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AUSTRALIAN

INCORPORATING AUSTRALASIAN RADIO WORLD

Vol. 16. SEPTEMBER, 1951. No. 2.

1'6

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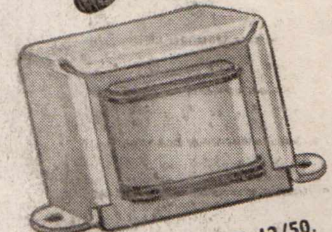
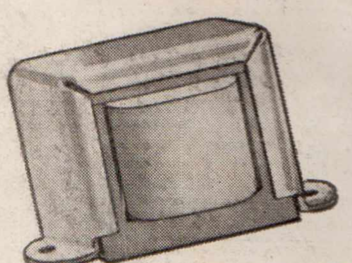


TYPE 12/50.
Inductance 12 Henries at 50 mA. D.C. with 10 volts 100 cycles A.C. superimposed.



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A MONTHLY PUBLICATION

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Vol. 16. SEPTEMBER, 1951. No. 2.

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OUR COVER

RADIOTRON VALVES UNDER FINAL TESTING.

The scene on this month's front cover depicts Radiotron Converter type valves undergoing a series of routine tests, some of which must be carried out in the screen room in the background.

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Editorial . . .

THE AMATEUR EXPERIMENTER

In these days of high scientific achievement is there anything the amateur can do that is likely to be of lasting value to radio?

There have always been amateur experimenters in many branches of pure and applied science, and no doubt there always will be. In days gone by, when the universities and learned societies knew no more about some phenomena than did the man in the street, scientific discovery was open to anyone with the inclination, time and disposition to study such phenomena in a logical and scientific manner, In fact, many important discoveries were made by men who today would certainly be classed as amateurs.

Now, however, the situation is different. The sum of human knowledge is so vast that no single brain can compass it. Not only must scientists or engineers specialise in a particular subject, but in a branch or even sub-branch of that subject, in order that new fields may be explored. On the face of things, the day has gone when theamateur with limited resources in equipment and scientific training, can pursue a line of experiment and produce results that will ever interest the expert scientist or engineer.

The face of things, however, is no more a reliable guide to truth than ever it has been; human knowledge may be vast, but what remains to know is always vaster.

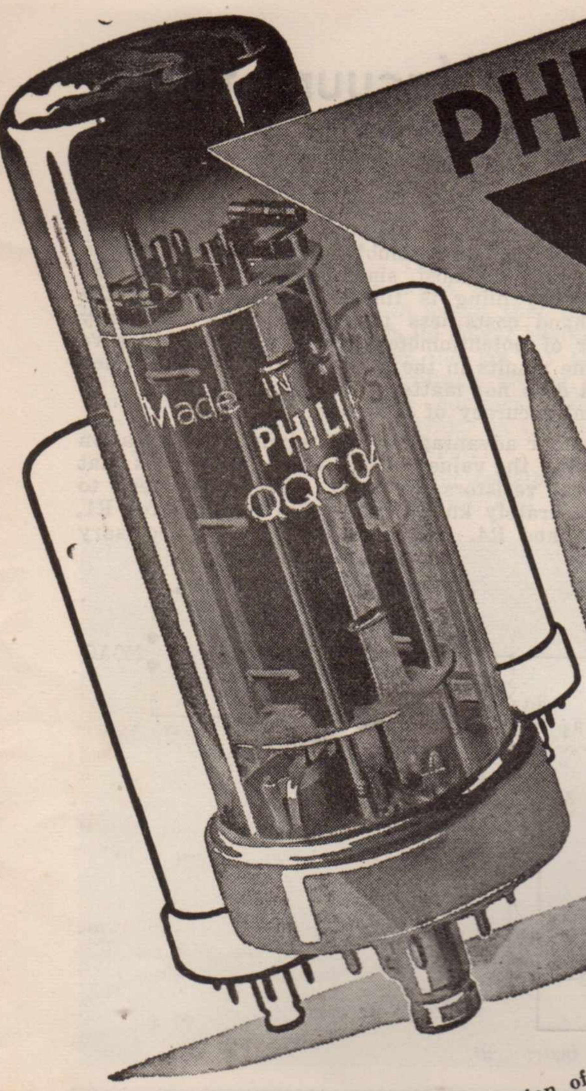
The day of the amateur experimenter is not past, and never will be — we trust. There are doubtless many experimenters who would like nothing better than to feel that, by their own efforts, they were advancing in some measure our knowledge of radio. For them will be a real incentive to apply the knowledge they have gained in creating more.

In our next issue is a short article describing a co-ordinated series of practical constructional articles which are to be presented in these pages under the collective title of the A.R. & E.—V.H.F. Programme. This scheme is a new departure, not only for this journal, but also, it is thought, for any technical periodical. The idea behind the series, and the scope of the articles will be described in the article reffered to above. On the receiver side, it is thought that our own ideas will in all probability be quite adequate, but apart from this, there is a great deal of room for difference of opinion and, in particular, for different requirements.

This applies more particularly to transmitting circuits. In addition to straight-out receiving and transmitting gear, there is the interesting problem of ancillary equipment. For V.H.F. bands, it is no less necessary than at lower frequencies to have available absorption frequency meters, modulation monitors, and the other small but invaluable pieces of equipment that enable one to work with so much more sureness, speed, and satisfaction. In fact, it is really more necessary to have these things on the V.H.F. bands than at lower frequencies.

The main idea behind the V.H.F. programme, is to assist those amateur transmitters who feel that with a little help in the way of suitable published articles, they could make a start in this new and intriguing territory. They will also, we hope, be of some value to those who have been put off by the difficulties, imagined, or real, of V.H.F. gear; from this it should not be inferred that the articles, or the equipment described in them, are elementary only. It is our theory that the amateur can build just as good transmitters and receivers for very high frequencies as he often does for the lower ones, and, what is more important, that the one is no more difficult than the other.

To this end, we would hereby invite any of our readers who expect to be taking an interest in the V.H.F. Programme, to send us their suggestion for any V.H.F. equipment they would like to see incorporated. We cannot, of course, guarantee to fall in with all suggestions, but will do our best to make the series as interesting and useful as possible to the greatest number of V.H.F. enthusiasts. In this way we too can play our small part in the advancement of Radio and Electronic knowledge.



PHILIPS TX valves top the VHF range

QQC04/15

The QQC04/15 is a double tetrode transmitting valve capable of providing an output of 20 watts at a frequency of 186 mc/s and 8 watts at 300 mc/s. This valve is not only entirely satisfactory for all normal transmitting and frequency multiplier applications but is particularly suited to mobile operation because it is *directly heated.* Heating time is approximately 2-3 seconds.

Characteristics

Filament Voltage	6.3 V.
Filament Current	0.68 A.
Plate Voltage (max.)	400 V.

Interelectrode Capacitances

Grid to Plate	0.05 pF
Input	5.7 pF
Output	1.7 pF

Valve fits standard 8-pin Loctal Socket.

QE04/10

The QE04/10 valve is an indirectly heated beam tetrode with aligned grid construction to minimise screen grid current. It is rated to dissipate a maximum of 7.5 watts in the anode. It is particularly suited for frequencies up to 150 mc/s both as an amplifier or frequency multiplier.

The QE04/10 has extensive application possibilities as an oscillator or frequency multiplier up to a frequency of 150 mc/s or even higher.

Characteristics

Filament Voltage	6.3 V.
Filament Current	0.6 A.
Plate Voltage (max.)	300 V.
Plate Current	25 A.

Interelectrode Capacitances

Grid to Plate	0.1 pF
Input	8 pF
Output	5.4 pF

Valve fits standard EF50 Base.

QQE06/40

The Philips QQE06/40 is an improved version of the 829B. The design of the valve incorporates features which produce considerably smaller output capacitances and which, therefore, result in higher resonant frequencies. (Approx. 500 mc/s.) In addition, because of the low inductances of the connections between the cathode and screen grid, more stable operation at high frequencies is obtained.

Characteristics

Filament Voltage		Filament Current	
Series	12.6 V.	Series	0.9 A.
Parallel	6.3 V.	Parallel	1.8 A.

Interelectrode Capacitances

Grid to Plate	0.08 pF
Input	6.7 pF
Output	2.1 pF

Fits standard 829B Socket, Type 40202.

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Part II (Conclusion)

THE CIRCUIT (Continued)

The input circuit is so arranged that the lower portion of the signal voltage divider, R3, is at the same time part of the filter which prevents signal frequency voltage from being applied to the grid of the meter valve. When the input signal is applied to the diode, the resulting negative D.C. output voltage is in the direction which decreases the plate current of the left–hand half of the 6SN7. Since the valve is a cathode follower, the cathode is driven negative by the same amount. But no signal is presented to the right-hand half of the 6SN7, whose

Readers will no doubt choose which method appeals to them most, since adjusting some carbon resistors by filing is time-consuming, but on the other hand costs less than buying the necessary number of potentiometers. Both methods will give the same results in the long run, though, and which is used does not matter from the point of view of the final accuracy of the meter.

A further advantage of not relying on calculation for finding the values of the series resistors is that if pre-set resistors are used, there is no need to have accurately known high-value resistors for R1, R2, R3, and R4. All that will then be necessary

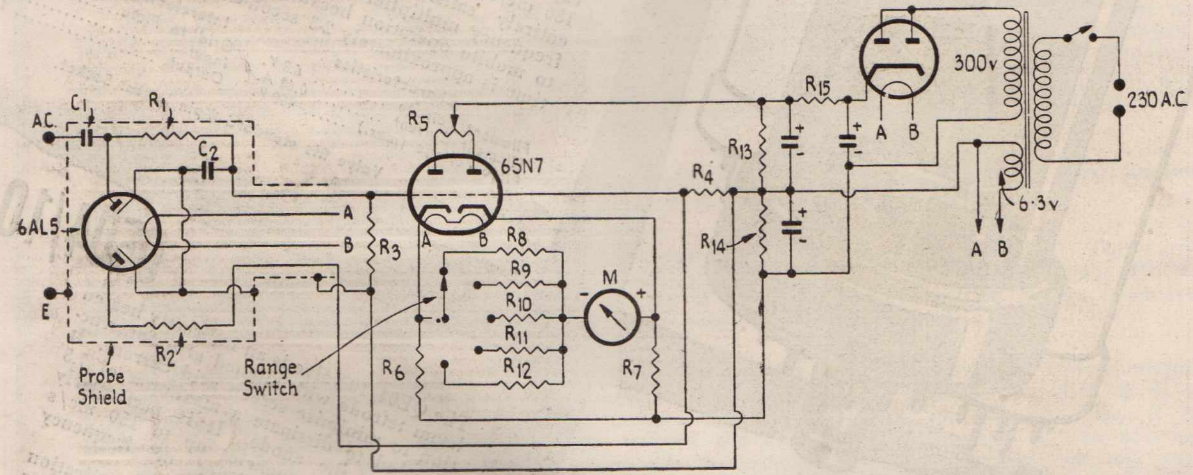


Fig. 1.—Full circuit of the instrument.

plate current does not change. A voltage thus exists between the two cathodes, and the meter is defected. Now because of the cathode follower action of the triodes, the cathodes are points of low impedance, and can thus supply a reasonably large current without causing any change in the voltage at either cathode. It is therefore possible to use the meter as a voltmeter, and provide it with multiplying resistors, just as is done in an ordinary multi-range voltmeter. It is possible to use a quite simple formula in order to work out the resistors that are needed for giving the required full–scale readings, but such a procedure will not give very good accuracy, because the formula contains a figure for the mutual conductance of the valve, and this is not accurately known. If it were, it would be entirely possible to put in calculated values for the meter series resistors, and thus avoid altogether the nuisance of calibrating the meter after its construction has been finished. Unfortunately it is not possible to do this, so in actual practice, we must either adjust some fixed resistors to exactly the values which give the desired full-scale readings, or else make part of each resistor variable, and pre-set them while calibration is being performed.

COMPONENT LIST

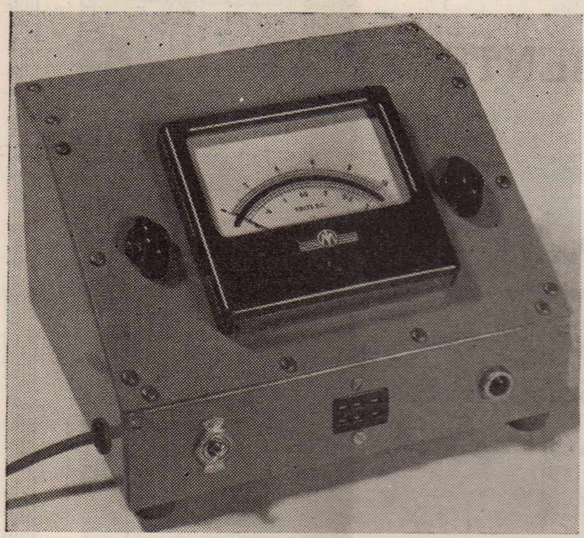
C1, 0.005 uf., 500v.
C2, 0.01 uf., 500v.
Electrolytics (unmarked on diagram) 8 uf., 450v.
R1, R2, 15 megs.
R3, R4, 10 megs.
R5, 5k. balancing pot.
R6, R7, 47k.
R8, 500 ohms, plus 250-ohm pot. in series.
R9, 2500 ohms plus 5k. pot. in series.
R10, 10k. plus 10k. pot. in series.
R11, 47k. plus 50k. pot. in series.
R12, 150k. plus 100k. pot. in series.
R13, R14, 33k.
R15, 5k.
Rectifier valve, 6X5-GT.

is to match R1, and R2, and R3 and R4. This can be done even if one has no means of accurately measuring high values of resistance, and the method to be used in this event will be described a little later.

The power supply is very simple, and uses a 6X5 as a half-wave rectifier, out of a 150v-a-side

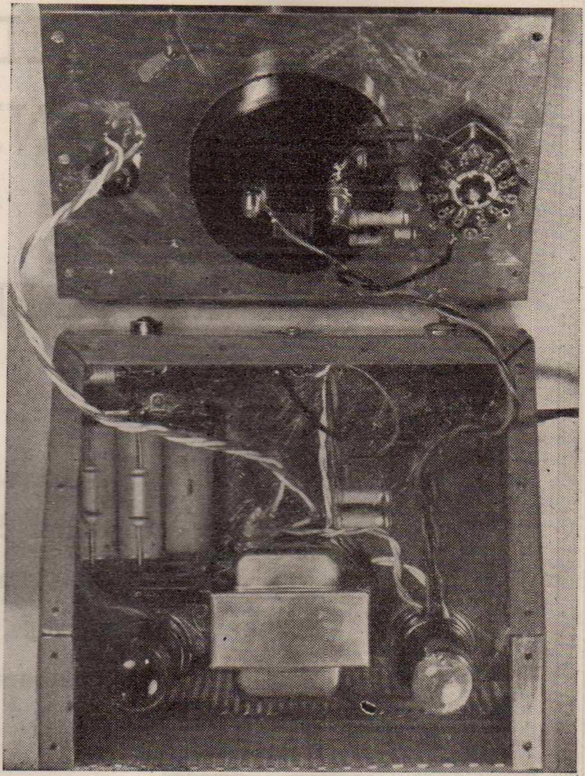
30ma. instrument transformer. The full 300 volts from the secondary is employed, the centre-tap being taped up and not used. Resistance smoothing is used, because very good filtering is not needed, and because it reduces cost appreciably. For the same reason, the 6X5 is used in preference to a small metal rectifier. The 6X5 does not need a seperate heater winding when 300 volts R.M.S. is applied to its plates, which means that the small instrument transformer, with its singel heater winding, is quite satisfactory for the job. At the output end of the filter is a voltage divider, giving equal positive and negative supplies, since the centre point of the voltage divider is earthed, and not the negative end of the supply,

The lower end of the cathode resistors is connected to the negative supply rail, and the plates



Panel view of the main portion of the V.T. Voltmeter. The socket on the front takes the connecting plug on the probe cable, the control on the left of the meter is the range switch, and that on the right is the zero-set potentiometer.

to the positive rail, while the grid return lead goes to the centre point., and is earthed to the chassis. It would have been possible to let the whole circuit float, not connecting it to the chassis at all, but although this would have one important advantage, it also suffers from rather a serious disadvantage, and it was decided not to use this method. If the whole circuit is left floating with respect to the chassis of the instrument, it would be possible to place both input terminals at any D.C. potential when taking a reading. That is to say, a direct measurement could be taken across the plate load resistor, or across the primary of a transformer connected in the plate circuit of an amplifier valve. It would, of course, be necessary to insulate the outer case of the probe if this were done. The disadvantage comes in the fact that it would still be necessary, if stray readings are to be avoided, to earth the "earthy" end of the probe through a condenser. It is earthed in this way, in any case, by the capacity chassis of the high--voltage secondary of the power transformer; the catch is that every time the input terminals of the probe are connected to a circuit the earthing condenser would charge up, and this takes place through the diode very quickly, giving a momentary but very large surge of voltage to the grid of the meter valve. This surge causes the meter to bang hard over



Inside view of the V.T.V.M.

unless it so happens that it is set to its highest voltage range, and because this behaviour is not very good for the movement, it was felt that it would be better to forego the facility of being able to have both input terminals "up in the air" to D.C., and give the added protection to the meter movement. It very seldom happens that a measurement with both input terminals above ground is essential, since in almost all cases the same answer can be had by connecting the "low" end of the input to the chassis of the equipment under test. The biggest disadvantage of this is that it is not possible to reverse the meter input leads in order to measure the negative peak voltage of the signal—the meter reads positive peaks only, on account of the polarity of the measuring diode.

CONSTRUCTION

The construction used for the prototype is well illustrated in the photographs and drawings shown herewith. The front cover shows the external form of the meter. The sloping panel type of cabinet is rather more trouble to make than the conventional box, but is well worth the extra ease with which the instrument can be read and used. The whole

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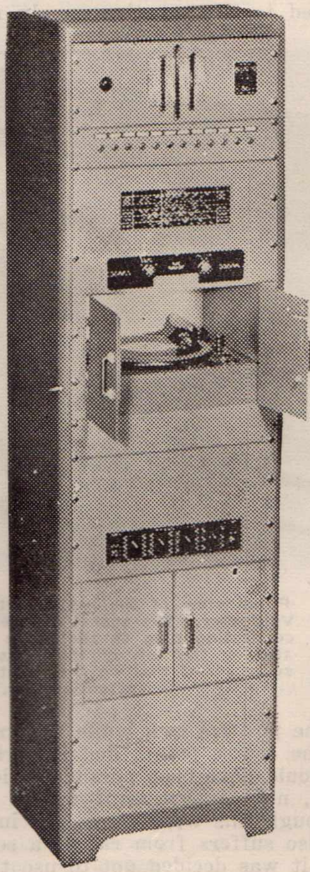

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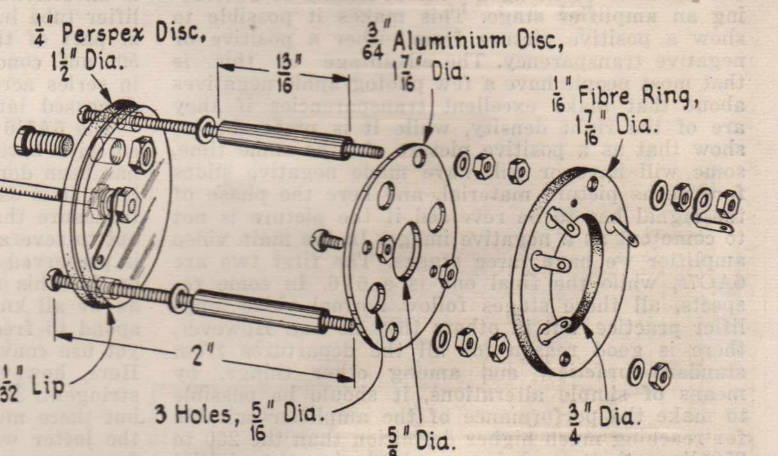
box is made in two pieces, as shown in the drawings, and it should be noted that the back is left open, or covered with wire gauze, so as to provide adequate ventilation. There is no chassis, in the conventional sense, everything being mounted directly on to either the inside of the box, or else to the front panel. This does not cause any hardship because there are so few parts, and because the run of the leads is not in the least important, the whole thing apart from the probe, being purely a D.C. device. Both valves are mounted on Amphenol sockets fixed in metal bases, of the kind intended to hold the sockets for through-chassis use. The socket, however removed and turned upside down before being replaced, and a hole is bored in the brass base so that the leads can be brought out. The bunched leads can be seen issuing from the sockets in the inside photograph. At the back of the box, in the centre, is mounted the power transformer, with the 6SN7 to the right (in the photograph) and the 6X5 on the left.

back. Three were used because it is impossible for the instrument to wobble, either because of inaccuracy of the construction, or when placed on a surface that is not level.

HOW TO SELECT THE CRITICAL RESISTORS

By the critical resistors we mean R1 to R4 inclusive. The range setting resistors do not count, since they are to be separately adjusted during calibration anyway, and because as long as they are adjustable, we do not need to know their value exactly.

The same thing goes up to a point, for the high-value resistors in the diode circuit that we are now discussing. Their exact values are not so important as the fact that both pairs must give the same ratio of voltage division.. On this will depend to some extent, the manner in which the balanced diode circuit is able to compensate for fluctuations in the heater voltage that will arise as a result of



"Exploded" view of the construction of the probe.

The electrolytic condensers can be seen mounted on insulated tag strips close to the rectifier tube, while a further pair of strips is provided on the other side of the floor to take the resistors R3 and R4, which can just be seen in the photo. On the front of the box are mounted the on/off switch, the socket for the probe cable, and a lamp bezel, The meter, range switch, and balancing potentiometer, are all mounted on the panel. The series resistors are mounted between their respective contacts on the switch, and a short length of heavy wire soldered to a stout lug gripped by the nearest meter terminal. The mechanical part of the construction is in no way critical, and there is no necessity at all for sticking to the original layout. The probe construction is another matter, however, and builders would be well advised to keep to the layout suggested in the photograph shown in last month's instalment of this article. Here we have given an exploded diagram of the construction, which, in conjunction with the photograph, should enable the probe to be duplicated quite easily. The construction of the main box was of aluminium, which is much easier to work, especially for fairly complex shapes like this one, and the panel is held on with self-tapping screws. Rubber feet are provided, two at the front, and one in the centre at the

normal line voltage variations. It will be seen from the circuit diagram that R1, and R2 are 15 megs, each, and that R3 and R4 are 10 megs. It would be very convenient if we could go out and buy resistors of these values with tolerances of, say, 1 per cent., but unfortunately, we cannot, and must make the best of the wide-tolerance resistors that can be had. The starting point, therefore, is to procure a number of ½- or 1-watt resistors whose nominal value is 10 megs. The first step is to build the rest of the circuit in its entirety. We then have a D.C. V.T. voltmeter that can be used as a means of matching the resistors. One of the 10 meg. resistors—it does not matter which—is temporarily wired into the position of R4, and another as R3. Next, we take a low-resistance potentiometer, say, 1000 to 5000 ohms, and connect it across a single 1½-volt torch cell. The positive end of the combination is then earthed to the chassis, and the first of the resistors to be tested is connected between the moving arm of the potentiometer and the socket pin which connects to the input grid of the 6SN7.

With this set-up, it can be seen that two of the unknown resistors are made into a voltage divider, which applies a fraction of the output of the cell to the input grid of the 6SN7. The procedure is

Continued on Page 30

The "R. & E." Amateur Television Project

Part VI

The only remaining portion of the original block diagram that has yet to be described is the circuit of the electron-multiplier photo-cell, and the video amplifier which brings its output signal up to usable proportions.

The circuit, shown herewith, uses four valves in addition to the photo-cell. First comes a 6AU6 miniature, used as a wide–band video amplifier stage, with shunt-peaking compensation, and this is followed by a 6J6, arranged as a cathode-follower type of phase inverter. These two valves are mounted on a small chassis with the photo-cell, and form a sort of head amplifier or pre-amplifier. The 6J6 acts either as a straight-forward cathode follower, or as a phase inverter, and enables the polarity of the signal to be changed without adding or subtracing an amplifier stage. This makes it possible to show a positive picture from either a positive or negative transparency. The advantage of this is that most people have a few photographic negatives about that make excellent transparencies if they are of the right density, while it is preferable to show that as a positive picture. At the same time, some will have or will have made negative slides for use as picture material, and here the phase of the signal has to be reversed if the picture is not to come out as a negative image. In the main video amplifier we have three stages. The first two are 6AC7s, while the final one is a 6V6. In some respects, all these stages follow normal video amplifier practice, but in others they do not. However, there is good reason for all the departures from standard practice, and among other things, by means of simple alterations, it should be possible to make the performance of the amplifier suitable for reaching much higher definition than the 200 to 250 lines that are being resolved in the initial equipment. It might have been possible to do the present job with fewer tubes, but had this been so, it would certainly have been at the expense of simplicity and ease of adjustment. Let us then examine the circuit in some detail.

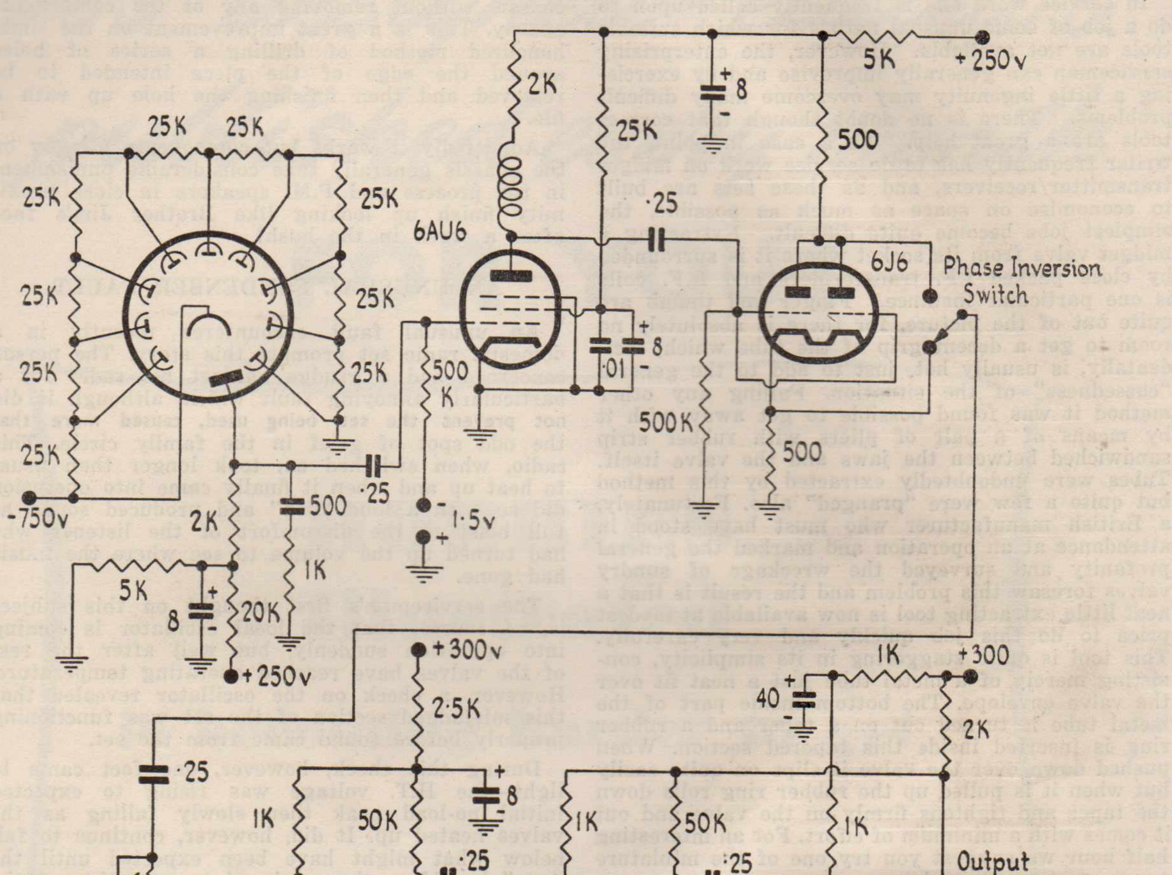
DETAILS OF THE VIDEO CIRCUIT

The first thing of interest is the 931A multiplier photo-cell and its circuit. The cell consists of a conventional photo-cathode, which is the curved electrode in the middle of the symbol. This is the electrode on which the light is received, and which emits electrons in proportion to the amount of light that strikes it. These electrons are attracted to a second electrode called a **dynode**, which is about 75 to 100 volts positive with respect to the cathode. The electrons strike the dynode and from it dislodge secondary electrons, greater in number than the original ones. Thus, a larger stream of electrons issues from the dynode than originally hit it, and the beam of electrons is said to have suffered electron multiplication. These electrons are now attracted by a second dynode, about 75 volts positive with respect to the first, and the multiplication process occurs again. Altogether there are nine dynodes, and after impinging on each one, the electron stream is augmented in size. All that is necessary to obtain this sort of amplification is to have the dynodes at successively higher positive potentials with respect to each other, and this is the purpose of the string of 25k. resistors, connected to a voltage of—750 or so. The last dynode is at earth potential. The fact that a negative supply is used has no effect on the operation of the system, but it makes the rest of the circuit easier to arrange. The electrons from the last dynode are collected by a plate, or anode, which is made more positive than the last dynode, and which is treated so that it does no secondary emission. The current drawn by the anode is passed through a small load resistor of 2000 ohms, and in doing so causes the signal to appear as a voltage drop across it. A coupling condenser therefore transfers this voltage, which is an alternating one, to the grid of the first amplifier tube in the normal way, and the most unusual part of the circuit is completed, except for the 500 uuf. condenser and 1000-ohm resistor which are in series across the 2k. load resistor. These will be discussed later under the heading of adjustments.

The 6AU6 has its cathode earthed, and is provided with battery bias, from a small 1.5v. cell. This has been done in order to avoid the use of cathode bias. It is essential in the video amplifier, not only to ensure that the high-frequency response extends out to several megacycles, but that the low response is preserved down to well below 25 c/sec. The reason for this may not be immediately apparent, for as we all know, normal audio amplifier circuits respond to frequencies as low as this quite well, and yet use conventional cathode biasing arrangements. Here, however, the requirements are rather more stringent. Not only must the response be retained, but there must be very little phase shift, and it is the latter which is the limiting factor in the performance, rather than the plain amplitude or response. We have four stages here, and if normal cathode biasing were used in all of them, the low–frequency phase response would not be nearly good enough, and would cause undesirable effects in the picture. The simplest cure is to do away with cathode bias altogether, and use batteries, which can take up very little room, and have no disadvantages in experimental gear. Note also the very heavy bypassing of the screen of the 6AU6 and the 6AC7s. Contrary to audio practice, 8 uf. electrolytic condensers are used here, and the reason is again to be found in the need for preserving the low frequency response. Since electrolytic condensers are not very effective bypasses at high frequencies, they are paralleled in all cases by 0.01 mica condensers, which look unnecessary, but are actually essential. Another point also connected with the low frequency response, is the use of 0.25 uf. grid coupling condensers.

The coil in the plate circuit of the 6AU6 is a high-frequency peaking coil, which, when properly proportioned, extends considerably the high frequency response. In the first place, high frequency response is extended by using very low values for the plate load resistors of all the amplifier stages. This renders the input and output capacities, of the valves, which tend to bypass high frequency components to earth, much less effective, according to

Photo-cell and Video Amplifier Circuit



the well-known principle, by virtue of which capacities become less effective as bypasses the lower the resistance across which they are connected. The coil forms a very low Q tuned circuit, together with the stray capacities, and makes use of them to boost the higher frequencies that would have been lost otherwise. In the present case, the coil consists of a single-layer winding of 40-gauge wire, wound to a length of 7/16in., on a half-inch diameter former.

At the input of the first 6AC7 will be found the first main departure from standard practice. We have here a voltage divider made up of a 100k. resistor and a 2k. resistor, with the output to the grid of the tube taken from the junction. Thus, only about one-fiftieth of the voltage available from the 6J6 is applied to the next stage. As might be expected, there must be a very good reason for, doing a thing like this and there is. The fact is that the network in the grid circuit of the first 6AC7 is a frequency compensating device, whose job it is to cause a great increase in the amplification at the high video frequencies, compared with that at low. If the 60 uuf. variable condenser were omitted, all frequencies would be equally attenuated, but as it

Continued on Page 32

IN TUNE WITH THE TRADE

In service work one is frequently called upon to do a job of some unusual nature for which suitable tools are not available. However, the enterprising serviceman can generally improvise and by exercising a little ingenuity may overcome many difficult problems. There is no doubt though that correct tools are a great help. As a case in point, the writer frequently has to do service work on midget transmitter/receivers, and as these sets are built to economise on space as much as possible, the simplest jobs become quite difficult. Extracting a midget valve from its socket where it is surrounded by close packed I.F. transformers and R.F. coils is one particular instance. Finger and thumb are quite out of the picture, for there is absolutely no room to get a decent grip of the tube which, incidentally, is usually hot, just to add to the general "cussedness" of the situation. Failing any other method it was found possible to get away with it by means of a pair of pliers with rubber strip sandwiched between the jaws and the valve itself. Tubes were undoubtedly extracted by this method but quite a few were "pranged" also. Fortunately, a British manufacturer who must have stood in attendance at an operation and marked the general profanity and surveyed the wreckage of sundry valves foresaw this problem and the result is that a neat little extracting tool is now available at modest price to do this job quickly and very carefully. This tool is quite staggering in its simplicity, consisting merely of a metal tube just a neat fit over the valve envelope. The bottom inside part of the metal tube is turned out on a taper and a rubber ring is inserted inside this tapered section. When pushed down over the valve it slips on quite easily but when it is pulled up the rubber ring rolls down the taper and tightens firmly on the valve and out it comes with a minimum of effort. For an interesting half hour we suggest you try one of the miniature types on your finger!

This same manufacturer has also produced another tool which has proved its worth for straightening and aligning the pins of miniature button base valves. This consists of a steel plate with funnel-shaped holes to guide the pins of the valve into the jig. Side supports to the tool keep the valve pins straight with respect to the valve itself.

These tools also bring to mind another very valuable asset to the workshop which is available locally in a variety of sizes—this being a very effective chassis hole cutter. Many are the times a serviceman finds it necessary to cut a hole in a chassis perhaps for mounting an electrolytic or an extra valve or even perhaps the cutting out of a new chassis from the blank state. This particular tool cuts a neat, well-finished hole and by a clever method of shaping the male portion of the cutter spreads the cutting pressure fairly evenly besides bending the blank so that it is easily removed from the tool when the operation is completed.

The cutting pressure is applied by means of a screw shaped to take the Allen wrench lever provided and this is constructed in such a manner that it is quite simple to cut a hole in an assembled chassis without removing any of the components nearby. This is a great improvement on the time-honoured method of drilling a series of holes around the edge of the piece intended to be removed and then finishing the hole up with a file.

Admittedly it works but components already on the chassis generally take considerable punishment in the process and P.M. speakers in close proximity finish up looking like Brother Jim's face after a week in the bush!

AN UNUSUAL CONDENSER FAULT

An unusual fault encountered recently in a domestic radio set prompts this story. The person concerned had a grudge against his radio for a particularly annoying fault which, although it did not prevent the set being used, caused more than the odd spot of grief in the family circle. This radio, when switched on, took longer than usual to heat up and when it finally came into operation did so with a loud "pop" and produced sound at full blast to the discomfort of the listener who had turned up the volume to see where the music had gone.

The serviceman's first thought on this subject is, of course, that the local oscillator is coming into operation suddenly, but well after the rest of the valves have reached operating temperature. However, a check on the oscillator revealed that this misjudged section of the set was functioning properly before sound came from the set.

During this check, however, one fact came to light—the H.T. voltage was rising to expected initial no-load peak then slowly falling as the valves heated up. It did, however, continue to fall below what might have been expected until the "pop" heralding the coming into operation of the radio sent the B voltage up to normal level. Condensers in general now became suspect but a quick check on all likely offenders revealed nothing. At this stage that sixth sense which all radiomen develop, suggested measuring the bias voltage on the grid of the output valve; this bias being developed across a resistor network in the centre tap of the power transformer secondary. Here things started to go all wrong, for instead of the expected negative bias a strong positive voltage was present until the "pop" reversed the order of things and voltages became normal. The fault was now very apparent—the coupling condenser was obviously breaking down on the high initial B voltage and impressing a positive voltage on the grid of the output valve. As this valve warmed up it drew progressively heavier current until it pulled the high tension down to such a level that the coupling condenser sealed itself off with a "pop" and the set came into operation suddenly. The B voltage, of course, rose to normal but this apparently was not sufficient to cause the condenser to break down thereafter while the set was running. A new coupling condenser of the appropriate type rectified matters and the owner, now reconciled to his wayward music box, departed in pleasanter frame of mind.

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NOVICE SET BUILDING

A SECTION FOR THE BEGINNER

THE ALL WAVE ONE (PART 2)

When describing the All Wave One in our last issue, we stated that this month we would give some attention to the general operation of the receiver, but before proceeding further it is essential to give a word of warning to beginners and advanced constructors alike.

As a regenerative detector is in actual fact an oscillator when operating under certain conditions, it can be a serious source of interference to other neighbouring receivers. We therefore draw your attention to the following regulation which states:

"In the case of receiving apparatus used on frequency bands reserved for broadcasting. (a) It shall be an offence against these regulations for any licensee or other person to use, or for any licensee to permit the use of, any receiving set in an oscillating condition to the detriment of reception by other licensees."

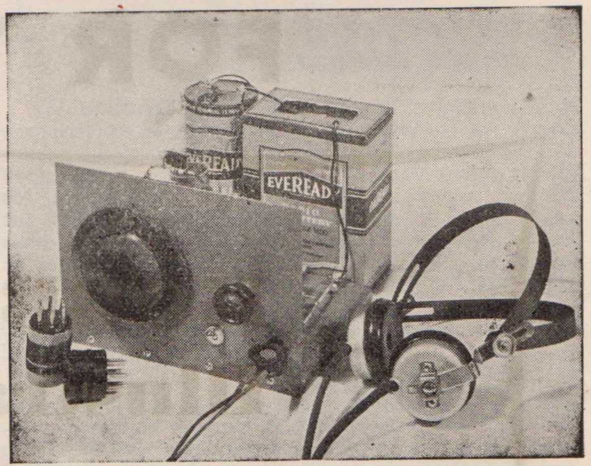
Summing up, then, it is definitely illegal to operate a regenerating detector, in an oscillating condition, unless preceded by a stage of radio frequency. It is much better to exercise care in manipulation than to invite the attention of your local radio inspector.

Unless great care is paid to the construction details of the All Wave One many troubles may be introduced which may have serious effect on the overall effiency of the receiver. The most common and at the same time the most serious trouble is the "fringe" or "threshold" howl. The howl is usually apparent when the reaction is adjusted to the most critical point where oscilation is barely maintained. Obviously "fringe" howl, if particularly bad, will render DX-ing almost impossible. It frequently occurs when the detector output is fed into an inductive load such as transformer coupling to an audio stage. The All Wave One uses resistance coupling, which reduces howl to a minimum, but it may also be caused by the grid condenser—grid leak combination. There is no set value of these components to eliminate howl; consequently various combinations should be tried. Howl is usually caused by stray R.F. getting into the audio stage, and various precautions are: a very small fixed condenser placed each side of the R.F. choke in the detector output to earth, or connecting a .0003 mfd by-pass condenser and choke in series with any long speaker or 'phones lead carrying plate current.

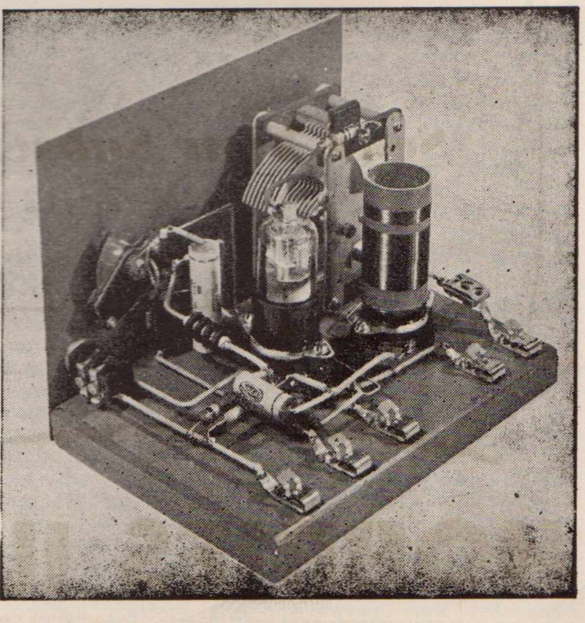
Another difficulty, particularly in the case of the beginner, is that of obtaining even reaction over the entire short-wave or broadcast bands. The specifications for coil dimensions are for the average number of turns required for the reaction coil. The turns may vary in number, due first to unavoidable differences in circuit capacity when contsructing the set, and also to variations in H.T. voltage, so it is quite possible that the newly constructed set will not oscillate until an extra turn or so has been added to the reaction coil. The following procedure is an excellent one for finding the exact number of reaction coil turns with the minimum trouble. Tune to the lowest frequency of the band, adjust the reaction coil turns, so that the receiver will just oscillate when the reaction condenser is fully closed. The same procedure will apply for all bands.

Another trouble frequently found on shortwave bands is "dead spots", the effect being that the receiver will not oscillate at certain points on the dial. The trouble is usually due to absorption at that frequency by the aerial, which happens to resonate at that particular point.

Last, but by no means least, the aerial and earth system must be the best possible. Most installations will be governed by their particular localities, but where circumstances will allow, the aerial should be 100 feet from insulator to insulator and 30 feet or more high. The earth system should receive as much care as the aerial, and a good connection made to the water pipe by means of a good earth clip or a soldered joint. As an alternative, six feet of water pipe driven into moist ground may be used.



Front Panel View

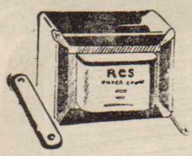


Rear View of Receiver

See that the BIG 3 in your circuit is R.C.S.

Coils
I.F.'s
Filter Chokes

The true basis of performance of any circuit is *stability*. That is why enthusiastic amateurs and radio engineers everywhere prefer to use R.C.S. components, particularly R.C.S. I.F.'s coils and filter chokes, because not only are R.C.S. components built to the very *highest and latest standards*, but the processes of their manufacture are such that *guarantee stability*. R.C.S. components pass through many tests during their assembly, and are thoroughly *impregnated against drift* due to moisture penetration or the extreme and sudden variations of climatic conditions experienced in Australia. If you're contemplating a new rig, piece of new gear, then why not *ensure peak performance right from the start.* Specify R.C.S components throughout.



Filter, Audio & Vibrator Chokes

TC60 100 M/A 30 H. Filter Chokes.
TC65 50 M/A 30 H. Filter Chokes.
TC66 New 14/60 Filter Choke.
TC80 150 M/A 20 H. Filter Choke.
TC81 200 M/A 20 H. Filter Choke.
TA4 100 H. 1000 ohm. D.C. Res. Audio Choke.
TC58 Low Tension 3 Amp. 50 M/H Vib. Choke.
TC70 High Tension 75 M/A 50 H. Vib. Choke.

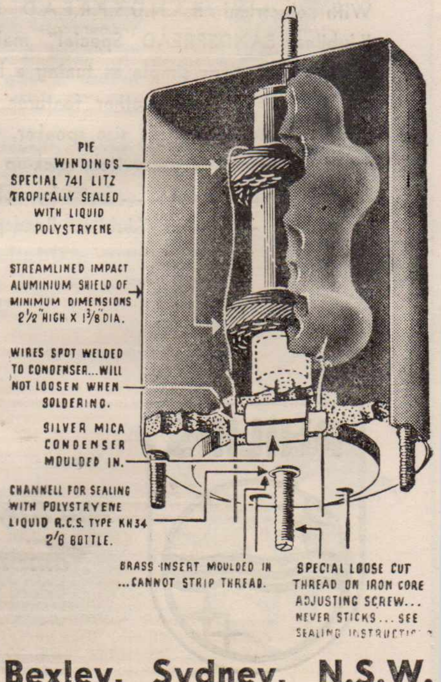
If your local retailer cannot supply, write us and we will arrange for your retailer to receive supplies immediately, or we'll advise you where supplies can be obtained.

Coils

E356 455 K.C. I.C. B'cast Aer.
E357 455 K.C. I.C. B'cast R.F.
E358 455 K.C. I.C. B'cast Osc.
E342 455 K.C. Air Core B'cast Aer.
E343 455 K.C. Air Core B'cast R.F.
E344 455 K.C. Air Core B'cast Osc.
E345 460 K.C. I.C. B'cast Aero.
E346 460 K.C. I.C. B'cast R.F.
E347 460 K.C. I.C. B'cast Osc.
E352 Midget Magnasonic B'cast Aer.
E353 Midget Magnasonic B'cast R.F.
E354 Midget Magnasonic B'cast Osc.
T90 I.C. Reinartz.
T89 T.R.F. Air Core Aer.
T88 T.R.F. Air Core R.F.
T87 T.R.F. Air Core R.F. with Reaction.
H121 Short Wave 13.42 metres I.C. Aer.
H122 Short Wave 13.42 metres I.C. R.F.
H123 Short Wave 13.42 metres I.C. Osc.
H124 10 meter Air Core Aer.
H125 10 metre Air Core R.F.
H126 10 metre Air Core Osc.
H127 20 metre Air Core Aer.
H128 20 metre Air Core R.F.
H129 20 metre Air Core Osc.
H130 40 metre Air Core Aer.
H131 40 metre Air Core R.F.
H132 40 metre Air Core Osc.
H133 80 metre Air Core Aer.
H134 80 metre Air Core R.F.
H135 80 metre Air Core Osc.
H136 B'cast Unshielded Aer.
H137 B'cast Unshielded R.F.
H138 B'cast Unshielded Osc.
F125 Std. 6in. dia. Loop Aer.
F126 Midget 4in. dia. Loop Aer.

Intermediate Transformers

IF170 Std. 455 K.C. 1st stage I.C.
IF171 Std. 455 K.C. 2nd stage I.C.
IF172 Std. 455 K.C. 1st stage I.C.
IF173 Std. 455 K.C. 2nd stage I.C.
IF174 Std. 455 K.C. low gain I.C.
IF162 Std. 460 K.C. square can 1st stage.
IF163 Std. 460 K.C. square can 2nd stage.
IF164 Std. 460 K.C. square can low gain.
IF168 Midget Magnasonic 1st stage I.C.
IF169 Midget Magnasonic 2nd stage I.C.
IE74 Std. 175 K.C. 1st stage I.C.
IE75 Std. 175 K.C. 2nd stage I.C.
IF180 10.7 Meg. I.C.
IF181 Ratio Detector.



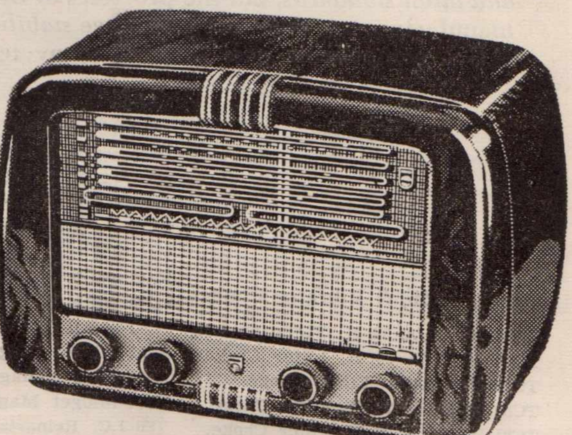
R.C.S. RADIO PTY. LTD., 651 Forest Rd., Bexley, Sydney, N.S.W.

Become a Direct Subscriber to this Journal and receive your Copy early

See page 33 for Subscription Form :: Also Advise Your Friends

HERE'S a compact, 5-valve, table-model radio of outstanding POWER. It gives completely effortless reception — even to the most remote short-wave stations. Very few bigger radios (even 6-valve models) can match its amazing distance-getting ability.

With electrical B.A.N.D.S.P.R.E.A.D tuning, Philips "Jubilee BANDSPREAD Special" makes short-wave station location as simple as tuning a local broadcast station. It has many other features too, including multi-purpose valves, full size speaker, 4-position tone control, in-built on/off switch, pick-up terminals, de-luxe moulded cabinet . . . but why not see and hear it yourself — Philips "Jubilee Bandspread Special"



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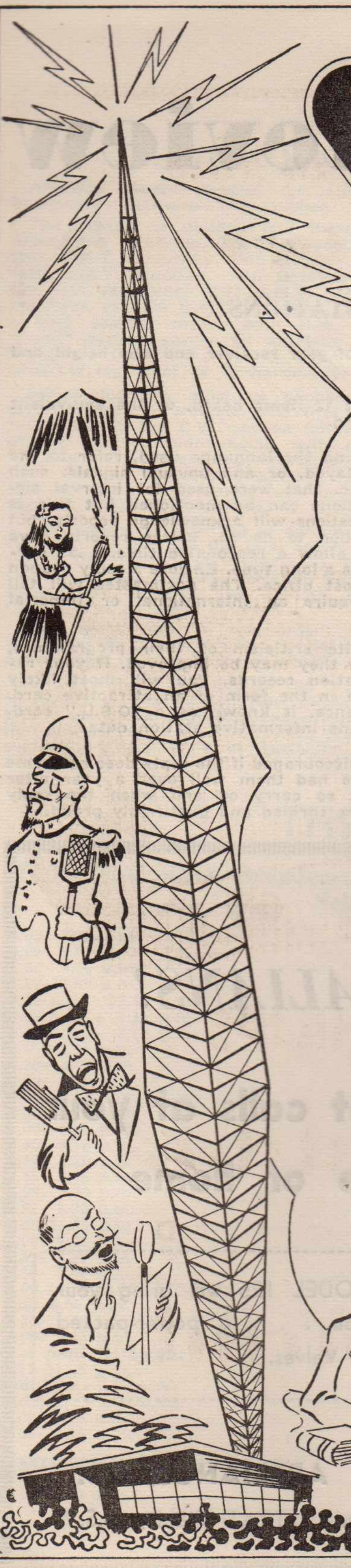
Special

MODEL 124

PHILIPS

The Royalty amongst Radio

. . . it's the ONLY 5-valve, dual-wave, table radio in Australia with electrical bandspread tuning and complete short-wave coverage.



International Broadcasting and SHORT-WAVE REVIEW

BUSMAN'S HOLIDAY.

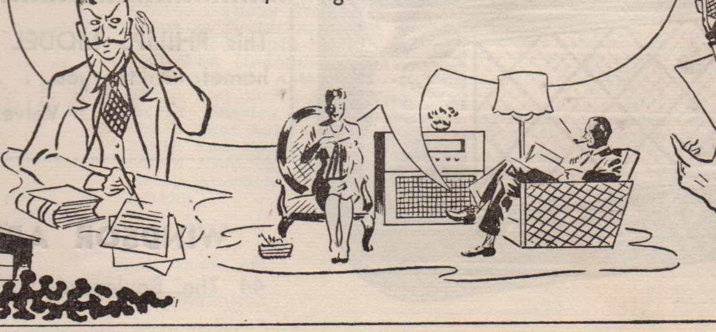
Quite recently when on vacation up in the delightful Murrumbidgee Irrigation Area I found myself in front of a radio set, not my own 9 valve receiver, but a small bedside 4 valve belonging to mine host at the Yenda Hotel, and at his request. . he knows my interest in short-waves . . . I gave him an interesting demonstration of just what can be heard on this midget receiver, and with only 14 feet of aerial hanging on the picture rail.

Just as I have always maintained, there is a terrific amount of enjoyment to be had from an inexpensive set.

I do not know why it is but so many I have come across are afraid to tune to the short-waves . . . they appear to be frightened that by altering the change-over switch that it may throw the receiver out of gear . . . it will not, and I venture to suggest if they once do it, and by following the notes on reception in these pages, they will get a never dreamed of thrill.

London, New York, San Francisco, Delhi, Stockholm, etc., and if you want it Moscow can be heard at remarkable strength and with surprising clarity. And do not forget you have our own "Radio Australia" sending out their messages and delightful programmes to over-seas countries. Try it and you will find the World at your finger tips'.

Refer Pages 16 to 21



Short-Wave Review

Conducted by L. J. Keast

HOW TO SEND A REPORT ON OVERSEAS STATIONS.

A further letter from Mr. Anderson shows that with his new receiver his loggings have improved but he seems a little discouraged that he has not had more verifications of his reports. He has asked me to let him know how to prepare a report as he thinks maybe he has omitted to give the information required. As more and more are taking to Dx-ing I am printing in this issue information I prepared many years ago for one of the biggest Radio Manufacturers in Australia and which should help others who are in the same doubt as Mr. Anderson.

1. First of all be sure to give your name and address. You must mention the State and Country, as your report may be going to some station that has not the remotest idea where your town is unless assisted as advised. The engineers will appreciate it if you can give them your lititude and longitude. (Sydney, New South Wales, is Lat. 33.55 S., Long. 151.12 E.)

2. Give the date of the programme you are reporting. To avoid confusion, write the date out fully, e.g. May 1st. 1951. This is important, because if shewn as 1/5/51 it would be taken in America as January 5th. 1951.

3. Give the call-sign and the wave-length or frequency you are reporting.

4. It will be a gracious courtesy to shew THEIR time as well as your own if you can.

5. Give particulars of your receiver and also height and length of aerial.

6. Tabulate at least 12 items heard, or the equivalent of 30 minutes listening.

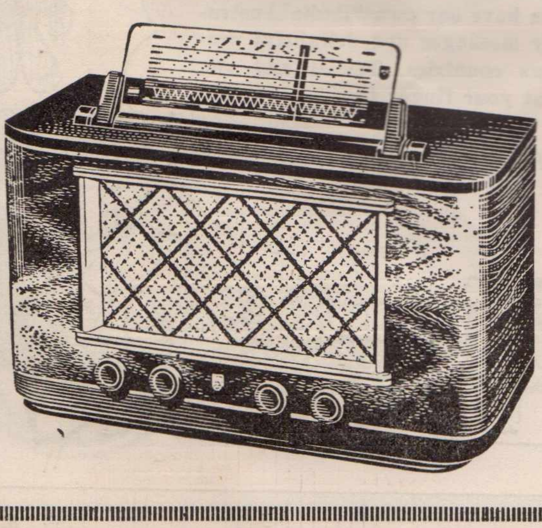
If unable to understand the language used, refer to the title of any music played, or and unusual signals, such as gongs, chimes, etc. that were used for interval signals. Weather conditions can be mentioned but this is not essential. Most stations will acknowledge reports, but are under no obligation to do so, unless reports have been solicited. Then allow a reasonable time. . .as surface mail to-day takes a long time. Enclose a reply coupon procurable at any post office. The postmastes will tell you whether you require an International or Imperial Coupon.

Some stations invite criticism of their programmes, others ask as to how they may be improved. If your report tallies with station records, you will most likely receive a verification in the form of an attractive card, which in radio parlance, is known as a "Q.S.L." card. Quite often it contains informative station data.

Finally, do not be discouraged if the reply does not come along quickly. I have had them well over a year after the report was sent so carry on and when the reply does come you will be thrilled and gustifiably proud.

ATTENTION NEW AUSTRALIANS!

IMMEDIATE DELIVERY



Our agent calls at your camp or home

This PHILIPS MODEL 125 will bring your hometown to you . . . 6 power-packed Valves.

WINDSOR APPLIANCE CO.

44 The Boulevarde, STRATHFIELD, N.S.W.

AUSTRALIAN DX's

Amateur Radio Contest for amateur operators and Shortwave listeners—The Jubilee VK-ZL Contest.

The contest is divided into three sections—C.W. telephony and receiving. The C.W. section will commence at 0001 G.M.T., Saturday, 13th October, and will conclude at 1200 G.M.T., Sunday, 14th October. The telephony section will commence 0001 G.M.T., Saturday, 20th October, conclude at 1200 G.M.T., Sunday, 21st October. The receiving section covers both C.W. and telephony. The "open" section covers all amateur bands in either telephony or C.W. or any one band in either section. A separate log must be forwarded for all sections entered.

Serial numbers must be exchanged during the Contest by amateur stations. The first three figures will be the R.S.T. in the C.W. section followed by serial number of the contact commencing with any number between 001 and 100 for the first contact, and increasing in value by 1 for each successive contact. In the Telephony section the first two figures will be the R.S. report and then as in the C.W. section.

The method of scoring is simple. One point is scored for each contact and the final score is obtained by multiplying the number of contacts by the number of countries or VK-ZL Districts work on all bands. Each United States call district and British Isles prefix will be regarded as separate countries.

Logs must show in this order: Date, time (G.M.T.) band call of station worked, serial number sent and received and new country or VK-ZL district worked.

A cup will be awarded to the highest scoring station in Australia and also in New Zealand in both the telephony and telegraphy sections whilst a plaque or medallion will go to the highest scoring station in both of these sections in each state of Australia and district of New Zealand.

Certificates will be presented to other place-getters.

Trophies and certificates will also be awarded in connection with entries from other countries, but the Contest Committee reserves the right to decide the type and number of prizes or certificates. This will depend entirely on the number of logs received from any particular country.

The New Zealand Association of Radio Transmitters is co-operating with the Wireless Institute of Australia in conducting the Contest.

Overseas logs should be received by the Contest Manager, Box 1734, G.P.O., Sydney, Australia, not later than 31st January, 1952. Australian and New Zealand logs should be in Sydney not later than 30th November, 1951. Every contestant will receive a copy of the results, together with a QSL card acknowledging his participation in this Jubilee DX Contest. Contestants are requested to submit logs irrespective of the number of contacts they have made.

THE SHORT WAVE BUG BITES HARD.

After a spell of 4 years, Mr. H. Stevenson of Brisbane is back again and from a modest 5 valve dual wave receiver used in 1947 he now has a specially built 7 valve set covering from 16 meters right through to 550 meters He has an unusually long aerial—125 feet—but only 20 feet high with a shielded lead in of 25 feet. The results are satisfying as shown by the long list of stations logged within the last month.

Mr. W. R. Anderson of Sydney who has often been mentioned in these columns is still trying to improve on reception and has bought another set which he says is the best he has had to date. He is a flat dweller and is troubled by interference and is now experimenting with various types of aerial.

THE MONTH'S LOGGINGS

Daily Shortwave Broadcasts from "RADIO AUSTRALIA" Schedule Effective until October, 1951

6.00- 7.55 a.m.	To New Zealand	19 metre Band.
6.00- 9.00 a.m.	British Isles and Europe	25 metre Band.
6.30- 9.00 a.m.	Forces in Japan	19 metre Band.
8.13-10.50 a.m.	New Zealand, South and S.E. Asia	16 metre Band.
9.15 a.m. - 12.45 p.m.	South-East Asia	19 metre Band.
10.45 a.m. - 2.15 p.m.	Forces in Japan	13 metre Band.
10.45 a.m. - 2.15 p.m.	South and South-East Asia	16 and 19 metre Band.
2.15- 6.15 p.m.	South and South-East Asia	16 metre Band.
2.30- 3.45 p.m.	North America (West Coast)	19 metre Band.
2.30- 3.45 p.m.	Africa	19 metre Band.
4.00- 4.45 p.m.	French Indo-China (French)	19 metre Band.
4.00- 4.45 p.m.	Tahiti, Europe (French)	25 metre Band.
4.00- 6.15 p.m.	British Isles and Europe	31 metre Band.
4.45- 6.15 p.m.	British Isles and New Zealand	25 metre Band.
4.45- 5.30 p.m.	South-East Asia	19 metre Band.
5.45- 6.45 p.m.	New Caledonia (French)	19 metre Band.
6.28- 7.30 p.m.	Forces in Japan	25 metre Band.
6.28- 8.30 p.m.	South-East Asia	19 metre Band.
6.28-11.55 p.m.	Forces in Japan	31 metre Band.
7.00- 7.30 p.m.	China, North-East Asia	25 metre Band.
7.30- 8.30 p.m.	United Nations Broadcast for China (Chinese)	25 metre Band.
7.30- 7.50 p.m.	News at Dictation Speed	25 metre Band.
8.00 p.m. 12.45 a.m.	South and South-East Asia	25 metre Band.
830- 9.00 p.m.	Indonesia (Indonesian)	19 metre Band.
8.30-10.00 p.m.	China, North Asia	25 metre Band.
9.00- 9.45 p.m.	South and South-East Asia	19 metre Band.
10.00 p.m. - Midnight	North America (East Coast)	25 metre Band.
10.15-11.30 p.m.	South-East Asia (including Thai ½-hour Fri.)	31 metre Band.
Midnight - 2.15 a.m.	South and South-East Asia	31 metre Band.
Midnight - 1.00 a.m.	North America (Central and Mountain)	25 metre Band.
1.00- 2.15 a.m.	North America (West Coast)	25 metre Band.
1.00- 2.15 a.m.	Africa	31 metre Band.

EMISSION FRANCAISE.

1.30- 2.30 a.m.	Radio Indonesia	4.945 m.c.	60.68 met.
		7.27 m.c.	41.27 met.
3.00- 4.00 a.m.	Radio Indonesia	11.77 m.c.	25.48 met.
		15.15 m.c.	19.80 met.

(Continued on page 19)

CRAFTSMAN-BUILT RADIOGRAMS AND SPECIALITY SETS.

Attention!

NEW AUSTRALIANS

AND OTHER D.X.'s INTERESTED IN A RADIO SET TO GIVE FIRST-CLASS SHORT WAVE RECEPTION . . .

HERE IT IS

IMMEDIATE DELIVERY

★

UWAGA!

(IN POLISH)

Nowoprzybyli, zaintere — sowani w kopnie pierwszorzednego aparatu radjowego dla odbioru krotkofalowego. Natychmiastowa dostawa w niniejszym sklepie.

★

ACHTUNG

(IN GERMAN)

Neue Australier und andere neuankommlinge die interessiert sind in einen radio-apparat der erstklassigen kurzwellenempfang gibt.
Here ist er fur sofortige auslieferung.

★

FIGYELEM

(IN HUNGARIAN)

Uj Ausztralok es mas D.P.-K akik erdekelve vannak radio irant amelyen eisoranguan lehet rovid hullamot fogni.
Kaphato azonnali szalitassal.

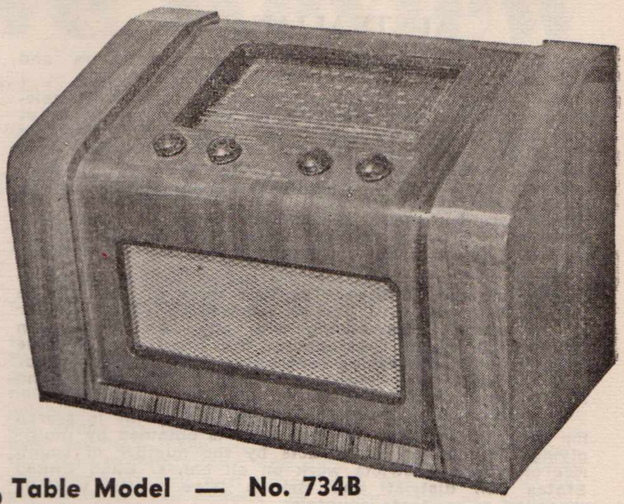


Table Model — No. 734B

FEATURES

- SEVEN power packed valves for spanning the world.
- Frequency coverage, triple wave, 500 KC - 1500 KC broadcast band; 13-42 metres and 40-120 metres on the TWO short wave bands.
- Tuned R.F. stage and push pull output.
- Large, legible console type dial.
- 8 inch heavy duty speaker.
- Large, modernistic, totally enclosed polished wooden cabinet, with protective back panel and attractive aluminium speaker grille.
- Extension speaker and pick-up terminals, also "Radio-Gramo" switch.
- Dimensions: 22in. across x 15in. high x 11½in. deep.

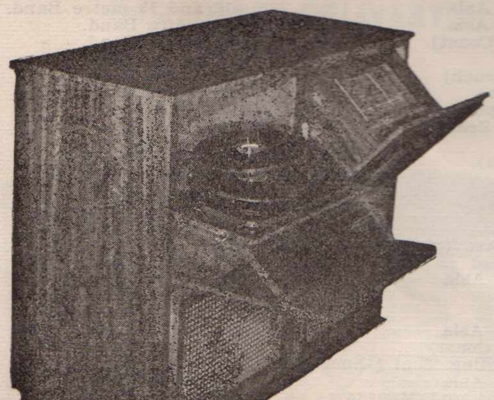
All Electrosound chassis (240v. A.C. or any specified D.C. home lighting plant voltage) are interchangeable, and any of these can be fitted to any of our various cabinets. Enquire from your local dealer or from Electrosound direct.

IN POLISH . . .

Wszystkie Electrosound radja (240v. pradu zmienneco albo wyszczegolnionego pradu stalego) da ja sie nawzajem zamienic iwszystkie, mozna zlatwoscia wmontowac w ktorykolwiek z naszych kabinetow radjowych. Informacje i dalsze szczegoly od naszych zastepcow lub wprost z Electrosound fab ryki.

IN GERMAN . . .

Alle Elektrosound Radio-Apparate (240v. Wechselstrom oder jede spezifierte Gleichstrom Haus Beleuchtungs Anlagen Spannung) sind auswechselbar und konnen in unsere verschiedenen Radiogehause eingebaut werden. Weitere Auskunfte von Ihrem Radiohandler oder direct von der Firma Electrosound



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Short-Wave Review — Continued from page 17

FOREIGN LANGUAGE BROADCASTS

PROGRAMME IN ARABIC

E.S. Time	Transmitted From	Wave Band (Metres)	
2.15- 2.45 p.m. Daily	Khartoum	9.746 m.c.	30.78 met.
2.30- 4.00 a.m. Daily except Saturdays	Khartoum	9.746 m.c.	30.78 met.
2.30- 3.30 a.m. Saturdays	Khartoum	9.746 m.c.	30.78 met.
5.00- 5.30 a.m. Saturdays	Khartoum	9.746 m.c.	30.78 met.
Midnight - 1 a.m. Saturdays	Khartoum	9.746 m.c.	30.78 met.
6.00- 7.30 a.m. Fridays	Khartoum	9.746 m.c.	30.78 met.
5.00- 7.00 p.m. Sundays	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
9.00- 1.00 a.m. Sundays	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
4.00- 8.30 a.m. Sundays	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
4.30- 6.00 p.m. Week Days	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
9.45 p.m. - Midnight Week Days	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
4.00- 8.30 a.m. Week Days	Radio Algeric, Algiers.	9.57 m.c.	31.34 met.
10.00 p.m.- 2 a.m.	Radio International, Tangier.	6.11 m.c.	49.10 met.
4.00-10.00 a.m.	Radio International, Tangier.	6.11 m.c.	49.10 met.
1.45- 2.15 p.m.	BBC Programme	9.675 m.c.	31.01 met.
2.45- 3.15 p.m.	BBC Programme	12.04 m.c.	24.92 met.
3.00- 4.15 a.m.	BBC Programme	12.04 m.c.	24.92 met.
	BBC Programme	15.07 m.c.	19.91 met.
4.30- 5.00 a.m.	BBC Programme	9.58 m.c.	31.32 met.
5.30- 6.30 a.m.	BBC Programme	12.04 m.c.	24.92 met.

PROGRAMME IN TURKISH

E.S. Time	Transmitted From	Wave Band (Metres)	
8.30-10.00 p.m.	TAQ, Ankara	15.195 m.c.	19.74 met.
2.00- 7.00 a.m.	TAP, Ankara	9.465 m.c.	31.70 met.
2.00- 7.00 a.m.	TAS, Ankara	7.285 m.c.	41.18 met.
2.00- 7.00 a.m.	TAT, Ankara	9.515 m.c.	31.45 met.
3.00- 3.30 a.m.			
6.00- 6.15 a.m.	"Voice of America"	13, 16 and 19 met. bands.	
3.15- 3.30 p.m.	"Voice of America"	25, 31 and 49 met. bands.	
5.30- 6.00 a.m.	BBC Programme	15.18 m.c.	19.76 met.
		11.80 m.c.	25.42 met.
9.15- 9.30 a.m.	BBC Programme	11.86 m.c.	25.30 met.
		9.64 m.c.	31.12 met.
5.30- 5.45 p.m.	BBC Programme	11.86 m.c.	25.30 met.
		9.66 m.c.	31.06 met.

PROGRAMME IN SWISS

E.S. Time	Transmitted From	Wave Band (Metres)	
8.30- 9.15 a.m.	HER-3, Berne	6.165 m.c.	48.66 met.
11.30 a.m.- 2.00 p.m.	HER-3, Berne	6.165 m.c.	48.66 met.
8.30- 9.15 a.m.	HER-4, Berne	9.535 m.c.	31.46 met.
11.30 a.m.-2 p.m.	HER-4, Berne	9.535 m.c.	31.46 met.
4.45- 6.30 a.m.	HEU-3, Berne	9.665 m.c.	31.04 met.
6.45- 8.15 a.m.	HEU-3, Berne	9.665 m.c.	31.04 met.
9.30-11.00 a.m.	HEU-3, Berne	9.665 m.c.	31.04 met.
8.30- 9.15 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
5.15- 7.45 p.m.	HER-5, Berne	11.865 m.c.	25.28 met.
10.45 p.m.-12.30 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
12.45- 2.30 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
2.45- 4.30 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
4.45- 6.30 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
6.45- 8.15 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
9.30-11.00 a.m.	HER-5, Berne	11.865 m.c.	25.28 met.
11.00- 2.00 p.m.	HER-5, Berne	11.865 m.c.	25.28 met.
9.30-11.00 a.m.	HEI-5, Berne	11.715 m.c.	25.61 met.
10.45 p.m.-12.30 a.m.	HER-6, Berne	15.505 m.c.	19.60 met.
3.15- 4.40 p.m.	HER-6, Berne	15.505 m.c.	19.60 met.
1.00- 8.00 a.m.	HER-6, Berne	15.505 m.c.	19.60 met.
5.15- 7.45 p.m.	HER-7, Berne	17.784 m.c.	16.87 met.
12.45- 2.30 a.m.	HER-7, Berne	17.784 m.c.	16.87 met.
2.45- 4.30 a.m.	HER-7, Berne	17.784 m.c.	16.87 met.
10.45 p.m.-12.30 a.m.	HER-7, Berne	17.784 m.c.	16.87 met.
5.15- 7.45 p.m.	HER-8, Berne	21.52 m.c.	13.94 met.
8.00-10.30 p.m.	HER-8, Berne	21.52 m.c.	13.94 met.

PROGRAMME IN FINNISH

E.S. Time	Transmitted From	Wave Band (Metres)	
10.15-10.25 p.m.	01X5, Helsinki	17.8 m.c.	16.85 met.
1.00- 7.00 a.m.			
8.50- 9.15 a.m.	01X4, Lakti	15.19 m.c.	19.75 met.
12.45- 1.30 a.m.	CKNC, Montreal	17.82 m.c.	16.84 met.
(Monday only)	CKCX, Montreal	15.19 m.c.	19.75 met.
4.30- 4.45 a.m.	"Voice of America"	13, 16 and 19 met. Band.	
5.15- 5.30 a.m.	"Voice of America"	19, 25 and 31 met. Band.	
4.00- 4.30 a.m.	BBC Programmes	9.675 m.c.	31.01 met.
		11.68 m.c.	25.68 met.
7.00- 7.15 a.m.	BBC Programmes	7.185 m.c.	41.75 met.
7.00- 7.15 a.m.		9.675 m.c.	31.01 met.
		11.68 m.c.	25.68 met.

(Continued on page 21)

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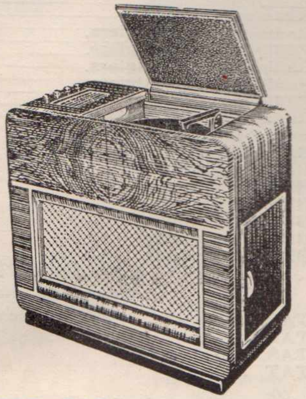

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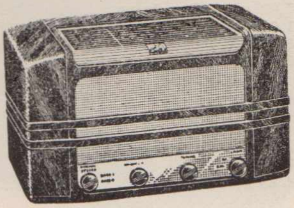

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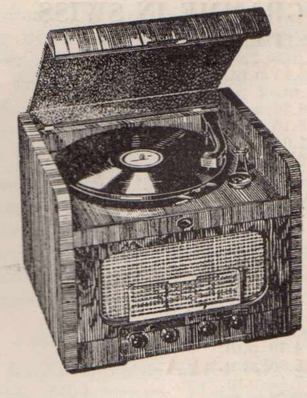

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SHORT WAVE REVIEW (from page 19)

PROGRAMME IN NORWEGIAN

E.S. TIME	TRANSMITTED FROM	WAVE BAND IN METRES.
5 — 6 a.m.	LLP, LKV and LLH — Oslo.	13, 19, 25 and 31.
9 — 10 a.m.	LLG, LKQ and LKV — Oslo.	19, 25 and 31 bands.
11 a.m. — Noon	LKV, LKQ and LLG — Oslo.	19, 25 and 31 bands.
9 — 10 p.m.	LLP, LLM, LLK and LLG — Oslo.	13, 19, 25 and 31.
11 p.m. — Midnight	LLP, LLN, LLM and LLK — Oslo.	13, 16, 19 and 25.
10 — 10.15 p.m.	BBC Programme — London.	25 and 31 bands.
3.45 — 4 a.m.	BBC Programme — London.	25, 31 and 42 bands.
4.30 — 5 a.m.	BBC Programme — London.	31 and 42 bands.
5.20 — 5.40 a.m.	CKNC and CKCS — Montreal.	16 and 19 bands.

PROGRAMME IN PORTUGUESE

HERE IS THE LATEST SCHEDULE OF NATIONAL BROADCAST PORTUGAL OVERSEAS SERVICE

TIME-TABLE

10.00 p.m. - Midnight	To Far East, Macao and Timor.	15.380 m.c.	19.51 met.
12.15- 2.30 a.m.	Portuguese India, Gua, Damao and Dio.	15.380 m.c.	19.51 met.
3.30- 6.30 a.m.	Africa, S. Tome, Angola & Mozambique	11.958 m.c.	25.1 met.
		9.746 m.c.	30.78 met.
7.00- 9.00 a.m.	Atlantic (South), Brazil, Cape Vert & Guinea.	11.958 m.c.	25.1 met.
		9.746 m.c.	30.78 met.
10.00-Noon	Atlantic (North), U.S.A. & Cod Fishing Fleet.	9.746 m.c.	30.78 met.
		6.374 m.c.	47.07 met.

"RADIO AUSTRALIA"

FOR NEW AUSTRALIANS

"SAY IT WITH PAUL."

The New Australian Programme.

To enable New Australians to familiarize themselves with their radio receivers, we are printing hereunder the short wave broadcasts of the "Say it with Paul" programmes transmitted by the Australian Broadcasting Commission.

Times shown unless otherwise mentioned are Australian Eastern Standard Time.

			Saturday	Sunday
VICTORIA				
VLR	9.68 m.c.	30.99 met.	12.45-1.00 p.m.	7.45-8.15 a.m.
VLH	11.88 m.c.	25.25 met.	7.30-7.45 a.m.	
QUEENSLAND				
VLQ	9.66 met.	31.06 met.	7.00-7.15 a.m.	7.45-8.15 a.m.
VLM	4.917 m.c.	61.01 met.	7.00-7.15 a.m.	7.45-8.15 a.m.
SOUTH AUSTRALIA				
VLH	11.88 m.c.	25.25 met.	7.00-7.15 a.m. (South Aust. Time)	
WESTERN AUSTRALIA			(Western Australia Time)	
VLW	9.61 m.c.	31.22 met.	7.00-7.15 a.m.	7.45-8.15 a.m.
VLX	4.897 m.c.	61.26 met.	7.00-7.15 a.m.	7.45-8.15 a.m.
NEW GUINEA				
VLQ	9.66 met.	31.06 met.	7.00-7.15 a.m.	7.45-8.15 a.m.

FOREIGN LANGUAGE BROADCASTS

New readers are advised that listening times and wave bands of the following list of Foreign Language Broadcasts was published in our August issue Vol. 16 No. 1, back copies of which are obtainable from this office at 1/6 per copy plus 2d. postage.

They include:— Dutch, Italian, German, Polish, Rumanian, Yugoslav, Bulgarian, Albanian, Danish, Czechoslavakian, Lithuanian, Spanish, French, Ukranian, Greek, Portuguese, Hungarian, Swedish.

This new feature has been well received by old and New Australians and is continued in this Sept. issue, listing the countries that space would not allow to be covered last month.

We look forward to your co-operation, in keeping this section of our magazine up to date, by asking you to forward your suggestions and any alterations to the schedule shown. PLEASE ADDRESS ALL CORRESPONDENCE TO THE EDITOR C/O THIS JOURNAL, so that we can co-relate the information, and publish same for the benefit of all concerned.

APOLOGIES.

In acknowledging assistance given in the compilation of Foreign Language broadcasts, the name of "Radio Australia" was overlooked. This is regretted as the information supplied through Mr. Graham Hutchins has been most helpful. Listeners will find that by tuning to "Australian DX-ers Calling" at 5 p.m. Sunday, they will hear many useful tips regarding Short Wave broadcasts.

Tune to VLA-9, 9.58m.c. 31.32 met.
VLA-11, 11.76 m.c. 25.51 met.

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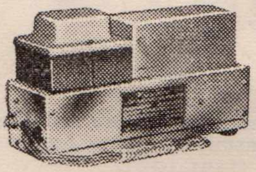

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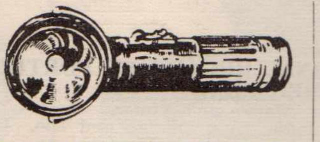

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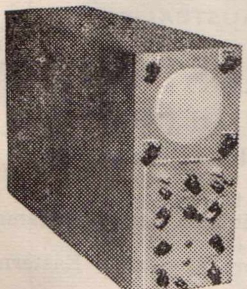

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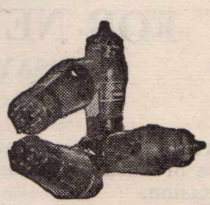

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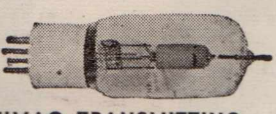

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*Type KY21	£5 17 0
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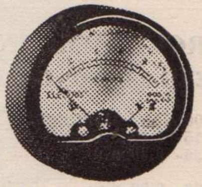

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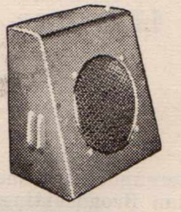

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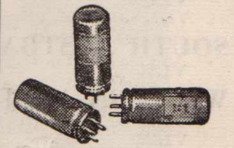

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AMATEUR RADIO
SECTION

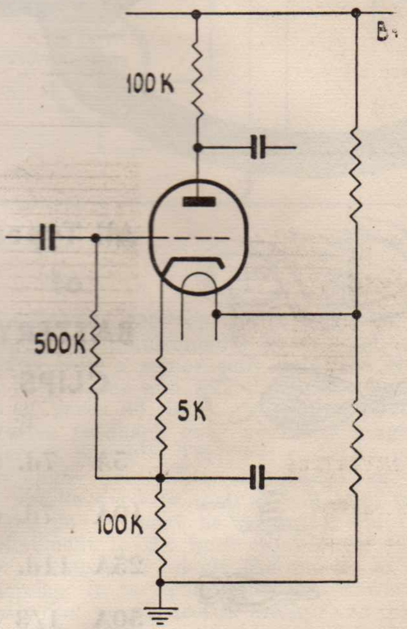
ELIMINATE THAT HUM-M-M-M-M

This article is dedicated to all those radio servicemen and enthusiasts who at some time in their lives have attempted to remove hum from audio amplifiers or hash from vibrator-powered receivers.

The elimination of these unwanted additions to an otherwise satisfactory piece of equipment has proved a stumbling block to a whole host of radiomen and added another grey hair to the whitening locks! However, there are many things which may be done to minimize this form of trouble so we shall begin with the case of the humming amplifier or audio section. Strictly speaking hum should not be a great problem in low-gain equipment if normal precautions are observed, but the trouble really starts when microphone pre-amplifiers are included on a chassis which is shared by a power transformer and rectifier. The first obvious thing to do in this case is to keep as great a distance between the pre-amplifier valve and the power transformer as is possible. That usually means having the transformer at one end of the chassis and the valve with its associated circuitry at the other end. The next consideration is the actual type of power transformer itself. This, for best results should be of the vertical mounting type rather than the flat variety since the flat transformer really makes the chassis a large lamination to the inestimable joy of numerous eddy currents induced therein. Besides which the vertical transformer is so much easier to mount and means far less hacking about of chassis so we gain both ways. Filter chokes "where employed" should be mounted with their cores at right angles to that of the power transformer and situated also as far from the high gain section as possible. The "where employed" is intentional for it is the writer's belief that resistive filtering can prove every bit as effective in average amplifiers where extreme bass response is not necessary and where a certain amount of negative feedback is employed.

At this stage we can mention a point which although not of supreme importance, is nevertheless worthy of consideration, this being the chassis material. Steel, while making a good robust chassis, does conduct magnetic fields from the power supply very readily and adds to the problems of the unwary. Aluminium, on the other hand, is not troubled in this respect and is to be preferred by the person who is not well versed in the "anti-hum art."

Turning now from the constructional to the electrical side, one finds a variety of causes, cures, and preventions. Firstly, it is essential that all earthing points associated with each valve should be returned to a common point on the chassis. By this is meant that bias resistors and condensers, grid leaks and screen bypass condensers should be earthed at the same spot on the chassis. Failure to do this is one of the most common causes of hum encountered in audio equipment and until this exacting rule is complied with further efforts will only prove fruitless. Our second point, or rather

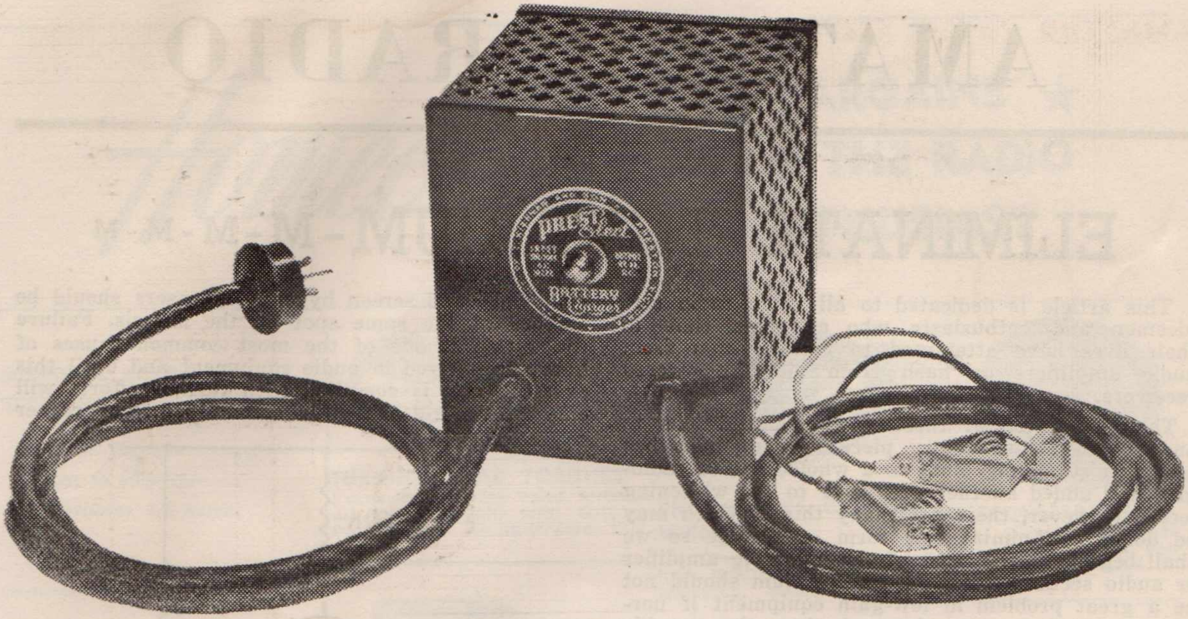


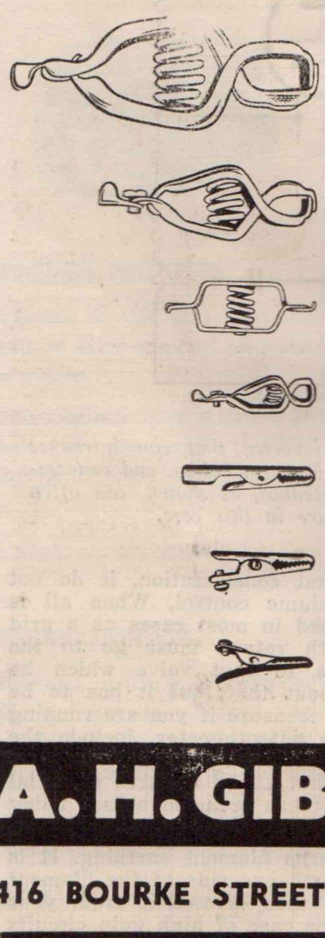
A well-known phase inverter that can introduce hum. Using a separate heater winding, and connecting it to a positive potential, as shown, can often effect a cure in this case.

* * *

an extension of our first consideration, is do not neglect the humble volume control. When all is said and done he is used in most cases as a grid leak so back his earth return must go to the earthing point common to that valve which he serves. We're sorry about that, but it has to be done and just for good measure if you are running a screened lead to the potentiometer, include the earthed lead inside the screened shielding for luck. It may seem fantastic that a lead at earth potential can pick up hum, but it has occurred before today where the lead is rather long.

Our next point concerns filament earthing. It is not just sufficient to earth one side of the filament or heater winding and then divorce it from your mind. Particularly in the case of high gain circuits is this factor critical. The earth should be applied





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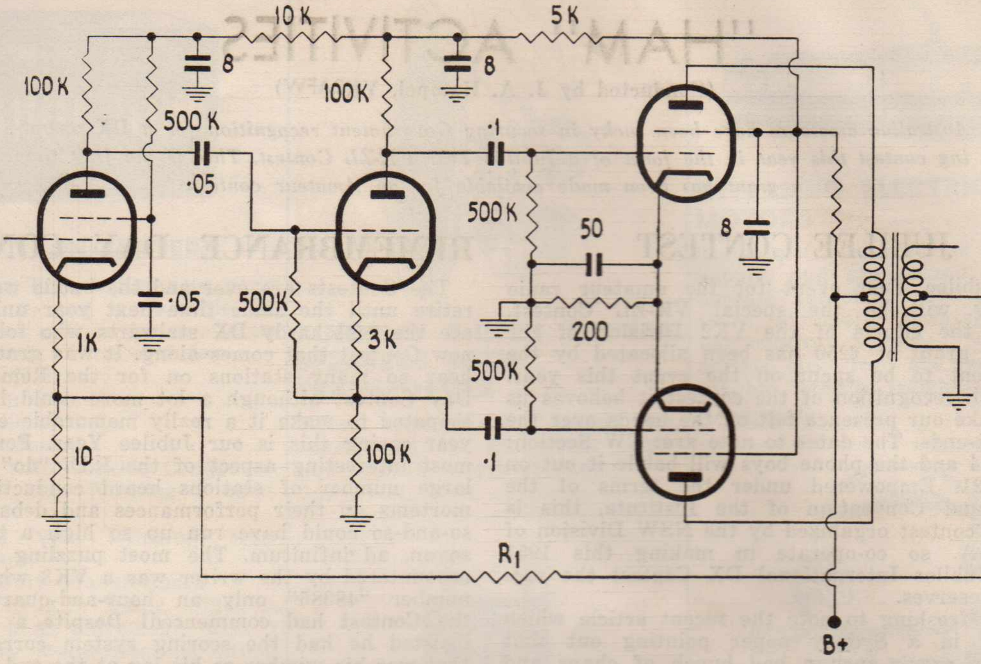

A well-tried audio amplifier circuit with negative feedback. Typical valves are: 6J7, 6J5, and p–p 6V6's. The degree of feedback is regulated by the value of R1, which, as explained in the text, is also dependent on the voltage at the point on the output transformer from which the feedback is taken.

to the pre-amplifier valve or that valve operating at highest gain, and try earthing either side of the heater to see which gives best results. If the answer is still in doubt connect a 100-ohm potentiometer across the heater and put the centre arm to earth. A little careful adjustment of the pot. will soon give the best position, and if the moving arm comes to rest about centre, two 50-ohm resistors may be used instead of the pot. Generally, they are easier to find a parking place for than a wire-wound pot. anyway. In persistent cases of heater-induced hum, applying a positive bias to the heater winding can effect a ready cure. This voltage should be higher than the highest cathode bias on any of the valves and may be derived from a divider from H.T. to earth as shown. Don't overlook the fact that a phase inverter of the lifted cathode type (see diagram) may have as much as 100 volts on the cathode and the filament bias should be higher than that.

The case of that type of phase inverter, however, is exceptional and it is really a better idea to run the filament of that valve from a separate heater winding and put the positive bias on that. By doing that all other valves in the amplifier are not running with a high voltage difference between cathode and heater with consequent risk of breakdown or leakage between the two. Having complied with all these requirements your amplifier should now have only a minor purr left like the family cat at fifty paces and this figure can be increased to lots of paces ad. inf. by including about 4 D.B. of negative feedback over as many stages of the amplifier as possible. This will clear up practically all the hum remaining, but negative feedback should not be used to remove bad hum caused by faulty design—it must be regarded simply as the last refinement to the hum eliminating drill. Don't get too enthusiastic about the merits of feedback and increase it to large amounts, however, since this calls for very careful design and high-grade components. Generally speaking 4 D.B. is a good workable amount without incurring all manner of troubles on complex waveforms. The accompanying diagram is a well tried and effective circuit for degenerative feedback. The value of resistor R1 will be dependent on the impedance tap used on the output transformer. For a 3-ohm tap it should be approximately 100-200 ohms.

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"HAM" ACTIVITIES

(Conducted by J. A. Hampel, VK2AFW)

Australian amateurs have been lucky in securing Government recognition for a DX operating contest this year in the form of a Jubilee Year VK-ZL Contest. This is the first time a grant has been made available for an Amateur contest.

JUBILEE CONTEST

The Jubilee Year event for the amateur radio fraternity will be the special VK-ZL Contest. Through the efforts of the VK2 Division of the W.I.A. a grant of £250 has been allocated by the Government to be spent on the event this year. With such recognition of the contest it behoves us all to make our presence felt on the bands over the two week-ends. The dates to note are: CW Section: Oct. 13-14 and the phone boys will battle it out on Oct. 20-21. Empowered under the terms of the last Annual Convention of the Institute, this is the first contest organized by the NSW Division of the W.I.A. so co-operate in making this 1951 VK-ZL Jubilee International DX Contest the success it deserves.

It is refreshing to note the recent article which appeared in a Sydney paper pointing out that Amateurs aren't such a bad bunch of chaps and illustrating the need for radio listening posts to safeguard everyone's interests in the ether. More articles along these lines to educate the public would not go amiss either gentlemen. Now, what about one on the Amateurs' part in flood and other emergency networks? Queue forms on the right.

Any consistent station on 40 these days seems to come up with the same query: "Have you worked a ZL yet?" Since the New Zealand hams have been allocated this additional band for telephony use their appearance on 40 has provided plenty of VK's with their first "DX" station since there are quite a number who still remain on this favorite band. About the same time as they were allowed to start up on 40 fone the NZ-ers were given a part of the 160 metre band. This will mean a lot of stations running up against BCI trouble with their fundamentals only one harmonic removed from the broadcasters. So from June 10th the ZL's got a break and the VK's collected back a bit of the QRM the ZL's have been receiving from across the Tasman.

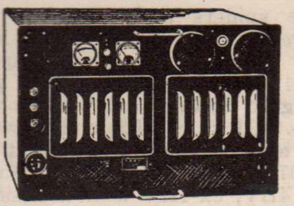
Over 'Stateside the Federal Civil Defence Administration are putting into effect a scheme to set up a fully equipped defence radio network and it is gratifying to note the inclusion of the Amateur organizations in the plan. In almost every town or small country area the amateurs will play a part in the web of stations which will be put into use in case of emergency. The Military Amateur Radio Service, MARS), will also support the government controlled network. On reading through the report on this move it brings forward the glaring question of ourselves: "How prepared are we to co-ordinate our efforts as individuals as an efficient communications network if required to do so at short notice?" It is unfortunate, but very true, that few stations are ready to put their equipment to that use.

REMEMBRANCE DAY CONTEST

The Contests are over and the battle weary now retire until the same time next year unless they are the real hardy DX stalwarts who follow each new Contest that comes along. It was gratifying to hear so many stations on for the Remembrance Day Contest although a lot more could have participated to make it a really memorable event this year seeing this is our Jubilee Year. Perhaps the most interesting aspect of the R.D. "do" was the large number of stations heard conducting post-mortems on their performances and debating how so-and-so could have run up so high a total, and so on, ad infinitum. The most puzzling of scores encountered by the writer was a VK3 who gave a number "48385" only an hour-and-quarter after the Contest had commenced! Despite a query he insisted he had the scoring system correctly and that was his number so his log at the end of the 24 hours should be worth seeing. The VK6 boys had some high totals and their placing in the final count this year should be close to the top.

The VK2 Federal Contest Committee only recently empowered to handle this very important part of Amateur events and activities is to be congratulated on the very fine job they are doing in handling the Contests. With printed logs sheets being forwarded to every station with explanatory notes there should be no doubt in any mind about rules and the like that often occurs over such events. It is a pity however that the powers that cannot be release the information a little earlier as this would mean a much wider publicity coverage per the medium of this and other publications; no information was forwarded for inclusion in these notes and consequently the committee have only themselves to blame when no publicity is given to forthcoming events when the details are released with only short notice before they are scheduled to take place. Nevertheless, the congrats are still in order especially for the idea behind the Jubilee Year Relay Contest early in September when amateurs had to pass a short message on the Australian Jubilee Year and its attendant International VK-ZL Contest to each overseas station worked; no better method could be devised to disseminate news about our activities as the usual idea of forwarding the information to overseas magazines does not always work out. Now if the W's would only do something like that when they intend holding an international event we might be able to find out about them in time instead of finding ourselves in the middle of a contest as often happens.

This publicity business prompts a further mention of the availability of space in this section each month for news from clubs, societies and kindred organizations. Not only will the added



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- 2 .015,000 Volt Working Condenser.
- 1 .0210,000 Volt Working Condenser.
- 1 .0015,000 Volt Working Mica Condenser.
- 3 Heavy Duty Transformers.
- 1 0-100 Volt A.C. Meter, which is an 0-1 M.A. movement, with 1 M.A. Dry Metal Rectifier fitted.
- 1 0-5 M.A. D.C. Meter, and many other parts such as stand off insulators, coils, etc. Easily worth £20.

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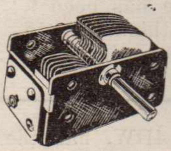

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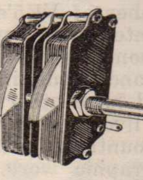

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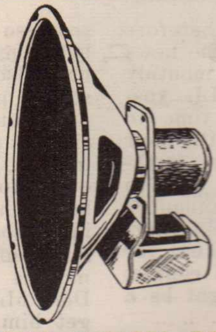

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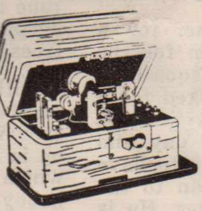

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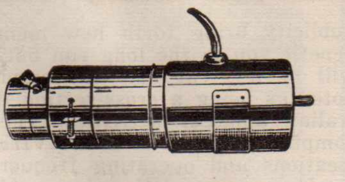

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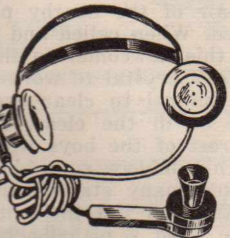

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publicity bring forth new members and therefore benefit you in the long run but of course the news will be a great help in compiling these monthly notes as being a cross-section digest of ALL Australian amateur activities. There is still time to compile a full list of active VHF stations with their locations and operating frequencies for the forthcoming summer DX season so if you want to help others on the band and at the same time announce your presence on the VHF bands and so help yourself as the other chap will then be looking out for you if he knows there is a station he can contact in some town or direction he considers might be a good path to try.

When the writer took over the happy task of editing these notes each month a promise was made that no station would be slated in these columns by his call sign and as that still stands the call of the station that sat up in the middle of 40 during the R-D Contest and sent V's to the despair of the nearby phone men cannot be mentioned. When called and questioned about the practice this newcomer to the bands explained he only had one crystal to work on so he intended to blast the channel to clear everyone off it so he would then be in the clear. Despite his apparent logic the rest of the boys were heard giving him a run for his money some hours later; I doubt if he worked many stations as others were heard commenting on the incident during the day. On the other hand a bouquet goes to 5CF, another newcomer who only had one rock but managed to run up an impressive score by using good operating technique.

soon so perhaps the spiders and silverfish had better move out before it is too late for them. Mick has also finished a triple conversion rx. sp. it sounds promising.-.-. 4EH is busy packing his gear preparatory to moving to Sydney and will soon be signing a VK2 call.-.-. 4GP is ex-5DL and is working all his old pals back in VK5 with about the quota to push-pull 807's. Don has a three element beam on the way.-.-. 4HV, ex-1HV is now residing in Brisbane after only a short stay in Townsville. Apparently the letter was too hot after twelve months service on Heard Island, eh Harry?.-.-. Don, 5LO has loaned his 288mc gear to 5WM to get him interested in the band and the idea has apparently been successful as Wyke is extolling the virtues of the band after only a few QSO's .-.-. Brian, 5FQ? has some additional QRM in the form of another harmonic, a daughter Robin.-.-. 3AJI is still off the air but has hopes of a city flat shortly and then the next worry will be BCI so John is considering NBFM to escape trouble. John is vice-president of the Northern Suburbs Group which will shortly be heard under it own club call on all bands from 3.5mcs. right up to 580 mcs. and he has been busy constructing CRO modulation checker for the station. Members are so enthusiastic about the CRO as a monitoring system that several have now purchased 5BPI's for that purpose.-.-. In his spare time (?) John is putting together a fine collection of test gear although if his hopes of shifting to VK5 come true this veritable laboratory will come to an abrupt halt; VK5's will be seeing John again shortly when he makes another trip to endeavour to effect this

> In addition to my own observations on the bands this month there has been a better response from correspondents with news from their own areas; thanks go to VK's 5WM, 2AGU, 3TI, 4LM and 3AJI.: Is there an active VK6 chap willing to forward news from the west each month?

AROUND THE SHACKS

Harry, 5HN, took his mind off 288mc. for a while to fire up the forty metre rig again for the R-D day and then nearly got himself disqualified by interpreting the times as SAST and asked for a number after the event was over. Harry was on duty at the fire station for part of the day and could not devote all the time he would like to have to the contest.-.-. Wonder how many got on to the VK9? Max, 2OT, was one of the lucky ones. He is getting a two metre rig ready for the summer after returning from a recent trip to Sydney where a great deal of his time was spent in the shack of Dave, 2EO.-.-.

2VR will soon have a new 100 watt rig on the air using push-pull 811's in the final running with low voltage on them. Ron is a school teacher and used the recent holidays to good advantage to get his masterpiece of all-band operation completed.-.-. 3ARM is yet another station to become interested in clamp tube modulation and wants information on same. Why not try Allan, 5VO, Bob?.-.-. After a long absence from the band, 4BG has re-appeared on 40.-.-. 4MD has not been on for about twelve months now, but is threatening something drastic change of QTH.-.-. Dudley, 4DW, had the misfortune to lose his vertical in a recent blow and is now keeping on with an antenna strung between two trees fed by the parallel 807's.-.-.

Although not a Ham himself but close to a great number of Hams, and the VK5 Division of the W.I.A., Mr. Arthur Sheard recently passed on in an Adelaide hospital after a spell of ill health which had prevented his activity with his beloved hobby, and career, the morse code. Affectionately known as "Pop" to thousands he was responsible for training the greater number of VK5's and others who have since moved interstate. Pop had the happy knack of dispensing some of his home-spun philosophies with the code and made its study a pleasure, to many who would have otherwise given up interest. His memory will live on with the operators he has taught and the countless friendships he made in a lifetime of telegraphic work.-.-.

5CJ has two 813's ready to go but still no modulation transformer. Also down Mt. Gambier way my correspondent 5CH has been very inactive; still on the installation at the power house Claude? More power to you!.-.-.

(Continued on page 32)

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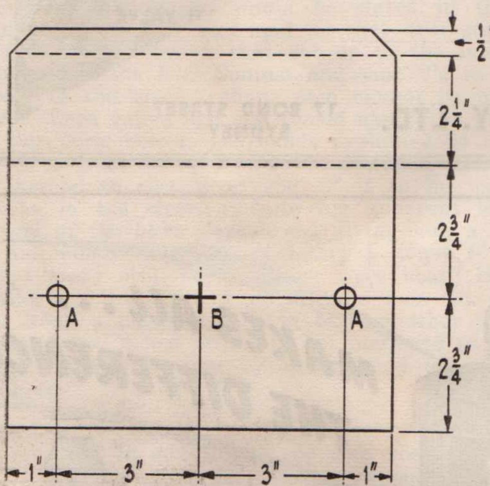
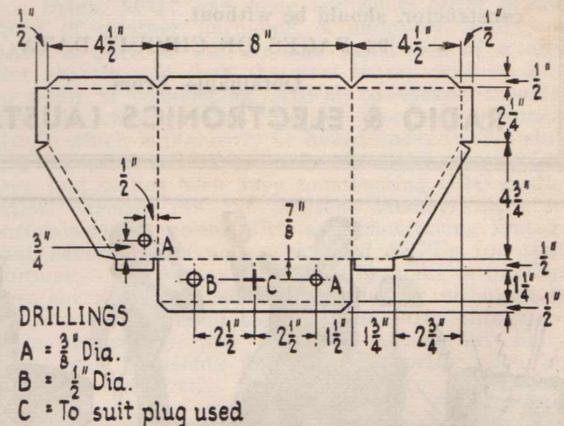
Vacuum-Tube Voltmeter (Continued from page 7)

then as follows: The potentiometer is turned fully anti-clockwise so that no voltage from the 1½-volt cell is applied to the input. Then the balancing potentiometer is adjusted until the meter reads zero. The range switch, during the test procedure, should be in the position for the lowest range, where it will be found that the 1½-volt cell will give about two-thirds of full-scale deflection, or less, depending on the value of the series resistor. The main point to note is that during the testing of the resistors, the meter series resistor should be adjusted to a value which gives as large a deflection as possible for a given input voltage, and then NOT TOUCHED, or the sensitivity of the meter will be change, and the comparative measurements will be of no use.



After the initial adjustments have been made, the meter reading is noted and a new resistor is substituted for the one connected between the cell and the input terminal. The new meter reading is taken ,and if the second resistor has exactly the same value as the first one used in the test position, the reading will be the same as before. All the available 10 meg. resistors are put into the test circuit, and are tagged with their meter reading. It is then a simple matter to pick out the ones which are nearest to each other in value. Because the resistor in the test position is the upper one of the voltage divider (the temporary R3 being the lower arm) the meter reading will be larger for the smaller resistors in the test position, and vice versa. We now pick out from all the readings two resistors whose readings are (a) as nearly equal as possible, and (b) among the middle range of readings. These two will be used for the permanent R3 and R4. Having picked out these two, the others are temporarily put on one side, and the the lower of the chosen pair is worked on to bring it up to the value of the higher. This is done by gently sawing a shallow slot in it with a hack-saw. For a start, just get the saw cut going, and replace the resistor in the test circuit. The change in reading may or may not be visible, but as long as the right one has been chosen for filing, its reading should recrease towards the reading of the uncut member of the chosen pair. The sawing is continued slowly, testing at frequent intervals, until the reading is the same as that of the uncut one. When the readings are identical, the resistors have the same value, and these two resistors are ready for wiring permanently into the instrument. It is a good plan, after every bit of cutting on the resistor being adjusted, to let it cool off for about



Left—Front panel; and Above—Cabinet for the V.T.V.M.

two minutes before taking another check on the meter, because these high-value carbon resistors have an appreciable temperature co-efficient, so that the heat of the sawing or filing alters their value quite considerably. Also, care should be taken to see that the meter zero is accurately set before each reading is taken.

Once the resistors for R3 and R4 have been chosen and adjusted, they can be permanently wired into the circuit, and it now remains to choose and adjust the resistors for R1 and R2. It is quite a simple matter to bring 10 meg. resistors up to 15 megs. by means of making several saw-cuts in each one, but so that the amount of sawing shall be a minimum, the resistors are chosen from the original bunch that show that lowest reading in the test circuit, and thus the highest resistance. The important thing is to ensure that the voltage dividers formed by R1 and R3 and R2 and R4 shall give an output of approximately 0.4 of the input voltage, and the meter is used to measure this ratio rather than the absolute resistance of the resistors. To do this, a further 1.5 volts is added to the test cell, and with the moving arm of the potentiometer connected directly to the input terminal, the pot. is adjusted to give exactly full-scale deflection of the meter. The first resistor to be adjusted is then inserted between the moving arm of the pot. and the input terminal. Since its value will be too low, the fraction of input voltage applied to the meter will at this stage be too high, and the meter will read somewhere betwen half and full scale. The resistor is then adjusted by sawing until without changing any of the controls (except the zero set, to see that the zero remains correctly adjusted) the meter reads 0.4 times full-scale deflection. At this stage, adjustment is stopped, and the next resistor is adjusted in the same way. We now have two resistors which, together with R3 give the desired voltage division, and which are also equal, so that it does not matter at all which is used as R1 and which as R2, They are then wired into position in the probe, and the construction is completed.

FINAL CALIBRATION

The most difficult part of the calibration of the completed instrument is to get hold of an accurate meter with which to match up its readings. It is suggested that a suitable meter is the Avo Model 7, or any similar multi-range meter whose accuracy is known to be B.S.1, or better, on the A.C. ranges. Having done this, we need an oscillator working at, say, 500 c/sec., and with good waveform. It is not advisable to do the calibration at 50 c/sec., using the mains as a source of voltage, because (a) the waveform is not always very good, and (b) because a slight correction factor has to be used at this frequency, and this makes it easier to make a mistake in performing the calibration. If the A.C. meter is not available, or if the oscillator cannot be acquired or built, then it is possible to calibrate the meter using D.C.

However, assuming that the standard meter and the oscillator are available, we proceed as follows: The meter is to be scaled to read **peak** A.C. volts, not R.M.S., because the diode rectifier is a peak-reading device, and peak volts is what it actually measures. Further, by scaling the meter to read peak volts, it can also be used, with a different probe, for D.C. readings, **without any scale changes,** and this is a most useful facility. The builder can, of course, choose his own ranges, since these depend solely on the values of meter series resistance, and can be picked to suit the meter scale available The meter in the prototype had two scales, 0–3 and 0-10, which are really the best for any multi-range meter on account of the generous overlap they give, as explained earlier, but if a single scale only is available, reading 0-5, a similar trick can be done by making the ranges 0-5, 0-10, 0-50, 0-100, for example, or, 0-5, 0-25, 0-125, and 0-250. However, it would be well worth while to re-scale any meter used, to have the two scales 0-3 and 0-10, whereupon the required overlap is provided, and also, multiplying factors are restricted to 10 and 100.

Taking the lowest range, of 0-3 volts first, we remember that this reads 3 volts **peak** at full scale, and that this corresponds to 3 x 0.707, or 2.212 volts R.M.S. The calibrating meter is almost certain to be scaled for R.M.S. volts, so that the correct reading to set up on the standard meter is 2.12v., and NOT 3.0v. This is done by connecting both the standard meter and the V.T.V.M. probe to the source of voltage at the same time, and setting the output voltage of the oscillator so

Continued on Page 32

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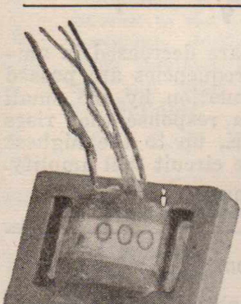
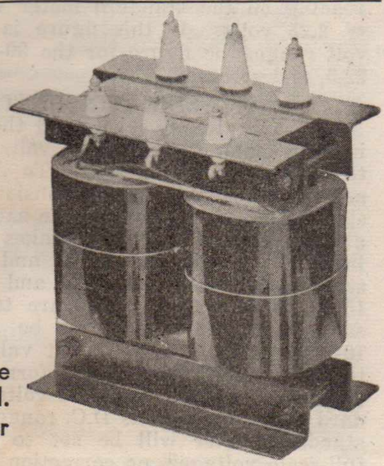
EQUIPMENT



This month we illustrate the outer limits of our transformer range. The item on the right is a 5 KVa High Tension Transformer, and the illustration on the left represents a Microphone Transformer, Impedances 50/25,000. Four of these items fit quite comfortably in a matchbox.



The foregoing may seem irrelevant, but it serves as an indication of the large number of applications for which A & R Transformers are produced. When the job is tough and the specifications rigid, an A & R Transformer is a natural choice.

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V. T. VOLTMETER

(Continued from page 31)

that the required reading of 2.12 volts is obtained on the standard meter. Then the appropriate range-setting resistor in the V.T.V.M. is adjusted until the V.T.VM reads full scale.

Calibrating the remaining ranges then consists simply of altering the oscillator output to give the required RM.S. reading on the standard meter, and adjusting the appropriate series resistor in the V.T.V.M. until full scale is indicated. For the 10-volt range, the R.M.S. meter setting will be 7.07 volts, and for the 30, 100, and 300-volt ranges, the settings will be 21.2 volts, 70.7 volts, and 212 volts R.M.S.

It is unlikely that an audio oscillator will give outputs as great as the higher of these voltages, so that it will be necessary to use an audio amplifier to get the required output voltage. Any good 10-watt amplifier should be satisfactory, but it might be necessary to use a step-up output transformer, such as a small modulation transformer in order to get the output voltage in such a way that one terminal can be grounded. If no oscillator can be used, it is possible to use the A.C. mains as a source of voltage, by applying a correction factor of 1.06 to the voltage read on the standard meter. This takes care of the fact that the response of the detector diode falls off slightly at frequencies below 50 c/sec., owing to the small size of the coupling condenser used in the probe. It would be possible to increase the value of this condenser, but only at the expense of stray capacity, and therefore of performance at the higher radio frequencies. Thus, when calibrating with 50 c/sec., the required reading on the standard meter will be 2.12 x 1.06 = 2.25 volts. If this figure is used for the 0-3 volt range, the figure for the 30-volt range will be 22.5, and so on.

CALIBRATING WITH D.C.

We have already mentioned the question of scaling the meter to read peak volts on A.C., and also to read correctly on D.C. To do this trick, it is necessary to have a probe consisting of a series resistor of 15 megs., so that the same voltage division as occurs with A.C. input, takes place with a D.S. input. This resistor can be and should be of the same values R1 and R2, and not the nominal 15 megs. if D.C. readings are to be correct. The same trick as before can be used to adjust a 10-meg. resistor to the right value, and then, with this done, calibration is performed using the D.C. probe, and a D.C. source of voltage, with the standard meter used on its D.C. ranges. In this case, the standard meter will be set to read the required full-scale voltages, no correction factor of any sort being needed, Batteries can be used for low voltages, and an ordinary 300-volt power pack for the higher voltages.

A little time spent on calibrating the meter as accurately as possible will be very well spent, and will give the meter a value that it could never achieve otherwise. If the standard meter agrees with itself on the different ranges, it will be found that the V.T.V.M. will also, as the linearity is as good as that of the meter movements itself, except at voltages below 1 volt, and this can be separately calibrated, and a curve drawn if the builder so desires.

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T.V. PROJECT, from page 9

is, the lower frequencies only are decreased in amplitude, while the very high frequencies are passed through with very little attenuation by the small condenser. The net result is a response that rises sharply from about 100 kc/sec., up to the highest frequency the remainder of the circuit will amplify.

(To be continued.)

HAM ACTIVITIES *(from p. 28)*

2NS is anxious to get through to Sydney on two metres. Trev has a good converter on the listening so turn your beams Bathurst way occasionally fellas.-.-. Hugh, 2WH, has the flood worries again and is kept pretty busy using Amateur Radio as his emergency link when the telephone line goes out, as it often does. Hugh recently loaned a two metre converter to 2APP in an endeavour to get Peter on the band. Trev, 2NS, was heard commenting on six metres the other day and blaming the city VHF boys who had visited him for his increased interest; anyway Hugh is glad as it is one less convert he has to worry about.-.-.

When you read this the 1951 Remembrance Day Contest will have passed and a fair idea of the result guaged. It will be interesting to compare this year's totals with those of last year since the new scoring system has been introduced. Don't forget those notes and news from your area; post them to me at 503 Radium St., BROKENHILL, NSW. by the 20th of each month. —J.A.H.

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