating voltages

Pure-tungsten filaments give best life performance when they are operated so as to conserve their emitting capability. They are designed with voltage and current ratings in accord with the service expected of the particular valve type. However, in applications where the normal emission at rated voltage is not required, the filament can be operated at a somewhat reduced voltage. The extent of the reduction depends on the peak emission requirements of the application as well as on the percentage regulation of the filament voltage. When these are known, the correct operating filament voltage for any tungsten-filament type can be calculated from its filament-emission characteristic. The permissible regulation in transmitters may be checked by reducing the filament voltage (with the transmitter under normal operation) to a value such that reduction in output can just be increased by an amount equivalent to the maximum percentage regulation of the filament-supply voltage and then increase further by approximately 2 per cent to allow for minor variations in emission of individual valves. It follows that the better the regulation, the less the filament operating voltage and, therefore, the longer the filament life.

Increasing life

It should be noted that a reduction of 5 per cent in the filament voltage applied to valves with pure-tungsten filaments will approximately double their life. A reduction of 15 per cent will increase the filament life almost tenfold.

During long or frequent standby periods, pure-tungsten-filament valves may be operated at decreased filament voltage to conserve life. When the average standby time is an appreciable portion of the average duty cycle and is less than 2 hours, it is recommended that the filament voltage of all but the largest types be reduced to 80 per cent of normal; and that for longer periods, the filament power be turned off. For the largest types, such as 898, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 12 hours; and that for longer periods, the filament power be turned off.

For turning on filament power, a filament starter should be used so as to increase the voltage gradually and to limit the high initial rush of current through the filament. It is important that the filament current never exceed, even momentarily, a value of more than 150 per cent of normal, unless the valve data specify otherwise. Similarly, as an added precaution, the filament power should be turned off gradually to prevent cooling strains in the filament.

Thoriated-Tungsten Filaments are now used mainly in certain transmitting and special valves. Thoriated-tungsten filaments are made from tungsten impregnated with thoria. Due to the presence of thorium, these filaments liberate electrons at a more moderate temperature of about 1700 degrees C (a bright yellow), and are, therefore, much more economical of filament power than are pure-tungsten filaments. The operating life of thoriated-tungsten filaments is ordinarily ended by a decrease in electron emission. Decreased emission, however, may be caused by the accidental application of too high filament, screen, or plate voltage. If the over-voltage has not been continued for a long time, the activity of the filament can often be restored by operating the filament at its normal voltage for 10 minutes or longer without plate, screen, or grid voltage. The reactivation process may be accelerated by raising the filament voltage to not higher than 120 per cent of normal value for a few minutes. This reactivation schedule is often effective in restoring the emission of thoriated-tungsten filaments in valves which have failed after normal service. Sometimes a few hundred hours of additional life may be obtained after reactivation.

Above rated voltage

The operating voltage of a thoriated-tungsten filament should, in general, be held to within $\pm$ 5 per cent of its rated value. However, in transmitting applications where the valve is lightly loaded, the filament may be operated on the low side — as much as 5 per cent below normal voltage. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, additional service may be obtained by operating the filament above its rated voltage. It should be noted that a valve having a thoriated-tungsten filament should never be operated under emission-limited conditions since this type of operation may overheat the valve and cause permanent loss of emission.

Stand-by voltages

During standby periods in transmitting service, thoriated-tungsten filaments may be operated according to the following recommendations to conserve life. For short standbys of less than 15 minutes duration, the filament voltage of all but the largest types should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. For the largest types, such as the 827-R and 861, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 2 hours; and that for longer periods the filament power be turned off.

Coated Filaments are used in receiving valves, certain transmitting valves, most mercury-vapour rectifiers, and

TROPIC-PROOFING

(Continued from page 5)

sulating properties and possessing rubber-like qualities. Fungus spores are not attracted.

The story of tropic proofing will make full and interesting reading in post-war days and the radio industry and the radio user will benefit by war experience. War is productive of good as well as evil and industry develops along lines undreamed of in the leisurely days of peace.

some special valves. Coated filaments employ a relatively thick coating of alkaline-earth compounds on a metallic base as a source of electronic emission. The metallic base carries the heating current. These filaments operate at a low temperature of about 800 degrees C (a dull red) and require relatively little power to produce a copious supply of electrons.

Reduced voltages

For proper performance of these types, rated filament voltage should, in general, be applied at the filament terminals. However, when coated-filament, high-vacuum valves are used in transmitting service with light loading, the filament voltage may be reduced as much as 5 per cent below normal to conserve life. Then, as conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated filament voltage to obtain additional service. In the case of gas or vapour valves, it is important that these types be operated, in general, at rated filament voltage. However, if the line regulation regularly and consistenly does not exceed 1 to 2 per cent, it is practical to reduce the filament voltage slightly (not over 5 per cent) with benefit to valve life.

During standby periods of less than 15 minutes, the filament voltage of quick-heating, high-vacuum types, such as the 1616 and 1624, should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. In contrast, the voltage of coated filaments in gas or vapour valves should not be reduced during standbys except under conditions explained in the preceding paragraph. In general, the filament voltage of small and medium types, such as the 866-A/866 and 872-A/872, should be maintained at normal rated value during standbys up to 2 hours; for longer periods, the filament power should be turned off. For large types, such as the 875-B, the filament voltage should be maintained at normal rated value during standbys up to 12 hours; for longer periods, the filament power should be turned off.

After having given normal service, or after having been operated at excessive voltage, coated filaments lose their emission. When such is the case, their usefulness may be considered as terminated.

NEW ACOUSTIC STETHOSCOPE

The Radio Corporation of America has developed an acoustic stethoscope designed to transmit sounds originating in the body over a frequency-range of 40 to 4,000 c/s. The range of the old type stethoscopes was 200 to 1,500 c/s. Dr. Harry F. Olson, Acoustic Research Director of the R.C.A. Manufacturing Company, reports that the new stethoscope will couple the ears of the physician much more closely to the human body through the use of a reversed taper tube, which greatly improves the matching of the acoustic elements. The use of a filter in the instrument controls the frequency-range.

(Continued on next page)

VALVE CATHODES— (Continued)

An **indirectly heated cathode,** or heater-cathode, consists of a heater wire enclosed in a thin metal sleeve coated on the outside with electron-emitting material similar to that used for coated filaments. The sleeve is heated by radiation and conduction from the heater through which current is passed. Useful emission does not take place from the heater wire. An important feature of this kind of cathode construction is that the functions of heating and emission can be independent of each other.

Heater-cathodes, or unipotential cathodes as they are frequently called, are used in high-vacuum valves operating at low plate voltage, such as receiving valves, low-power transmitting valves, and small special valves. They also find application in mercury-vapour valves and in cathode-ray tubes. Heater-cathodes, like coated filaments, provide a copious supply of electron emission at low cathode temperature (a dull red).

For proper performance of heater-cathode valves, rated heater voltage should, in general, be applied at the heater terminals. However, when heater-cathode high-vacuum valves are used in transmitting service and are lightly loaded, the heater voltage may be reduced as much as 5 per cent below normal to conserve life. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated heater voltage to obtain additional service.

During standby periods of less than 15 minutes, the heater voltage of high-vacuum valves should be maintained at normal rated value; for longer periods, the heater power should be turned off. In the case of vapour or gas valves, the heater voltage should be maintained at normal during standby periods up to 12 hours; for longer periods, the heater power should be turned off.

An **ionic-heated cathode** is one which liberates electrons when it is subjected to intense positive ion bombardment. The bombardment may be so intense as to raise the temperature of the cathode, frequently causing it to become visibly hot. The ionic-heated cathode in radio valves has found application in gas rectifiers intended primarily for automobile receiver service.

Cold Cathodes

The designation "cold cathode" is commonly used in referring to those cathodes which emit electrons when they are subjected to bombardment by other electrons, ions, or metastable ions. Cathodes of this type are sometimes designated as secondary emission cathodes. They are used in certain glow-discharge valves, and also in multiplier phototubes where they contribute to electron multiplication in the the successive dynode stages.

Not customarily referred to as cold cathodes, although they are such, is another group of emitters known as photocathodes. By definition, a **photocathode** is one which emits electrons when it is energised with radiation flux, such as light, infra-red radiation, or ultra-violet radiation. Such cathodes are used in phototubes. When used in gas phototubes, these cathodes not only emit under the influence of radiant flux but also as a result of bombardment and thus become partial secondary- emission cathodes.

Photocathodes are classified according to the spectral response characteristics of their respective photoactive surfaces. The S1 photosurface gives high response to red and near infra-red radiation. The S2 photosurface is similar to the S1 surface but extends somewhat further into the infra-red region. The S3 photosurface has a spectral response characteristic which is closest to that of the eye. The S4 photosurface has exceptionally high response to blue and blue-green radiation with negligible response to red radiation.

RADIO HEATING IS A MODERN WONDER

THERE has been a good deal of talk lately of the wonders of heating by wireless and the "new" science of "heatronics" which is to revolutionise industry and domestic life in the Brave New World. Much of this is speculation and wishful thinking, but there is, nevertheless, a basis of real achievement, and it may be worth while to review some of the successful new applications of eddy current and di-electric heating, known to all wireless experimenters as "losses" in transmitting and receiving equipment.

Eddy current heating has been employed for years in melting steels and other alloys which would suffer by contact with furnace gases, and valve manufacturers use this method for heating electrodes which would otherwise be inaccessible during the evacuation process. As the object in these cases is to secure uniform heating throughout the mass of metal comparatively low radio frequencies or high audio frequencies are used.

Surface hardening

As the frequency is increased there is a tendency for the current to concentrate near the surface. This is the familiar "skin effect" which increases the effective resistance of coils and conductors at radio frequencies, and it has recently been turned to good purpose for case-hardening tools, crankshaft bearings, etc., where a thin hard surface skin is required on a base of tougher temper. Older methods of case-hardening involved the heating of the whole article, the application of chemical compounds to change the constitution of the surface metal, reheating and then quenching, a succession of processes taking a considerable time and involving the possibility of blistering, non-uniform penetration of the hardening compound and surface cracking.

With radio-frequency heating the whole process is completed in a matter of seconds (four seconds for the bearing surfaces of a motor crankshaft is a typical recorded example). Since the body of the metal remains cold the article is self-quenching if the volume of surface-heated metal is a small proportion of the total volume. There is the minimum of distortion and the process is clean. Internal as well as external surfaces can be treated, and the depth of hardening is controlled by the frequency employed.

Making tins

Another application of RF heating is in tinplate manufacture. To reduce the amount of tin used, electroplating has taken the place of hot dipping but the electro-deposited surface is dull and porous, and must be re-flowed to give it a polish. In the case of the wide strip used for tin cans this is conveniently accomplished by passing the strip between coils carrying the R.F. current.

As an indication of the extent to which RF induction heating is being employed in industry, it has been estimated that in America the power already far exceeds the total used for broadcasting (about 4,000 kW).

Heating non-conductors

So far we have been dealing with the heating of metallic conductors, hut there is an equally important application of RF technique in heating non-conducting materials by virtue of their power factors as dielectrics.

Whereas radio frequencies are necessary to confine the heating effect to the surface in conductors, in dielectrics, where the heat is in any case generated simultaneously at all points throughout the bulk of the material, high frequencies are necessary in order to increase the heating effect when the power factor is low.

Low-voltage H.F.

For a given power dissipation the voltage across the electrodes can be reduced if the frequency is increased —an important practical consideration, as it reduces the possibility of trouble from flash-over.

Best results are obtained when the block of plastic material is of regular shape and can be placed between parallel electrodes, since this ensures a uniform field and absence of local overheating. Contact between the electrodes and the material is best if it can be arranged, since spacing calls for an increase of voltage and may cause flash-over.

For most of the plastic moulding powders in common use the power factor is of the order of 0.03 and frequencies between 10 and 15 Mc/s are generally used. The power required depends on the specific heat of the material, the temperature rise required, and a number of factors which can only be found by experiment in individual cases; a typical rating in 2 kW per lb. for a temperature rise of 200 deg. F. in 1 minute.

Radio heating has solved a long-standing problem of the plastics industry, namely, the production of thick block mouldings. The curing of phenal-formaldehyde resins is a function of both time and temperature, and with conventional methods of moulding the outer layers in contact with the hot press are fully cured before heat has penetrated to the interior. It is for this reason that the majority of moulded articles seen on the market—ash trays, switch covers, etc.—are of thin shell-like form. Even in thin mouldings of awkward shape, trouble may be caused by insufficient local internal heating, and a radio-frequency preheat will not only ensure a sounder product, but can effect a saving in moulding time.

Bakelite moulding

It would be ideal if the RF voltage could be applied in the press, but the difficulties of securing uniform field distribution ,to say nothing of insulating one half of the press, rule out this method. In practice the weighed amount of material is pre-formed into a cake with parallel sides which is then placed between the plates of a condenser in the output circuit of the

(Continued on next page)

A BOUQET FROM N.Z.

C/- Station 2YN,
P.O. Box 113,
NELSON, N.Z.
17th February, 1944.

The Manager,
Australasian Radio World,
243 Elizabeth Street,
Sydney, N.S.W.

Dear Sir,

I wish to congratulate you on your excellent publication, the "Australasian Radio World". I have now been a subscriber for two years, and have derived great benefit from it. In my opinion it is the best radio magazine in existence. What I like especially is that its articles and circuits of sets are so practical, and then the circuits too are ones of sets which can be constructed with a small outlay of money. The short-wave notes also are very helpful. So it is no wonder that I look forward each month with eagerness to receiving my copy.

As my 2 years subscription must have expired by now, I have pleasure in enclosing a further two years subscription. I value the magazines so much that I intend to get them bound each year.

You are certainly publishing a great magazine in spite of the war and its consequent difficulties. My hope is that you will be able to maintain such a high standard. I wish you every success.

Yours faithfully,

J. E. NEWMAN.

RADIO HEATING

(Continued)

RF power oscillator. The field is switched on for a predetermined period and the cake is then rapidly transferred to the hot mould and the press is closed. It is not necessary to "breathe" the press by opening it slightly to release the gases which arise from impurities or traces of water in the moulding powder, for these have already been driven off during the pre-heat.

Determining temperature

Exact determination of the internal temperature presents some difficulty, since metallic wire thermocouples would not give accurate readings while the field was applied. However, the rate of loss of heat from the poorly conducting material is slow, and useful information can be obtained by probing immediately after switching off the power.

Complete screening of the heating box is obligatory to prevent radio interference, and a fine tuning control, or better still automatic frequency control, is desirable in order to compensate for changes of dielectric constant and capacity during the heating cycle.

Making of plywood

Another industry in which radio heating may be said to have "arrived" is the manufacture of plywood. Nowadays the use of waterproof thermosetting resins as bonding media is universal, and the glueing process is a "gift" for radio heating, not only because of the time saved in getting heat to the glue lines which are embedded in poorly conducting wood, but because the RF power can be applied while the wood is under pressure. The earthed top and bottom platens of the press together form one electrode, and the "live" electrode consists of a thin metal sheet inserted in the middle of the pile of sheets. As in the case of plastic mouldings, the radio heating of plywood shows to best advantage in thick sections.

De-hydration by R.F.

New applications of RF heating are being recorded almost daily. Removal of the last traces of water from dehydrated foodstuffs by RF heating has shown a marked improvement in keeping qualities over oven-drying methods. Articles made from transparent plastic films and the coverings of packages are being sealed by a spot welding technique involving dielectric heating.

In conclusion mention may be made of the increasing use of diathermal heating of body tissues, one of the earliest applications of radio heating.

—"Wireless World" (Eng.)

WIDER TONE CONTROL

FROM the early days of radio until a short time ago it was the aim of the amplifier designer to obtain "flat" frequency response and even to-day some of the die-hards still throw out their chests and boast that their amplifier is "flat". But the newer generation of enthusiasts consider the flat amplifier as flat in more ways than one, in fact, as old-fashioned or even "stuffy" (as the Marines say). The modern idea is to have a frequency response which is arranged to compensate for the failings in the original recording, in the pick-up, in the loud-speaker and even in the acoustic properties of the room in which the amplifier is operated.

Three hand controls

The compensation can be fixed, and designed inherently in the circuit, but a more useful arrangement seems to be to have manual control, so that the degree of compensation can be varied according to circumstances. For example, two recordings may be found to vary considerably in the matter of low note accentuation. With a flat amplifier the recordings might be classified as satisfactory and unsatisfactory, but with compensation it becomes possible to obtain satisfactory reproduction from both recordings.

Tone compensation has long been practiced in the shape of the infamous "tone control" which could lop off the high note response as required. Modern compensation follows the same lines but allows either lows, the middle register, or the highs to be cut, separate controls being provided for each of these ranges.

No inductances needed

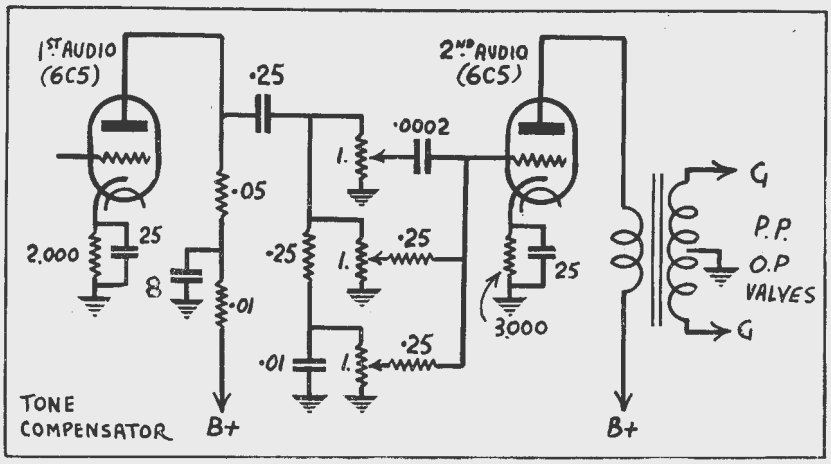
It might he expected that it would he necessary to use intricate filter networks in order to get the necessary frequency discrimination to arrange a thorough control of the type required, but in practice quite a satisfactory arrangement can be had without the use of accurate inductances, merely by a network of resistors and condensers with three one-megohm potentiometers as the three range controls. We show a typical circuit for a triode first amplifier feeding into a triode second amplifier which is transformer-coupled to a pair of push-pull output valves. The same arrangement can be used in other types of popular amplifier arrangements, but it should be borne in mind that the normal gain is lowered when control is employed, so that ample gain should be allowed for in the design.

In other words. it is not much use having the arrangement unless there is sufficient reserve of gain so that the control can be used as fully as desired and the output power level brought back to normal by advancing the usual volume control.

ELECTRIC DE-ICER

A new device for preventing the formation of ice on propeller blades is being tried out. A strip of rubber which has been made electrically conductive is fastened to the edge of the blade. Passage of the current through the rubber warms it enough to prevent ice formation.

—Ohmite News.



Circuit for the triple tone control with separate knobs for highs, middle and lows.

SERVICEMAN LICENCES ISSUED

Pursuant to the Control of Radio Service Order under National Security (General) Regulations and in conformity with the notice pubished in the Commonweath Gazette, a person shall not, after the 3rd April, 1944, carry on the business of a Radio Serviceman, except under the authority of a licence.

The Control of Radio Service Order provides for the appointment of an Advisory Committee and Licensing Authority. Applications are duly considered and issued to those approved. Licensees are requested to carefully study the Control of Radio Service Order, copy of which may be obtained from the Sub-Treasury, Melbourne.

Class B (part-time) licences are issued on the understanding that in carrying out radio servicing in spare time such work should not interfere with the duties and responsibilities of present employment.

Attention is also directed to the necessity for complying with any regulations governing employment which may require permission to engage in any work or occupation outside regular hours of duty.

No radio serviceman or radio mechanic (as defined in the Order), other than the persons specified in the application for licence, shall be employed without the prior consent in writing of the Licensing Authority.

It will be noted that licensees are authorized to carry on the business of a Radio Serviceman, only at the address shown on the licence. It is not the purpose of the Department to prevent licensees travelling within a reasonable distance of their establishments to attend to radio service but it is expected that servicemen will restrict such travel to an absolute minimum. Licensees should encourage, as much as possible, set owners to bring their receivers to servicemen's premises, arrangements regarding such transport to be made by the owner of the set.

Consideration has been given to the allocation of zones to all licensed servicemen in Victoria but as it is realised that persons engaged in radio service have already effected considerable economy as to the area in which they operate and also in the conservation of materials and fuel, etc., it has been decided to defer zoning in this State for the time being.

Attention is drawn to the fact that the Licence does not necessarily signify any degree of competence but merely authorises "to carry on the business of a radio serviceman" in terms of the abovementioned Order. Licensees should not therefore make any reference to the fact that they hold a licence from the Department in any advertising, invoices or letterheads, etc.

In accordance with the terms of the Order, it is necessary to keep a permanent record of all radio service work. It is not intended that these particulars should be forwarded regularly to the Department, but are to be available at any time on demand. This information must include the following:—

Date of service rendered.

Name and address of set owner.

Trade name of set or other means of identification.

If set was serviced on your premises or in clinet's home.

Weekly total of hours engaged in service work by each radio serviceman and radio mechanic.

Not to be included as service jobs are the testing of valves, dry batteries and accumulators or the charging of same, when no other service is rendered, except where these duties are carried out in the home of the set owner.

Co-operation is earnestly requested to assist the Department in its objective to maintain Radio Receivers in a satisfactory condition throughout the community and at the same time conserve manpower and transport.

Further information regarding the Control of Radio Spare Parts Order will be issued by the Directorate of Radio and Signal Supplies.

RADIO HISTORICAL QUIZ

How good is your knowledge of the historical background of the radio art? How did the terms we now bandy about so freely—ohms, henries, and all the others—originate? Who discovered the fundamental principles of radio and electricity, and when?

Test your knowledge by the following questions. You should answer at least five correctly for an average score seven or more right would be an excellent showing. Correct answers are given on page 26.

1. Who coined the words "positive" and "negative" and applied them to electricity?

2. Who invented the carbon microphone telephone transmitter?

3. Who discovered the piezoelectric effect of quartz, and when?

4. Where did Ohm's Law come from?

5. Who first discovered electrical conduction?

6. Where did the term "microphone" come from?

7: When was static electricity first observed?

8. Who discovered the principle of the electrostatic condenser?

9. Who invented the scanning disc, as used in television a few years back?

10. Who first proved that electromagnetic waves could be sent through space at the speed of light?

See page 26 for Answers.

Book Review

THE 1944 A.R.R.L. RADIO HANDBOOK

The Radio Amateur's Handbook is now an institution with a background extending back over more than two decades. Through these years of experience the men who write the HANDBOOK have learned the subtle art of presenting technical radio instruction so understandably that prospective amateurs could absorb the essentials rapidly and so attractively that they would do so of their own volition and interest. By experiment and refinement, by long practice and experience, they have carefully and methodically evolved in the HANDBOOK that long sought-after goal—a way to make learning radio easy.

Uniquely fitted as it was for the job, it isn't surprising, therefore, that the HANDBOOK has been so important an instrument in helping to provide the English-speaking nations with the highly trained radio technicians and operators vitally needed for successful modern warfare.

This new 1944 edition is designed to perform that function even more effectively. It differs from previous editions mainly in the considerable expansion and revision of the "theory" part of the book—the chapters on fundamental principles and design. Chapter two on Electrical and Radio Fundamentals, for example, has been doubled in length. Chapter three on Vacuum Tubes has been enlarged about 60 per cent. Explanations of certain principles have been amplified where practical teaching experience showed this to be desirable, and discussions of additional topics useful as grounding for students of all branches of modern radio technique have been included.

TE RADIO AMATEUR'S HAND BOOK (Twenty first Edition—1944), by the Headquarters Staff of the American Radio Relay League. The standard manual of amateur radio communication, revised, re-designed and re-styled in the light of wartime needs as a radio training text for class or home study. 664 pages, 6½ x 9½, including catalogue section and 10-page topical index. 1,125 illustrations, 125 charts and tables, 175 basic formulas. Available in Australia in about one month's time.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

FORTISSIMO

As if keeping in tune with the thunder of 444 guns in 36 salvoes—Moscow's greatest victory salute—the signal from Radio Centre Moscow on 19.7 metres on Tuesday morning April 11, was terrific. And was our usual female news reader pleased to be telling us of Marshal Stalin's Order of the Day announcing the liberation of Odessa? I'll say so, and it seemed as if the customary, "Death to the German Invaders" was given with more than the usual vehemence.

WHISPERING WILLIES ARE STENTORIAN WILLIAMS NOW.

Not long ago it was an "event" to hear one of the few New York s/w transmitters, for any length of time at any strength, but nowadays there are many and, from a whisper come in with a thump. So if you have difficulty . . . through over-powering morse . . . to hear the sun-kist news from California, try the Yankee Doodle from the Eastern side of U.S.A.

From 9 p.m. you will find them in the 25 and 30 metre band; as a matter of fact WGEX on 25.33 metres, announced the other night at 10 p.m. the "V. of A." news-cast could be heard over 1 station in the 16 metre band, 2 in the 19 and 4 in the 25 metre band.

ERRATUM

WOOD 25.27 metres shown under S/W Notes in April issue should have read WOOW.

HAIR'S BREADTH

If you are calibrating your receiver, an "off spot" is Army Testing on 7.84 m.c. 38.27 metres. Heard from around 1.30 till 3.30 p.m. Plays record after record with frequent announcements. On closing says will be back at 12.00 hours G.M.T. (10 p.m. Sydney).

Another spot, in between Eastern languages, is VUB-2 7.24 m.c. 41.44 metres. Listen around 10.25 p.m. and it is almost a certainty you will hear a description of a football match.

TELEVISION

The BBC have started a series of talks on this subject and can be heard over GSC 31.32 metres on a Sunday at 1.15 p.m. On April 16 title was "Television was Fun," and for 23rd we were promised "What the Viewer Saw." On Friday 21, through 2FC I heard Mr. David Sarnoff, President, Radio Corporation of America in "America Speaks to Australia," and he had some very interesting things to say about Television and Electronics.

NEW STATIONS

CBFX, Montreal, 9.63 m.c. 31.35 m.: Although I have been on the look out for new Canadian stations, I happened on this one quite accidentally. On March 28 I first heard them just after WNBI on 31.02 had closed at 9.30 p.m. Wandering along I was attracted by an "American" voice. Result of hanging on was, "And that is the end of the news from the CBC news room in Montreal."

Have heard them several times since, but listening now is difficult with Delhi right on the same frequency. However, it is more or less 50-50 and CBFX can be copied. Call sign is given at 9.45—L.J.K.

Radio Lausanne, Switzerland, 6.345 m.c., 47.28 metres: This is the same frequency as used by the Swiss Broadcasting Corporation in Berne from 4 to 7.45 a.m. However, in the afternoons from 3.30 till closing at 4.40, sometimes later on a Sunday, announcer calls the station Radio Lausanne. French is used throughout. At 3.45 p.m. you can do your daily dozen, a la Suisse.

Radio Baghdad, Iraq, 7.09 m.c., 42.32 m.: Mr. Rex Gillett of Adelaide sends particulars of this one. Unfortunately, his note reached me just after April issue had gone to press. Mr. Gillett heard them in English records from 4.30 till 5 a.m. when after hearing station announcement and clock striking, they went into foreign language and by 5.15 hod faded out. Nice catch, Rex.

VUD-, Delhi, 9.63 m.c., 31.15 m.: Still a further outlet for All India Radio. First heard on March 17, after announcer had said on 25.27 m., programme could be heard on 19.62, 25.27, 25.45 **31.1,** 31.30 fair around 9 p.m. as it seems to be mixed up with Chinese and at 9.30 has CBFX on top.

Advanced Press eadquarters, Naples, 8.42 m.c., 35.63 m.: Mr. Walker of West Australia mentions this one. Soys is very similar to AFHQ on 33.48 and is heard around 8—9 a.m. with despatches for the press agencies, etc.

Moscow 15,408 k.c., 19.47 m.: Mr. Edel 'phoned me about this one. They open at 11 p.m. with good signal and present Home News in Russian. Can be followed most nights till well after midnight.

INDUCTION SOLDERING

Induction heating is ideally suited for soldering applications. This method, when used to solder the required thirty wires to a terminal connector for a fighter plane, completes the required connections in only fifteen seconds, leaving the joints clean and uniform. If done by hand, the job requires about fifteen minutes.

Shortwave Notes and Observations

OCEANIA
AUSTRALIA

Ou old friend VLG-6 15.23 m.c. 19.69 metres is back again and from noon for half an hour presents over seas Service to Australian Forces. Skip distance makes it difficult to hear here, but catching some of the news, I say Hear, Hear.—L.J.K.

Fiji

VPD-2 Suva, 6.13 m.c. 48.94 metres. Appears to have settled down on this spot; great signal at 6 p.m. with news from Australia. (Gillett) (Whiting). (Think only broadcasting on Sundays —L.J.K.)

News and Talks 4—7.30 p.m. on Sundays; N.Z. Hour 5—6 p.m. for N.Z. Airmen in Pacific. (Cushen.)

AFRICA
Algeria

"United Nations Radio" calling from Algiers" is the opening phrase when opening at 5.45 p.m. on 31.46 metres. "God Save the King" followed by "Star Spangled Banner." Good signal (Gillett).

AFHQ, 33.48 metres is R4 at 5.30 most mornings, while outlet on 49.67 is good both morning and early evening. (Gillett). Heard well just after 7 a.m. (Whiting). 49.67 News in English at 6 a.m. Heard again when opening at a.m. with the two anthems. (Gillett). Fair at 6 a.m. but plenty of noise. (De 'Lisle)

Belgian Congo

RNB, Leopoldville, 30.66 metres. Good at 8 a.m. (Eyres). Still carries English at 10.15 a.m. daily, strength good (Walker). Closed with French at 3.48 p.m. (Edel, De 'Lisle).

Egypt

SUV, Cairo, 29.84 metres, is very good at 5 a.m. with news. At 5.15 say, "That is the end of the news from Cairo, listen again at the same time tomorrow." Then go on in foreign language (Gillett).

SUX, 38.15 metres is good at 4.35 a.m. (Gillett).

Cairo, on approximately 5.82 m.c. 51.54 metres, has Yank programmes till 2 a.m. and perhaps later. Only fair signal as spoilt by morse. (Walker).

Gold Coast

ZOY, Accra, 7.05 m.c., 42.54 metres, Broadcast in English and close down at 4.30 a.m. with "God Save the King". Strength is quite good and they announce as in 43 metre band. (Gilllett).

(This station was shown as New Station in April issue as mentioned by Mr. Nolan. Actually it should have been shown in March issue and credited to Mr. Gillett of Adelaide, as he mentioned it in a letter to me dated February 7, but the note was mislaid. Sorry, Rex.—L.J.K.)

ZOY, 49.96 metres. Excellent from 4 a.m. fVery interesting transmission; call for reports. (De 'Lisle).

CR7BE Lourenco Marques 30.38 metres. Best and most interesting African at 3 a.m.—variety from this one. (De Lisle.)

Mozambique
French Equatorial Africa

FZI, Brazzaville, 19.25 metres. At 9.30 p.m. poor compared with 25.06 (De 'Lisle).

On 25.06 is still heard well with news in English read by a woman at 9.45 a.m. (Walker).

Best African at 7.30 a.m. and 4.30 p.m. (De 'Lisle).

AMERICA, CENTRAL
Panama

HP5G, 25.49 metres. Excellent call at mid-day (Gaden).

U.S.A.

WLWK, Cincinnati, 15.25 m.c., 19.67 metres. Opens at 10.15 p.m. now.—L.J.K.

WRUW, 19.54 metres. Closes at 9.15 a.m.; opens at 8 p.m. (Walker).

KROJ, 19.75. Good in early morning (De 'Lisle).

WBOS, Boston, 25.27 metres. Heard closing at 9.30 p.m. (Edel).

European trans. R3 at 5.30 a.m. (De 'Lisle).

KWIX, 'Frisco, 25.21 metres. Some nights—good at times—(Gillett). Very poor now, at nights, (Cushen).

WRCA, New York, 25.22 metres. Splendid around 10 p.m. asking for reports—programme schedules will be forwarded in return. (Gillett). At nights a couple of points stronger than WCRC (Gaden).

WGEA, 25.33 Closes at 10.15 a.m. (Walker).

WGEX or WGES, Schenctady. What is the call on 25.33 metres at 10 p.m.? Rex Gillett says it is S, but I imagine at is **X**—L.J.K.

Sure I heard WGEX from New York at 10 p.m. (Edel).

WCRC, 25.36 metres. Open at 9 p.m.—good signal—L.J.K. Dr. Gaden says, "At 9.45 p.m. have heard call-sign WOOW and on other nights, WCRC." (Think WCRC is correct at that hour.—L.J.K.)

WLWO, Cincinnati, 25.62 metres. Good with news at 7 a.m.; closes at 7.15 —L.J.K.

WLWK is the call given at 9 and 10 p.m., although programme sheet for April 15 in my possession gives it as WLWO. When closing at 10 p.m. on April 13, said, would return in 15 minutes on 15,250 k.c., which is 15 minutes earlier than programme list. Signal at 10 o'clock on 25.62 is excellent and on April 20 reached R9 Q5. —L.J.K.

WCDA, New York, 26.92 metres. Fair signal in French at 8.35 a.m. on April 14.

At 8.45 announcer said something I could not catch, but station went silent except for metronome effect which stayed on till 8.59 when, as it stopped, announcer said, after usual closing station announcements, said WCDA would return at 2.15 a.m. EWT (4.15 p.m. Sydney) on 6060 k.c. 39.5 metres. —L.J.K.

Heard around 7.30 a.m. (Gillett).

KWV, 'Frisco, 27.68. Excellent at 4 p.m. (Gaden).

WRUL, 25.58. Closes at 9.15 a.m. re-opening at 9.30 (Walker). Closes at 4 p.m. (Cushen).

KROJ,('Frisco, 30.31 metres. Very good at night, around 8 o'clock (Eyres)

Most reliable of the 'Frisco all English programme stations at night. (The Alaskan programme in afternoon can be heard well most days from 4 o'clock till closing at 5.45.) Carries a lot of programme in parallel with KWIX (25.21 metres) and often announces, KROJ 9.89 m.c. and KWIX, 11.9 m.c. —L.J.K.

R6 at 3 p.m. directed to Alasko; at night colossal signal, best Yank at 10 p.m. (De 'Lisle).

WKLJ, New York, 30.77 metres. Heard in French on favourable nights. R5 Q3—L.J.K.

R9 when closing at 10 a.m. (Walker). Hardly that good here.—L.J.K.

WRUS, Boston, 30.93 metres. News at 9 p.m. then into Spanish, closes at 9.30 announcing as coming back in 15 minutes on WRUS 15,130 k.c. 19.83 —L.J.K.

WNBI, 31.02 metres. From about 9 p.m. good musical programme till closing at 9.30. Closing announcements are in several languages.—L.J.K.

Heard news at 7 p.m. but morse in background. (Gillett, S.A.).

WRCA, 31.02 metres, is R9 on opening at 10 a.m., call used to be WNBI. (Walker).

WOOC, 31.08 metres, closes at 8.45 a.m.—L.J.K.

WLWO, 31.28 metres, Spanish at 9.45 a.m. (Edel).

WCRC, New York, 31.28. Excellent for quarter hour before closing at 8.45 p.m.—L.J.K.

KWIX, 31.35 metres is R4 at 10 a.m. improving to R7 by 11 o'clock (Walker). Heard closing at 2.45 p.m. and very nice, too, (Gaden). News in English at 11 p.m. (Edel).

WOOW, New York, 38.36 metres. Closes at 8 a.m. Fair signal, good at 8 a.m., and also heard at 4 p.m.—used to close at 4.45, but now continue till later. (Cushen).

KGEI, 'Frisco, 41.38 metres. Give news from "British News Room" at 10.15—L.J.K.

Good at 9 p.m. (Eyres) R6 in special to Philippines at 7 p.m. (De 'Lisle).

KES-2, 33.59 metres. Heard from 9.30 till 10 p.m. Good (Whiting).

WRUW, 38.44 metres. Opens at 4.15, fair at 5 p.m. (Cushen). Heard closing at 7.45 p.m. and then moving to 19.54 metres (Walker).

WGEA, New York, 7 m.c. 42.86 metres. Heard closing at 5 p.m. on April 10.—L.J.K.

WRUA, 39.6 closes at 9.15 a.m. reopens at 9.30 a.m. (Walker).

WKLJ, 39.66 fair at 5 p.m. (Cushen)

WLWO, 39.6 now closes at 6 p.m. instead of 5.30 (Walker, Cushen).

WCDA, 48.62 closes at 8.45 a.m. (Gaden).

WRUA, 48.86. Heard over the weekend at good strength, closing at 4 p.m. (Cushen).

WBOS, 48.86. News in English at 6 p.m. (Edel).

WRUW, 6040 k.c., 49.66 metres. Opens at 9.30 a.m. (Walker) closes at 4 p.m. (Cushen).

KWID, 7.23, 41.49 metres. Like the signal, but wish programme wasn't all

AMERICA, SOUTH

Argentina

LRM, Mendoza, 6.185 m.c., 48.51 metres. Fair signal at 9 p.m. (Gillett).

Brazil

PRL-7 Rio de Janiero, 30.86 metres gets through the noise on a few occasions. R3 at 9 a.m. (Gillett).

Ecuador

Heard HCJB 24.08 poorly at 12.40 p.m. on a few occasions, but they often reach R8 in the morning around 7.30; but on 30.12 not nearly so good. (Gillett). Steady through noise at 7.32 a.m. (Whiting).

THE EAST

China

XGOY, Chungking. Very difficult to keep track of these people in programme to Australia. Seem to have moved from 25.27 metres to approximately 25.19, or 11.909 m.c. Some nights open in Chinese as early as 7.30, but give news in English at 8.03. Signal is good, but modulation dreadful, as usual.—L.J.K.

Chungking appears to be unsettled again and gone back to what I make 25.19 metres. Heard them there both at night and also at 10.30 a.m. (Gillett).

XGOY, Chungking, on 30.83 metres, according to my latest check are at good level around 11 p.m. (Gillett). Quite likely, seem to be drifting about on all frequencies—Crystal trouble, probably.—L.J.K.

XGOY, 41.81 metres, at 9.45 p.m. transmission for Blue Network; at midnight with XGOY on 50.04 news in English, (Edel).

India

At 9.30 p.m. news is given over 19.62, 25.27, and 31.28 metres and at 10 p.m. through 31.28 and 41.15 metres.—L.J.K.

Delhi on 25.27 heard well at 10 p.m. in programme for Forces. (De 'Lisle).

VUD-3, 19.62 metres, back on the air again, news at 9.30 (Gillett).

GREAT BRITAIN

GSG, 17.79 m.c., 16.86 metres. Opens at 9.45 p.m. in Eastern Service (Edel).

GWD, 15.42 m.c., 19.46 metres, opens at 9.45 p.m. in Eastern Service. (Edel).

GWO, 9.625 m.c., 31.17 metres. Not heard very often, but has been excellent the last few days around 3.45 in programme for West Africa.

If you want to hear Home News, tune to GRO 48.54 metres at 5 p.m.

New B.B.C. Quiz—Give it a Name

Mr. Walker of Applecross, West Australia, writes: "New BBC on 9540 k.c., 31.45 metres, heard with European Service one evening at 6.30. This was NOT mistaken for 9530 or 9550, as it was slap up against WGEA on 9530."

And:—

Mr. Gillett of Adelaide writes: "Have heard London on 31.50 metres at 6 p.m. in the European Service when they carry news in English in conjunction with several other transmitters.

Another one from this quarter has been heard at 4.45 a.m. on 49.06 with an English programme. Incidentally, GSL 49.10 metres is also on."

GRG, 11,68 m.c., 25.68 metres. Our old friend is back again and can be heard from 3.30 to 5.15 p.m. directed to Iraq and Iran.—L.J.K.

GSB, 31.55 metres. Heard most of the forenoon and very good in afternoon in G.O. Service (Whiting).

U.S.S.R.

On Sunday, April 9, Moscow on 31.36 metres broadcast a complete list of wave lengths. Mentioned session to Australia on 24.27 metres at 9.20 p.m. (Gillett).

(Yes, I have a list compiled by my friend Mr. Edel. I am showing them under Schedules. The session on 24.27 metres comes through quite well on most nights and at 10.7 they call the C.B.S. and N.B.C.—L.J.K.

Moscow, 25.24 metres. At 10.7 p.m. call CBS and NBC (Gaden). At 9.20 p.m. Front Line News followed by Moscow on 19.05 metres gives News Reel and Front Line news at 2 a.m. (Edel).

Leningrad 25.79 metres. Good at 9.30 p.m. (Whiting).

Moscow on 28.72 metres is using various languages from 2.30—5.30 p.m. (Edel).

On 41.10 metres news in English is given at 3, 4, 5, 6, 7 and 8 a.m. (Edel).

Not often we hear English from RW-15 Khabarovsk 31.36 metres, but they come into line now, from 9.40 p.m. with 24.65 and 30.43 metres. —L.J.K.

MISCELLANEOUS

Azores

——, Ponta Delgada, 42.74 metres. Think I am hearing this around 7.30 a.m. (Gillett).

(Heard someone around 7.02 m.c. the other morning, but morse interfered with audibility. Understand uses one loud chime before station announcement and at 7 o'clock strikes 7. That would be 7 p.m. the previous day—L.J.K.

British Mediterranean, 41.58 metres. News at 4.45 and 5.15 a.m. interval signal is 6 notes on a piano. (Gillett). (Can follow them till 7.30 a.m. when terrible "scranning" is put on.—L.J.K.

Canada

CBFX, Montreal, 9.63 m.c. Heard giving news at 9.30 and 10 p.m. Announces as CBM and S/w station CBFX Montreal (Cushen).

(This is the station mentioned under "New Stations". Requires patience to hear, as being on same frequency as Delhi it is 50-50 who gets through.—L.J.K.

Allied and Neutral Countries Short-Wave Schedules

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

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

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

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
GSH	London	21.47	N	13.97	8.45 pm—1.15 am.
HER-	Berne	18.45		16.26	Tues. and Sats. Now on 23.14m
GVO	London	18.08		16.59	1—2.15 am..
AFHQ	Algiers	18.02		16.64	9.20 pm
GRQ	London	18.02		16.64	11—1.15 pm
VWY	Kirkee	17.94		16.72	Around 9.30 pm
GRP	London	17.87	S	16.79	8 pm—1.15 am; 1.45—3.15 am
EIRE	Athlone	17.84		16.82	10—11.20 am; 3.30—4 am; News 2.45 am
WCDA	New York	17.83		16.83	11 am—4.30 am
WCRC	New York	17.83		16.83	7.15—9.15 am
GSV	London	17.81	S	16.84	1.30—4.45 am
VLI-8	Sydney	17.80		16.85	7.30—8 pm
WLWO	Cincinnati	17.80	S	16.85	7.30—8.45 am; 10.15 pm—4.30 am
GSG	London	17.79		16.86	8—8.30 pm; 1.15—2.45 am
WRCA	New York	17.78		16.87	11—2.45 am
OPL	L'poldville	17.79		16.88	4.55—6.15 am
KROJ	'Frisco	17.76		16.89	11—Noon; News at 11 am.
WRUW	Boston	17.75		16.90	1—3.15 am
GVQ	London	17.73	S	16.92	5.30—7 pm: 2—2.15 am
LRA-5	B'nos Aires	17.72		16.93	Sats 6.45—6.30 am
—,	Brazzaville	17.71		16.94	6.30—7 am
GRA,	London	17.71		16.94	6 pm—2.45 am; News 6 pm
HVJ	Vatican City	17.44	N	17.20	11 pm—1 am
GVP	London	17.70		16.95	7 pm—12
KMI	'Frisco	17.09		17.5	1—4 am
WCW	New York	15.85		18.93	3 am—7 am
LSL-3	Beunos Aires	15.81		18.97	
—,	Moscow	15.75		19.05	9.40 pm—11.30 pm
FZI	Brazzaville	15.59		19.25	9.15—10.15 pm
RNB	L'poldville	15.53		19.33	9 pm—11 pm
KKR	Bolinas	15.46		19.4	News and commentary 12—12.30 pm
GRD	London	15.45	S	19.43	4.30—5.15 pm; 1.15—5 am
GWE,	London	15.43	S	19.44	9.15 pm—1 am; 3—8 am
GWD	London	15.42	S	19.46	5—7 pm; 2—2.15 am
—	Moscow	15.40	N	19.47	11 pm—2 am
GRE	London	15.37		19.51	5.45—7 pm; 10.15—1 am; 1.30—4 am
ZYC-9	Rio deJ'niero	15.37		19.51	Schedule unknawn.
KWU	'Frisco	15.35	S	19.53	1—4 am; 6.30—8.15 am; 9.45—11.30 am
—	Moscow	15.35		19.54	8.15—10.20 pm. (English from 9.40)
WRUW/L	Boston	15.35	S	19.54	8.15—9.15 am; 8 p.m.—
WGEA	Schenectady	15,33		19.57	7.30—8.45 am
KGEI	'Frisco	15.53		19.57	Closes at 11 am
WGEO	Schenectady	15.33		19.57	9.15 pm—5.30 am
VLI-3	Sydney	15.32	S	19.58	7.30—8; 8.15—11 pm
GSP	London	15.31	S	19.60	7.15 am—12.15 pm; 3.45—5.15 pm; 9.15—10 pm; 10.30 pm —1 am; 2—2.15 am
KWID	'Frisco	15.29		19.62	3.30—11 am; 3—4.45 pm
VUD-3	Delhi	15.29		19.62	1.30—7.30 pm; News 1.30 and 5.
WCBX	New York	15.27		19.64	9 pm—6.45 am; 7—9.45 am
GSI	London	15.26	S	19.66	1.30—7 am
WLWK	Cincinnati	15.25		19.67	7.30—10.15 am; 10.15 pm—7.15 am.
VLG-6	Melbourne	15.23	X	19.69	Noon—12.30; 3.10—3.40 pm
—	Moscow	15.22		19.70	7.15—7.40 am; 8.47—9.30 am; 11.15—11.40 am; 9.40 —10.20 pm
WBOS	Boston	15.21		19.72	10.15 pm—1 am; 1.15 am—2.45 pm
XGOY	Chungking	15.20		19.73	Heard testing with U.S.A. 5—7 pm
TAQ	Ankara	15.19		19.75	7.30—10.15 pm; 11.30 pm — 12.45 am.
KROJ,	'Frisco	15.19		19.75	6—10.45 am
WOOC	New York	15.19	N	19.75	12.45—4.45 am
WKRX	New York	15.19		19.75	5.30—7 am
XGOX	Chungking	15.18		19.76	Wed. only, 10—10.45 am
GSO	London	15.18		19.76	8.45—9 pm; 10.15—11.15 pm; 1.30—1.45 am; 3.30—4 am
TGWA	Guatemala	15.17		19.78	3.45—4.55 am (Mon. till 8.15 am)
VLG-7	Melbourne	15.6	S	19.79	6—8.10 am (Sun. from 6.45)
SBT	Stockholm	15.15		19.80	1—4.15 am. News 1.01 am
WNBI	New York	15.15		19.81	10 pm—7 am
GSF	London	15.14	S	19.82	3—5.15 pm; 8 pm—6 am
KGEI	'Frisco	15.13		19.83	3.15—4.15 am
WRUS	Boston	15.13	S	19.83	5—6.30 am; 9.45 pm—
HVJ	Vatican City	15.12		19.84	Irregular in afternoons
—	Moscow	15.11	S	19.85	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am
HVJ	Vatican City	15.09		19.87	See 19.84 m.
GWC,	London	15.07	S	19.91	3.45—5.15 pm; 8 pm—1.15 am; 4—8 am
GWG	London	15.06		19.92	No schedule.
WWV	Washington	15.00		20.00	See 10 m.c.
—	Moscow	13.42		22.35	Around 10.45 pm
WKRD	New York	12.96		23.13	10 pm—9.15 am
HER-	Berne	12.96	N	23.14	Tues and Sats 6—7.30 pm
CNR	Rabat	12.83		23.38	9.30—10 pm
HCJB	Quito	12.45		24.11	6—7 am; 9.55 pm—11 pm
—	Moscow	12.26	S	24.47	Home prog. 3—9 pm; News 9.20, calls BBC 10.30 pm
TFJ	Reykjavik	12.23		24.54	3.15—3.30 pm
—	Moscow	12.19		24.61	7.45—9.23 am; 10—10.50 am
—	Moscow	12.17	S	24.65	4.45—5 pm; 7.30—8.50 pm
R. France	Algiers	12.12		24.75	2.30—4.30 pm; 5—7.30 am; 7.45—8.15 am
ZNR	Aden	12.11		24.77	2.13—3.30 am
GRF	London	12.09		24.80	10 pm—1.15 am
GRV	London	12.04	S	24.92	4.30—7 pm; 12.45—1.15 am
FZI	Brazzaville	11.97		25.06	4.45—8 am; 1—2 pm; 4—4.15 pm; 11.30—12.15 am
Radio TBILISI	Tiflis	11.96	S	25.08	8.45—11.45 pm
—	Moscow	11.94	N	25.10	9.40—10.54 pm in English
ZPA-5	Enc'nac'n	11.95	N	25.10	Heard around 10.30 am
GVY	London	11.95		25.09	8 p m—1.45 am; New 9 pm, 11 pm and 1 am.
GVX	London	11.93	S	25.15	
XGOY	Chungking	11.90	X	25.19	8—9.35 pm; Heard around 10.30
VLG-9	Melbourne	11.90		25.21	Not in use
KWIX	'Frisco	11.9	N	25.21	3—9.58 pm
CXAIO	Montevideo	11.90		25.21	9.5 am—12.10 pm
WRCA	N.Y.	11.89	S	25.22	6—10 pm; 3—6.45 am; 7 am —1.30 pm
VPD-2	Suva	11.90		25.22	8.30—10 am
WKTM	New York	11.89		25.23	8—10 am
AFHQ	Algiers	11.88		25.24	6.57 pm
VLR-3	Melbourne	11.88	S	25.25	Daily 11.45 am—5.45 pm (Sun from 12.50 pm)
WOOW	New York	11.87	N	25.27	10.45 pm—4.45 am
VLI-2	Sydney	11.87		25.27	4.55—5.25 pm
WBOS	Boston	11.87	S	25.27	5—7.15; 7.30 am—2 pm; 7.45 —9.30 pm
VUD-,	Delhi	11.87		25.27	7.45—10.30 pm; News 7.46
KWIX	'Frisco	11.87	S	25.27	6—9.30 am
XGOY	Chungking	11.87	X	25.27	See 25.19
HER-5	Berne	11.86		25.28	10.55—12.30 am
GSE	London	11.86	S	25.29	9.15 pm—7 am
WGEX	Schenectady	11.84	S	25.33	10 pm—10.15 am
VLG-4	Melbourne	11.84	S	25.34	3.10—3.40 pm; 6.10—7 pm; 7.30—8 pm; 8.15 9.45 pm
GWQ	London	11.84		25.34	7 pm—12.30 am 1.30—4.45 am
VLW-3	Perth	11.83	S	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	Opens at 11 pm in Hindustani
WCRC	N.Y.	11.83	S	25.36	5.15—8.45 am; 9 pm—
WCDA	N.Y.	11.83	S	25.36	8.45 pm—
GSN	London	11.82	S	25.38	4—6 am; 5.45—7 pm;
XEBR	Hermosillo	11.82		25.38	11—3 pm
COBH	Havana	11.80		25.41	Heard at 8 am and 9.30 pm
COGF	Matanzas	11.80		25.41	Said to be off the air.
GWH	London	11.80		25.42	7 pm—12.30 am; 1.30—4.45am
WRUA	Boston	11.79	N	25.45	Closes 9.30 pm; 9.45 pm—
VUD-6	Delhi	11.79		25.457.45	pm—12; News 7.45

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
KGEI	'Frisco	11.79		25.43	7 am2.45 pm
GVU	London	11.78	S	25.47	2—5.15 pm; 9—10 pm; 12.45—2.30 am.
HP5G	Panama	11.78		25.47	11.15 pm—12.30 am; 2.45—6 am
VLR-8	Melbourne	11.76	S	25.51	6.10 am (Sun 6.45 am—12.45 pm)
GSD	London	11.75		25.53	7—9.45 am; 3—5.15 pm; 8—midnight; 12.30—1.15 am
—,	Moscow	11.75		25.53	9.30—9.55 am
GSB	London	11.75		25.53	2—2.45 pm
HVJ	Vatican City	11.74		25.55	Mon. & Thurs: Calls Eng. 4 pm Thurs & Sat calls Aust. 5 pm
COCY	Havana	11.73		25.56	11 am—4.15 pm
GVV,	London	11.73		25.58	8.45 pm—1.15 am; 1.30—6.30 am
WRUL,	Boston	11.73	S	25.58	6—8 am; 8.15—9.15 am; 9.30 am—
CKRX	Winnipeg	11.72		25.60	3—7.45 am
OPL	L'poldville	11.72		25.60	9.55—11 pm; 4.55—6.15 am.
Brit. Medit. Stn		11.72		25.60	10 pm—2 am
HER-5	Berne	11.71	S	25.61	Daily: 4—7.45 am; Tues & Sat 6—7.30 pm
PRL-8	R. de J'niero	11.72	N	25.61	English announcements at 6 am
YSM,	San Salvador	11.71		25.62	4—5 am
VLG-3	Melbourne	11.71		25.62	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm
WLWO	Cincinnati	11.71	S	25.62	4.45—7.15 am;
WLWK	Cincinnati	11.71	N	25.62	4.45—7.15 am; 8.30—10 p.m.
CXA-19	M'tevideo	11.70		25.63	9—10 pm; 7 am—1 pm
SBP	Motala	11.70		25.63	1—4.15 am; 7.20—8.40 am; 11 am—12, opens again at 9.05 pm
CBFY	Montreal	11.70		25.63	9.30 pm—1.30 pm
GVW	London	11.70	S	25.64	1.30—7 am
HP5A	Panama City	11.70		25.64	11 pm—3 am; 11.10 am—3 pm
CE1170	Santiago	11.70		25.64	10 pm—12
GRG	London	11.68	S	25.68	5.15—9.45 am; 3.30—5.15 pm; midnight—3.45 am
—,	L'poldville	11.67		25.71	Now on 30.66 metres.
Leningrad		11.63	N	25.79	9.30—9.43 pm; 9.50—10.17 pm; 11.30—11.43 pm; 11.50 12.18 am
COK	Havana	11.62		25.83	2 am—1 pm (Mon. 3—9 am)
WRUA	Boston	11.14	S	26.92	10 pm
WCDA	New York	11.14	X	26.92	5—9 am
CSW6	Lisbon	11.04		27.17	5—8.30 am
KWV	San F'cisco	10.84		27.68	4—6.45 pm; 7—9 pm
VQ7LO	Nairobi	10.73		27.96	12.45—5 am
KES-3	Bolinas	10.62		28.25	3—8.15 pm
VLN-8	Sydney	10.52		28.51	Idle at present
—	Moscow	10.44	S	28.72	3—6 pm and again at 9.15 pm
—	Moscow	10.23		29.33	4.15—5.50 pm; 9 pm—11 pm
—	Moscow	10.10		29.68	4.45—5.45 pm
Moscow		10.08		29.75	Heard at 3.50 pm
SUV	Cairo	10.05	S	29.84	4.30—5.30 am; 5.30 am
WWV	Washington	10.00		30.00	National Bureau of Standards frequency check, in speech on hour and half hour.
—	Brazzaville	9.98		30.06	4—5.20 am; 7—7.30 am 7.30—8.30 pm; 11.45—12.15 am
HCJB	Quito	9958		30.12	6—7 am; 9.55 pm—12
WRX	New York	9905		30.29	8 am—2 pm; 2.15—7 pm
WKRD	New York	9897		30.31	6.45—8.30 pm; 5—7 am.
WKRX	New York	9897		30.31	8—10.45 am
KROJ,	'Frsco	9.89		30.31	12.15—5.45 pm; 6 pm—11 pm 1.15—4.15 am
—	Moscow	9.88	S	30.34	11 pm—1 am Home prog.
CR7BE	L. Marques	9.88	X	30.38	4.30—6.30 am; News 5.50
EAQ	Madrid	9860		30.43	4—6 am; News 4.15
—	Moscow	9860	S	30.43	8—10.15 pm
COCM	Havana	9833		30.51	9.45 pm—3 pm
GRH	London	9825	S	30.53	7.15 am—12.15 pm; 3—7 pm 12.45—1.15 am; 5—7 am
RNB	L'poldville	9.78	S	30.66	3—4.45 pm; 1.55—2.30 am 3.15—8.30 am
—	Moscow	9770		30.71	10—10.30 am.
WKLJ	New York	9750		30.77	5.30—10 am; heard at 8.30 pm
T14NRH	Heredia	9740		30.80	10—11 pm (Wed. Fri. & Sun. 1.30—3.30 pm)
CSW-7	Lisbon	9735		30.82	See 27.17 metres.
Leningrad		9.72	N	30.85	Heard around 5.15 pm; 9—10 pm and 11 pm
CE-970	V'paraiso	9.73		30.82	Heard around 2 pm
XGOA	Chungking	9720		30.86	5—6 am; 9 pm—1 am; News 12 am
PRL-7	R de J'niero	9.72	F	30.86	8 am—1 pm
OAX4K	Lima	9715		30.88	8.30 am—2.20 pm
WRUW	Boston	9.70	S	30.93	4.45—8 am
WRUS	Boston	9.70	N	30.93	8.15 am; 9.15 am; 9.30 am Heard closing 9.30 pm
FIQA	Tananarive	9700		30.93	12.30—1 am
GRX	London	9690	S	30.96	8 am—2.45 pm; News 7 pm; America calls Europe 7.15 pm
TGWA	Guatemala	9685		30.96	11.50 am—2.45 pm (Mon. 10 am—2.45 pm)
LRA-1	B'nos Aires	9688		30.96	1.30—4 am; 5.30—6.30 am—Noon.
XEQQ	Mexico City	9.68		30.99	Midnight—4.45 pm
VLW-6	Perth	9.68		30.99	8.30 pm—1.30 am
WRCA	New York	9.67	N	31.02	10 am—4 pm
WNBI	New York	9.67	S	31.02	6 pm—9.30 pm
Brit. Medit Stn.		9.67		30.02	10 pm—2 am; 4—7 am
VLQ-3	Brisbane	9.66	S	31.05	11.45 am—5.15 pm (Sun from 11 am)
GWW	London	9.66		31.06	Heard at 10.30 pm
LRX	B'nos Aires	9.66	S	31.06	1.30—7 am
HVJ	Vatican City	9.66		31.06	2—4.30 am
WGEO	Schenectady	9.65		31.08	Not in use at present
WOOC	New York	9.65	S	31.08	6—9 am
WCBX	New York	9.65		31.09	1.45—4 pm
XGOY	Chungking	9.64		31.10	9.35 pm—1.40 am; News 12 and 1 am
COX	Havana	9.64		31.12	2.50—2 pm
LRI	B'nos Aires	9.64		31.12	7.57—10 pm! 3.30—4.30 am; 5 am—1 pm
GVZ	London	9.64	S	31.12	6—7.45 am; 3—7 pm; 8 pm 1.15 am; 2—5 am
CBFX	Montreal	9.63	N	31.15	Heard around 9.30 p.m.
VUD	Delhi	9.63	N	31.15	Heard around 9.30 p.m.
GWO	London	9.62	S	31.17	3.45—5.15 pm
—	Addis Ababa	9.62		31.17	1.40—2.30 am
TIPG	San Jose	9.62	N	31.20	Heard around 10 pm
XERQ	Mexico	9.61		31.21	Heard at 2 pm
ZYC-8	Rio de J'n'ro	9.61		31.21	9 am—12
ZRL	Capetown	9.60		31.22	5.15 pm—12.30 am.
HP5J	Panama City	9.60		31.23	10 pm—4.30 am; 11.30 pm—1.30 pm; Sun. 11 am—1 pm Mon.
CE960	Santiago	9.60		31.24	9 am—2 pm
GRY	London	9.60	S	31.25	5—7 am
—	Athlone	9.59		31.27	7.05—7.25 am; News 7.10 am
VUD-4	Delhi	9.59		31.28	8.30—11.35 pm; 12.15—1 am; 2.30—4.30 am; News 10 pm; 12.50 am and 4 am
WCRC	New York	9.59	N	31.30	8—8.45 pm
WLWO	Cincinnati	9.59		31.30	9 am—2 pm
WLWK	Cincinnati	9.59		31.30	Idle
VLR	Melbourne	9.58		31.32	6—11.30 pm
VLI-10	Sydney	9.58		31.32	Idle at present
VLG	Melbourne	9.58		31.32	12.15—12.45 am (Eng. for India) 1—1.45 am (for Nth America)
GSC	London	9.58	S	31.32	7.15 am—2.45 pm
WRUS	Boston	9.57	S	31.35	6.45—8 am; 8.15 am
KWIX	'Frisco	9.57	S	31.35	10 am—2.45 pm; 10 pm
KWID	'Frisco	9.57		31.35	Not in use at present
—	Khabarovsk	9.56	S	31.37	7.40—8.45 pm; 6 pm—12
OAX4T	Lima	9.56		31.37	11 pm—Midnight
XETT	Mexico	9.55		31.39	Continuous
GWB	London	9.55		31.41	6.15—7.45 am; 4.10—4.30 pm 5.10—6 pm; 6.30—7.30 pm; 8.45—10 pm; 10.45 pm—11.15 am; 1.30—5.45 am.
WGEA	Schenectady	9.55		31.41	Not in use at present
XEFT	Vera Cruz	9.54	X	31.42	Midnight—4.15 pm
—	Moscow	9.54		31.43	1.15—1.40; 9.30—10.20 pm
VLG-2	Melbourne	9.54	S	31.45	10 pm—Midnight
AFHQ	Algiers	9.53		31.46	12.45—1 am; 2—8.30 am; News 5 am
SBU	Stockholm	9.53		31.47	7.20—7.35 am; 11 pm—12. News 7.20 and 11 am
HER-4	Berne	9.53		31.47	See 25.61 metres
WGEO	Schenectady	9.53		31.48	5.15—7.15 am; 7.30 am—9.30
GWJ	London	9.53		31.48	7—10.45 pm; 11 pm—12.30 am
ZRG	Joh'burg	9.52	X	31.50	11 pm—12.45 am
COCQ	Havana	9.51		31.53	10 am—1 pm; 8.20—11 am
GSB	London	9.51	S	31.55	7.15 am—1.30 pm; 2—2.30 pm; 3.45—5.15 pm;9.15 pm—2.15 am; 3—7 am
PRL-7	R de Janeiro	9.50	F	31.57	Moved to 30.86 metres
XEWW	Mexico City	9.50		31.58	11.58—5.45 pm
GWF	London	9.49		31.61	5 pm—12.30 am; 1.30—4.30 am
KRCA	'Frisco	9.49		31.61	3 pm—3 am
WCBX	New York	9.49		31.61	9.50 am—1.30 pm
—	Moscow	9.48		31.65	4—5 pm; 8.30 pm—12.45 am; 1.45—2.15 am
TAP	Ankara	9.46		31.70	1—5.45 am; News 3 am. Talk at 6.30 am on Fridays
GRU	London	9.45	S	31.75	1.30—3.30 am; 5.15—6.30 am
COCH	Havana	9.43		31.80	8.45 am—3.15 pm
—	Moscow	9.43		31.81	7—7.25 am; 2.15—2.45 pm; 3.30—4 pm
GRI	London	9.41	S	31.88	2.45—8.30 am; 9 am—1.45 pm
FGA	Dakar	9.41		31.88	3—4.15 am
OAX4W	Lima	9.40		31.90	Heard closing at 3 pm
—	Moscow	9.39		31.95	9.30—11 am; 1.30—2 am; 10 am—1 pm

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
COBC	Havana	9.37		32.00	11 am—3.15 pm
OAX4J	Lima	9.34		32.12	9 am—4 pm; 11 pm—12 am; 3—6 am
LRS	B'nos Aires	9.32		32.19	8 am—12; 10—11am; 4—4.30 am
COCX	Havana	9.27		32.26	10.45—3 pm
COBQ	Havana	9.22		32.54	10 pm—11.15 am
HC2ET	Guayaquil	9.19		32.64	10.30 pm—3.30 pm
CN1R1	Rabat	9.08		33.03	4—8.50 am; 4.30—4.50 pm; 9.30—11 am
VWY	Kirkee	9.04		33.16	Around 8 am
—	Brazzaville	9.04		33.19	11.45—12; 4—5.15 am; 7—7.30 am; 7.30 pm—8.30 pm
COBZ	Havana	9.03		33.23	10.45 pm—2 pm
—	Moscow	8.99		33.37	5.50—6 am
AFHQ	Algiers	8.96		33.48	2—9 am; News 4 and 5
—	Moscow	8.94		33.54	Around 8.45 pm
KES-2	'Frisco	8.93		33.58	8.15 pm—4 am
—	Dakar	8.83		33.95	5.15—6.45 am; 5.30—5.50 pm; 10.15—11 am.
COCQ	Havana	8.83		33.98	8.20 pm—2.15 pm
COCO	Havana	8.70		34.48	7.30 pm—3.30 pm
COJK	Camaguey	8.66		34.62	2.30—3.30 am; 6.30—9 am; 11—11.30 am
WOO4	New York	8.66		34.64	10 am—4 pm; 4.15—7 pm
APHQ	Naples	8.42	N	35.63	8—9 am
—	Moscow	8.05		37.27	1—1.30 am; 2—4.15 am; 7.15 8.45 am
CNR1	Rabat	8.03		37.34	4—9.45 am; 3—5 pm
FXE	Beirut	8.02		37.41	11 pm—7 am
YSD	San Salvador	7.89		38.00	10 am—1.30 pm
SUX	Cairo	7.86	S	38.15	3.30—5.30 am
WOOW	New York	7.82	S	38.36	5—9 am
WKRD	New York	7.82		38.36	4—6.15 pm
WKRX	New York	7.82		38.36	7—10 pm
WRUW	Boston	7.80	S	38.44	4.15—7.45 pm
WRUA	Boston	7.57	S	39.6	6.45—8 am; 8.15—9.15 am; 9.30 am—
WLWO	Cincinnati	7.57	S	39.6	2.15—6 pm
WKTS	New York	7.57		39.6	2.15—4.30 pm
WKLJ	New York	7.57	S	39.66	Heard around 5 pm
—	Moscow	7.56		39.68	1—6.30 am; 8—9 am; 11.10—11.30 pm
WDJ	New York	7.56		39.66	9.15 am—6 pm
KWY	'Frisco	7.56		39.66	10.30 pm—12.30 am
SU—	Cairo	7.50		40.00	1.30—3 am
YN2FT	Granada	7.49		40.05	10 am—1 pm
—	Moscow	7.46	N	40.21	Home Service heard at 1 am
HER—	Berne	7.39		40.56	1.15 1.47 am
—	Moscow	7.36	N	40.76	Home Service heard at 1 am
GRJ	London	7.32	S	41.01	9 am—1.30 pm; 2—5.15 pm
—	Moscow	7.30		41.10	2—9.30 am; 10—11 am; 1—3.45 pm; 4.30—5 pm
VUD-2	Delhi	7.29		41.15	7.45 pm—11.25 pm; News 7.45 pm; Special news for 15 minutes at 4 am
VLI-9	Sydney	7.28		41.21	Idle at present
GWN	London	7.28		41.21	No schedule
VUM-2	Madras	7.26		41.32	6—6.40 pm; 9.45—11.30 am; 12.45—12.50 pm. News 10 pm and 12.45 am.
GSU	London	7.26	S	41.32	4—6.30 am; 10.15 am—2.45 pm; 3—5.30 pm; 9.35—Midnight.
KGEI	'Frisco	7.25		41.38	1 pm—2.45 am.
GWI	London	7.25		41.38	4 am—1 pm; 2.45—7.15 m
VUB-2	Bombay	7.24		41.44	4.15—5.10 pm; 9.25—10.45 pm.News 5, 9.25 & 10 pm
VLQ	Brisbane	7.24	S	41.44	6—10 am
KWID	'Frisco	7.23	S	41.49	5 pm—3.05 am
GSW	London	7.32		41.49	3—5.15 pm
VLI-4	Sydney	7.22		41.55	11.35—12.45 am
VLQ-2	Brisbane	7.21	S	41.58	5.30—11.30 pm
Brit. Medit. Stn					
. . . —		7.21		41.58	4 am—
—	Moscow	7.21		41.61	7.50—9.30 am
VUC-2	Calcutta	7.21		41.61	8.30—9.30 pm
—	Modrid	7.20		41.63	6—9 am
GWL	London	7.20		41.64	No schedule
YSY	San Salvador	7.20		41.65	10.30 am—2 pm
GRK	London	7.18		41.75	
XGOY	Chungking			41.80	8 pm—3 am; 4.30—7 am
—	Moscow	7.17		41.80	5.20—6.30 am; 7.15—9.55 am 10—10.30 pm; 1—4.30 am
GRT	London	7.15		41.96	12.45—2 pm
EAJ-9	Malaga	7.14		42.00	6—9.05 am
—	Ovideo	7.13		42.05	5—7.30 am
GRM	London	7.12	S	42.13	3—6.15 pm
EA9AA	Melillo	7.09		42.31	Heard around 7 am
—	Radio Baghdad	7.09	N	42.32	4.30—5 am
GRS	London	7.06	S	42.46	2—5.15 pm; 2.30—8.45 am
ZOY	Acrca	7.05	X	42.54	Heard around 5 am
EAJ24	Cordoba	7 04		42.61	6.40—7 am
EAJ-3	Valencia	7.03		42.65	6—10 am

Call Sign	Location	Mc.		M.	Time: East. Australian Stand'd
—	Ponto Delgada	7.02	S	42.74	5—7.30 am
WGEA	Schenectady	7.00	S	42.86	10.30 am—5 pm
FO8,AA	Papeete	6.98		42.95	Wed. & Sats 1.57—2.45 pm
—	Moscow	6.98		42.98	2 am—9.23 am; 10—10.30 am
YNOW	Managua	6.87		43.67	10 am—2.30 pm
KEL	Bolinas	6.86		43.7	7—7.25 pm
ZLT-7	Wellington	6.71	S	44.68	7.30 pm in news session only
TGWB	G'temala	6.54		45.87	9.30 am—3 pm
COHI	Santa Clara	6.45	N	46.48	9.30 pm—2.15 pm
WKTM	New York	6.38		47.01	5.15—7 pm
	Berne	6.34		47.28	4—7.45 am; News 6.53
—	Radio Lausanne	6.34	N	47.28	3.30—4.40 pm
SUP-2	Cairo	6.32		47.47	4—7 am
FK8AA	Noumea	6.20		48.39	5.15—5.27 pm; 7—8 pm
GRN	London	6.19		48.43	5.45—6.30 am; 12—2.45 pm
VUD-2	Delhi	6.19		48.47	9.30—10.15 pm; 11—2.45 am News 10 pm; 11.45 am; Special 15 mins at 4 am
XECC	Puebla	6.19		48.47	From 2—4 pm
WGEO	Schenectady	6.19		48.47	2.15—5.15 pm
LRM	Mendoza	6.18		48.51	8.30—1 pm
GRO	London	6.18		48.54	5—10.45 am; 2.40—7.45 pm
HJCT	Bogota	6.18		48.54	9 am—2.15 pm
WCBX	New York	6.17		48.62	2—5 pm
WCDA	New York	6.17	N	48.62	7.15 am—
—	Antananarivo	6.16		48.62	1—2 am
HER-3	Berne	6.16		48.66	See 47.28 metres
GWK	London	6.16	S	48.66	5 am—1 pm; 2.45—4.45 pm; 10 pm—11.45 pm
HHBM	P-au-Prince	6.16		48.66	9 am—12 pm
HJCD	Bogota	6.16		48.70	Around 2 pm
CBRX	Vancouver	6.16		48.70	11.30 am—4.30 pm
EQB	Teheran	6.15		48.74	1.30—6.30 am; News 2.45 and 5.15
GRW	London	6.15	S	48.78	9 am—1.30 pm; 10 pm—3.15 am.
CKRD	Winnipeg	6.15		48.78	9 am—12 pm
WBOS	Boston	6.14		48.86	6—8 pm
XGOY	Chungking	6.13		48.92	9.35 pm—1.30 am; News 12 and 1 am. Also heard around 3.45 am
CHNX	Halifax	6.13	N	48.93	Heard around 10 pm
VPD-2	Suva	6.13	X	48.94	Sundays only: 4—7.30 pm, News 6 pm
LRX-1	B'nos Aires	6.12	N	48.94	7 am—2 pm; 9.30 pm—1.30 am
GWA	London	6.12		48.98	6 am—12 pm; 145—6.30 pm
HP5H	Panama City	6.12		48.99	9 am—2 pm
XGOY	Chunking	6.12		49.02	9.35 pm—2.30 am
XEUZ	Mexico	6.12		49.02	Around 2—3 pm
WKTS	New York	6.12		49.02	4—6 pm
WOOW	New York	6.12	S	49.02	9.15 am—4.45 pm
WCRC	New York	6.12		49.02	Heard closing at 4.45 pm
GSL	London	6.11	S	49.10	10 am—2.45 pm
XGOY	Chungking	6.11		49.10	News at 12
CBFW	Montreol	6.09		49.25	9.30 pm—1.30 pm
GWM	London	6.09		49.26	No schedule.
ZNS-2	Nasau	6.09		49.25	11—11.15 pm; 3.45—4.15 am
VUD	Delhi	6.08		49.3	8.30 pm—2.30 om
VQ7LO,	Nairobi	6.08		49.32	2—5 am; News 2.15 am
WLWK	Cincinnati	6.08		49.34	10.30 am—2 pm; 2.15—6.30 pm
CKFX	Vancouver	6.08		49.34	11.30 pm—4.30 pm
CFRX	Toronto	6.07		49.42	9 pm—3.30 pm
—	Moscow			49.42	6.30—7.30 pm
GRR	London	6.07	S	49.42	2.45—7.30 pm; 10.30 pm—8.30 am
SBO	Stockholm	6.06		49.46	Try around 7.30 am
WCDA	New York	6.06		49.50	9.30 am—5 pm
—	Moscow	6.06		49.50	Heard around 12.30 am
GSA	London	6.05		49.59	12—2.30 am
		6.05	N	49.59	9.35 pm (News 12 pm)
XGOY	Chungking				
XETW	Tampico	6.04		49.66	10 pm—4 pm
WRUW	Boston	6.04		49.66	2.15—6 pm; 9.30 am—
AFHQ	Algiers	6.04		49.67	2—9 am; News 4 and 6 am
		6.03		49.73	9 am—1 pm; 1.30 am—4 am
HP5B	Panama City				
—	Moscow	6.03		49.73	9.40—10.19 pm
CJCX	Sydney (Nova Scotia)	6.01		49.92	9 pm—4.30 am; 8 am—1 pm
VUD-3	Delhi	6.01		49.92	10.25—11.45 am
GRB	London	6.01		49.92	2—3.30 pm
ZRH	Joh'burg	6.00		49.95	1—7 am
CFCX	Montreol	6.00		49.96	10 pm—4 am; 8 am—2 pm
ZOY	Accra	6.00		49.96	8.30—9.15 pm; 2.15—5.15 am News 5 am
XEBT	Mexico City	6.00		50.00	1 am—3.30 pm
XGOY	Chungking	5.99	N	50.04	News 12 am
CR7-	L' Marques	5.86	N	51.19	2.45—6.30 am

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

R.T.P. (Preston) wants further details of the Western Electric amplifier which has a single-ended power stage.

A.—The circuit is quite interesting, but rather elaborate. We have in mind to sketch out the fundamentals and publish them in an early issue. The type number is W.E.91A. Inverse feedback is used, together with a triode output valve. The feedback could be expected to flatten out the response curve.

●

V.M.S. (Bendigo) wants to know the definition of a beam power valve.

A.—A beam power valve is a tetrode with grids so constructed as to form the electron stream into a concentrated beam, resulting in higher plate efficiency and power sensitivity. The 6V6G and 6L6G are typical examples. Used in ordinary circuits as single-ended output stages they are both inclined to harsh tone due to a big percentage of distortion, but this can be overcome by inverse feedback circuit, push-pull arrangements or both.

●

"R. Engineer" (Adelaide) asks about coil manufacture.

A.—In the United States it is quite normall for coi specialists to make coils for all the leading makes of sets, but in Australia there are quite a few of the larger factories making their own coils, or at least they did before the war. We expect small factories specialising on one component each, and supplying the biggest factories, will be the popular order in the production game of the future.

THE RADIO ENGINEER

A radio engineer (as defined by a Signal Corps inspector) is a person who passes as an exacting expert on the basis of being able to turn out with prolific fortitude infinite series of incomprehensible formulas calculated with micrometric precision from vague assumptions based on debatable figures taken from inconclusive experiments carried out with instruments of problematical accuracy by persons of dubious reliability and questionable mentality for the dubious reliability and questionable mentality for the avowed purpose of annoying and confounding a hopelessly chimerical group of esoteric fanatics referred to all too frequently as **practical radio men.**

—FM Radio-Electronics.

M.F.B. (Brighton) asks the American price of the HRO communications set.

A.—The set lists at 329 dollars, bare with extra for speaker unit, power unit and certain coils, making a total gross price of about 400 dollars complete. At present nominal rate of exchange this is about £133, but landed cost could be expected to be at least £200, if you could get the special permission to import and the permission to expart the necessary cash. We don't consider you would have a chance in a million of getting this permission unless you have a mighty good reasan for wanting the set.

●

H.E. (Marrickville) wants us to settle an argument about radio set manufacture in Sydney.

A.—By 1929 there were quite a large number of radio set factaries in operation, and most of them were using Australian-made components throughout, with the exception of valves. Quite a few of the 1929 models were A.C. operated.

●

E.A. (New Farm) is involved in an argument about transmitter aerials.

A.—Whilst it is true that most transmitters aim to have a high aerial, it is not found that greater efficiency or coverage is obtained by building the most on the top of a hill. On the contrary, most successful transmitters are located on low-lying swampy land.

●

Q.B. (Killara) sends in a reply-by-mail query but asks "please design me an amplifier of about ten watts, with two carbon micraphone inputs, two magnetic pick-up inputs, worked so that they can all be mixed—no push pull."

A.—Your query is quite beyond the scope of our service and you do not appear to have the slightest idea of the amount of work which would be involved in even attempting to handle it in the briefest way. Incidentally, it would not be easy to get 10 watts output without using push-pull. Under the circumstances we are holding your fee to your credit.

●

A.R.T. (Boyer, Tas.) has an amplifier of which he is proud.

A.—Yes, we would appreciate details of the circuit for publication, although, frankly, we doubt if a large percentage of our readers are particularly interested in a mixer without lass af gain. It would appear, however, that there are other features of interest and every point helps.

TOUCHING

Curious to find how many folk whose profession or trade is electricity in one of its many applications do not know how to touch a conductor about whose liveness there is any doubt. Of course, the best of all methods is not to touch it at all; still, there are times when we have to. Nine people out of ten will apply the fingertips. Then if it does happen to be "hot" the muscles of hand and forearm contract and next instant the hand is holding on to it with a vice-like grip. I had quite a business the other day to free a radio mechanic who was firmly and agonisingly attached to a source of 300 volts DC, for there was almost no room to squeeze past him and get at the switch. If you are in any doubt and must touch, do so with the **backs** of your fingers. The muscular contraction which closes the hand then automatically removes them from the live conductor and there cannot be any gripping.

—"Wireless World" (Eng.)

"Amplifier" (Melbourne) tells us that the "Listener-in" and the Australian DX Club are again collaborating this year to stage an amplifier championship in Melbaurne, and asks if we are prepared to run an article of assistance to intending competitors.

A.—Many thanks for the information and the suggestion, which we will be pleased to act upon. As the contest is not to be held until October you will have plenty of time to get tuned up. We will be greatly interested in the contest and prepared to do everything passible to help.

Correct Answers to Radio Historical Quiz Questions on Page 19.

1. Benjamin Franklin, in 1733.
2. Thomas Edison in 1877.
3. Pierre and Eve Curie of France, in 1880.
4. George Ohm propounded the law named after him, in 1825.
5. Stephen Gray, in 1725.
6. The term "microphone" was coined by Sir Charles Wheatstone in 1827.
7. Thales of Miletus in 640 B.C. observed that amber, after being rubbed, acquired the electric property of attracting straws.
8. Van Musschenbroek of Leyden, in 1745.
9. Paul Nipkow, of Berlin, in 1884.
10. Heinrich Hertz, in 1886.

—From "Q.S.T."

Prices drop on these Six Eimac Valves

Vacuum valves are now being massed produced on a vast scale at Eimac. The use of new manufacturing techniques has effected great savings which Eimac is passing along to users. The new prices listed below are now in effect.

	Old Price	*New Price*
304-TH	~~$ 65.00~~	$ 50.00
304-TL	~~65.00~~	50.00
450-TH	~~75.00~~	60.00
450-TL	~~75.00~~	60.00
750-TL	~~175.00~~	135.00
1000-T	~~175.00~~	100.00
1500-T	~~225.00~~	185.00
2000-T	~~300.00~~	225.00

Write today for new price sheet which covers these changes and provides essential data on all Eimac valves. Remember Eimac valves are first choice of leading engineers throughout the world... first in the new developments in electronics.

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THIS MAN GOT HIS JOB BECAUSE HE W

WHAT'S IN YOUR FUTURE?

Will the end of the war find you looking around anxiously for any type of employment because you belong to the tragic ranks of the unskilled?

If so, get to work immediately and join the ambitious young men who realise that Radio offers them limitless opportunities for advancement and an assured future.

LOOK WHAT A.R.C. HAS DONE FOR THIS MAN

"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

GLUING WOOD WITH RADIO WAVES

Incredible as it may seem, an R.F. "spot-gluer" has been tested under Active Service conditions similar to those of ordinary production. Exhaustive tests have clearly demonstrated that this process can successfully be used for tacking together layers of wood veneer. This operation is necessary to mould plywood shapes, such as aircraft fuselages, wing elements, stabilizers, etc. Here is a great new application of Radio which speaks well for the future. Truly it may be said "Radio wonders will never cease."

SECURE YOUR POSITION IN THE POST-WAR WORLD WHILST FOLLOWING YOUR PRESENT OCCUPATION

YOU CAN START RIGHT AWAY

Of the many industries crying out for skilled men, none is more important to the Nation than Radio. We offer you the opportunity to enter Radio either in industry or in the fighting forces. Here are three good reasons why you will benefit if you become Radio Trained:—

1.—You will enter today's most progressive industry.

2.—You will be pulling your weight in the war effort.

3.—You will have a splendid career ahead of you when the war is over.

COSTS LITTLE

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

PREVIOUS KNOWLEDGE UNNECESSARY

You don't need a knowledge of Radio or Electricity. We'll give you all you need of both—you'll start at the beginning, building up knowledge just as carefully and systematically as you would lay brick after brick in its place when buliding a wall. You get the knowledge you want presented in a manner that makes it easy to learn FAST.

SEND FOR THIS FREE BOOK

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ADDRESS .....
..... A.R.W. 1

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