THE AUSTRALASIAN

Radio World

AUGUST 1, 1936.
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—See story on page 6.

- "SIMPLIFIED D.W. BATTERY MONEYSAVER": D.C. MULTI-METER:
- 5-METRE BATTERY RECEIVER: "EMPIRE SHORTWAVE THREE":
- LIST OF PRIZES FOR BIG ALL-WAVE ALL-WORLD DX CONTEST

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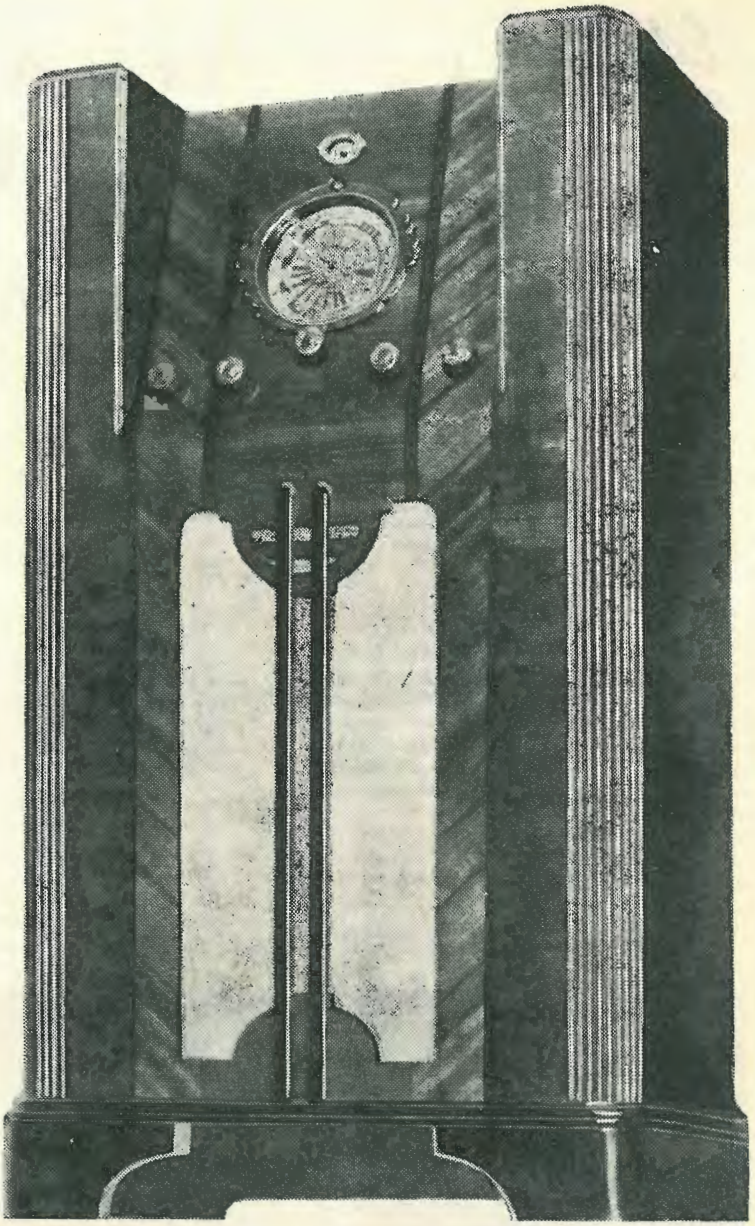

Model 460

Broadcast

The ideal receiver for country operation, this model has high sensitivity with extremely low noise level. Wonder dial and all other Kriesler features.

31 GUINEAS

Model 470

Dual Wave

Combining all the features of model 460 with the additional benefit of short-wave reception of all world stations, Kriesler offers this as the greatest development of modern radio.

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Editorial Notes....

FOUR YEARS OF PROGRESS

During the past four years, radio has progressed perhaps more rapidly than ever before, particularly in regard to receiver design. 1932 saw the coming of the six- and seven-pin valves, and with their advent set designers discarded the old reliables, represented by the '24, '35, and 47, in favour of the 57, 58, and 2A5. Now these in their turn are giving way to the new American metal and English spray-shielded releases. Base standardisation for all new type valves is also an advance worthy of mention.

CIRCUIT IMPROVEMENTS

Circuit design has improved in step with, or rather, because of, advances in valve design. Diode detection, automatic volume control, noise suppression control, and then dual-wave and all-wave receivers were all made commercially practicable by valves designed specially for these features.

BETTER TONE THE NEXT STEP

The next step will undoubtedly be in the direction of improving tone; in fact, leading manufacturers are already releasing medium-priced receivers capable of giving high-quality reproduction. During the past few years, set designers have been forced to concentrate on obtaining high selectivity and maximum sensitivity — the former, because of the steady increase in the number of stations operating on the broadcast band, and the latter, because of the rapid development of world-wide shortwave services. As a result, the modern superhet is more powerful and selective than ever before.

What is now needed is these qualities combined with high-quality reproduction — a combination not easily obtained, for it means much more than just providing a modern superhet tuner with a high-class audio channel. Either variable selectivity or some form of tone compensation is needed — preferably the latter — while improved speakers and better baffling are going to help considerably. Price levels will probably be a little higher, because really good tone is expensive to obtain, but nevertheless the manufacturer who caters for this latest trend is going to reap a worth-while reward.

THE AUSTRALASIAN RADIO WORLD

Incorporating The

ALL-WAVE ALL-WORLD DX NEWS.

Managing Editor:
A. EARL READ, B.Sc.

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The "Australasian Radio World" is published monthly by A. E. Read. Editorial offices, 214 George Street, Sydney, N.S.W. Telephone BW 6577. Cable address: "Repress," Sydney. Advertisers please note that copy should reach office of publication by 15th of month preceding that specifed for insertion.

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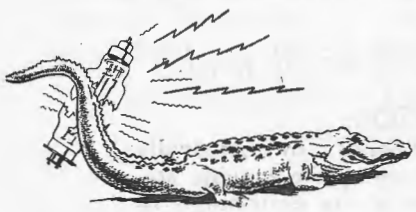
Pick-Ups . . .

The Beam Wireless Photogram Service between Australia and England gave Australian newspapers a wonderful scoop last month, when photographs of the attempt on the King's life were flashed across the world by radio, to appear in Sydney dailies within 24 hours of the event. The Photogram Service has played a dramatic part in many incidents since it was brought into operation in 1934. The assassination of King Alexander and the take-off of C. W. A. Scott's 'plane in the Centenary Air Race were two early events that were pictured here a few hours after they happened. The service is also proving of immense benefit to commerce by speeding up business tremendously. At a distance of 13,000 miles, reproductions of photographs, hand writing, drawings, plans, fashion plates, cheques, finger-prints and documents of all kinds are now being made.

★ ★ ★



There have been plenty of stories about mice getting into the "works" of a transmitter and causing a break-down —in fact, one of them put 2CO out of action for half an hour some months ago — but the Colombian shortwave station HJ1ABB must be the first to be put off the air by an alligator! During a chat with W2XAF in Schenectady, New York, the South American station abruptly went off the air. It transpired afterwards that a tame croc. from a near-by river had entered the transmitter building, and with a side-swipe of its tail, had wrecked one of the big transmitting valves!

★ ★ ★

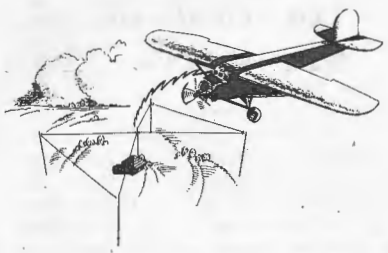
Radiotrician,
Service man,
Radio expert,
Service expert,
Radio mechanic,
Service technician,
What makes who a what?

Following the erection of a new 350-foot vertical radiator for Station WCKY, Connecticut (U.S.A.), a curious phenomenon was noticed by chief engineer Charles Topmiller. When the steel tower had been raised and guyed into position, rain clouds in passing struck the upper portion. Immediately rain started falling in a radius of 30 feet around the tower, and similar falls occurred on four consecutive days. It looks as though the cranks who write periodically to the papers blaming radio for both droughts and floods might be half right after all! Something must have gone wrong with stations in America during the recent record-breaking drought over there, though.

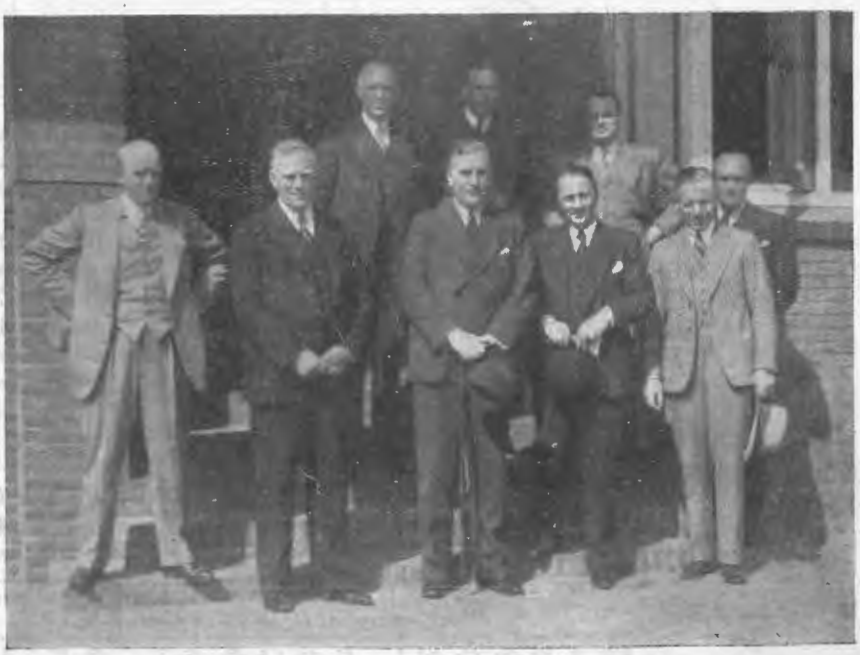
★ ★ ★

A receiver tuned with a telephone dial of the automatic variety has just been marketed in the States by one of the leading manufacturers there, following an idea that first originated in Germany. Any desired station is dialed in just the same way as a desired telephone number is selected. The dial controls relays and a motor which drives the tuning condenser around. The number dialed determines where the motor is to stop. The tuning is always exact, for it has been determined previously by precise instruments. As a means of eliminating slip-shod tuning, with consequent distortion. the idea is great, but production and service problems would worry most manufacturers to death.

★ ★ ★



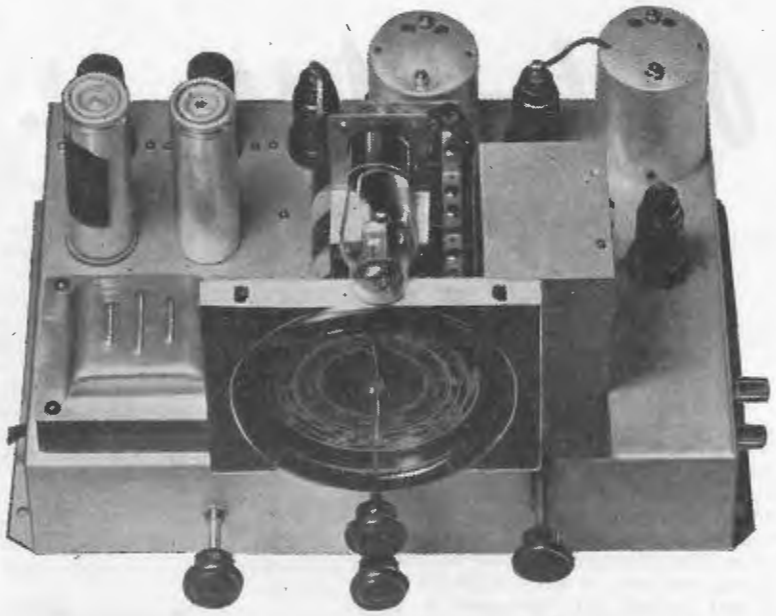
The W.A.S.P. Air Lines mail 'plane which travels over the Sydney-Broken Hill route twice a week is the latest to be fitted with a special receiver to enable the pilot to use the aural radio beacon established recently by A.W.A. at North Brighton, adjoining Mascot aerodrome. The beacon sends out four beams practically at right angles, and a 'plane approaching or travelling away from Mascot can pick up the signals and "ride the beam" to the aerodrome in any kind of weather—even through fogs, storms, or darkness. A receiver is also being fitted to provide entertainment for the passengers during flights.



This picture shows Mr. Menzies (centre) Australia's Attorney-General, standing on the steps of the Philips factory at Eindhoven, Holland, during his recent visit. He is accompanied by some of the directors.

"AIR-COMMODORE DUAL-WAVE FIVE" HAS HIGH GAIN AND SELECTIVITY

Performance is equal to that of many Six-valve Models



READERS who are planning to build the "Air-Commodore Metal-Valve Dual-Wave Five," described in the June "Radio World," will be interested in the following report on tests made with the kit subsequent to its description.

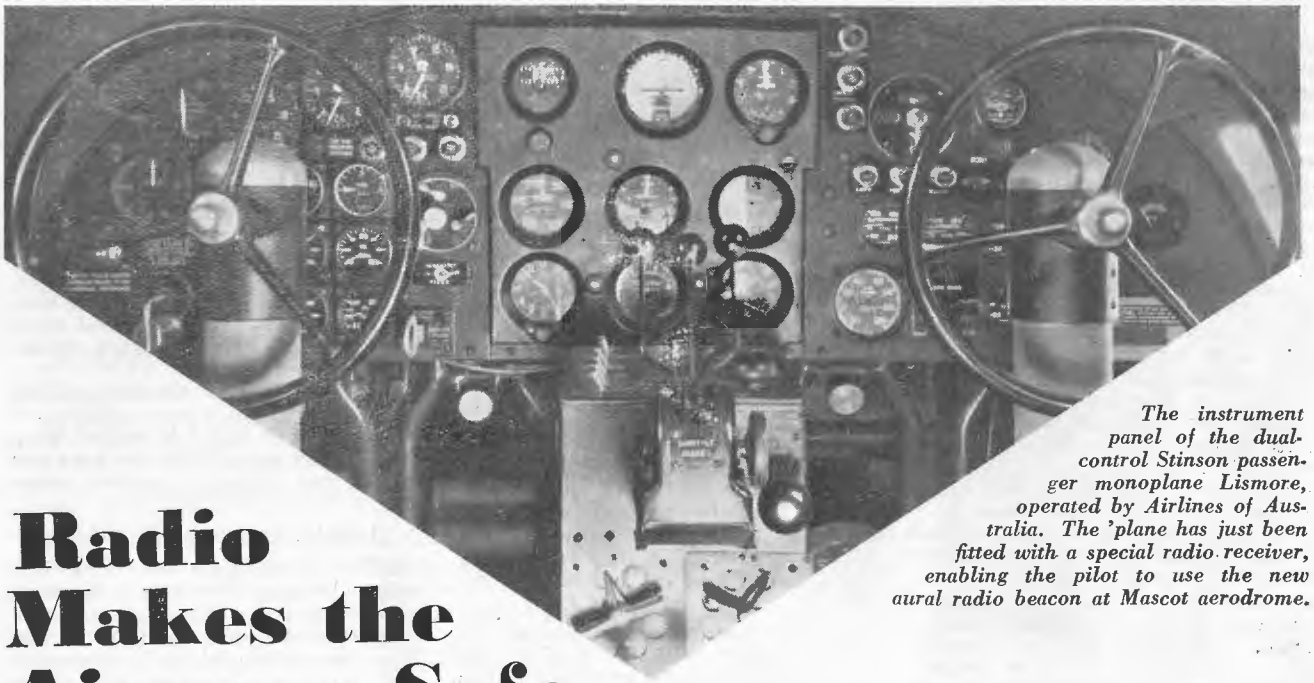
Three Different Localities

In order to get a comprehensive idea of the set's behaviour under different conditions, it was given a thorough tryout in three different and widely varying locations. The first test was made in the heart of the city, where although the noise interference was high, all the main inter-State stations could be received quite comfortably after three o'clock in the afternoon. London and Paris were also received at full volume, but were badly interfered with by local electrical noises. Even under these conditions, however, the "Air Commodore" showed a better signal-to-noise ratio than three other A.C. receivers (two five-valve superhets and one six-valve) tested at the same time.

74 Broadcast Stations

The second test was made in the Eastern Suburbs, with a tram line

(continued on page 56)



The instrument panel of the dual-control Stinson passenger monoplane Lismore, operated by Airlines of Australia. The 'plane has just been fitted with a special radio receiver, enabling the pilot to use the new aural radio beacon at Mascot aerodrome.

Radio Makes the Airways Safe

Radio aids to navigation have been perfected to such an extent that it is now possible for a pilot to take off on a flight and land again without taking his eyes from the instrument panel. How this is accomplished is explained in the following article.

By DOUGLAS N. LINNETT

RECENT years have seen a great advancement in the application of radio aids to increase the safety element in flying, until to-day blind flying, or flying by instruments, is an accomplished fact. Pilots can now rely implicitly upon their directional radio equipment, and fly into any sort of weather without the slightest fear of straying off their course.

Radio Beacons Are Invaluable

By riding the waves of radio beacons, pilots can make safe landings without watching the ground or the horizon. They can guide their 'planes merely by watching the dials on the instrument board and listening to signals of marker beacons through the headphones; while they can land in a fog, at night or in the teeth of a blizzard without any fear of hitting the ground too hard or running into any hangars or sheds.

Already there is one radio beacon installed in Australia, but this guides the 'plane only to a point above its destination. If the airport is hidden by rain or sleet, the 'plane might crash. Radio, however, has overcome the blind landing hazard by a system of directive beams which consist of runway beacon, marker beacons and a landing beam. All these provide continuous and accurate information on the position of the aeroplane in three dimensions, as it approaches and reaches the instant of landing.

Exact Position Given

The runway beacon gives indication of the directional position of the aeroplane with respect to the airport, and ensures keeping the aircraft directed to and over the desired landing runway.

Longitudinal position of the aircraft as it approaches the airport is given by a combination of the signals from a distance indicator with the aural signals received from two marker beacons. The distance indicator, operated from the beacon receiver, reads field intensity of the runway beacon and may be calibrated approximately in miles from the beacon (say, 0-5 miles). Absolute indication of the longitudinal position when near the airport is given by aural signals from two 5-watt marker beacon transmitters. One signal is heard when the 'plane is within 2000 feet of the airport, and the other when it is over the field boundary.

Vertical guidance is given by a horizontally polarized ultra-high-frequency landing beam, which has the necessary direction in the vertical plane while spreading the beam out in the horizontal plane to afford service in the 40-degree sector.

On the aircraft, a simple ultra-high-frequency receiver is used; but the sensitivity is so adjusted that the line of constant received signal below the inclined axis of the beam marks out a landing path which is suitable for the aircraft and the airport. The horizontal index line across the face of the combined instrument represents the half-scale deflection, and corresponds to the proper landing path. The horizontal pointer represents the position of the aircraft relative to this path.

The vertical and horizontal index lines of the combined instruments intersect in the centre of the instrument dial. The point of intersection, indicated by a small circle, represents the proper landing path, so by keeping the pointers crossed over the small circle, a suitable landing path is followed down to the point of landing, and the system requires a minimum of manipulation on the part of the pilot.

Landing A 'Plane By Radio.

In practice, the pilot follows the main radio beacon by listening to the blend of dots and dashes in his headphones. As he nears the airport, the signals get stronger and stronger until suddenly they stop. This marks the "blind spot" directly over the beacon itself and so the pilot knows he has reached his destination.

Re-tuning his receiver to the local runway beacon frequency, he swings the 'plane into a wide clock-wise turn and presently the earphones and instrument dial pick up beacon signals again. The 'plane is now following the runway beacon, which is simply a miniature of the big airway beacon.

Now the ingenious landing beam begins its work. Crossing the vertical needle on the beacon dial is a horizontal needle which swings up and down. If the 'plane is too high for its proper glide, the needle swings up; but if the 'plane is too low, down goes the needle. Next, the high-pitched signals from the first marker are heard in the headphones. These give the warning that the 'plane is 2000 feet from the field boundary and so the engine should be throttled down.

While the pilot is still following the landing beam by watching the instrument board, the low-pitched signals of the second marker beacon are heard. This indicates that the 'plane is over the edge of the field, and gives the warning to cut the motor. By this time, the pilot could see the ground in any kind of weather.

Flying Solely By Radio.

The complete practicability of this radio landing system has been amply demonstrated in making safe landings under conditions of zero visibility; while it has made possible blind flying in which radio is the sole means for navigation and for landing. So the technique of radio has made possible flying by instruments and this has immeasurably increased the safety element in commercial aviation.

The only limitation from the radio point of view is that the radio range over the main course gives only the direction towards the destination without any indication of the actual height above ground. The Barometric Altimeter now used gives the height above sea level, and can be adjusted to give the height above the starting point; but its limitations are obvious. For instrument flying, therefore, equipment to give the actual height above ground level is urgently required over certain types of country.

Several systems have been suggested; but the one which makes use of the phenomena known as "radio echo" seems to have the greatest possibilities. Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company, is reported to have proved experimentally the feasibility of the "Radio Altimeter"; while Professor Gun, of the Belle View Naval Research Laboratories. is said to have developed a system of radio altitude measurements for 'planes in flight.

The object is to measure the distance that a radio wave after leaving the 'plane and being reflected back to it again from the earth beneath, travels. Indications may be oral, graphic, visual, or in the form of a warning that will call the pilot's attention when certain limiting values have been reached.

As far as navigation is concerned, the only further information that the pilot requires is his exact position along the course he is flying. This is supplied by marker beacons of short transmitting range that are placed along the course, and which send out a characteristic signal to indicate the approximate position of the 'plane. Then, if there is a change from one radio range to another, similar marker beacons indicate the turning point, and give warning that the receiver must be re-tuned for the new direction.

Pedal-driven Teleradio
Boon to Isolated Districts

THIS month's front cover illustration shows the ingenious way in which the engineers of Amalgamated Wireless (A'sia) Ltd. have solved the problem of providing power for portable radio transmitting equipment used in inaccessible districts.

The pedal-driven generator shown on the right is the solution. When the transmitter is needed, a native boy mounts the machine and "rides." As the "bicycle" has no wheels, the boy gets nowhere, but the transmitter does, because the energy generated in this way provides all the power necessary to establish communication over distances of 200 miles and more. The complete equipment weighs about 1 cwt., and can be carried in sections.

The Archbold Expedition at present exploring North-west Papua kept in constant touch with the A.W.A. station at Port Moresby by means of one of these Teleradio sets, as they are called, during their journey of 560 miles up the Fly river. Incidentally, a member of the party who became ill during the trip was treated daily by radio from Port Moresby. The symptoms were described by radio to a doctor there, who radioed instructions back to the explorers.

Assists Distressed Ketch

Another illustration of the utility of the Teleradio set was provided several months ago, when an expedition was despatched from Port Moresby by the ketch Veimauri. One of the A.W.A.'s pedal sets had been fitted for the trip, which was expected to occupy twenty days.

On the second day out from Port Moresby very bad weather was encountered in the Gulf of Papua. The engine of the Veimauri stopped when the ketch was 50 miles from land, and as the boat was very heavily laden, the position became serious. The wireless was brought into action, and communication was established with Port Moresby Radio, the result being that a relief boat with an engineer and spare parts was despatched within an hour to the assistance of the ketch.

On this occasion the boy on the "bike" must have been something of a trick cyclist, to stick on and keep the machine going while the boat was rolling and plunging in the heavy seas.

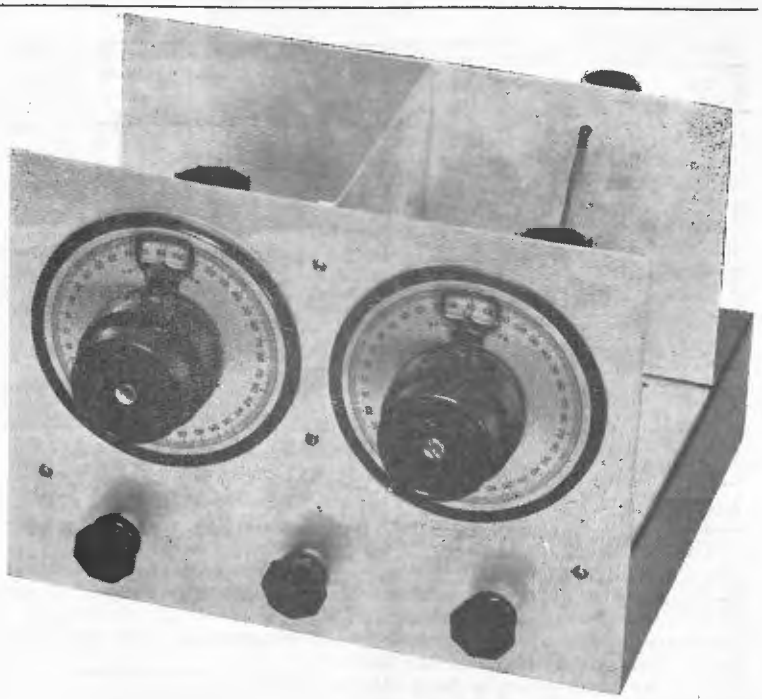
Popular In Isolated Districts

Teleradio sets have proved particularly valuable in Papua and the Mandated Territory of New Guinea, where no fewer than 36 of them are in use. They are employed by Government officials on their journeys into places remote from settlement, thus enabling constant touch to be maintained with headquarters. Planters and gold mining companies have lately learned of the value of this type of instrument, a call through which might save a journey of scores of miles over trackless territory.

Teleradio sets are admirable also as feeders of the main wireless lines of communication between New Guinea and the outside world. Thus an owner will transmit a message from his own locality to Rabaul or Moresby, to be sent on to a business firm perhaps in Sydney or other Australian capital. From the point of view of the owner of a small transmitter the traffic is good business, as the sender, instead of paying 2d. per word to get his message to the main station, has the right of retaining 1d. for acting as his own telegraphist.

The . . . "Empire Shortwave Three"

A three-valve battery-operated shortwaver using a 1C4 r.f. stage, 1C4 detector, with electron-coupled regeneration, and 1D4 output pentode.



The photograph on the right shows the finished receiver. The three lower controls are (left to right) rheostat, on/off switch, and regeneration control.

THIS three-valve battery shortwaver was designed primarily for simplicity of construction and operation, but also for high efficiency and low cost. The parts used are all standard; in fact, many set-builders will have quite a few of them on hand already.

While the "Empire Shortwave Three" is simple both in circuit and layout, it is a great distance-getter, and is of a type that is very popular among shortwave enthusiasts in America to-day.

The r.f. stage, using a 1C4 screen-grid pentode, not only gives plenty of gain, but, what is just as important, it effectively isolates the aerial from the detector, eliminating the danger of "dead spots" on the detector dial, due to aerial damping.

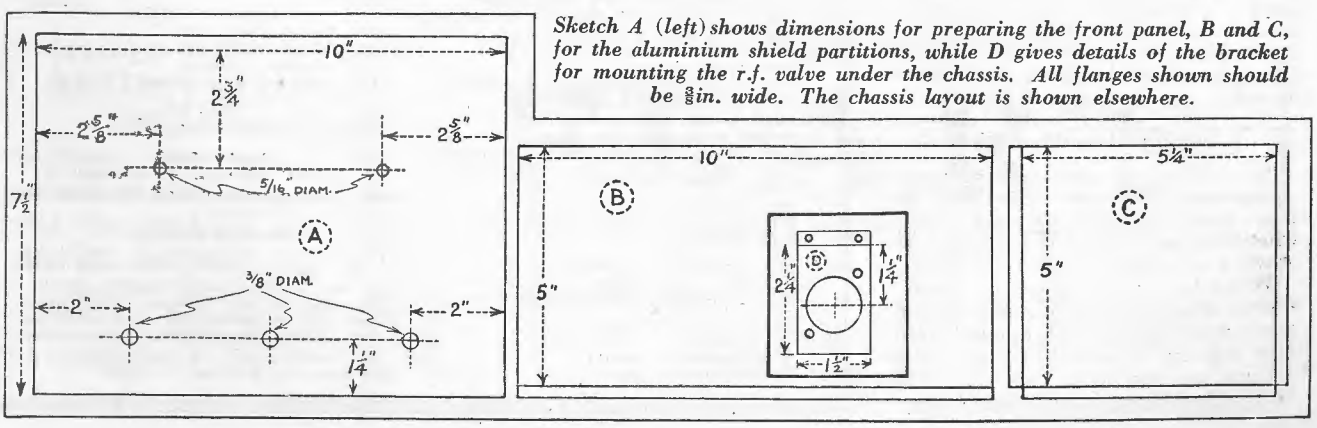
Electron-Coupled Regeneration

Another 1C4 is used as leaky-grid detector. By connecting a shortwave r.f. choke in the positive leg of the detector filament, and returning the negative side of the filament to a small reaction winding as shown in the circuit, electron-coupled regeneration has been obtained.

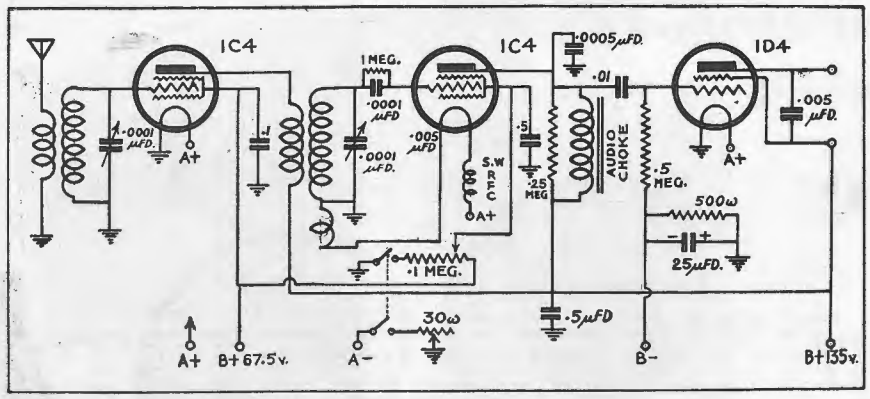
This method of obtaining feed-back gives excellent stability, with negligible de-tuning effect on the received signal when the regeneration control is advanced or retarded. Feed-back is controlled by using a potentiometer to vary the voltage applied to the detector screen—a method which gives velvet-smooth control, without the slightest sign of "ploppiness."

Separate Tuning Controls

A pair of 23-plate midget variable condensers (.0001 mfd. capacity) are used for tuning the r.f. and detector circuits. These condensers could have been ganged and only one main tuning control used, but the construction would have been complicated by so doing. Also, as it is hopeless to expect home-wound coils to track perfectly, especially on shortwave, it would have been necessary to include a trimmer across the r.f. section of the two gang condenser. This means that two tuning controls are needed, even with ganged condensers, so the latter might just as well be separately-operated.



Sketch A (left) shows dimensions for preparing the front panel, B and C, for the aluminium shield partitions, while D gives details of the bracket for mounting the r.f. valve under the chassis. All flanges shown should be ⅜in. wide. The chassis layout is shown elsewhere.



The circuit of the "Empire Shortwave Three."

In practice, the setting of the r.f. dial is not at all critical.

To keep the plate and grid leads to the r.f. valve short, the latter has been mounted horizontally under the chassis, as shown in the under-chassis photograph. The result is that there is little or no "pulling" of one tuning circuit by the other; in fact, after a station has been tuned in, the r.f. dial can be rotated through the full 180 degrees without upsetting regeneration in the slightest. It acts merely as a volume control.

Impedance Coupling Used

To ensure highest gain, the detector has been impedance-coupled to the 1D4 output pentode. Resistance coupling could be used instead, but there would be less gain and also smooth regeneration over every waveband would be difficult to obtain, due to low detector plate voltage.

To prevent any tendency towards threshold howl, and also to level up the frequency response, a .25-megohm resistor is connected across the choke.

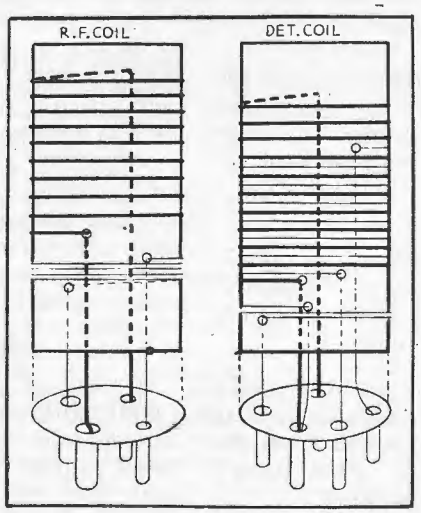
As regeneration takes place between screen and filament of the 1C4 detector, there is no need to include an r.f. choke in the plate circuit. The .0005 mfd. by-pass condenser prevents any r.f. present from passing to the grid of the 1D4, though if a trace of it does get through it is by-passed by the .005 mfd. condenser shown connected from plate to screen of the output pentode. This condenser also cuts out much of the "mush" that generally accompanies signals that have travelled half-way around the world.

D.P.D.T. On/Off Switch

A double-pole double-throw rotary on/off switch has been used, one section breaking the filament circuit when the set is switched off, and the other the potentiometer circuit.

When the set is turned on, there is a very slight current passing through the potentiometer. It amounts only to a fraction of a mill., but if it were present all the time the life of the "B" batteries would be shortened by a few weeks. Hence provision has been made to stop this drain when the set is turned off.

The simplest, cheapest and most satisfactory method of obtaining bias for a set of this type is to use automatic bias. To do this, a 500-ohm resistor is connected between earth and B —. The "B" current taken by the set, in passing through this, causes a voltage drop that is utilised for bias for the 1D4.



The method of winding the coils, and the connections, are shown in this sketch.

The 30-ohm rheostat has been provided so that either a 2-volt accumulator or two 1½-volt dry cells can be used for filament supply.

Goat shields have been used for both screen-grid valves as being the most suitable for a set of this type. This is particularly the case for the horizontally-mounted r.f. valve, as the shield is clipped on to it and is firmly held.

The "Empire Shortwave Three" is powerful enough to provide plenty of volume for operating a speaker on many shortwave stations, but 'phones will be found very handy for extreme DX work and for dial-searching generally.

Parts Should Be Chosen Carefully.

The parts needed to build the "Empire Shortwave Three" are listed elsewhere. While they are all standard and are readily obtainable everywhere, they should be chosen with care if best results are to be obtained.

The vernier dials are particularly important, as they make all the difference to the ease with which the set can be operated. There should be no trace of noise or back-lash.

The next essential is a smooth-working potentiometer for the regeneration control. When the moving arm is rotated, the increase in screen voltage should be both smooth and gradual, and also no scraping noise should be evident in the 'phones. Potentiometers provided with wire contacts mounted on the resistance element are useless for the purpose, because as the moving arm shifts from one contact to another so the voltage increases or diminishes in steps, resulting in "ploppy" regeneration. With the correct type of poten-

"EMPIRE SHORTWAVE THREE"—List of Parts

1 steel chassis; aluminium front panel and shield partitions; and steel bracket.
3 4-pin, 3 5-pin ribbed plug-in coil formers.
3 4-pin, 2 5-pin wafer sockets.
1 5-pin Dalton socket.
2 Goat valve shields.
2 23-plate midget condensers (Radiokes).
1 30 ohm rheostat (Radiokes).
3 small knobs.
1 100,000 ohm potentiometer.
1 high impedance audio choke (Radiokes).
1 5-pin plug and len. of 5-wire battery cable.
2 vernier dials (Utility).
1 D.P.D.T. on/off switch (rotary type).
1 pair headphones.

FIXED CONDENSERS.

1 .0001 mfd. T.C.C. midget mica.
1 .0005 mfd. mica.
1 .005 mfd. tubular (Solar).
1 .01 mfd. tubular (Solar).
1 .1 mfd. tubular (Solar).
2 .5 mfd. tubular (Solar).
1 25 mfd. dry electrolytic 25v. working (Solar).

FIXED RESISTORS.

1 500 ohm carbon 1-watt.
1 .25 ohm carbon 1-watt.
1 .5 ohm carbon 1-watt.
1 1 megohm ½ watt carbon.

VALVES.

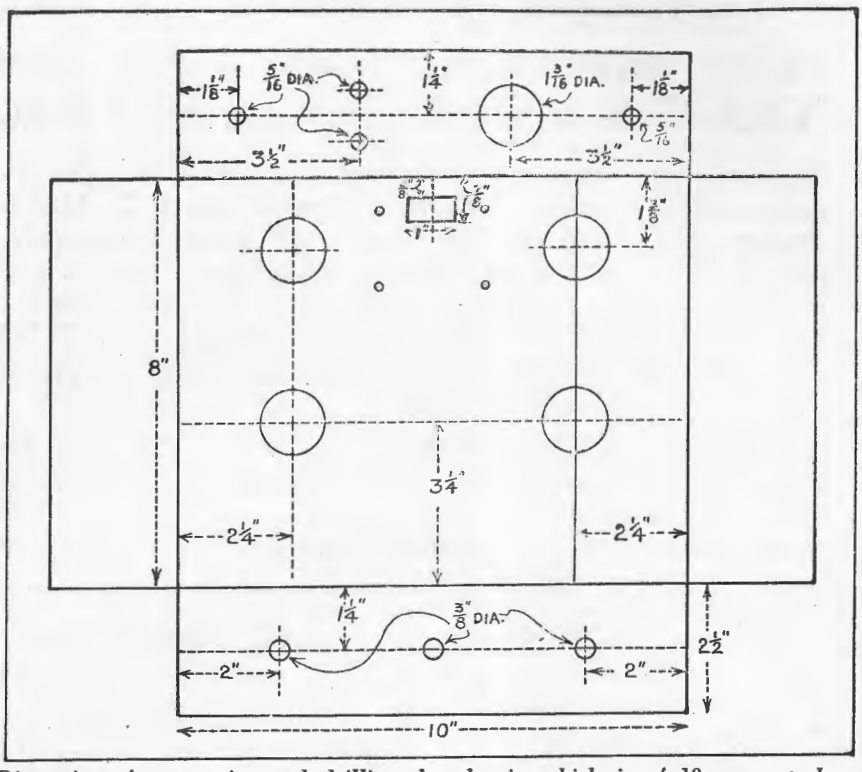
2 1C4, 1 1D4 (Radiotron, Ken-Rad, Philips).

BATTERIES.

3 45 volt "B" batteries (Ever-Ready).
1 2 volt accumulator or 2 1½ volt dry cells (Ever-Ready).

MISCELLANEOUS.

2 grid clips; push-back; 1 doz. small solder tags; 2 doz. 3/8" nuts and bolts; 2 yds. 16 ga. tinned copper wire; 4 terminals, 2 red, 2 black; small quantities of 24 gauge enamelled wire and 24 d.s.c. for winding coils; 2" length of 3/8" bakelite rod and small quantity of 30 d.s.c. for winding r.f. choke.



Dimensions for stamping and drilling the chassis, which is of 18-gauge steel, are shown above.

tiometer, reaction will be found to be very smooth.

One of the latest Radiokes high impedance audio chokes was used in the original receiver for coupling the detector to the output pentode. Alternatively, the primary or secondary, or the primary and secondary connected in series of an ordinary audio transformer can be used without much loss.

The Panel, Shield Partitions, and Chassis.

Full dimensions for the panel, shield partitions, chassis, and angle bracket for mounting the r.f. valve underneath the chassis, are given in sketches accompanying this article.

The chassis and bracket are of 18 gauge sprayed steel, the shield partitions of the same gauge aluminium, while the front panel is of 16 gauge frosted aluminium.

Winding the Coils.

Three pairs of coils are needed to cover the shortwave bands from approximately 18 to 90 metres. The method of winding and the connections are shown clearly in the accompanying sketch, while details of turns required for each band are given elsewhere.

The secondaries are wound with 24 gauge enamelled wire, and the primary and reaction windings with 24 gauge d.s.c. Every care should be taken to make a well-finished job of each pair of coils, as upon them the performance of the set largely depends.

The secondaries of the two smallest parts of coils are space-wound to the winding lengths given, the primaries of both detector coils being inter-wound with the secondaries. The primary of the 80-metre band detector coil is close-wound on a layer of empire cloth placed over the lower end of the secondary. The top turn can be secured in place with a small dab of sealing wax, and the end brought down and taken through the former just below the secondary.

The aerial primaries and the reaction windings are put on ¼ inch

Coil Details For The "Empire Shortwave Three"

BAND	R.F. Coil. PRI.	R.F. Coil. SEC.	Detector Coil. WINDING LENGTH	Detector Coil. PRI.	Detector Coil. SEC.	Detector Coil. REACT.
20-metre	4½	8¾	1"	5¾	8¼	2¼
40 „	7½	17¾	1½"	10¾	17¼	2¼
80 „	9½	28¾	close-wound	16¾	28¼	3¼

below the secondaries in each case. Notice particularly that the reaction windings should be put on in the opposite direction to the grid windings; otherwise regeneration will not take place.

The R.F. Choke.

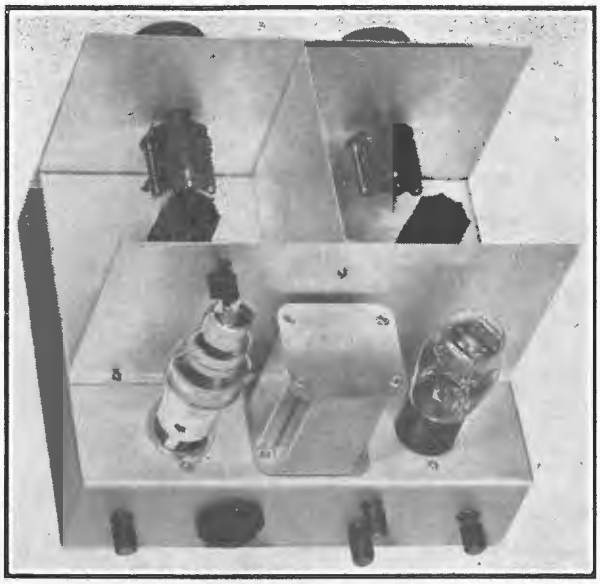
The r.f. choke used in the positive side of the detector filament circuit should have a very low d.c. resistance, so that it will not have any appreciable effect on the filament voltage of the detector. For this reason, most of the commercial short-wave r.f. chokes available are unsuitable, as they are wound with very fine gauge wire. However, the choke illustrated in the under-chassis photograph is very simple to wind.

A 1¾ inch length of ⅜ inch bakelite rod is needed for the former. A hole is drilled through close to each end and a ⅜ inch bolt and nut used for mounting a small solder tag. These form the terminals of the choke. Four pies of 27 turns each are required, each pie being separated from the next by a distance of about ⅛ inch. The pies can be jumble-wound, or else three layers of ten, nine, and eight turns can be put on for each.

★ ★

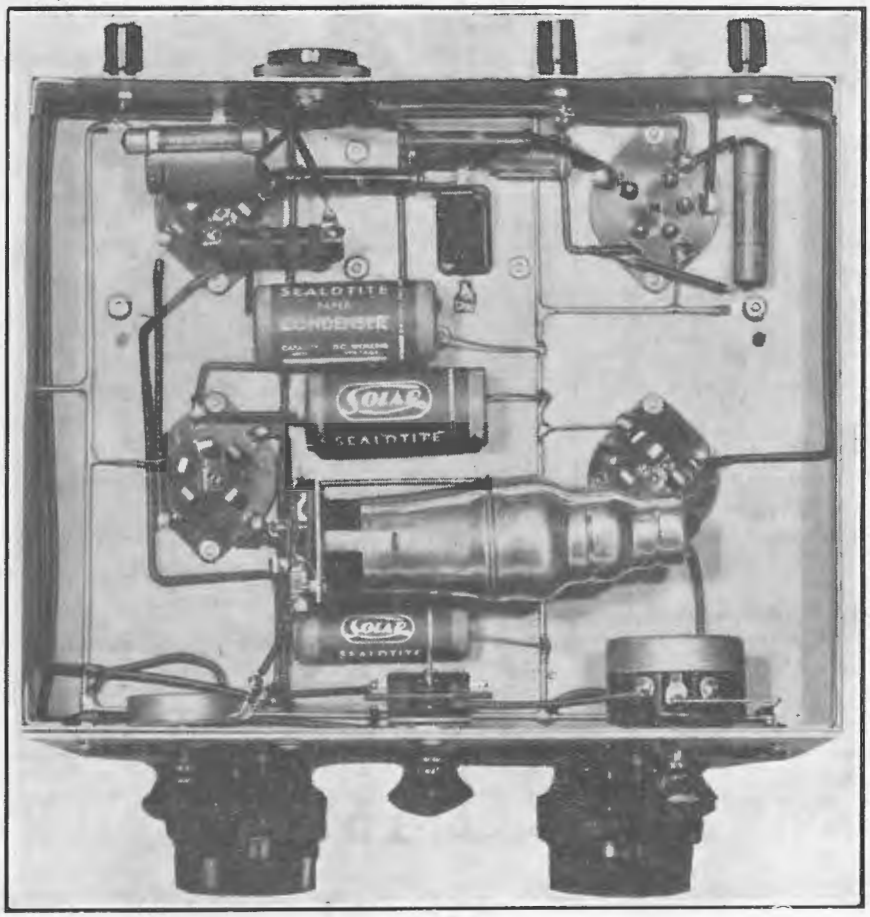
A rear view of the "Empire Shortwave Three," showing the 1C4 detector, high impedance audio choke, and output pentode arranged along the back of the chassis, behind the shield partition. One side of the grid leak and condenser is soldered directly to the detector grid clip as shown.

★ ★

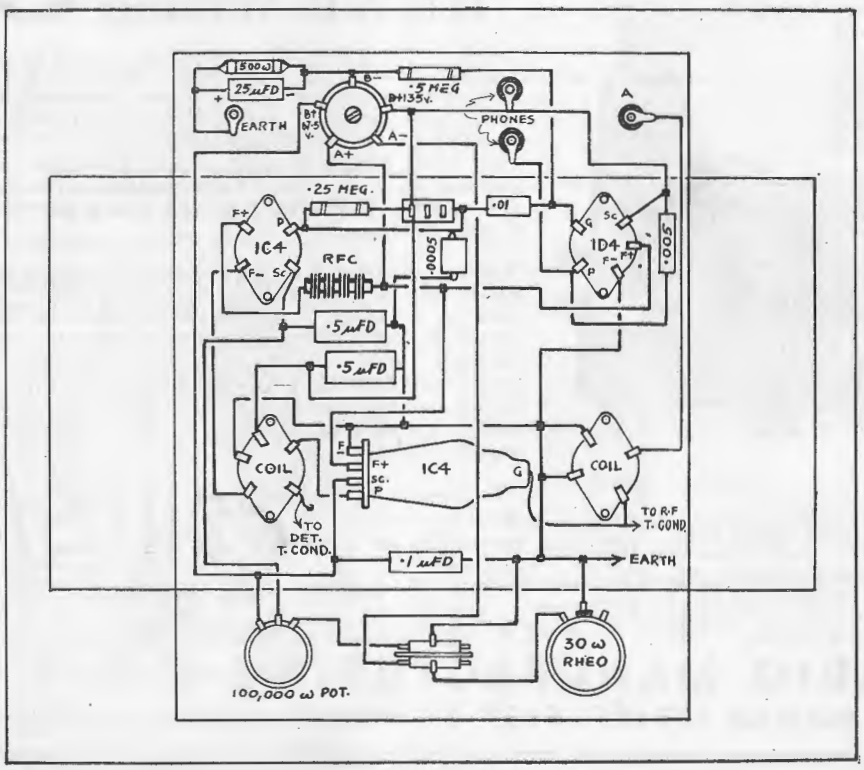


Assembling the Receiver

The assembly is commenced by mounting the valve and coil sockets, battery socket, and the aerial, earth, and 'phone terminals, which, with the exception of the earth terminal, should all be insulated from the chassis. The



The wiring is shown in this photograph and sketch.



right-angle bracket for mounting the r.f. valve under the chassis can be bolted in place next, followed by the audio choke.

The shield partitions and front panel are then bolted in place, and the rheostat, on/off switch, potentiometer, and tuning condensers mounted. The tuning dials can also be fitted at this stage, too.

Before mounting the condensers, however, solder short lengths of push-back to the fixed and moving plates terminals on each. All four leads pass through holes in the chassis, those from the moving plates going to earth, and those from the fixed plates going to the correct terminals on the coil sockets.

Putting in the Wiring

The wiring is commenced by running an earth line of 16-gauge copper wire around the chassis, as shown in the wiring sketch and under-chassis photograph. All earth returns are made to this line, as it is never a wise plan to depend on connections made to the chassis for this purpose.

Next, the filament circuits can be wired up, and then, starting from the aerial terminal, put in the remainder of the wiring systematically.

Of the five leads passing through the chassis, four run to the tuning condensers as previously explained. The fifth, running from the coil terminal to which is connected the top of the detector grid winding, passes through the chassis and the rear shield partition, to one side of the ½-watt grid leak and midget mica condenser. The other side of these two components, which are in parallel, connects to a clip which fits over the grid cap of the detector.

The leads of the five-wire battery cable are then soldered to the pins of the plug, and then everything should be given a thorough check to ensure that no mistakes have been made.

Operating Hints

Now fit the control knobs, insert the valves, plug in the batteries, and attach the headphones and aerial and earth leads. Then plug in the 80-metre band coils and switch on.

Set the tuning dials "in step," and slowly advance the regeneration control until a slight hiss, gradually increasing in intensity, is heard, denoting that the set is either oscillating or on the verge of it. Plenty of stations should soon be picked up by slowly rotating the tuning dials.

If the set oscillates too readily, remove the detector coil and slide the reaction winding a little further away from the grid winding. For greatest "punch" and smoothest operation, the set should slide into oscillation when the regeneration control is nearly full on.

THE EMPIRE SHORT-WAVE THREE

See the full constructional details elsewhere in this issue—listen-in on the world with remarkable shortwave set.

"EMPIRE SHORTWAVE THREE"
LIST OF PARTS.

	£	s.	d.
1 chassis, aluminium front panel and shield partitions; steel bracket		17	6
3 4-pin, 3 5-pin ribbed plug-in coil formers, Marquis. 6 at 1/6 each		9	0
3 4-pin, 2 5-pin wafer sockets—Tasma. 5d. each		2	1
1 5-pin Dalton socket			9
2 Goat valve shields		1	2
2 34-plate Midget condensers ((Radiokes). 4/6 each		9	0
1 30-ohm rheostat (Radiokes)		3	0
3 small knobs (Marquis), small knurled. 6d. each		1	6
1 100,000-ohm potentiometer (Bradley)		5	9
1 high impedance audio choke (Radiokes), A.F.1		18	6
1 5-pin plug and length of 5-wire battery cable. 10d. plug; 7d. yd.		1	2
2 Vernier dials (Utility). 12/6 each	1	5	0
1 D.P.D.T. on/off switch (rotary type), H. & H.		4	6
1 pair headphones (Lissen)		18	6
FIXED CONDENSERS:			
1 .0001 m.f.d. T.C.C. Midget, mica		1	0
1 .0005 m.f.d. T.C.C., mica		1	0
1 .005 m.f.d. tubular (Solar)			10
1 .01 m.f.d. tubular (Solar)			10
1 .1 m.f.d. tubular (Solar)		1	0
2 .5 m.f.d. tubular (Solar)		2	9
1 25 m.f.d. dry electrolytic 25V. working (Solar)		2	3
FIXED RESISTORS:			
1 500 ohm Carbon, 1-watt			9
1 .25 ohm Carbon, 1-watt			9
1 .5 ohm Carbon, 1-watt			9
1 1 megohm ½-watt Carbon, I.R.C.		1	3
VALVES:			
2 1C4, 1 1D4 (Radiotron, Ken-Rad, Philips). 17/- ea.	2	11	0
BATTERIES:			
3 45-volt "B" batteries (Diamond). 14/6 each	2	3	6
1 2-volt accumulator, 40-amp. (Velco)		13	4
MISCELLANEOUS:			
2 grid clips; push-back; 1 doz. small solder tags; 2 doz. ¾in. nuts and bolts; 2 yds. 16 ga. tinned copper wire; 4 terminals, 2 red, 2 black; small quantities of 24-gauge enamelled wire and 24 d.s.c. for winding coils; 3in. length ¾in. bakelite rod and small quantity of 30 d.s.c. for R.F. choke		4	9
	£11	**18**	**8**

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Add Class "B" Audio TO THE SKY-CRUISER BATTERY 4

The "Sky-Cruiser Battery Four" was fully described in last issue—now you can add Class "B" Audio. See the full details elsewhere in this issue.

"SKY-CRUISER" BATTERY FOUR

Parts needed to add Class "B" Audio

	£	s.	d.
1 4-pin, 1 6-pin wafer socket. 5d. each			10
1 class "B" input transformer (Radiokes)		18	6
1 .005 m.f.d. tubular condenser (Solar)		2	6
1 7-pin wafer socket and 7-pin plug		1	6
VALVES:			
1 19, 1 30 (Radiotron, Ken-Rad)		17	0
1 KC3 and 1 KDD1 (Philips)		16	0
	£2	**16**	**4**

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No matter where you live Vealls can supply—at keen Melbourne prices . . . remember Vealls pay freight on all Victorian Retail excepting Radio Cabinets, and on all Interstate orders excepting Batteries and Cabinets.

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NINE RANGE D.C. MULTI-METER

Here is a necessity to every radio fan, serviceman, mechanic and experimenter—a nine range D.C. multi-meter. See details elsewhere in this issue. Vealls can supply all parts required, including meter £4, or with carrying case 89/-. Parts only without meter or case 45/-. If desired, the complete parts ready wired and tested may be purchased for £5.

Complete Kit of Parts £4-0-0

Carrying Case, 9/- extra

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299-301 CHAPEL STREET, PRAHRAN.
Wind. 1605.

168 SWANSTON ST., MELBOURNE.
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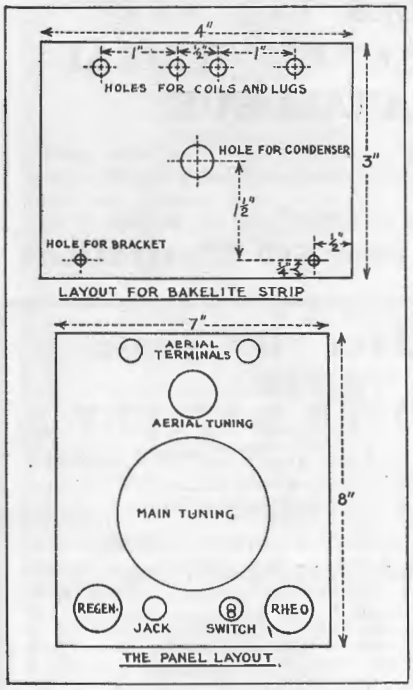
W 1188.

THE FASTEST MAIL ORDER SERVICE IN AUSTRALIA

A Simple Five-Metre Battery Receiver



Last month constructional details of a two-valve a.c. five-metre receiver were given. Here is a simplified battery version—using a pair of 30's—one as super-regenerative detector and the other as an audio amplifier.

By VK2EH

IN presenting this simple five-metre battery receiver, the writer has every confidence in its ability to put up an excellent performance. A similar set was in use at the writer's experimental station for several months during the five-metre distance tests conducted here and around Sydney last year. On it, stations between 60 and 70 miles distant were received at very good strength (R6-7).

The materials used are not costly, are readily obtainable from radio supply stores, are standard and suitable for other experimenting when a more advanced type of receiver becomes desirable, and what is dear to the hearts of most "fans," may already be in the "spare parts" box under the bench.

The Circuit

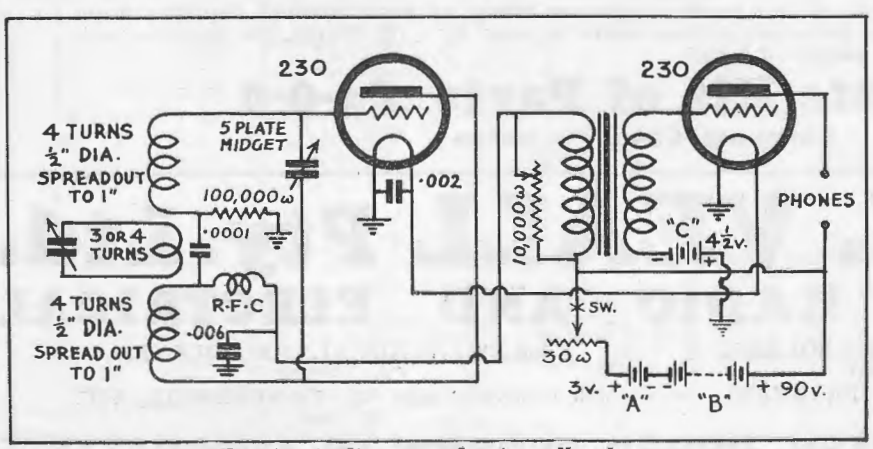
It will be seen that the circuit embodies a split Colpitts self-quenching detector with a conventional audio stage. The valves used are of the low-battery-consumption class.

Chassis and Panel

In the construction of a set to work at such high frequencies, close attention must be paid to the placement of parts. It is very necessary to keep large bodies of metal at a fair distance from the coils. This is achieved by mounting the coils on a strip of insulation material about 3in. above the chassis. The chassis is 8in. x 7in. x 2in. deep. The front panel is 8in. high and 7in. wide.

The Controls.

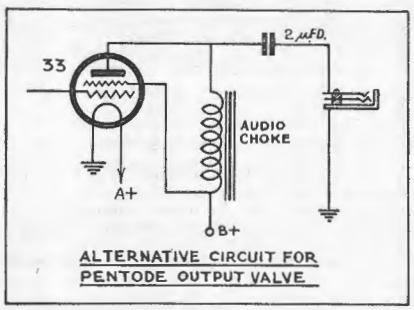
The knobs shown on the panel are: top centre, aerial tuning; large 4in. plain dial is main band tuning condenser control; the left-hand corner knob is for regeneration control; the filament rheostat knob is at the right-hand side; the telephone jack and filament switch are placed between these last two.



The circuit diagram, showing all values.

The Coils and Tuning Arrangements

The coils are soldered straight on to solder lugs clamped into position beneath the heads of four ⅛in. bolts



which pass through holes drilled in a piece of bakelite 4in. x 3in. The bakelite is fastened to the chassis by two strong angle brackets. The centre two holes are ⅛in. apart and the other two holes are 1in. away on each side of the centre two. The ⅛in. space is for the aerial coupling coil, while the plate and grid coils are each soldered to their respective pairs of solder lugs.

The aerial tuning condenser is secured to the front panel, but is insulated from it. The aerial coil is soldered directly to the aerial tuning condenser terminals so that it may be swung into line between the other two coils. The variable aerial coupling is necessary to maintain regeneration and prevent the detector "blocking." The main tuning condenser is also mounted on the bakelite strip. A flexible coupling unit and a piece of ¼in. bakelite shafting carries the condenser spindle out far enough for mounting the dial.

Coil Details

The coils are wound with number 14 or 16 gauge enamelled wire on a ¼in. former. The aerial coil is close-wound, and consists of three turns. The other two coils are each of four turns, space-wound to occupy 1in. In operation, these are opened out or squeezed together until the condenser tunes over the band. The .0001 mfd.

midget fixed condenser is soldered directly to the lugs at the coils. In this part of the circuit, the shorter the connecting wires the better.

The R.F. Choke

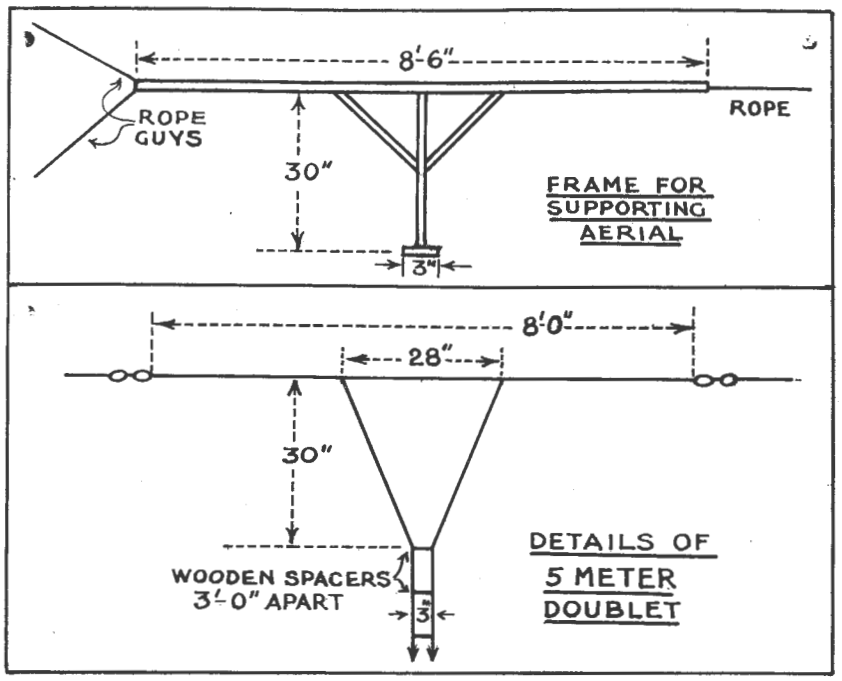
The R.F. choke is a most important unit, and must be correctly designed for the set to function as it should. It may be constructed by winding 30 gauge D.C.C. wire on a $\frac{5}{16}$in. glass or bakelite rod for a length of $\frac{3}{4}$in., or 30 turns of 26 D.C.C. wire on a $\frac{1}{4}$in. rod.

Detector Valve

The detector valve must be in good order, or otherwise the set may not super-regenerate, resulting in no signals being received. The remainder of the circuit and parts require no special mention, being used in a conventional audio stage.

Operation

Having completed the construction, connect the batteries, close the filament switch and turn the rheostat until a very dull glow is seen in the valve filaments. Then set the plate circuit resistor to about half its value, when a very pronounced rushing noise should be heard in the phones. Next, turn the rheostat, increasing the resistance in operation as far as possible, still maintaining regeneration. Couple an aerial to the receiver, tune it, adjust the coils, then look for the signals. Signals may be heard in the evenings between seven and midnight.



Details are shown above of the aerial and aerial support, which are mounted vertically

The aerial is very important. The type use at 2EH for both transmission and reception is known as the

matched impedance doublet. It consists of an 8-foot length of 16-gauge enamelled copper wire, fed with a transmission line of any convenient length. The feeders are spaced 3in. apart with wooden dowels boiled in paraffin wax. The end of the transmission line that is connected to the aerial, is "fanned out" to 28 inches commencing 30 inches from the end. The ends are soldered 14 inches each side of the centre of the aerial.

Mount the aerial vertically and as high as possible. Here at the "shack"

5-METRE BATTERY RECEIVER

List of Parts

1 aluminium chassis, 8" x 7" x 2".
1 aluminium panel, 8" x 7".
1 bakelite strip, 4" x 3".
2 4-pin valve sockets.
2 5-plate midget condensers (Radiokes).
1 10,000 ohm variable wire-wound resistance (Radiokes).
1 100,000 ohm fixed resistor.
1 .0001 mfd. fixed condenser.
1 .002 mfd. fixed condenser.
1 .006 mfd. fixed condenser.
1 audio transformer, 3:1 (Radiokes).
1 phone jack.
2 terminals.
1 30 ohm rheostat (Radiokes).
1 toggle switch.
1 R.F. choke (see text).
3 small bakelite knobs.
1 4" dial.
1 battery terminal strip.
1 pair headphones.

VALVES.

2 30's, or 1 30 and 1 33 (see text) (Ken-Rad, Radiotron, Philips).

BATTERIES.

2 45v. "B" batteries (Ever-Ready).
1 4½v. "C" battery (Ever-Ready).
1 2v. accumulator, or
2 1½v. dry cells (Ever-Ready).

SUNDRIES.

2 angle brackets for mounting bakelite strip to chassis; piece ¼" bakelite rod with coupling, for condenser shaft; small quantities of 14 or 16 gauge wire, also 26 or 30 gauge D.C.C. wire; 5-16" bakelite rod for R.F. choke; solder lugs, nuts, bolts, hook-up wire.

the aerial is mounted on a frame as shown in the sketch to preserve its correct shape, or else the impedance matching will be upset. The frame is made from ¾in. x ¾in. timber and then suspended from another aerial 50 feet high. The aerial described by 20D in last month's issue is also quite suitable.

The Batteries

The batteries may be connected through a 4-pin connector plugged into a 4-pin socket at the rear of the chassis, or by means of a battery terminal strip with four terminals. The bias battery is strapped under the chassis. An eliminator may of course be used in place of the "B" batteries, providing the voltage is not greater than 180 volts. A Philips eliminator was used with the original set.

Alternative Output

A pentode audio tube (233 type) may be used in place of the triode shown. In this case an audio choke or output transformer (speaker transformer to match valve) may be used. In this case the bias voltage should be — 7½ volts.

In conclusion, any listener hearing signals on five metres will be doing the experimenting amateur a service by sending a report to the station concerned. In most cases the station will send an acknowledgment card (QSL), but in order to ensure verification, the listener should enclose a stamp for return postage.

Definite 5 Metre Schedules for August.

Regular 5-metre transmissions will be conducted by the following stations during the Sunday evenings of August:

VK2OD: 7.15 to 9.30 p.m. (Music, relays and duplex telephony.)
VK2EH: 8 to 9 p.m. (Music, relays, and duplex telephony.)
VK2DL: 7.15 to 9 p.m. (Dual transmission, 41.1 and 5 metres; music.)

Times given are Eastern Standard time. Irregular tests will be conducted on various evenings after 7 p.m.

Palec Vacuum Tube Voltmeter

Useful Service Instrument

A soundly-designed vacuum tube voltmeter, such as that marketed by the Paton Electrical Instrument Company, is one of the most valuable instruments that any set designer or serviceman can have on hand.

One of the most serious sources of error in instruments of this type lies in the large input capacity that exists between the cable leads, one of which runs to the grid of the valve. In the Palec V.T. voltmeter, however, this drawback has been ingeniously overcome by mounting the valve—a 6J7 metal type—at the end of the flexible cable, as illustrated in the photograph above. In this way the grid cap can be placed in direct contact with the source of e.m.f. to be measured. Another advantage of the 6J7 is that the current drawn by it is substantially constant over a fairly wide range of plate voltages, with the result that minor variations in line voltage have no effect on the calibration.

Has Built-In Power Supply.

The instrument is a portable laboratory type weighing eight pounds, and is housed in a black leatherette case measuring 8¼in. x 9¼in. x 5½in. It is equipped with its own power supply operating on 200-

250 volts A.C. Valves used in the standard model are an 80 rectifier and a 6J7, but for ultra high frequency work a special model using an Acorn type 954 valve can be supplied.

Directly Calibrated Micro-Ammeter.

The measuring instrument is a 150 micro-ammeter carrying individual direct reading scales for all vacuum-tube voltmeter ranges. An additional feature is that the instrument can be used as a high resistance D.C. voltmeter (6,600 ohms per volt), with two ranges, 0-10 and 0-100 volts.

There are five switch positions. No. 1 provides a line check, in that by bringing the meter pointer to a marked position on the dial, all supplies to the vacuum tube voltmeter can be checked and set. Other ranges are as follows:—

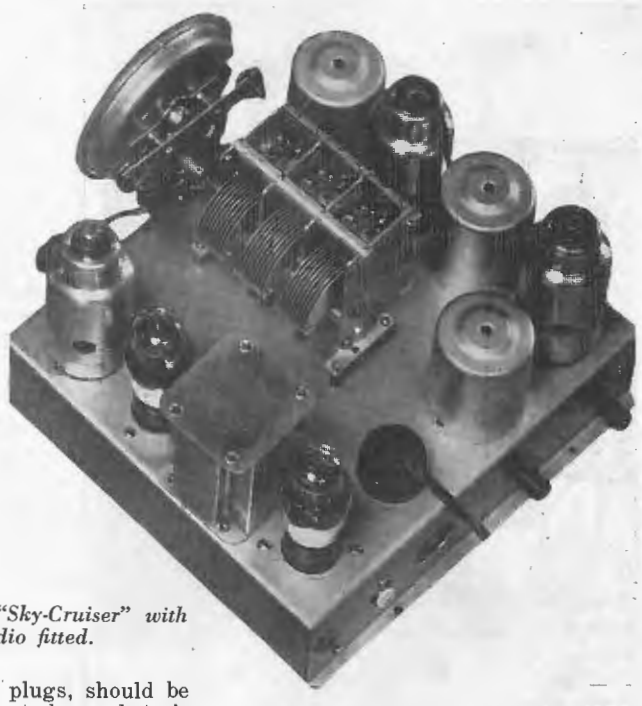
No. 2—0-3½v. Peak A.C., 0-2v. D.C.
No. 3—0-10v. Peak A.C. and D.C.
No. 4—0-50v. Peak A.C. and D.C.
No. 5—Ext. D.C. volts, 0-10, 0-100v.

Decibel Loss or Gain

A quick way of estimating gain or loss in terms of decibels is as follows. First memorise the following ratios: 1 db. equals 4-5ths; 2 db. equals 2-3rds; 3db. equals ½; 10db. equals 1-10th. Now, when gain in db. is given, break the figure up into these memorised fractions. Multiply the fractions and invert the answer. For example, say an amplifier has a gain rating of 8db. This breaks up conveniently into 3, 3, and 2, and the corresponding fractions are ½, ½, 2-3rds. Multiplication gives 1-6th as the answer. Inverting this indicates a gain of 6. To convert loss in db., proceed as above, but do not invert the fractions.

Adding Class "B" to the "Sky-Cruiser Battery Four"

In the "Sky-Cruiser Battery Four" described in last month's "Radio World," provision was made for replacing the single pentode output stage with a powerful class "B" audio system. The change-over is described below.



A rear view of the "Sky-Cruiser" with class "B" audio fitted.

WHEN the "Sky-Four" described last month was being designed, provision was made for the substitution of a "B" class audio stage in place of the single output pentode. On the grounds of economy, many will prefer to keep to the latter, but those who like plenty of volume will be interested in making the change-over.

"Sky-Cruiser Battery Four"

Parts Needed to Add Class "B" Audio

1 4-pin, 1 6-pin wafer sockets.
1 class "B" input transformer (Radiokes).
1 .005 mfd. tubular condenser (Solar).
1 7-pin wafer socket, and 7-pin plug.

VALVES.

1 19, 1-30 (Radiotron, Ken-Rad), or
1 KC3 and 1-KDDI (Philips).

The parts needed are few, and the change-over is not difficult. First of all, the 5-pin socket used for the pentode, together with those for the speaker and battery plugs, should be taken out. The pentode socket is replaced with a 4-pin wafer, the battery socket with a 6-pin, and the speaker socket is re-mounted under the hole on top of the chassis, left vacant in the original set. A 7-pin socket is also mounted on the rear wall of the chassis.

The next job is to mount the class "B" input transformer. That illustrated is one of the new improved wide range Radiokes transformers, designed to give high fidelity of reproduction. Before mounting it, five holes should be drilled in the chassis to take the terminals. These can be seen in the under-chassis photograph.

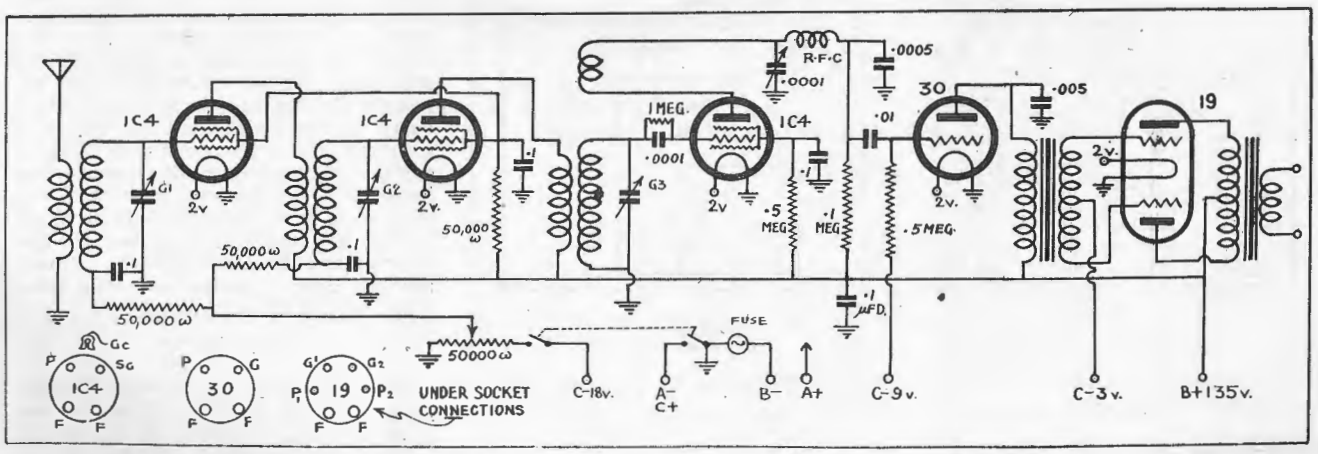
Completing the Wiring.

The wiring can now be put in. The filaments of the 30 and 19 are wired first of all. Then, starting at the grid of the 30, put in the remainder of the wiring. The battery socket is re-wired last of all, the seven connections required being:—B—, B+135v., A+, A—C+, C—3v. (for 19), C—9v. (for 30), and C—18v. (bias for r.f. stages), The "A—" and "C+" terminals are joined at the batteries.

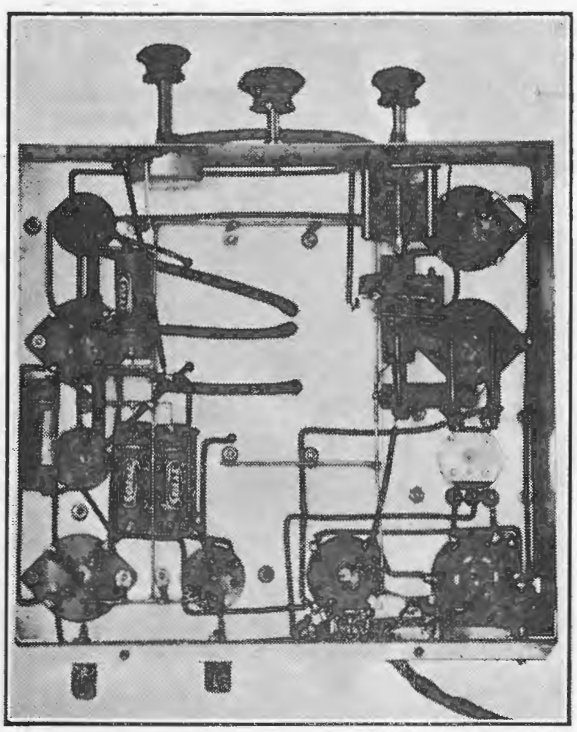
The .005 mfd. condenser from the plate of the 30 to earth forms a fixed control of tone. It reduces high note response a little, and makes reproduction well-balanced. According to personal tastes, a slightly larger capacity could be used to give deeper tone, or the condenser could be omitted altogether.

Economical On Batteries.

When any set with a "B" class audio system is used, it should alway be remembered that the "B" current drain is largely proportional to volume. To operate the set always



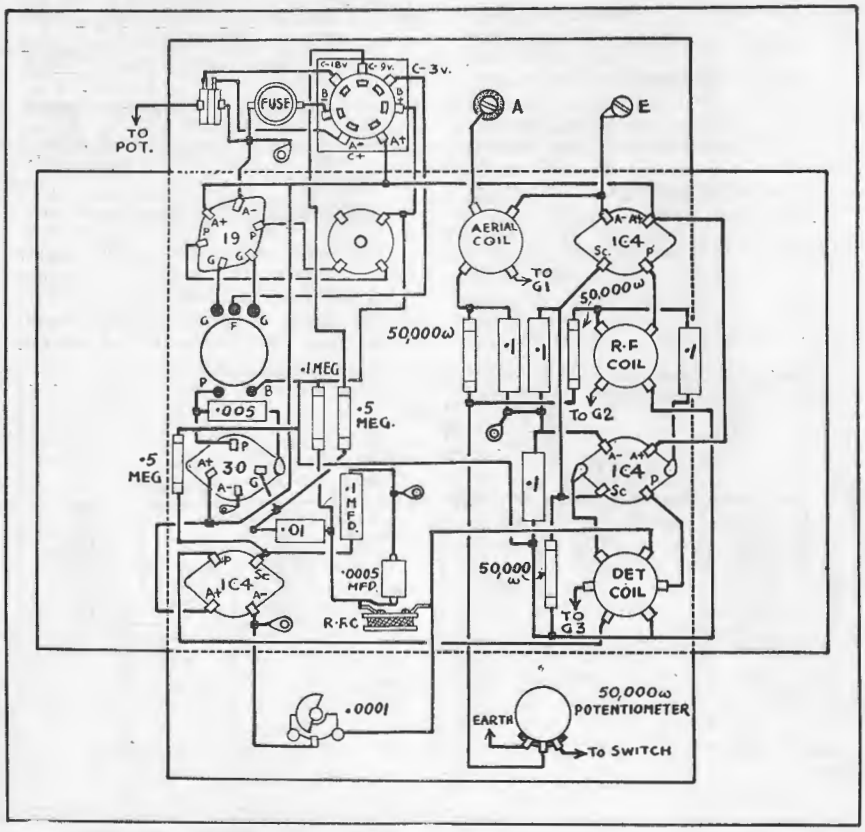
The amended circuit differs from the original only from the grid of the stage following the detector, onwards.



This under-chassis photograph shows the re-arrangement of sockets necessary for adding class "B." The 7-pin battery socket is now mounted on the rear wall of the chassis.

at maximum volume means heavy running costs.

For instance, the "Sky-Cruiser" with class "B" audio takes just under 7 mills. "B" current with the volume control turned right back (no signal), and with a bias of —3 volts on the 19. At full volume, the current fluctuates between 10 and 18 mills., while at comfortable listening volume—ample for any room—the drain varies between 8 and 12 mills., with an average current of not more than 10 mills. Thus, to get the best service from the "B" batteries, the volume control should be used with discretion.



The complete wiring of the five-valve model is shown in this sketch.

How the B.B.C. Gives 100 Per Cent. Service

By M.T.H.

STATIONS operated by the British Broadcasting Corporation very rarely break down, because of the strict precautions taken by the engineers. At a big station, such as Brookman's Park, a Diesel engine for providing power for both transmitters is kept in reserve. The stand-by engine is started automatically by relay switches, so a serious power breakdown is almost an impossibility. There is also a large room filled with banks of accumulators, which can take the load of the whole station for nearly an hour.

Each of the valve panels carries spare sets of valves, which can be brought into operation by switches. The panels have glass doors, behind which are steel-framed doors connected to switches which automatically cut off the power when the engineers open the panels to get at the valves.

In the early stages of the transmitter, nearly every valve is duplicated, and big push-pull switches change over the leads from one valve to the other, applying plate, filament and bias voltages to the new valve. In the first water-cooled stage, the change-over is done by rotary switches which by degrees cut out one circuit, earth all points, and then switch on the new valve.

In the final stage, where the push-pull banks of water-cooled valves are connected to the aerial circuit, there is one spare valve for each set of five valves. An accurate record is kept of the filament life of these big valves, and the possibility of more than one "going west" at a time is very remote. In the event of break-down, the spare valve is switched in by relays, and enables the transmitter to carry on until the end of the programme, when the push-pull circuits can be re-balanced and a new valve inserted if necessary. Several hundred pounds' worth of water-cooled valves are kept in reserve at the London and North Regional stations, and all other stations are also provided with a reserve store.

It is not necessary to twist heater leads to avoid the risk of introducing hum into other circuits; it is just as satisfactory to place them side by side.

Radio Ramblings

A page for letters from readers. A prize of 2/6 will be awarded for every technical tip published.

★ ★ ★

Hanging QSL Cards

This is a good way to mount verification cards on the wall, without filling it with tacks. Get a large piece of cardboard; hang it on the wall, and then attach the cards to it with drawing pins. Another way is to get some paper tape (adhesive tape can be bought very cheaply), and cut it into one-inch pieces. Stick the bottom of one "veri" on to the top of the next, and so on. With one tack, 8 or 10 verifications can be hung. When taken down, the cards can be stacked tidily, just as though they were separated. —Jack Glew (AW13DX), Bentleigh, Vic.

★

Simple Polarity Indicator

After buying a fair number of American and English DX magazines, I have always hoped that some day Australia could boast one of its own. Now, after reading your July issue, I find that the magazine I have wanted is here. I especially like your S.W. section, and hope that you continue to supply plenty of S.W. dope.

Here is a small hint for the "Radio Ramblings" page, that I trust will be of some use to others. I suppose there are readers, who, like myself, have wanted some gadget for determining the poles of an accumulator or battery. Well, here is a simple yet effective instrument.

A short length of ½ in. glass tubing is fitted at both ends with a cork, through which a short length of copper wire has been forced. The tube is three-quarters filled with a solution of 10 grains of phenolphthalein, ¼ oz. sulphate of soda, and enough water to give the right volume. Shake the solution well before filling the tube.

When placed across a battery the negative pole will turn a reddish colour, which will disappear when the solution is shaken.—Harry D. Hibberd (Bendigo, Vic.).

★

"Transocean" Gives Great Results

There is no doubt that a magazine such as the "Radio World" was wanted throughout Australia. There have been many books, but they give all their space to the programmes and too little to amateur matters. Even the layman is interested in the strictly amateur side of the game. A friend of mine recommended the book and I am glad to say I got it, and it was No. 1, too. I will not miss one issue. Your articles on broadcast dxing are very interesting and helpful, and I have no doubt are appreciated throughout Australia.

I have not had very much experience in dxing of the broadcast band, but on short waves have had a fair amount. I have had a small two-valve all-wave battery set for some years; my best on that was ZL's on 'phone about QSA4, R6-7.

It was after seeing the description of the "Transocean" in the "Radio World" that I purchased the kit and built it. I have had excellent results on S.W. Last Sunday afternoon W's were teeming in on 20 m. Only picked out a few W6's and 7's, also XE2. Heard more, but got only the tail end of their addresses—missed the calls—worse luck. The XE2 was QSA5, R7-8; had to retard the volume, it was so loud.

Tuning is done on an indoor aerial, and reception is on the speaker (Am-

STROBOSCOPIC INDICATOR CHECKS TURN-TABLE SPEED

ONE simple way of checking the speed of a gramophone turntable is to time the revolutions by using a stop-watch. For true reproduction the speed should be 78 revs. per minute.

A much simpler method, however, is to use the stroboscopic indicator shown in the accompanying illustration. It should be cut out, pasted on a sheet of cardboard, and cut into a circular disc, with a hole made in the middle to clear the turntable spindle.

To check the motor speed, place the disc over a record and watch it while playing by the light of an electric lamp supplied by a.c. mains with a frequency of 50 cycles. Next, adjust the speed regulator until the ring of black and white divisions appears stationary. When it does, the speed is exactly 78 revs. per minute.

How it Works

There are 77 black divisions and the same number of white spaces on the disc, the number being dependent on the frequency of the a.c. mains (in this case 50 cycles per second). For every cycle there are two voltage peaks, a maximum positive and maximum negative, so that with 50-cycle mains there are 100 peaks per second. These cannot be seen, of course, but nevertheless are there.

To give synchronism with the light, 100 black divisions on the disc should pass a given point in one second. At 78 revs. per minute, the disc makes 1.3 revs. per second. Therefore, the number of divisions that should pass the given point in one revolution is 100 ÷ 1.3, which equals 76.9. By dividing the disc into 77 divisions, a speed which is correct to .1 per cent. is obtained.

For any other frequency of supply, the number of black divisions is equal to— $\frac{\text{frequency} \times 60 \times 2}{78}$

plion dynamic). My outdoor aerial is, well, terrible—but will put up a doublet when I get the poles.—R. A. McGhee (Brisbane).

★

"Master Five" Steps Out!

The "Dual Wave Master Five" described in the June "Radio World" is an excellent performer. Sensitivity and selectivity are both very good. Tone is full and pure, right up to full volume, which is ample for any home.

By using a variable resistance control in the oscillator plate supply of the 1C6 valve, in place of the 25,000 resistance, weak signals on the short-wave band can be brought up to fine volume and the performance improved considerably. Reproduction on pick-up is also very pleasing.

Wishing your magazine every success.—Lindsay Smith (Horsham, Vic.)

★

Original DX Reports Bring Good Results

Have readers ever considered this aspect of dxing? Quite frequently over 2UW I have heard re-broadcasts from New York Radio City, British B.B.C., and hosts of American and Continental stations. These 2UW broadcasts come in from midnight to dawn by courtesy of A.W.A. interception department at La Perouse (N.S.W.).

I have written to the stations concerned and told them of their overseas reception being re-broadcast. I usually send details of 2UW's 24-hour schedules and a few clippings from newspapers and local post-card views. Very often I have sent an Australian commemoration stamp, and as there are generally stamp collectors on radio stations, this is a greatly appreciated courtesy.

A local radio magazine or a newspaper sent to foreign radio stations is also appreciated, also match box labels, or tram, train or 'bus tickets. For best results, dxers should make their reports as interesting and original as possible. Send your photograph, a packet of flower or vegetable seeds, or perhaps a visiting card—anything to make your report a little out of the ordinary. If possible, include some of your local tourist bureau folders or maps. Again, when sending a DX report to U.S.A. or Canadian radio stations, always advise them that reliable and authentic publicity can be had from the Australian National Travel Association, Hotel Clark, Los Angeles, Calif., U.S.A.

Any New Zealanders or Australians wanting a local DX session should write to Mr. Henry Gregory, c/o Station 2UW, State Shopping Block, 49 Market Street, Sydney, N.S.W., Australia. Mr. Gregory will put on DX programmes any night, midnight-to-dawn hours. 2UW is getting out very well in U.S.A., India and England, and they invite DX co-operation. Their New Zealand breakfast session from 4 to 5 a.m. E.A.S.T. is well worth listening to.

Another station that broadcasts regular DX programmes—for New Zealand—is amateur station VK2QY, 45 Oxford Street, Paddington, N.S.W. Gilbert S. Hayman (Bronte, N.S.W.).

Systematic Servicing Brings Best Results

Thorough Set Overhaul Gives Most Satisfaction

By "SERVICEMAN"

IN servicing receivers, a definite system of tracking down faults should always be followed. "Hit or miss" methods should not be tolerated, as in nine cases out of ten they mean high charges and low profits. A well-equipped and properly-run service department can not only show a good return, but also it is a valuable aid in building goodwill.

The system for service procedure outlined below is perhaps more thorough than that generally used by servicemen, but it certainly gets results.

Suppose, for example, a radio comes in for service, and after a few minutes with the voltmeter the serviceman finds it has a shorted screen by-pass condenser. Most servicemen would replace that condenser with an equivalent unit and return the receiver as O.K. Methods like this do more to increase the cost of service than anything else, because, while the charge may be low in the first instance, the chances are ten to one that there are more leaky condensers and perhaps weak valves in the set which will necessitate another call a few weeks later. If such a case occurs, the owner not only pays for two calls, but he may also begin to doubt the ability of the serviceman.

The system developed by the writer includes rigid inspection and test of nearly all parts of a radio chassis and speaker. For the sake of clarity, each test is numbered, described, and details of the test equipment used are given.

Test No. 1 really includes the service call. It is useless for a serviceman to rush into a home, collect the radio set, and rush it back to the workshop, because the trouble might easily be a faulty aerial wire, a shorted lightning arrester, a blown fuse, a break in the power flex, or a slipping knob or dial. A service call should include a rigid inspection of the aerial and earth system—and of the power circuit if the receiver fails to light up. If it lights but will not work, valves should be tested and replaced if necessary.

If the fault is apparently in the chassis itself, the set should be brought in to the workshop for repair. This procedure applies to sets located within a limited radius. If any great distance has to be covered it is wise to treat the case as a special one and endeavour to repair the set on the job.

In Test No. 2 it is assumed that the receiver has been brought in for repair. The best procedure is to remove it from its cabinet and clean the dust out of cabinet and chassis.

Then connect the receiver to a power outlet and hook up the aerial and earth. If there is still no reception, make a careful test of the valves.

The power transformer may smoke, which indicates a short or a breakdown. The rectifier plates may get red hot, indicating a short, probably in a filter condenser. Of course, in the case of a faulty transformer or condenser, the unit must be replaced before further tests can be made.

Test No. 3 includes the checking of all condensers and resistors. Faulty condensers are among the commonest causes of breakdown. For this test use a good condenser analyser capable of measuring leakage and capacity. Any doubtful condenser should be discarded, particularly if high voltage is applied across it. Many "call-backs" are eliminated if proper attention is given to the condensers ,and it should be remembered that radio owners do not like their sets going out of action about once a month.

Condensers should also be checked for capacity and while making this test it is as well to pull gently on the pigtails to make sure the condenser does not open intermittently. Resistors should be checked with an accurate ohmmeter or bridge, and anything showing a tolerance greater

(Continued on page 54.)

From a whisper . . .
TO CONCERT HALL VOLUME!

WIDE TONAL RANGE

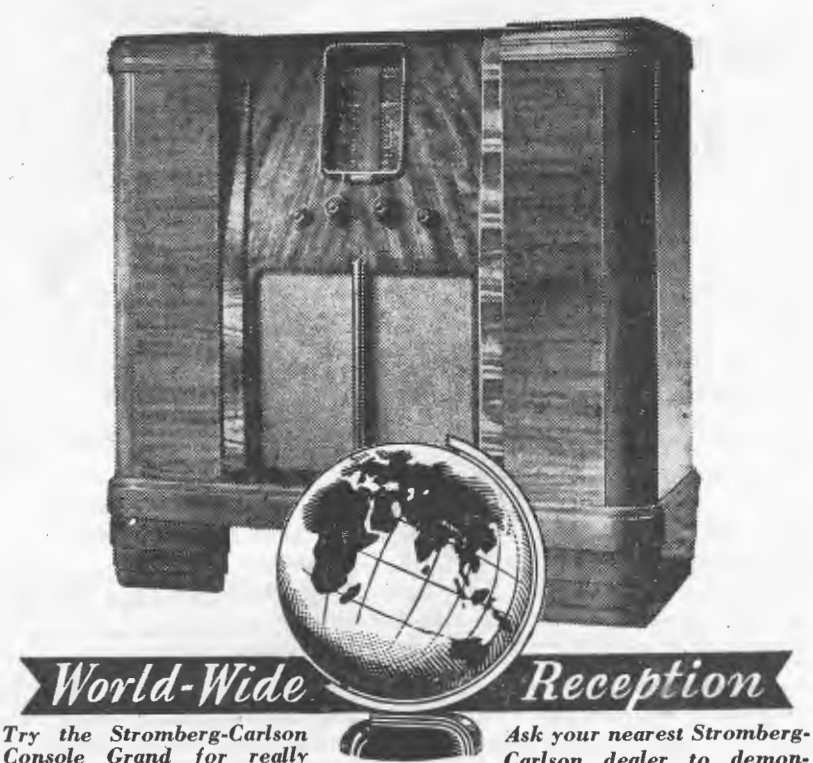
Such as you've never heard before!

You'll quickly understand the amazing popularity of the Stromberg-Carlson 1936 Console Grand, once you have actually seen the magnificent cabinet and heard the unrivalled tone of this modern-as-the-minute Radio!

Tune it down to a whisper, or increase its volume to concert hall strength . . . in every note of the tonal range you enjoy that same faithful reproduction.

The Console Grand cabinet is 88% heavier than the average, and thus entirely eliminates cabinet resonance. Here are some of the marvellous features of this wonder set:—

7 valves. Short wave covers 16-51 metre bands (which includes 5 short wave reception channels). Broadcast covers 194-555 (all Australian stations). Tone compensation. 6 watt undistorted power output. Specially designed speaker. Tone control. World-wide range. Mammoth chassis. Selectorlite dial which revolutionises tuning. 3-way isolation switch (broadcast, short wave and pick-up). New non-microphonic condenser. Full automatic volume control.



Try the Stromberg-Carlson Console Grand for really remarkable DX. London, Paris, Berlin, etc., as clear as locals. Hundreds of other shortwave stations heard. All Australian, New Zealand, etc., on broadcast band.

Ask your nearest Stromberg-Carlson dealer to demonstrate to you in your home. Other Stromberg-Carlson models from 14 guineas—there's one to suit every personal preference.

CONSOLE GRAND—MODEL 736—39 GUINEAS

Stromberg-Carlson

Wholesale Distributors in Australia and New Zealand

N.S.W.: Bennett & Wood Ltd., 284 Pitt Street, Sydney, and at Lismore. Wagga Wireless Distributors, Box 93, Wagga. Heiron & Smith (Salonola), 91 Hunter Street, Newcastle.

Queensland: Noyes Bros. (Sydney) Ltd., Burton House, Elizabeth Street, Brisbane. Lawrence & Hanson Electrical Co. Ltd., 87 Elizabeth Street, Brisbane.

S.A.: Savery's Pianos Ltd., 29 Rundle Street, Adelaide. Radio Wholesalers, James Place, Adelaide.

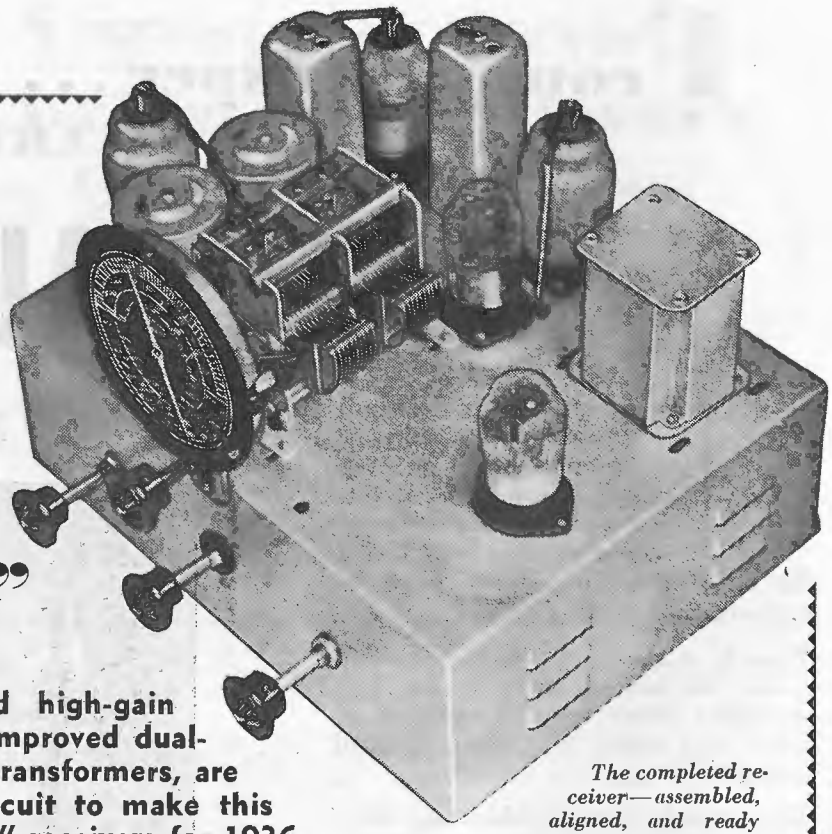
Victoria: Warburton Franki (Melb.) Ltd., 380-382 Bourke Street, Melbourne. M. Brash & Co. Pty. Ltd., Elizabeth Street, Melbourne; Vealls Pty. Ltd., 243-249 Swanston Street, Melbourne.

Tasmania: Hobart: Findlays Pty. Ltd., 80 Elizabeth Street; **Launceston:** Wills & Co. Pty. Ltd., 7 The Quadrant; **Devonport:** Findlay & Wills Pty. Ltd.; **Burnie:** Findlays Pty. Ltd.

W.A.: Musgroves Limited, Lyric House, Murray Street, Perth.

N.Z.: Gough, Gough & Hamer Ltd., Christchurch.

The Radiokes "Simplified Dual-Wave Battery Moneysaver"



Five of the latest metal-clad high-gain battery valves, together with improved dual-wave coils and iron-cored I.F. transformers, are combined in an up-to-date circuit to make this battery kit-set one of the "star" receivers for 1936.

The completed receiver—assembled, aligned, and ready for operation.

A YEAR or so ago it was impossible to design a battery receiver that would give results comparable with those obtained from an a.c. operated set using an equivalent number of valves. To-day, however, with the introduction of new high-gain 2-volt valves, this is no longer true.

Radiokes engineers claim that this battery version of their "Moneysaver" described last month can not only out-perform any other set in its class, but also, is the first receiver of its size and economy of operation capable of bringing in shortwave and broadcast stations at the same volume as a modern a.c. dual-wave superhet.

That this claim is not an exaggeration has been borne out by actual tests, which proved that for sensitivity, selectivity, tone and volume, the battery "Moneysaver" compares very favourably with the best of five-valve a.c. dual-wavers.

Latest Valves An Important Feature.

Five of the new battery-type valves recently released in the Philips and Mullard makes are used in the kit. Three of them are metal-clad, and all use the new universal "P" base.

The mixer-oscillator is a KK2 Octode, which while similar in design to earlier converters of its type, embodies several important improvements that result in better performance.

Independent A.V.C. and diode detection, together with high audio gain and good fidelity, are all provided by the "P" base KBC1, working in conjunction with a KC3 driver and KDD1 "B" class output valve. This latter valve has a maximum power output of nearly 2 watts—more than ample for any home.

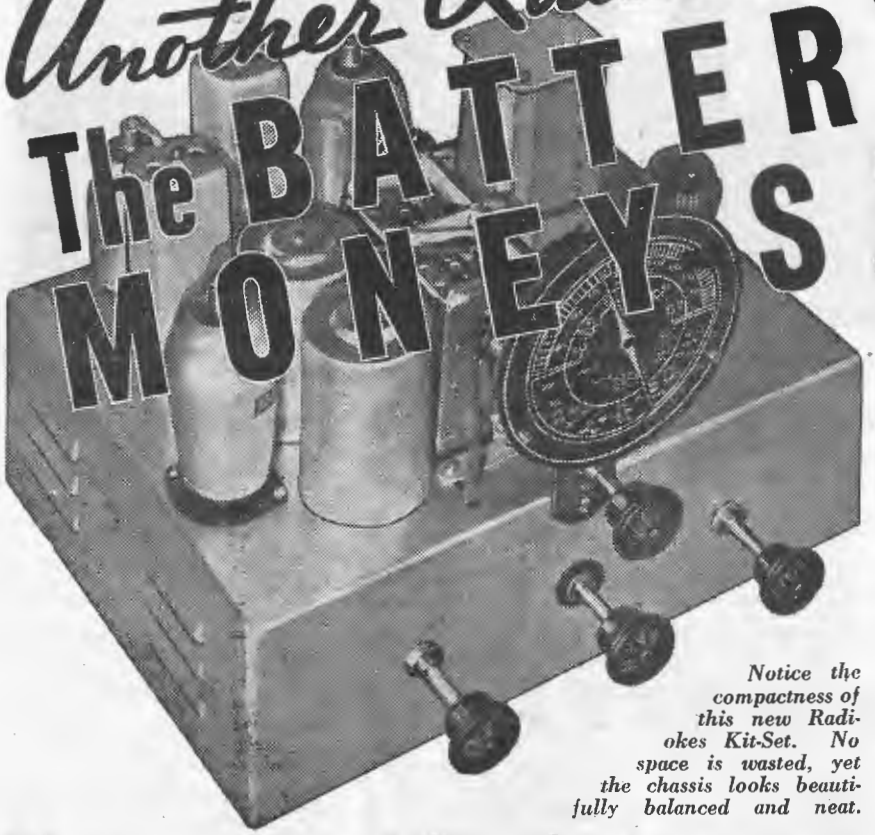
The quality of reproduction is very good, but builders who would like to take advantage of the wide range audio transformer supplied, and who do not mind slightly lower audio gain, can substitute a 30 driver and 19 output valve for the KC3 and KDD1. The resultant fidelity is excellent, though the total "B" current consumption increases from approximately 11 m.a. to 15 or 16 m.a.

Iron-Core I.F.'s Give High Gain.

Both selectivity and gain are exceptionally high in this receiver—due largely to the use of Litz-wound iron-core intermediates. The dual-wave aerial and oscillator coils are not only very compact—both sets of windings are in each case housed in a single can—but also, improved design has resulted in much higher efficiency, with perfect tracking. The padding condenser for broadcast, by the way,

Another Radiokes Sensation!

The BATTERY DUAL WAVE MONEY SAVER



Notice the compactness of this new Radiokes Kit-Set. No space is wasted, yet the chassis looks beautifully balanced and neat.

Wonder 5-Valve Dual-Wave Kit-Set

HERE'S the latest Radiokes Kit-Set winner! The Battery "Moneysaver"—a wonderful 5-valve dual-wave battery superheterodyne in Kit-Set form, ready for anyone to assemble in just a few hours. Easy-as-winking to wire up—works perfectly from the moment you connect the batteries . . . and what a performance! Think of the price, too—the complete Radiokes Kit-Set costs only £9/17/6.

Phenomenal Performance!

This is not just a mere advertising phrase—it is the considered judgment of Radiokes engineers after severe testing under actual working conditions in various localities. The Radiokes Battery "Moneysaver" is the first receiver of its size, number of valves, and low battery consumption, capable of receiving short wave and broadcast signals with the same power and sensitivity as a good six valve A.C. TYPE DUAL-WAVE SUPERHETERODYNE. In fact, sensitivity, selectivity, tone and volume compare favourably with the best of five and six valve A.C. dual-wave sets.

Advanced in Design Yet Simple to Assemble

Just look at the marvellous features of the "Moneysaver" Kit-Set:—

Iron cored I.F. transformers—"Pi-wound" Litz high selectivity coils—Latest Mullard metal clad, high gain, battery valves—"Colourvision" dial—Full automatic volume control—"Wide Range" "B" Class audio transformer—Low battery consumption—High selectivity—High gain.

Yet you can assemble this kit in a few hours. Send the coupon NOW for full particulars, or order the Radiokes Battery "Moneysaver" from your nearest radio dealer. The price (not including valves, speaker, and batteries), is only £9/17/6.

Complete Kit-Set only £9.17.6

Complete to the very smallest nut and bolt, the Radiokes Kit-Set of matched components costs only £9/17/6, and the only extras you need are valves, speaker, and batteries.

Build it Yourself!

No technical knowledge is required to assemble this simple yet powerful Kit-Set. You follow the simplified instructions which are supplied with each Kit-Set. Taking reasonable care, YOU CAN'T GO WRONG. Radiokes engineers have already wired up all the difficult bits, so that you just connect the main components together.

If you have the least shadow of doubt that you cannot assemble this remarkable Radiokes Kit-Set, post the coupon below. We will send you absolutely free a big, beautifully-produced instructions booklet which shows you just how amazingly simple it is to put the Kit-Set together, and also gives you full particulars of the battery "Moneysaver." If you are interested in the all-electric version of the "Moneysaver," mark the coupon, and a special free 8 page booklet will be sent you, post free. But send the coupon NOW, for the demand for these booklets is tremendous, and supplies are limited. Fill in the coupon now—post it TO-DAY!

FREE Booklet—Send this Coupon

RADIOKES LTD., Box 10, P.O., REDFERN, N.S.W.

Please send me, post free, FREE BOOKLET describing the "Moneysaver" Battery Kit-Set.
"Moneysaver" A.C. Kit-Set.
(Strike out one not wanted.)

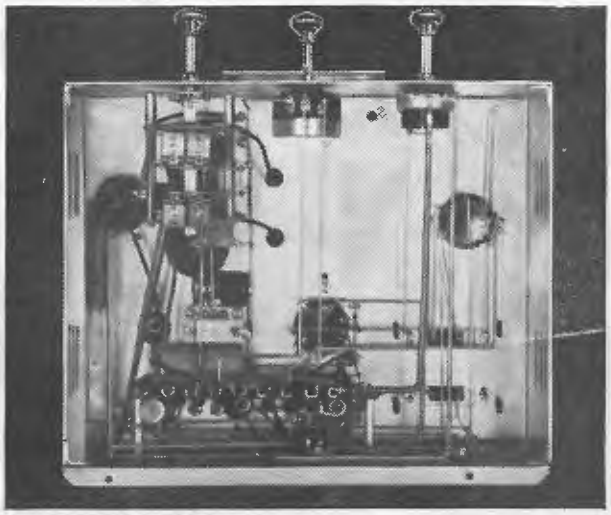
NAME.....

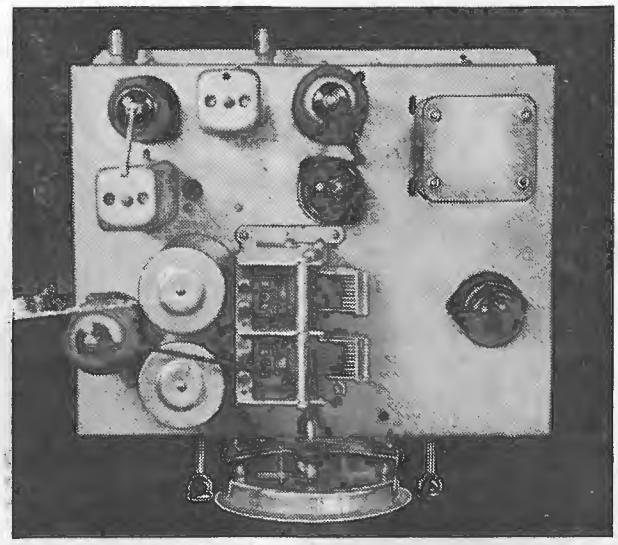
ADDRESS.....

R.W.8/36.

RADIOKES

BATTERY DUAL-WAVE MONEY SAVER KIT-SET





Above: An under-chassis view of the completed kit, showing the simplicity of the assembly and wiring.

Right: This plan view shows the well-spaced layout. The special iron-cored I.F.'s are housed in attractive square cans.

is pre-set at the factory to the correct capacity and needs little, if any, adjustment.

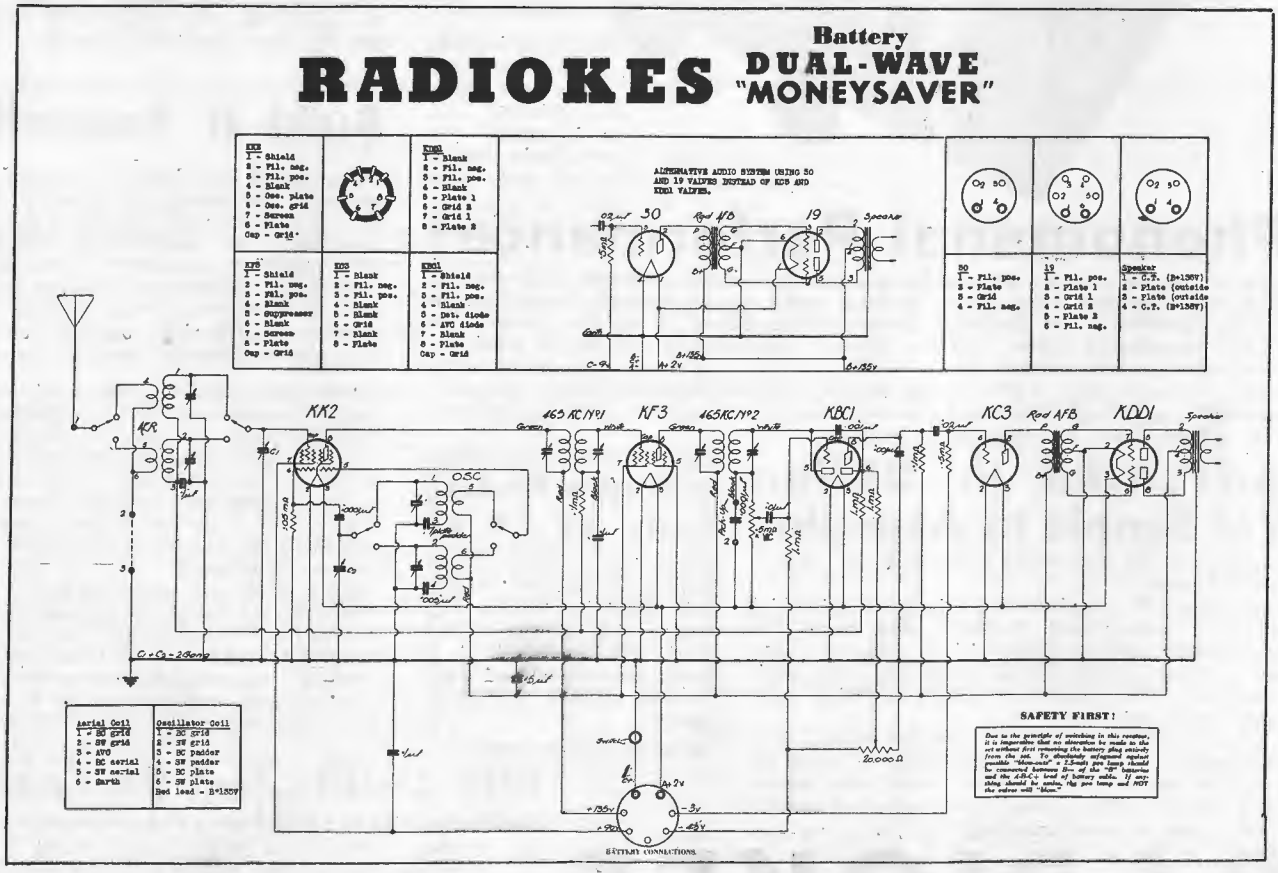
Stromberg-Carlson Gang and Switch

The two-gang condenser supplied with the kit is a Stromberg-Carlson type "F," which has a new patented construction making it over 90 per cent. non-microphonic.

The wave-change switch is also a new Stromberg-Carlson product. Each bank has three sections of three silver-plated contacts, mounted on very low-loss stamping material.

Two-Colour Tuning Dial

The "Colourvision" aero dial is calibrated in metres for both wave-bands,



The circuit of the "Simplified Dual-Wave Battery Money saver" uses a KK2 converter, KF3 i.f. amplifier, KBC1 second detector, KC3 driver, and KDD1 class "B" output valve.

Radiokes "FIVE-VALVE SIMPLIFIED DUAL-WAVE BATTERY MONEYSAVER" . . . . . Kit of Parts

1 RKS-8B chassis (sprayed).
1 Stromberg-Carlson 2-bank switch (special) same as RKS-8.
1 Radiokes D.W. aerial coil in can.
1 Radiokes D.W. oscillator coil in can.
2 Radiokes SIC-465B I.F. Transformers (Nos. 1 and 2).
1 Radiokes AFB audio transformer.
1 Radiokes DC-1 "Colourvision" dial.

RESISTORS.

3 Erie 1 meg. resistors.
1 Erie .5 meg. resistor.
2 Erie .1 meg. resistors.
1 Erie .05 meg. resistor.
1 .5 meg. volume control, with switch.
1 Radiokes 20,000 ohm volume control (sensitivity control) with insulating washers.

CONDENSERS.

1 Stromberg-Carlson 2-gang condenser, type "F," without trimmers.
2 Radiokes 2-gang MEC trimmers without mounting holes.
1 .5 mfd. condenser.
3 .1 mfd. condensers.
1 .01 mfd. condenser.
2 .001 mfd. condensers.
1 .02 mfd. condenser.
1 .005 mfd. mica condenser.
2 .0001 mfd. mica condensers.
1 Radiokes 7-plate padder (peaked on oscillator).

SOCKETS.

5 "P" sockets (must be numbered).
1 4-pin socket.
1 7-pin socket (small).
1 7-pin plug.

SUNDRIES.

4 Radiokes knobs.
1 Radiokes T-33 panel completely wired with 1½" pillars.
6 bakelite terminals (2 red, 4 black).
3 large grid clips.
4 2.5 volt pea lamps.
1 yard copper braiding.
5 yards hook-up wire.
3 yards 16 gauge tinned copper wire.
1 yard 7-way battery cable.
15 ⅜" x ⅛" R.H. brass screws.
12 ¼" x ⅛" R.H. brass screws.
2 ¾" x ⅛" R.H. brass screws.
3 ¼" x ¼" brass spacers with ⅛" hole.
30 ⅛" hex. nuts.
12 lock washers, ⅛" hole.
12 solder lugs, plain single end.
3 yards 2 mil. spaghetti.

VALVES REQUIRED.

1/KK2; 1/KFB; 1/KBC1; 1/KC3; 1/KDD1 (Philips, Mullard).

SPEAKER REQUIRED.

Permanent magnet dynamic, input transformer to match KDD1 (Amplion "Star" type 05).
type O5).

BATTERIES REQUIRED.

3/45-volt heavy duty or triple duty, each tapped at 22½ volts; 1/4½-volt "C" battery tapped at 3 V. (Ever-Ready).
1/2-volt 100 amp. hour accumulator.

and has automatic colour switching. When the set is tuned to the broadcast band, the broadcast scale is illuminated in green.

When the wave-change switch is turned to shortwave the green fades out, and the shortwave scale is illuminated in red. The principal Australian stations and the international wave-bands are clearly indicated.

Doublet Aerial and Pick-up.

Though an ordinary "L" type aerial will bring in dozens upon dozens of shortwave and broadcast stations at full volume, maximum results will be obtained if a doublet aerial with transposed lead-in is used.

Provision is made for an aerial of this type, and as well, pick-up terminals are provided, both additions being taken care of by the two sets of three terminals mounted on the rear wall of the chassis.

An All-British Kit

As in the a.c. "Moneysaver" described last month, every part supplied with the kit is of British manufacture, and is of guaranteed quality.

Construction Described in Detail

Space does not permit this month of a detailed description of the kit's assembly. However, this is covered in a pamphlet that will be supplied by Radiokes Ltd. free on request.

The assembly is covered down to the last detail in step-by-step instructions given so fully and clearly that success is assured, even to those who have never tackled set-building before.

The description is lavishly illustrated with photographs, and as well there is a full-size wiring diagram with every connection clearly shown on it.

A Few Don'ts for Dxers

Don't report to any station unless you are positive you heard it.

Don't be impetuous. If your verification does not arrive per return post, remember that stations have other important work to do.

Don't send a second report until reasonable time has elapsed.

Don't try to be technical unless you ARE.

Don't resort to fulsome flattery; it will avail you nothing.

Don't forget to enclose return postage or coupon, especially to amateurs.

Don't use ordinary writing paper; the official report form lends prestige.

Don't take any notice of these hints if you do NOT want verifications.

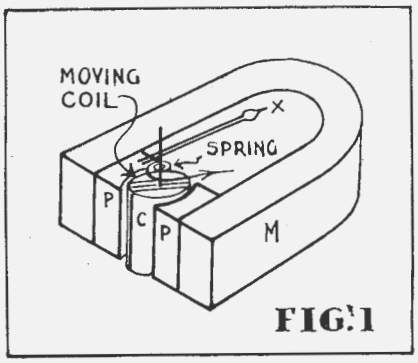


FIG. 1

The A B C Of Multi-Range Meter Design

By using a 0-1 milliammeter as a basis and adding shunts and multipliers to extend current and voltage ranges, a multi-range meter can be made up that will be found invaluable both in set-building and trouble-tracking. This article explains how the necessary resistance values are calculated.

A SET-BUILDER without a meter of some sort is as helpless as a ship without a rudder. Like the ship, he can travel a certain distance but never for long in any one direction, and his chances of finally reaching his destination are very small.

High accuracy, flexibility, and low cost are the three main requirements of a meter designed for radio use. All three are fulfilled by employing a high-grade moving coil 0-1 m.a. meter as a basis, and extending voltage and current ranges by means of multipliers and shunts (series and parallel resistors).

How a Moving-coil Meter Works

The bare essentials of a moving coil meter are illustrated in fig. 1. M is a U-shaped permanent magnet with soft iron pole pieces PP. A cylindrical iron core, C, is clamped so as to leave a small, uniform air gap. Encircling the iron core and travelling in the gap is a light framework of aluminium or copper, carrying a coil of fine silk-covered wire, and pivoted so that it can rotate over the whole of the arc covered by the pole pieces, the movement being controlled by two springs, one above and one below. These also serve to conduct the current to and from the moving coil.

When a current passes through the latter, the resultant magnetic field set up interacts with that of the permanent magnet, and the coil (together with the pointer X) turns until the restraining influence of the springs brings it to a stop.

The coil frame not only acts as a support for the wire which carries the current to be measured, but also damps the motion owing to the eddy currents induced in it by the permanent magnet.

The coil, over the whole of its arc of movement, will be travelling across a field of constant and uniform flux density produced by the permanent magnet, and the torque, or turning force, that the coil experiences will be proportional to the current in the coil. Thus, readings over the whole scale are uniform.

High Sensitivity Essential

Regarding it first as a current-measuring device, the sensitivity of a meter is best expressed as the current at full-scale deflection. If this current is 1 milliampere, then such is the sensitivity.

In most voltage measurements in radio, it is essential that the current taken by the measuring instrument be kept as low as possible, to avoid the danger of obtaining misleading readings.

For this reason, a voltmeter taking 1 m.a. at full scale deflection has higher accuracy than one taking 2 m.a., and much higher than one taking 5 m.a.

The sensitivity, which can be regarded as a good indication of the accuracy of such a meter, can be obtained by dividing the full scale deflection in amperes into 1—in other words, it is the reciprocal of the full scale current in amperes. The result is given in ohms per volt; in this case, it is $\frac{1}{.001}$, or 1000 ohms per volt. A 0-2 and 0-5 m.a. meter would have sensitivities of 500 and 200 ohms per volt respectively.

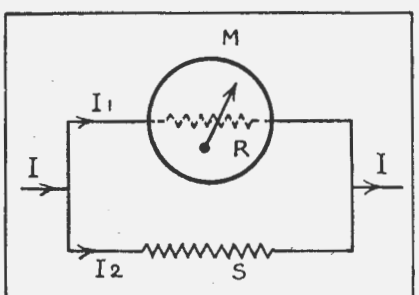


FIG. 2

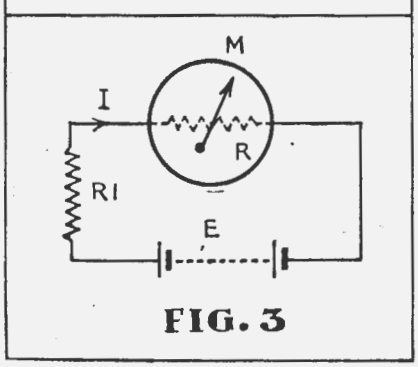


FIG. 3

Extending Current Range

Every meter has a resistance of its own, which for a 0-1 milliammeter is generally round about 30 ohms. In fig. 2, this is represented by R. If a current of 1 m.a. were flowing through the meter, the needle would register full scale deflection. If a resistance equivalent to that possessed by the meter were then connected across the terminals of the latter, half the current would flow through each, and the meter would register .5 m.a. Thus the current-measuring capacity of the meter has been doubled by the addition of the shunt, as a current of 2 m.a. is now needed to register full-scale deflection.

This explains the way that the current ranges are extended. To take a general case, let the resistance of the shunt be S ohms, the main current I m.a., and the branch currents I_1 and I_2 (see fig. 1). With S across it, the meter will be capable of measuring a current of say N times the full scale deflection.

We now have:—

$$I = I_1 + I_2 \quad \ldots\ldots\ldots\ldots\ldots \text{(a)}$$
$$NI_1 = I \quad \ldots\ldots\ldots\ldots\ldots \text{(b)}$$

Next, substituting for I in (a), we get

$$NI_1 = I_1 + I_2$$
$$\text{Therefore } I_1 (N - 1) = I_2 \ldots \text{(c)}$$

The potential difference across the meter equals RI_1, and that across the shunt, SI_2. Both must be equal, as they are potentials from A to B. Thus we have $RI_1 = SI_2$.

Therefore, substituting for I_2 (from (c))

$$RI_1 = SI_1 (N - 1)$$
$$\text{giving } S = \frac{R}{N-1} \quad \ldots\ldots\ldots \text{(d)}$$

Thus, if we had a 0-1 m.a. meter of, say, 30 ohms resistance, and we wanted to measure 10 m.a. full scale,

the value of the shunt required could be found as follows:—

$$R = 30 \text{ ohms, and } N = \frac{10}{1} = 10 \text{ ohms.}$$

$$\text{From (d), } S = \frac{30}{10-1} = \frac{30}{9} = 3.333 \text{ ohms}$$

With a shunt of this resistance across the meter, current at full scale deflection would be 10 m.a, with proportionate intermediate readings. In this case, actual readings given by the meter should be multiplied by 10 to obtain the true reading.

Measuring Voltages

To measure voltages, a series instead of a parallel resistor is used. The meter is still purely a current indicator; it measures voltages only because of the resistance in series with it. In fig. 3, R_1 is used to limit the current passing through the meter at the maximum voltage to be measured to 1 milliamp.

Thus, if R is the meter resistance and E the maximum voltage to be measured, from Ohm's Law, the current

$$I = \frac{E}{R + R_1}$$

$$\text{As } I = 1 \text{ m.a.} = \frac{1}{1000} \text{ ampere.}$$

$$\frac{1}{1000} = \frac{E}{R + R_1}$$

giving $R + R_1 = 1000\ E$.

As mentioned before, R is usually only about 30 ohms. If E is 20 volts, $R + R_1 = 20{,}000$, and compared with R_1, R is very small, and for practical purposes can be neglected. This leaves R_1 equal to 1000 E, which means that the value in ohms of the required series resistor is equal to the maximum voltage the meter is required to measure, multiplied by 1000. Thus, for ranges of 20, 200, and 500 volts, series resistors 20,000, 200,000, and 500,000 ohms are required.

If the meter required 5 m.a. to give full-scale deflection, then R_1 would equal 200 E, and for the voltage ranges given above the necessary series resistors would have values of 4,000, 40,000, and 100,000 ohms respectively.

Resistance Measurements

Fig. 4 shows the set-up for a single-range ohmmeter, still using a 0-1 milliammeter. The current that will flow is given by the formula:

$$I = \frac{E}{R_1 + R_2} \quad \ldots\ldots \text{(a)}$$

(where R_2 is the unknown). If E = 4.5 volts and R_1 is fixed, maximum current will flow when $R_2 = 0$ ohms. But the meter will read up to 1 m.a. only, and so the minimum value that R_1 should be to restrict the current passing to this value can now be obtained by substituting in (a).

$$I = 1 \text{ m.a.} = \frac{1}{1000} \text{ amp.} = \frac{4.5}{R_1 + 0}$$

Therefore $R_1 = 4500$ ohms.

In practice, R_1 is made up of a fixed and a variable resistance connected in series, in order to compensate for any voltage drop in the battery. With the test prods shorted, the resistance is adjusted until the meter gives exact full-scale deflection, thus ensuring that the current passing with zero external resistance

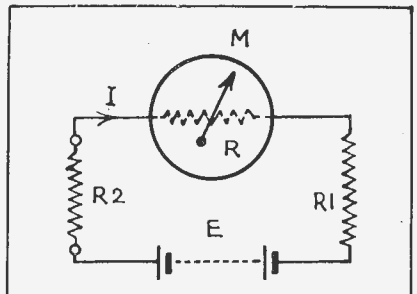


FIG. 4

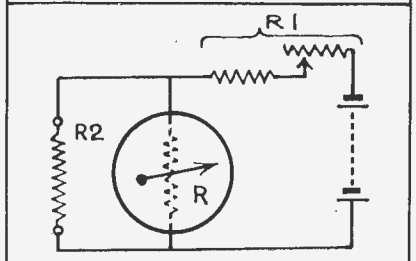


FIG. 5

is 1 m.a. In this way the accuracy is fully preserved, even though the voltage of the battery drops with use.

Now, suppose that the unknown resistance has a value of 1500 ohms. In this case the current reading of the meter will be:

$$I = \frac{4.5}{1500 + 4500} \times \frac{1000}{1} \text{ m.a.}$$

$$= .75 \text{ m.a.}$$

From similar calculations, corresponding readings for unknowns of, say, 4000, 20,000, and 100,000 ohms are .53, .18, and .045 m.a. respectively. Using these and other intermediate values, a graph can be easily plotted so that the resistance of an unknown corresponding to any current reading can be instantly read off.

Obtaining Different Ranges.

Usually a 0-1 m.a. meter has a scale divided into 50 divisions, each division thus representing a current of 0.02 m.a. With the meter needle "dead on" the first division, a current of .02 m.a. is flowing. This represents roughly the maximum value of resistance that can be measured using the values assumed for R_1 and E (4500 ohms and 4.5 volts).

From (a), we find that

$$X = \frac{E - IR}{I}$$

$$= \frac{4.5 - (.00002 \times 4500)}{.00002}$$

$$= 220{,}000 \text{ ohms, approximately.}$$

For the other extreme, the 49th division on the 50-division scale represents a current of .98 m.a. Substituting in the above equation, we find that this represents a resistance of roughly 100 ohms. So the resistance range that is covered is from 100 to 220,000 ohms.

Now, if R_1 and E in fig. 4 are doubled, each extreme of the original range is doubled, so the new range is from 200 to 440,000 ohms. Values read from the graph should now be multiplied by 2. If R_1 and E are increased to 45,000 ohms and 45 volts—ten times their former values—the range extends from 1000 ohms to 2.2 megohms.

Measuring Low Resistances

As regards measurement of low resistances, the method given above is accurate enough for most purposes. Occasionally, however, the need arises for high accuracy, and in such cases the method shown in fig. 5 can be used.

The ohmmeter test prods are shorted, and the resistance R_1 is adjusted to give exact full-scale deflection. The unknown R_2 is then shunted across the meter as shown.

This diverts part of the current flowing through the meter, the amount depending on the resistance of R_2. For example, if it is the same as the internal resistance of the meter, the latter will show a half-scale reading.

When the reading has been taken, the value of R_2 is calculated from the formula

$$R_2 = \frac{R \times I}{I \text{ max.} - I}$$

where R is the meter resistance, I the current reading, and I max. the full-scale deflection current.

With this method, highly accurate measurement of resistance from about 2000 ohms down to 20 ohms is possible, and reasonable accuracy is still obtained down to as low as .5 ohm.

A Nine-Range D.C. Multi-Meter

The principles underlying the design of multi-range meters are fully explained in the preceding article. In that following, the construction of a multi-range tester that set-builders and servicemen will find invaluable is outlined.

IT was pointed out in the previous article that high accuracy, flexibility, and low cost are the main requirements of a meter designed for radio use. All three are possessed by the multi-range meter now to be described.

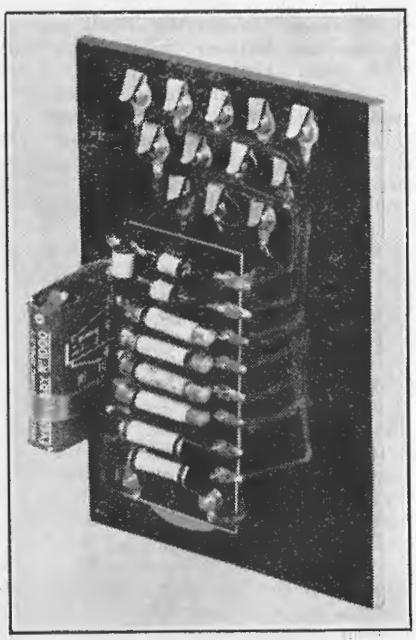
High accuracy has been ensured by using a high-grade 0-1 milliammeter as a basis for the circuit, and by using laboratory-tested shunts and multipliers to give the various current and voltage ranges. As for flexibility, no less than nine ranges are incorporated—four voltage (0-10, 0-50, 0-250, and 0-500 volts) three current (0-1, 0-10, and 0-100 mills.) and two resistance (0-10,000 and 0-100,000 ohms).

The last consideration, that of cost, is as important as any, as few set-builders can afford more than one good meter. This point has been carefully watched in this tester, with the result that the complete kit of parts, including an engraved and ready-drilled panel, can be purchased for only £4. Alternatively, anyone who has a 0-1 milliammeter already on hand can use it and merely buy the balance of the kit. A meter of any resistance up to 100 ohms can be used, as will be explained later.

A photograph of the completed multi-meter, showing the nine ranges it covers engraved on the panel.

Features of The Kit

The complete kit of parts for the tester is shown elsewhere. The basis of the instrument is a Palec 0-1 milliammeter — a precision-built, high-grade meter that can be depended on to give high accuracy and trouble-free service.



A sub-panel view of the tester.

Reads A.C. As Well

The meter is fitted with a universal scale, and as it is calibrated both for A.C. as well as D.C., it can be easily converted for A.C. operation as well by adding a four-pole double-throw switch and a small copper oxide rectifier unit. The conversion will be described in a future issue of the "Radio World."

Sockets Simplest and Best

Nine sockets of a special positive contact type have been used for the various ranges. A multi-contact switch could have been used instead, but on practically all counts the sockets are preferable. A switch that will give trouble-free operation for all time is both expensive and difficult to obtain. In the current ranges especially, the switch contacts **must** have zero resistance—even a small fraction of an ohm could mean serious error in readings.

As well, a multi-contact switch is not easy to wire, but sockets are simple. The two test leads supplied are each fitted with a plug at one end and test prod at the other. The leads are rubber-covered, and, unlike those sometimes supplied with commercial testers, will stand up to plenty of wear.

Assembly Is Straight-Forward

The panel is supplied ready drilled and engraved, and all that builders have to do is to mount and wire the parts, when the tester is ready for operation.

The multipliers for the four voltage ranges are guaranteed accurate to within 1%, and are specially treated against humidity.

Nine-Range D.C. Multi-Meter—Palec Kit of Parts.

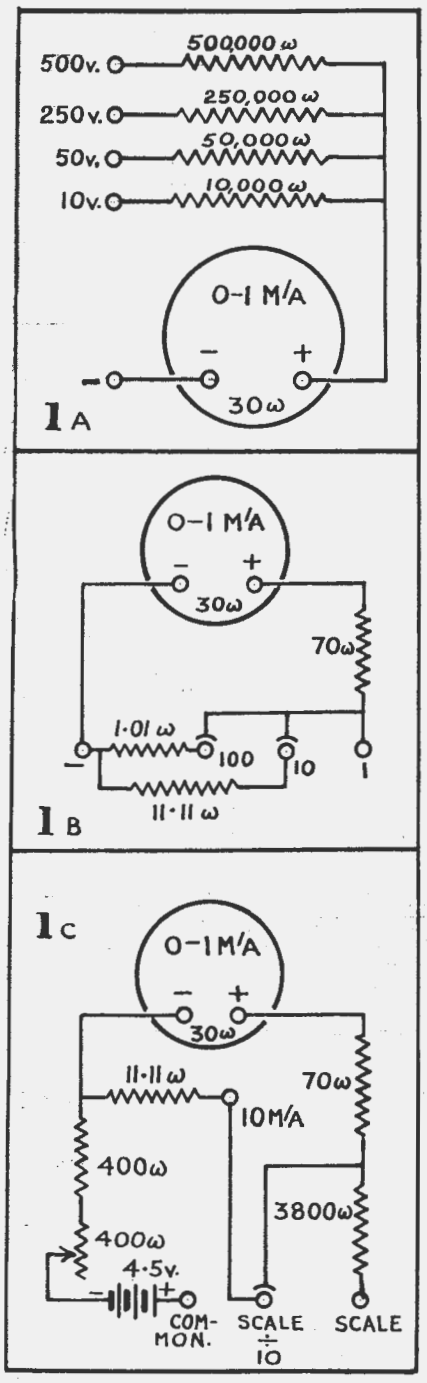
- 1 0-1 m.a. meter, 30 ohms internal resistance, with universal scale (Palec).
- 1 10,000 ohm multiplier.
- 1 50,000 ohm multiplier.
- 1 250,000 ohm multiplier.
- 1 500,000 ohm multiplier.
- 2 shunts (1.01 ohms and 11.11 ohms).
- 1 70 ohm resistor.
- 1 3,800 ohm resistor.
- 1 400 ohm resistor.
- 1 400 ohm vernier potentiometer with knob.
- 1 bakelite resistor panel.
- 1 engraved ebonite panel.
- 12 sockets (spring type).
- Pair of test prods, with leads and plugs.
- 1 4.5v. torch battery (flat type), with mounting strap.
- Hook-up wire, nuts and bolts.
- 1 leatherette-covered case, with carrying handle (optional).

The leatherette-covered case and carrying-handle, as shown in the photographs, is supplied as an extra. Alternatively, builders could make up a wooden box in which to house the completed meter.

The Circuit Explained

Figures 1 (a), (b), and (c) show how the circuit of the tester is built up around a 0-1 m.a. meter.

The resistors for the four voltage ranges are calculated from the simple formula given in the previous article:



R1 = 1000 E, where R1 is the series resistor and E, the maximum voltage to be measured in each case. Thus, for ranges of 0-10, 0-50, 0-250, and 0-500 volts, series resistors of 10,000, 50,000, 250,000, and 500,000 ohms are required. A sensitivity of 1,000 ohms per volt is obtained on all voltage readings.

In 1 (b) is shown the three-range milliammeter circuit, the ranges being 0-1, 0-10, and 0-100 m.a. The 70-ohm resistor shown in series with the meter has been included for two purposes. Firstly, because of its addition, the resistance of the meter can be regarded as 100 ohms (70 ohms + 30 ohms internal resistance of meter). This means that the resistance of each shunt required is over three times greater than that needed if the 70-ohm resistor were not included. For instance, without this resistance the value of the shunt needed for the 0-10 m.a. range would be equal to R where R is the meter

$$\frac{}{N-1},$$

resistance, and N the maximum current (in mills.) to be read. Substituting, this equals $\frac{30}{10-1} = 3.333$ ohms.

Regarding the meter resistance as 100 ohms, however, the shunt value is $\frac{100}{10-1}$ = 11.01 ohms.

Shunts are difficult to wind correct to a tiny fraction of an ohm, and so by using the series resistor any slight deviation from the calculated value is rendered much less important than if the resistor were omitted. This applies particularly to the 0-100 m.a. range, where without the 70-ohm resistor, a shunt of only .3 of an ohm would be needed.

The second reason why this resistor has been included is one that will appeal to set-builders who have 0-1 milliammeters on hand, possibly of different values of internal resistance to that of the Palec meter used in the kit. By replacing the 70-ohm resistor with one equal in value to 100 ohms minus the internal resistance of the meter on hand, the latter, providing it is a dependable make, can be used equally well, and without any further alteration to the circuit values. Special resistances for this purpose, up to 100 ohms in value, can be obtained from the Paton Electrical Instrument Company.

It will be noticed that the connections to the 10 and 100 m.a. sockets are "open" until the test leads are plugged in. The same is true for the "Scale ÷ 10" socket of the ohmmeter circuit.

There are two resistance ranges: 0-10,000 ("Scale ÷ 10") and 0-100,000 ohms ("Scale"). A glance at the circuit will show that, for the latter range, the maximum resistance that

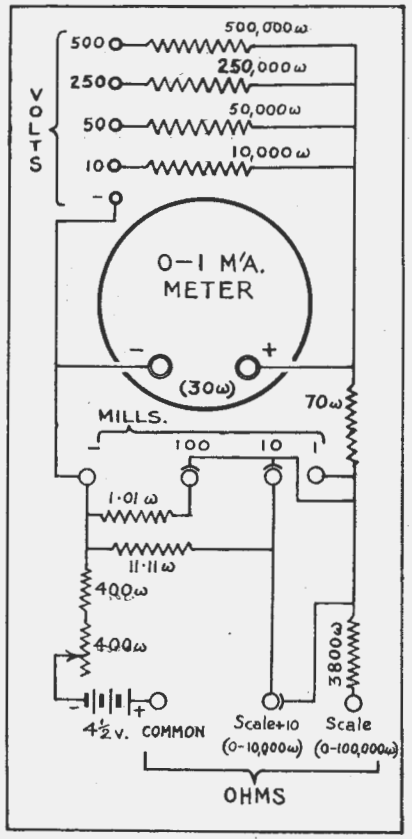


Fig. 2.—The separate circuits shown in figs. 1 (a), 1 (b), and 1 (c) for the various voltage, current, and resistance ranges are combined above to give the complete circuit used in the tester.

can be included in circuit equals 3800 + 70 + 30 + 400 + 400 ohms, = 4,700 ohms. When the 3-cell battery is new, the voltage is approximately 4.65 volts, so when the test prods are shorted, a resistance of 4,650 ohms is needed to give exact full-scale deflection on the meter (1 m.a.). In practice, this adjustment is made by shorting the test prods, and setting the 400-ohm potentiometer to full scale reading. Resistances of up to 100,000 ohms can then be read off directly on the meter scale, which has been calibrated on the assumption that a 4.5-volt battery will be used.

For the "Scale ÷ 10" range, the 10 m.a. shunt is brought in circuit across the meter. The current that now flows when the test prods are shorted divides into two branches, 1-10th passing through the 100-ohm branch, and 9-10ths through the 11.11-ohm shunt. The equivalent series resistance of these two resistors in parallel equals 10 ohms. For a current of 10 m.a., a resistance of 465 ohms is needed to show full scale deflection on the meter (assuming the battery voltage to be 4.65 volts). This value of resistance is obtained by adjusting the potentiometer until a

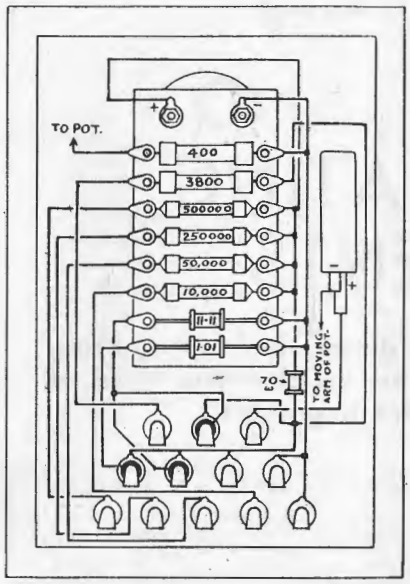


Fig 3.—This sketch shows the complete wiring, which can also be seen in the sub-panel photograph.

reading of 1 m.a. is registered on the meter.

Now, if the meter shows a certain reading, in ohms, when the value of an unknown resistance is being tested, the correct value is obtained by dividing the scale reading by 10, because actually only one-tenth of the current flowing through the resistance is passing through the meter.

As the battery ages, its internal resistance increases, and the voltage drops. The potentiometer compensates for this, so that at all times exact readings can be obtained. After six or nine months' use, however, the voltage will fall to about 4.4 volts, and the battery should then be replaced. Otherwise, resistance readings obtained will not be reliable.

The three circuits shown in figures 1 (a), 1 (b), and 1 (c) are combined in figure 2 to give the circuit of the multi-range tester.

Assembling the Tester

The panel is supplied with the sockets already mounted on it, and with the spring contacts of the 10 mill., 100 mill., and "Scale ÷ 10" sockets already insulated from the sockets themselves by means of insulating washers.

The potentiometer can next be mounted, followed by the meter. Next, the shunts and multipliers, and other fixed resistances, should be mounted on the bakelite resistance panel as shown in the photograph and sketch of the wiring.

The panel is next bolted to the meter, and wired up. The battery can be mounted last of all, by means of the aluminium strap provided. Full details of the wiring are shown in fig. 3. Use fairly heavy gauge push-back, and be careful to make every soldered joint as perfect as possible by tinning all contacts before soldering, and using a hot, clean iron.

When the wiring is finished and checked, the meter can be mounted in its case and the panel screwed down. The meter needle is then accurately set to zero by rotating the small milled knob mounted on the instrument.

Finally, the test leads are plugged into the "Common" and "Scale" sockets for resistance measurement, the ends shorted by holding the test prods together, and the potentiometer knob rotated until an exact full-scale reading is obtained. The instrument is then ready for use.

Some Don'ts For S.W. Listeners

By "Megacycle"

TUNING a set is an entirely different matter from tuning a regular broadcast receiver. The main reason for this is that short waves have characteristics unlike those of medium waves.

Here is a short list of DON'TS which should be of interest to all those who have not had much experience of shortwave DX work.

Don't tune for shortwave stations in the same way as you would tune for broadcast. By rotating the tuning knob quickly you may pass over several stations. The reason for this is due to the exceedingly sharp tuning of the short wavelengths.

Don't tune in indiscriminately on the short waves, or you will probably get nothing. Most sets are calibrated in metres or megacycles. Therefore, use a reliable list showing frequencies and schedules of the principal stations, and search for each one in turn.

Don't tune in at the wrong time. Most stations come in only at certain times of the day as well as at certain times of the year.

Don't expect to pick up shortwave stations easily. It requires careful tuning to bring in the very distant stations.

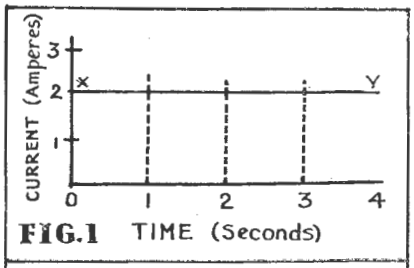


FIG.1

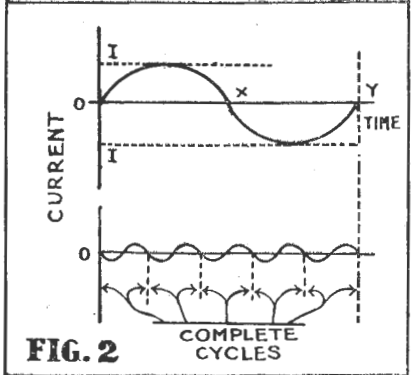


FIG. 2

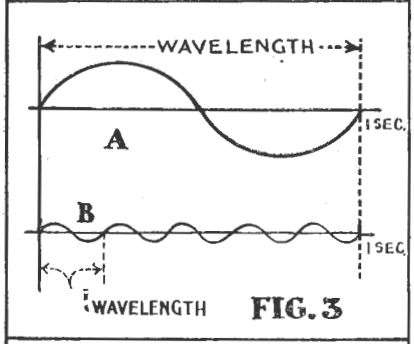


FIG. 3

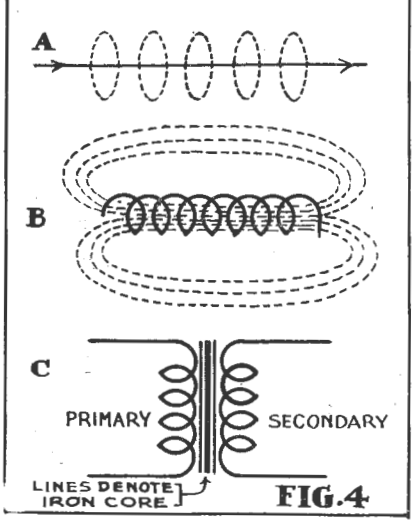


FIG.4

Radio Step By Step . . . 3

DIRECT AND ALTERNATING CURRENTS

The differences between direct and alternating currents are explained in this article—the third of a special series for beginners.

So far only one kind of current, that known as direct current, has been considered. There is another variety—alternating current—that is just as important as d.c., if not more so, because the principles governing radio transmission and reception depend on its action.

Direct current flows in one direction only, i.e., is uni-directional. Fig. 1 shows a graphical representation of a steady direct current of 2 amperes. The time is taken from the moment the switch controlling the circuit in which the current flows, is turned on. Because neither the voltage nor the resistance changes, then from Ohm's Law ($I = \frac{E}{R}$) the current must remain the same, and so it is represented by the straight line "XY."

Under certain conditions the current might not remain constant, but no matter how much it fluctuates, as long as it always flows in the same direction, it is still direct current.

A.C. Changes Direction Regularly

Alternating current, just as its name implies, alternates, or changes its direction of flow from time to time. Its action can also be best explained graphically.

At the point "O" on figure 2, both time and current values are at zero. Starting at this point, the current steadily increases until it attains a maximum value "I," and then it decreases at exactly the same rate until at the point "X" on the "Time" axis it has fallen to zero. Now it changes its direction and flows the other way. This is shown on the graph by drawing the curve representing its progress below, instead of above, the "Time" axis.

Once again, the current steadily builds up to a maximum value "I," but in the opposite direction this time —and returns to zero again (at the point "Y"). From this point on the whole process is repeated again and again until the circuit is broken.

Each completed operation—current starting from zero, building up to maximum, returning to zero, reversing direction and again building to maximum and returning to zero—is termed a cycle. If the time taken from "O" to "Y" is 1 second, then the frequency of the current is 1 cycle per second.

If, as shown in the lower portion of the sketch, 5 complete cycles are performed in the 1 second, then the frequency is 5 cycles per second. Most alternating current mains supplies have a frequency of 50 cycles per second.

Audio and Radio Frequencies

So far we have dealt only with low frequencies, which are measured in cycles. Low frequencies, or audio frequencies as they are often called in radio, extend upwards to the upper limit of audibility, which is about 18,000 cycles per second. Frequencies much greater than this are spoken of as high, or radio frequencies, though there is no clear-cut line of division between the two.

High frequencies such as those used in radio are measured in kilocycles (thousands of cycles) or megacycles (millions of cycles) per second.

Thus station 2FC, transmitting on a frequency of 610 kilocycles per second, has no less than 610,000 cycles of high frequency alternating current flowing in its transmitting aerial every second.

Wavelength and Frequency

There is a simple relationship between wavelength and frequency that will become obvious after figure 3 has been studied a little.

The length of one complete wave is shown in figure 3(a), where the frequency is one cycle per second. In 3(b), where the frequency is 5 cycles per second, the wavelength must obviously be one-fifth of what it is in 3(a). It is clear that the more waves there are every second (the greater the frequency, in other words) the shorter is the wavelength. In fact, the two are inversely proportional—double one and the other is halved.

Speed of Radio Waves

All radio waves travel at the same speed—that of light. This is 186,000 miles per second, which is approximately equal to 300,000,000 metres per second.

It now becomes clear that if a station operates on a frequency of 1,000

kilocycles per second, which equals 1,000,000 cycles per second, the length of each wave in metres must equal the distance covered in one second divided by the number of cycles per second — in this case, 300,000,000 ÷ 1,000,000, which equals 300 metres.

So we see that the frequency with which the waves are created governs the wavelength, and if either wavelength or frequency in cycles is known, the other can be found by dividing the known quantity into 300,000,000. (If the frequency is in kilocycles, then 300,000 is the figure to use.)

Measuring A.C.

Some further qualities of alternating current will now be considered. First of all, as a.c. is always changing in value, it is measured in terms of its average, or Root Mean Square, value.

This gives in amperes the current which would be required with d.c. to provide the same heating effect. The R.M.S. value of an alternating current is approximately .707 of the peak value. The voltage of an a.c. supply, which alternates in the same way as the current and at the same frequency, is measured in exactly the same way.

A.C. Superior to D.C.

The main advantage of a.c. over d.c. for a mains supply is that it can be easily transformed to any desired voltage. By stepping it up to a high voltage and low current, it can be transmitted over long distances with little loss. Where required, it is easily stepped down again to a lower voltage by a transformer.

How a Transformer Works

If a direct current is passed through a length of wire, a magnetic field surrounding it is set up, as shown in figure 4(a). This field can be strengthened greatly by winding the wire in the form of a coil, as shown in 4(b). The lines of force surrounding the coil remain steady until the current is cut off, when they collapse and disappear.

If a.c. is applied to the winding instead of d.c., it can be seen that the magnetic field will build up and collapse twice for every cycle of the alternating current, because the a.c. itself builds up and returns to zero twice during every cycle.

Now, if we were to place another winding in close proximity to the first, as shown in 4(c), it would be found that the fluctuating magnetic field in the first coil would induce an alternating E.M.F. or voltage in the second. This action is known as mutual induction.

The amount of transfer that takes place depends on the degree of coupling that exists between the two windings. This can be greatly increased by providing both coils with an iron core, as is done in audio and power transformers.

If both coils have the same number of turns, then theoretically the voltage induced in the second will equal that applied to the first. If 250 volts a.c. be put across the primary, which is always the winding across which the voltage is first applied, and the secondary has twice the number of turns the primary has, then a voltage of 500 will be available across the terminals of the secondary.

Of course, this is assuming that there are no losses; actually a transformer has an efficiency of about 85 per cent., which means that if a voltage is required to be stepped up to twice its value, slightly more than twice the number of primary turns are needed for the secondary to allow for loss during the transfer.

Next month: Inductance and Capacity.

The Lighter Side of DX

Some Tit-Bits Of Ham Humour

By Leon S. Stone

THE following examples of radio humour were culled during DX listening to amateur stations. Some equally funny incidents have happened at times during broadcasts from commercial stations, but unfortunately, I have not recorded them. The hams, naturally, provide the most unintentional humour over the air, owing to the more personal touch in their broadcasts, and to the habit most of them have of absent-mindedly leaving their microphones open to the wide world.

DX From Next Door!

An amateur station in one of the Sydney suburbs was going full blast belting out a transmission of gramophone records for hours on end late one Sunday evening, in the days when "ham" stations were allowed on the broadcast band before midnight on Sunday. Next day his bellicose neighbour hailed him over the back fence: "Do you know I got six new stations on my set last night?" "Really," replied the "ham" innocently, "what were they?" "You—you ———," replied a very annoyed listener. Talk about "double spotting"!

What's This "CQ" Station?

An N.S.W. ham got a good laugh out of a report from a listener in Queenstown, Tasmania. Verbatim, with original spelling and all, it read: "Sir—I was listening the other night on the shortwave at 9.15 p.m. and I picked up over the waves at such strength that I am curious to know what power you were using. It was coming in at such strength that I had to cut back the volume for good reception. It was as good as 3LO on broadcast. Can you tell me what wavelength CQ is using [!] which I heard you calling nearly every amateurs I pick up are call for CQ. I remain, yours sincerely, ——" Some report!

73 es 88 de YL!

Romance is not yet dead, even in the serious (?) atmosphere of amateur experimental stations. Tuning in on the 80-metre band to an N.S.W. ham announcer, I heard: "Stand by, old man, a YL [and any dxer knows what that cryptic couple of letters means!] here wants to speak to you." YL's voice is then heard: "Is that 3 XX? A YW here—one young woman, you know." A nervous little laugh follows. "I can hardly believe you love me." Knowing hams as I do, neither can I!

A New Kind Of DX Special.

While on the subject of romance (if any) in amateur radio. A married ham operating an experimental station gave himself away properly to the YF. A receiving set is installed in her bedroom so she can comfortably listen to hubby's programmes. During the early hours of one morning one of his girl friends rang the station. Racy conversation between the two continued for close on an hour. The ham (in more senses than one) had blissfully forgotten he had the station "mike" switched on, with the result that the edifying conversation was broadcast to hundreds of listeners as well as to his wife in the next room, who was fuming. It was a very chastened hubby who told himself he would be rather more discreet in future with station 'phone calls—particularly from attractive YL's!

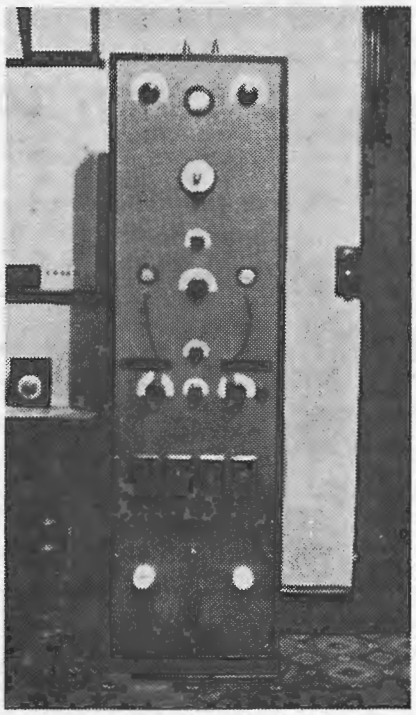
A "Low" Station.

A Sydney ham has never been allowed by the rest of his fraternity to forget that one morning he announced to another experimenter: "My station is a lower one than yours". Omission of "wavelength" caused the damage.

Prize-Winning Transmitter Has Worked All Continents

Portable Tests: 5-Metre Schedules: Lakemba Radio Club Notes and News

By W.J.P.



THE transmitter shown above is owned and operated by Mr. Bert Dimmock (VK2OW), of Hurlstone Park, and succeeded in winning first prize in the transmitting section at the recent Amateur Radio Exhibition organised by the Wireless Institute of Australia. The transmitter is a conventional four-stage, crystal-controlled job, using a 59 oscillator in a tritet circuit, 46 frequency doubler-buffer; 210 buffer and two 210's in push-pull in the final.

The oscillator and doubler power supply is obtained from a 300-volt pack, with a separate supply of 400 volts for the buffer, and a 500-volt pack for the final. Separate filament transformers are used for all the valves in the R.F. side. The popular link coupling is used, both in the intermediate stages and to the aerial. The aerial is a single wire-fed multiband matched impedance. With this transmitter all continents have been worked (W.A.C.), while all parts of the British Empire have also been contacted (W.B.E.).

Genemotors for Country and Portable Work.

A party of members of the Lakemba Radio Club, including 2OD, 2OW, Messrs. Taylor and Langley, recently paid a visit to Mr. J. Buchanan (VK2ABT), a new country amateur at Yerrinbool, N.S.W. The object of the visit was to test out the efficiency of a genemotor for portable work, and also to investigate the possibilities of 5-metre communication with Yerrinbool. Contact was made with 2ABT from a position on the Great Southern Highway, per medium of a portable 40-metre 'phone transmitter. It was most interesting to learn that 2ABT was also using a genemotor for the power supply, because results were so good that the car party thought that he was using crystal control in the transmitter, so pure was the carrier. For the operation of these genemotors a large 6-volt battery is usually required the current drain on the battery being from 1 to 5 amps., depending on the type and power output of the genemotor.

On the return trip to Sydney, the transmitter was kept in operation most of the way down. It was noted that the output dropped slightly when it became necessary to switch on the car headlamps, due to the extra load on the battery. However, from tests conducted, indications were that genemotors should prove very popular for portable and country work.

Breaking Into 5 Metres.

VK2OD suggests that for those who are breaking into five metres, considerable care should be taken with the tuning of the receiver, and attempts should be made to locate harmonics from telephony stations who may be operating on the higher wavebands. With reference to the receiving aerial, it is a good plan to arrange it in a well elevated position, but to those who are not so fortunately situated, it is suggested that they try the aerial in various available positions, because 5-metre signals have a habit of turning up in the most unexpected places.

Should signals be rather weak on the 5-metre aerial, a good standby is to use a single piece of wire strung vertically for the greater part of its length, which may be up to 60 feet, attached to the aerial coil, which may be tuned by a 5-plate midget condenser in a similar way to that described by 2EH elsewhere in this issue. 2OD also recommends the newcomer to the ultra-high frequencies to experiment carefully with various aerial systems, once he has his receiver operating correctly.

Further Freak Reception.

It was revealed in last month's issue of "Radio World" how the code signals from a ship could be heard through the talkie equipment of a Sydney theatre. According to a club member, Mr. W. G. Picknell, similar "reception" was obtained at Inverell, N.S.W. Patrons of the local picture theatre were astounded to hear, "Hullo CQ! Calling CQ!"—coming from the talkie speakers. Eventually, it was traced to Harry Hutton (VK2HV), whose station was in operation on telephony nearby!

How NOT To Send DX Reports.

The following is a copy of a DX report received by VK2DL. Reports such as these often cause station operators to literally "tear their hair" with rage!

April 26, 1936.

The Director,
Station VK2DL,

I am an ardent listener to shortwave, and often listen to radio broadcasts from foreign stations. At about 7.30 p.m. E.S.T. I tuned in your station and I heard many songs and musical selections and talks. This is the first time I have heard your station. I hope to be able to pick you up again on my shortwave receiver. The reception was clear and loud. It was satisfactory. I will thank you in advance for a verification card from your station. Good luck to your station.

(Signed) Mr.....,
New York, U.S.A.

The above report might possibly be satisfactory for reporting to a local station, but the essential points so necessary for long distance reporting are missing. The time does not state whether it is American or Australian E.S.T., the wavelength is not given, the type of music, titles or announcements have been omitted, also the type of receiver used. Yet reception was clear and loud!

Choosing and Using A

Vacuum-Tube Voltmeter ... (2)

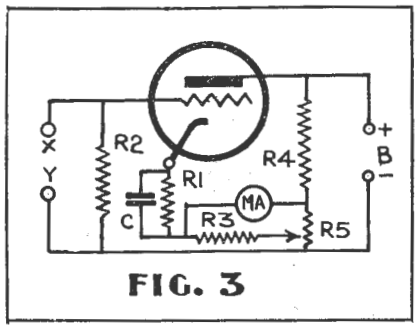


FIG. 3

Last month the principle upon which the vacuum tube voltmeter operates was explained, and the features necessary in an instrument designed for service work outlined. In the concluding instalment below, a few of the varied uses of a V.T. voltmeter are indicated.

Specially written for the "Radio World" by

A. H. MUTTON, B.E.

Paton Electrical Instrument Company.

IN last month's article, the essential features of a vacuum tube voltmeter designed for radio use were discussed in detail. They can be summed up as follows:—

(a) The instrument should not require more than about one microwatt of power to operate it, so as to avoid dropping the voltage in the circuit under test.

(b) It must measure a wide range of voltages to be able to check stage gain.

(c) It must read voltage, independent of frequency.

(d) Its input capacity must be kept at an absolute minimum.

Many other features are desirable, but not so important as those above. Fig. 3, which is reproduced from last issue, shows a suitable vacuum tube voltmeter circuit.

6J7 Offers Important Advantages

An improvement consists in using a pentode such as the 6J7. This gives readings independent of plate voltage, which is a great feature for A.C. operation.

Also, this metal valve can be located at the end of a flexible lead, so that no wires need be attached to the grid for introducing the voltage to be measured. This keeps input capacity down to that of the valve itself. R2 is a 5-megohm resistance, used solely for maintaining D.C. continuity to the grid, so that a bias is supplied to it even when the circuit under test would not do so.

It will be assumed in what follows that the vacuum tube voltmeter in use is similar to that above, i.e., that it has an input capacity of about 5 mmfd., an input resistance of a very high figure, and a range of measurable voltage, .1 v. to 50 v. The whole secret of using a vacuum tube voltmeter successfully consists in being sure of what is measured. This must be particularly stressed in receiver use. **A good vacuum tube voltmeter will measure any voltage supplied to it, R.F., I.F., A.F., or D.C.,** so it is necessary for the user to see that only that voltage required to be measured reaches it.

Isolating the Needed Voltage

To stop D.C. reaching the voltmeter is simple. Connect a condenser of reasonable size (say, .001 mfd. for R.F. working, and .1 mfd. for A.F. and 50-cycle working) in the lead to the measuring valve's grid—see fig. 4(a). Be sure the insulation of this condenser is excellent, or a progressive change in the voltage reading will result, as the leak charges up the grid.

To measure A.F. in a circuit containing, say, D.C., A.F., and R.F.—see fig. 4(b)—use a blocking condenser and a low pass filter circuit of the usual type. A 2 m.h. choke with .0001 mfd. condensers across the circuit from either side of this choke will be suitable.

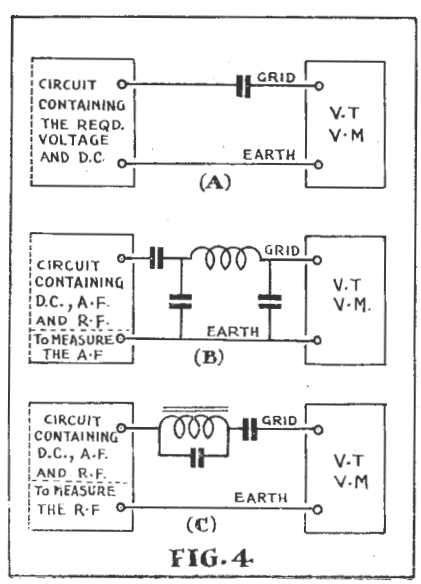


FIG. 4

To measure R.F. where A.F. is present is not so simple, but can be done by stopping the A.F. with a tuned A.F. choke, the tuning condenser of which allows the R.F. to pass to the vacuum tube voltmeter—see fig. 4(c). Usually one finds no need for more than a D.C. blocking condenser, as the R.F. or A.F. can generally be stopped elsewhere.

Now for some uses.

Stage Gain.

This is one of the most important of the vacuum tube voltmeter's many uses. As an example, consider the measurement of I.F. stage gain in a superhet. Fig. 5 will be taken as a normal type of circuit. Proceed as follows:

Connect an output meter across the speaker and supply an unmodulated input signal to the set. Tune in the set, using the "mush" of the signal or by temporarily modulating it in some way. Next, connect the vacuum tube voltmeter's grid to "Y" and its other lead to the chassis. Set the input signal to obtain a small readable signal on the voltmeter. Re-tune the trimmer C2 to see if the voltmeter's capacity is upsetting the circuit. This will be immediately evident on the output meter, which will alter its reading when the vacuum tube voltmeter is connected. Obtain the original reading by re-tuning C2. Next measure the low value unmodulated signal across C2.

Now remove the vacuum tube voltmeter and obtain the same output by re-setting C2 to its original value. Next, connect the vacuum tube voltmeter between "Z" and earth, placing a blocking condenser in the grid lead to the vacuum tube voltmeter. Re-set C4 if necessary to get the

same output reading, and measure the amplified voltage.

It will be noticed that the gain is not measured by connecting across C4. This is because the voltmeter lead, if attached to the lower side of C4, would introduce extra capacity from this point to earth, and would possibly upset other circuits not shown in this skeleton circuit. Also, it is easier to connect to earth. This connection introduces two extra D.C. voltages between "Y" and the earthed lead of the meter, but the blocking condenser prevents their being effective.

A.F. stage gain is much simpler to measure. Simply connect the vacuum tube voltmeter across the input and output of the stage or stages, taking steps to prevent D.C. operating the meter, and measure a constant input signal as found at these two points. If required, various frequencies may be used and a "response curve" of the stage or stages obtained.

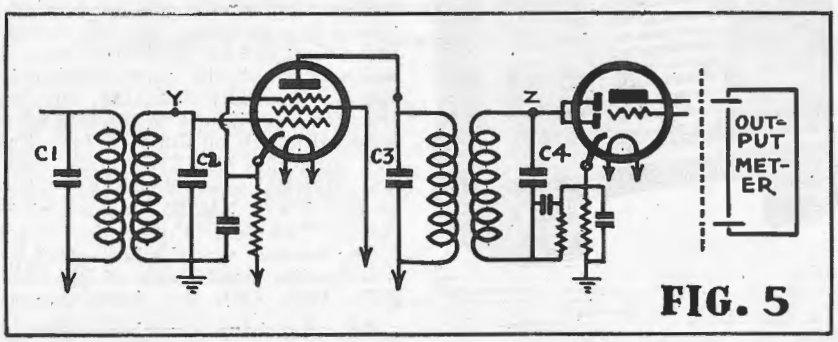


FIG. 5

A.V.C. Voltages.

The vacuum tube voltmeter measures these with ease. Before testing, it is wise to remove the 5-megohm grid resistance from the meter's input circuit as it is not now required and parallels the A.V.C. resistor, effectively reducing its value. There is little to be said about this test. No precautions against unwanted voltages are required.

Oscillator Voltages.

Connect the meter across the oscillator coil or between the elements of the valve, taking care that D.C. cannot enter the meter's circuit. The capacity of the vacuum tube voltmeter will alter the frequency slightly, but unless other things in the circuit necessitate it, this need not be allowed for, as the oscillator's output voltage will not be affected.

Percentage Modulation Measurements.

It is sometimes interesting to know the percentage modulation of a signal arriving at the second detector. It checks the first detector's action and gives a rough check on the source of modulation, i.e., whether the signal generator is deeply modulated or not.

Connect the voltmeter across the diode resistance in the second detector's circuit and measure the voltage there when the input signal is unmodulated, and also when modulated. The percentage modulation is then given by

$$\text{Percentage modulation} = \left\{ \frac{\text{Voltage (modulated)}}{\text{Voltage (unmodulated)}} - 1 \right\} \times 100$$

Hum Measurements

These can be made at a great many points in the circuit of a receiver, such as across the voltage divider, across the speaker transformer, across the automatic bias resistor of the power valve, and at the input to the power valve.

In all cases be careful to prevent D.C. operating the meter, and as far as possible always measure between some point in the circuit and earth. This latter statement might almost be regarded as a law in receiver work. Generally one then finds several voltages sent along to the meter, but one can usually "stop out" the unwanted ones.

As an example of incorrect procedure, consider the measurement of hum at the speaker transformer. Do not connect the vacuum tube voltmeter directly to the transformer's terminals. It is much better to connect from the plate side of the transformer to earth, making sure, if necessary, that one is not also measuring the hum in the "B" supply by checking this. If it is large allow for it.

Other Receiver Uses

Every voltage in the receiver can be checked with a vacuum tube voltmeter, with the aid of a few condensers and resistors. Even the H.T. secondary winding on the power transformer can be tested, by simply using a high resistance voltage divider.

For instance, if the vacuum tube voltmeter has an input resistance of 5 megohms and a full scale deflection

(Continued overleaf)

of 50 volts, it will read to 500 volts when a 45-megohm resistor is connected in the lead to its grid, since the valve then has applied to it a voltage of one-tenth that applied across the series resistor and the 5-megohm grid resistance. If these values are inconveniently high, lower ones such as input grid resistance of .1 megohm and a series resistance of .9 megohm may be used.

Filament voltages, screen grid voltages, detector voltages—all can be measured with ease. When once one learns to take a few precautions, it is soon found the vacuum tube voltmeter is invaluable as a time-saving service and laboratory aid.

Six-Valve All-Wave Ultimate

Has Many Attractive Features

IN New Zealand, locally built receivers share the market not only with Australian-made sets, but also with leading American makes. It is undoubtedly a fine achievement that the Auckland firm of Radio Ltd., in the face of this keen competition, has in the past few years established such a reputation for Ultimate receivers that now they rank with three or four imported makes as best-sellers in New Zealand.

Produced in one of the most modern factories in Australasia, Ultimate radios are not only up-to-the-minute in design, but as well are precision-built throughout of high quality components.

A little over a year ago these sets were introduced into Australia by Messrs. Geo. Brown and Company, of Sydney, and have sold consistently well.

Six-Valve All-Wave Model

A fairly wide range of A.C. and battery Ultimates is available, including a recently-landed 11-valve twin chassis de luxe model that is attracting widespread interest.

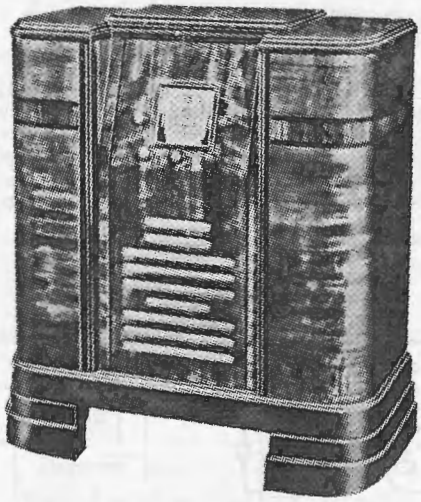
One of the most popular receivers in the A.C. range is the six-valve all-wave model illustrated above. It can be supplied in three different style console cabinets, that shown being the "Baby Grand."

To ensure plenty of gain and high selectivity, an r.f. stage has been incorporated. There are three wave-bands instead of the usual two, giving complete coverage of the short waves from 16 to 130 metres as well as of the broadcast band. Incidentally, this is the model on which 603 broadcast band stations were logged by J. R. Bain, a New Zealander, in a recent DX competition conducted in that country.

The Five Controls

The controls (left to right) are:—Combined on/off switch and volume control, quiet tuning control (for use in localities where power interference is prevalent), main tuning control, three-position wave change switch, and tone control.

The tuning control not only operates the conventional double-ended pointer, but also a special "logging hand" as well. This hand is a single-ended auxiliary pointer which rotates 16 times faster than the main indicator.



By its use, tuning is made both simple and accurate, particularly on short-wave.

Three-Colour Dial

The dial is illuminated in red on the broadcast band, in blue on the medium shortwave band, and in green on the short waves. For the first band, the dial is calibrated in kilocycles, and in metres for the remaining two.

Other Features

Among other attractive features of this model can be included the volume and tone control colour indicators; an effective A.V.C. system; high-gain r.f. and i.f. transformers; and a wave-change switch with additional contacts to short out the unused coils, resulting in a complete elimination of "dead spots" on the dial.

The Month On Shortwave

By Alan H. Graham

RECEPTION during the past month has been fair, conditions being much better in the morning and afternoon than at night.

Taken on the whole, stations on the 31-metre band are the most consistent, and almost any morning quite a number can be logged at good speaker strength. Naturally, the Daventry (GSB) and Zeesen (DJA and DJN) transmitters are outstanding — the two last-named having been extremely good this month around 8 a.m.

Not far behind comes W2XAF, which is usually quite good until mid-morning, when very bad fading spoils signals. The other Americans are not nearly so good, though W1XK made a welcome re-appearance at reasonable strength on several mornings this week.

Another regular on the band is the Rome transmitter 12RO, which is usually at speaker strength. Other stations heard include PRF5, which occasionally comes in splendidly with an entertaining programme of South American music (incidentally, they usually have an English session at 8.30 a.m. on Tuesdays); LKJ1, which is unfortunately heterodyned by W2XAF; HBL and CT1AA.

Swedish Station Best 20m. Catch

The 20m. amateur band is still a source of enjoyment for DX enthusiasts, as splendid "catches" may be made even at the most unexpected times. Generally speaking, the best time for reception is in the late afternoon, although on June 16 four English amateurs (G5VL, G5NI, G6XR and G2NH) were heard on 'phone around 8 a.m. SM5SX, located at the Royal Technical University, Stockholm, Sweden, was the best catch last month—the usual quota of W's, K6's, XE's, VE's, CO's, etc., being logged.

The 25m. band is rather unexciting as the usual stations are the only ones audible — Paris (TPA3 and TPA4), Daventry, W8XK and RNE all being fairly regular.

Zeesen Best on 19 Metres

On 19 metres the best reception has been from the Zeesen transmitter, DJB, during the mid-morning period, when they are regularly heard at good speaker strength. W2XAD were also unexpectedly heard on several occasions, at quite fair strength for them, both before and after midday. By the way, reports on this station are eagerly sought after by the station engineers.

Verifications From America

Finally, the last American mail brought a most interesting batch of verification cards. They included the following:—

W9XAA.—Frequencies 17,780, 11,830 and 6,080 k.c. Address: 666 Lake Shore Drive, Chicago, Ill. "The Shortwave Voice of Labor and Farmer."

20m. amateurs.—HI2K, Santo Domingo, Dominican Republic; CO2KC, Habana, Cuba; CO7CX, Central Florida, Cuba; VE5OT, Vancouver, Canada; and the Americans W3AHR, W3DPC and W5BEE.

10m. amateurs ('phone).—W3CWG, Lake Hopatcong, N.J.; and W5ERV, Shreveport, Louisiana (operated by Mr. S. H. Powell, who is, in his own words, "65 years young").

More About The 6L6 Beam Power Amplifier

In the June issue of the "Radio World" advance details were given of the new 6L6 beam power amplifier. The theory of its operation is covered in the article below, published by courtesy of the Amalgamated Wireless Valve Company, Ltd.

THE Radiotron 6L6 is a new type of tetrode intended for use in the power output stage of an A.F. amplifier. Unlike most earlier double grid valves, the 6L6 does not exhibit any secondary emission effects at low plate and control grid voltages; its characteristics, therefore, resemble those of the usual power output pentodes. Some unique features of the 6L6 are high power output, high efficiency, and high power sensitivity.

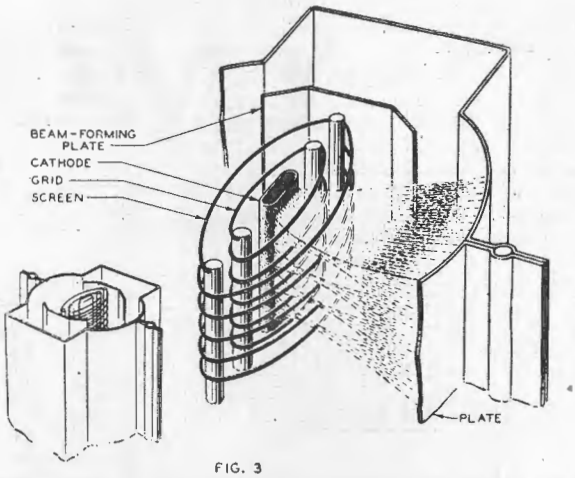


FIG. 3

SKETCH SHOWING FORMATION BY GRID WIRES OF BEAM SHEETS

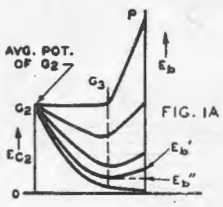


FIG. 1A

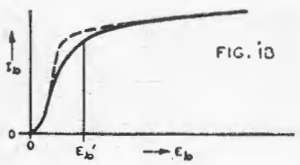


FIG. 1B

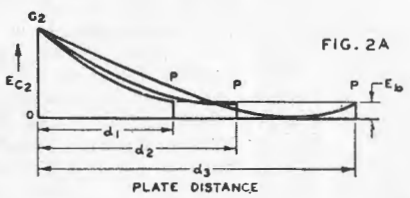


FIG. 2A

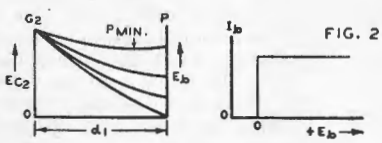


FIG. 2B

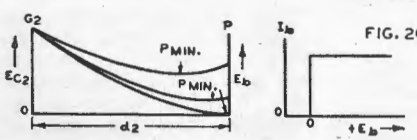


FIG. 2C

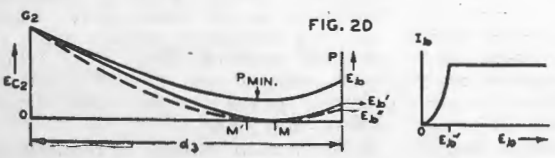


FIG. 2D

The Pentode Suppressor Grid.

When the plate voltage of the usual tetrode is less than the screen voltage, an appreciable number of secondary electrons, which are emitted from the plate because of bombardment by primary electrons, are attracted to the screen. The plate current, therefore, is greatly reduced.

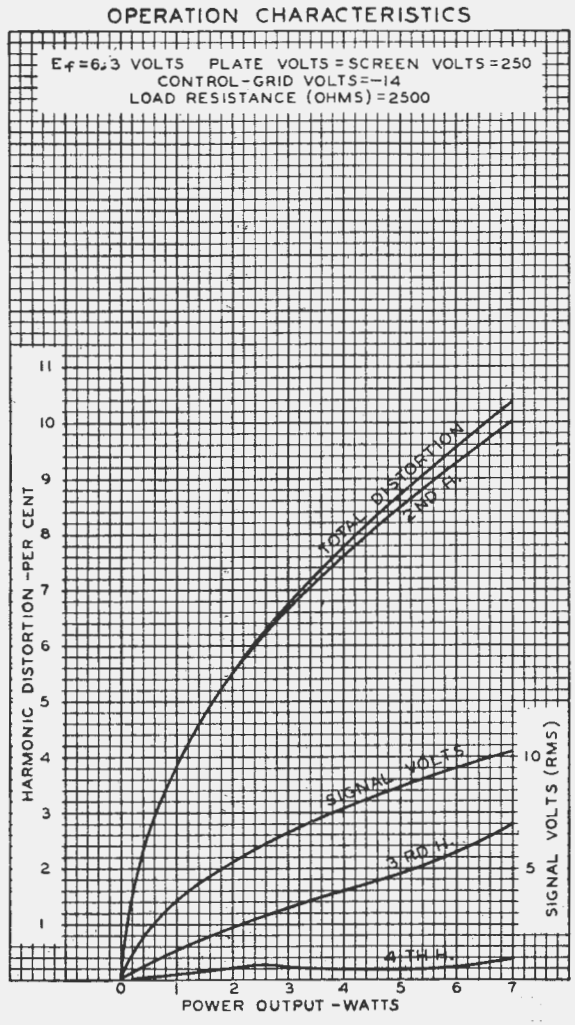
For this reason, the plate voltage of the usual tetrode should not swing below the screen voltage if the output is to be substantially free from distortion. A zero potential suppressor grid (G_3), positioned between screen (G_2) and plate (P), serves to prevent the loss of plate current due to secondary emission. Hence, in a pentode, the plate voltage (Eg) can be made less than the screen voltage (Eg_2) without appreciable secondary emission effects.

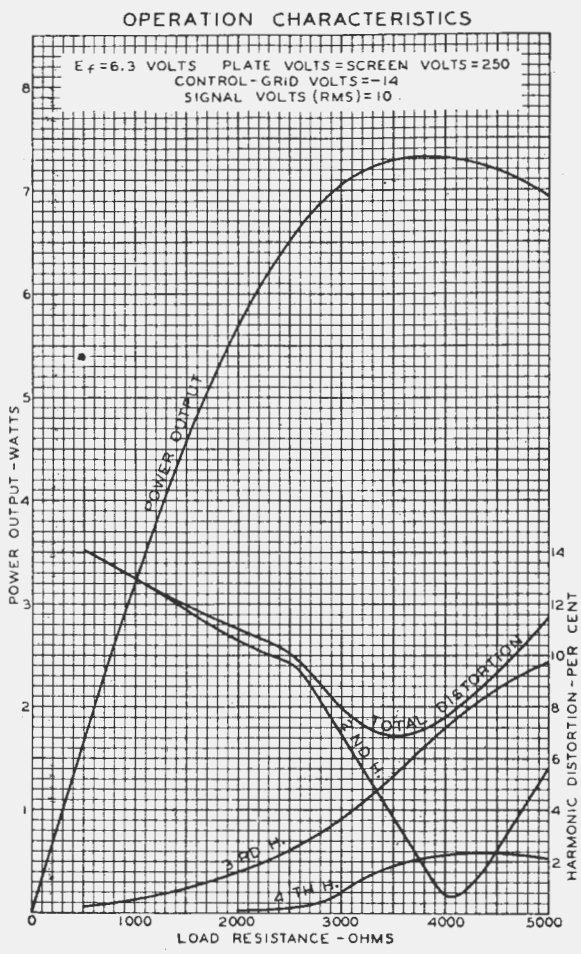
The manner in which a suppressor prevents secondary emission loss in plate current can be explained by fig. 1A. When the suppressor is connected to the cathode, the potential of the suppressor wires is zero, and the potential of the spaces between the wires is positive by an amount depending upon the geometry of the valve and the applied voltages. The effect is, therefore, to reduce the potential at all points between the screen and plate.

Fig. 1A shows the approximate potential distribution between the screen and plate of a pentode for various plate voltages. When Eb is greater than a certain critical value (E^Ib) a potential minimum is formed in the vicinity of the suppressor. When the difference between the plate voltage and the potential at the suppressor (Eb^I-Eb^{II}) is great enough, secondary electrons from the plate are not attracted to the screen, but return to the plate.

Consequently, for all values of Eb greater than Eb^I, there is no appreciable loss in plate current due to secondary emission. Under these conditions the plate current is nearly independent of plate voltage.

Fig. 1B shows the plate characteristic of a typical pentode. The knee between Eb and Eb^I is rounded, due mostly to the non-uniformity of the field around G_3, giving no definite value of Eb^I where the plate current begins to become independent of plate voltage.





There are several other factors which govern the sharpness of the knee, such as the shapes, sizes and uniformity of the grids and cathode. Much of the distortion of the field occurs at the grid side rods. The ideal curve (dotted in fig. 1B) would have a greater usable range of plate voltage, with reduced third-harmonic distortion.

The 6L6 dispenses with a physical suppressor in order to reduce secondary emission effects. Suppression is obtained by creating a potential minimum between G_2 and plate by space charge effects. The electron stream to the plate is confined to a beam whose electrons have nearly uniform path lengths and velocities. Such a design results in a plate characteristic that has a relatively sharp knee at low plate voltage.

The Virtual Cathode.

If we had a valve in which each electron traversed the same distance in the same time on its journey from cathode to plate, many of the pentode difficulties could be obviated.

Consider such a tetrode. Apply a voltage to its screen, and a lower voltage to its plate. Shifting the plate further from the screen under those conditions gives a set of potential grade curves as in fig. 2A. After a distance D_1, there is found to be a point of minimum potential between screen and plate, which tends to repel secondary electrons, preventing their passage to the screen.

In simpler words, the cloud of electrons set free by bombardment of the plate has been moved out beyond the reach of the screen grid's positive field. If, then, the plate voltage is increased, the cloud extends further inward toward the grid, but owing to the increased intensity of the plate's positive field, it is not sufficiently negative to set up a current from plate to screen, but simply retards the normal flow of plate current, making it practically independent of plate voltage.

Below the critical voltage, at distances of either D_1 or D_2 (figs. 2B, 2C), the cloud is not present in any large extent, its electrons being drawn to the screen grid by its positive potential. Thus there is a sharp falling-off of plate current at a critical voltage, after which a negative current may flow. By increasing the distance to D_3 (fig. 2D), it is found that a region of minimum potential (M^1, M, P min.) exists for all values of plate potential, and that the cloud of electrons is always present, even at very low values of plate potential.

Thus the field between the plate and screen has a region of low potential which effectively prevents the production of further secondary electrons, in much the same way as the suppressor of a pentode. The resulting tetrode, however, has a much sharper knee at Eb^1 in fig. 2D than has a pentode.

The cloud of electrons near the positively-charged plate is, in effect, a virtual cathode, the position of which is changed by varying the control grid voltage or the plate potential. With the correct screen to plate distances, the potential of P min. can be made just enough to suppress secondary emission effects. The plate then acts as a diode plate, which reaches a saturation current when its potential reaches Eb^1, after which there remains an almost constant potential grade between the virtual cathode and plate.

If the screen voltage is reduced, or

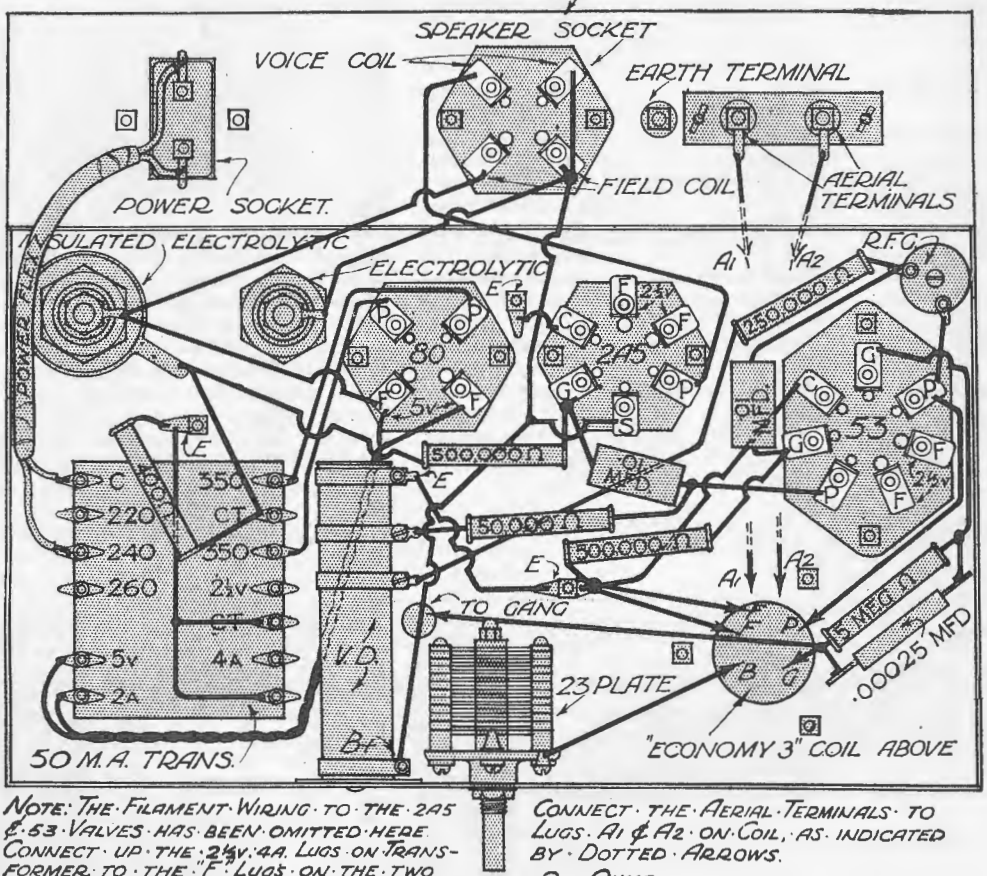
THE "ECONOMY 3"

COMPLETE KIT OF PARTS
3 KEN-RAD VALVES
8in. ROLA SPEAKER

£4/9/6
COMPLETE

POINT · TO · POINT · WIRING · DIAGRAM · OF · "ECONOMY · 3."

BACK OF CHASSIS: INSIDE VIEW



NOTE: THE · FILAMENT · WIRING · TO · THE · 2A5 & · 53 · VALVES · HAS · BEEN · OMITTED · HERE. CONNECT · UP · THE · 2½V; · 4A. · LUGS · ON · TRANSFORMER · TO · THE · "F" · LUGS · ON · THE · TWO VALVES; · TWIST · THE · WIRES · TOGETHER.

CONNECT · THE · AERIAL · TERMINALS · TO LUGS · A1 & A2 · ON · COIL, · AS · INDICATED BY · DOTTED · ARROWS.

Ω = OHMS.

PARTS REQUIRED

- 1 Chassis.
- 1 Transformer.
- 1 .00035 Condenser.
- 2 8 Mfd. Condensers.
- 1 .0025 Condenser.
- 2 .01 Tubular Condensers.
- 1 400 Ohm Resistor.
- 1 50,000 Ohm Resistor.
- 1 250,000 Ohm Resistor.
- 1 5 Meg. Resistor.
- 2 500,000 Ohm Resistors.
- 1 6-Pin Socket.
- 1 7-Pin Large Socket.
- 2 4-Pin Sockets.
- 3 Terminals.
- 1 23 Pl. Condenser.
- 1 R.F. Choke.
- 1 Coil Can.
- 1 Special Coil.
- 1 Dial.
- 1 A.C. Chassis Plug and Socket.
- 1 15,000 Ohm Divider.
- 3 "Ken-Rad" Valves.
- 1 "Rola" Speaker, 8in.

TOTAL COST, £4/9/6.

The "Economy Three" has for the past 12 months given wonderful results to owners in all parts of the Commonwealth and New Zealand.

Many letters have been received stating that both local and interstate stations have been heard on this powerful little set. Being small, it has many advantages; it only consumes 3 pennyworth of electricity for 60 hours' use, and does not need lining up, as only one tuning condenser is used.

Its size and compactness make it quite portable.

Only 8 feet of inside aerial wire is required for full loud-speaker results.

The point-to-point diagram will be a great help to most home builders. With the aid of this the wires can be marked off as they are placed in the chassis, thus leaving no chance of mistake.

Purchasers of the complete Kit of Parts, which includes all the necessary parts, 3 Ken-Rad valves and the latest type of 8in. "Rola" Dynamic Speaker, at the special price of £4/9/6, are entitled to take advantage of purchasing a high-quality electric soldering iron, which is guaranteed for 12 months, at the nominal charge of 6/9. Hardware such as hook-up wire, solder lugs and screws, are given free of charge.

Ken-Rad 2½-volt valves are shown in the diagram. These can be substituted by their equivalents in 6-volt series, the only alteration being the changing of the power transformer to a 6-volt type.

A conventional circuit diagram and any information required will be given without obligation to those who write or call at Radio House Pty. Limited, 296-8 Pitt Street, and at No. 6 Royal Arcade, Sydney.

The genuine "Economy Three" Kit is only available from Radio House at either of the above addresses.

Goods sent C.O.D. N.S.W. only. Weight of Kit, 20lbs. Freight extra.

Radio House Pty. Limited, 296-8 Pitt St., & 6 Royal Arcade, Sydney

the control grid voltage made more negative, the density of the cloud of electrons becomes less, and the diode saturates at a lower value of plate voltage. The voltage at which the knee occurs depends either on the screen voltage or the control grid bias.

Radiotron 6L6.

To simulate the ideal conditions of the hypothetical valve discussed above, the electron streams must be focussed into some form of parallel "beams." In the 6L6 this has been done by carefully winding the two grids with the same pitch, and even more carefully aligning them so that each turn of the screen grid lies exactly outside that of the control grid along a line perpendicular to the cathode.

In pentode valves, the grid side rods do much to disturb the field near the plate. To overcome such effects in the 6L6, two side plates, called "beam forming plates," have been placed at the sides of the grids in the plane of the virtual cathode, as shown in fig. 3. Being held at cathode potential, these plates effectively screen the plate from the field of the side rods of the screen grid, and deflecting the "beams" into paths very nearly perpendicular to the axis of the cathode after passing the screen. Fig. 3 illustrates the combined effect.

It must be noted that the screen current is greatly reduced, as few electrons flying from the cathode are caught by its field. A saving of overall power input thus results, and the efficiency is high. The careful design of the valve generally, coupled with the large cathode, has given a very high value of mutual conductance—4,300 micromhos, at 175 volts screen and a negative control grid bias of 12.5, and 250 volts plate potential. The sensitivity for this reason is very high, and only small grid swings are necessary for high output under most conditions.

While the overall distortion for a given output is less with Radiotron 6L6 than a single 42 type pentode, at higher outputs, which would seriously overload the latter valve, the predominant harmonic produced by the 6L6 is the second. When used in push-pull this can be nullified, and far greater outputs at low distortion are possible when the valve is operating along its optimum load line.

Operation of Radiotron 6L6.

In Table I are given a number of operating conditions, both for single valve and push-pull.

Conditions Nos. 1, 2, 6 and 7 are those most likely to be used by receiver manufacturers, who must necessarily consider the required power input to plate. The power supply is most generally the limiting factor.

Condition 6, giving 14.5 watts output with 2% distortion and with a grid swing of 32 volts peak, should prove of service in any large receiver. Where fidelity is required, there must always be a reserve of output power. Radiotron 6L6 offers a method of obtaining that without resorting to abnormally high voltages.

The other conditions, Nos. 3, 4, 5, 8, 9, 10, should prove very useful to the maker of P.A. equipment or cinema sound equipment.

For Radio Mechanics

Special Training Class

THE Marconi School of Wireless, conducted by Amalgamated Wireless at 97 Clarence Street, Sydney, has organised an intensive course of instruction for youths who wish to become radio mechanics. The course comprises a daily lecture on the theory of electricity and radio, with special application to receiving sets, the rest of the day being devoted to practical work. Students will be instructed in assembling, wiring and testing, and also in the use of tools.

The intention is to start the class on August 3 and to terminate in February, 1937, when the busy season of radio manufacture is about to commence. The Marconi School has recently been enlarged in order to accommodate the increasing number of students in various classes.

TABLE 1

SUMMARY OF OPERATING CONDITIONS FOR THE 6L6

	SINGLE-VALVE OPERATION									PUSH-PULL OPERATION							
Condition	No.1		No.2		No.3		No.4		No.5	No.6		No.7		No.8		No.9	No.10
Class of Operation*	A_1		A_1		A_1		A_1		A_1	A_1		AB_1		AB_1		AB_2	AB_2
Kind of Bias	*Fixed*	*Self*	*Fixed*	*Self*	*Fixed*	*Self*	*Fixed*	*Self*	*Fixed*	*Fixed*	*Self*	*Fixed*	*Self*	*Fixed*	*Self*	*Fixed*	*Fixed*
Heater Volts[1]	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Plate Volts	375	375	200	200	300	300	250	250	375	250	250	400	400	400	400	400	400
Screen Volts	125	125	200	200	200	200	250	250	250	250	250	250	250	300	300	250	300
D-C Grid Volts[2]	-9	-9[3]	-11.5	-11[3]	-12.5	-11.8[3]	-14	-13.5[3]	-17.5	-16	-16[3]	-20	-19[3]	-25	-23.5[3]	-20	-25
Peak A-F Grid Volts	8	8.5	11.5	11.5	12.5	12.5	14	14	17.5	32[4]	35.6[4]	40[4]	43.8[4]	50[4]	57[4]	57[4]	80[4]
Zero-Sig. D-C Plate Current (Ma.)	24	24	52	55	48	51	72	75	57	120	120	88	96	102	112	88	102
Max.-Sig. D-C Plate Current (Ma.)	26	24.3	57	56	55	54.5	79	78	67	140	130	124	110	152	128	168	230
Zero-Sig. D-C Screen Current (Ma.)	0.7	0.7	3.5	4.2	2.5	3	5	5.4	2.5	10	10	4	4.6	6	7	4	6
Max.-Sig. D-C Screen Current (Ma.)	2	1.8	5.7	5.6	4.7	4.6	7.3	7.2	6	16	15	12	10.8	17	16	13	20
Load Resistance (Ohms)	14000	14000	3000	3000	4500	4500	2500	2500	4000	5000[5]	5000[5]	8500[5]	8500[5]	6600[5]	6600[5]	6000[5]	3800[5]
Distortion - Total %	9	9	9	9	11	11	10	10	14.5	2	2	2	2	2	2	**	**
- 2nd Har. %	8	8	8.7	8.7	10.7	10.7	9.7	9.7	11.5	-	-	-	-	-	-	-	-
- 3rd Har. %	4	4	2.5	2.5	2.5	2.5	2.5	2.5	4.2	2	2	2	2	2	2	**	**
Max.-Signal Power Output (Watts)	4.2	4	4	4	6.5	6.5	6.5	6.5	11.5	14.5	13.8	26.5	24	34	32	40#	60##
Power Sensitivity (Milliwatts/volt[2])	131	111	60.6	60.6	83.3	83.3	66	66	75.1	28.4	21.8	33.1	25	27.2	19.7	24.6	18.8
Efficiency (%)	42	42.8	32	32.5	37.3	37.7	30	30.6	43.2	37.2	38.3	50	52	51.6	58	56.8	61.2
Peak Grid-Input Power (Mw.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	180[6]	350[6]
Bias Resistor (Ohms)	-	365	-	185	-	220	-	170	-	-	125	-	190	-	200	-	-

* Subscript (1) indicates that grid current does not flow during any part of input-voltage cycle. Subscript (2) indicates that grid current flows during some part of input-voltage cycle.

** With zero-impedance driver and perfect regulation, plate-circuit distortion does not exceed 2%. In practice, plate-voltage regulation, screen-voltage regulation, and grid-bias regulation should be not greater than 5%, 8%, and 3%, respectively.

\# An output of 20 watts can be obtained at the grid-current point of Condition 9.

\#\# An output of 23 watts can be obtained at the grid-current point of Condition 10.

[1] When the 6L6 is operated at maximum ratings, the heater voltage should not exceed 7 volts.

[2] Maximum resistance in the grid circuit should not exceed 0.1 megohm for fixed-bias operation nor 0.5 megohm for self-bias operation.

[3] No signal.

[4] Grid to grid.

[5] Plate to plate.

[6] Driver stage should be capable of supplying this power to the grids of the 6L6's at low distortion. The effective resistance per grid circuit of the Class AB stage should be kept below 800 ohms and the effective impedance at the highest desired frequency should not exceed 700 ohms.

The All-Wave All-World DX News

Official Organ of the All-Wave All-World DX Club

★ ★ ★

Club Is Proving Highly Popular

Every DX fan in Australia must have wanted a DX Club to join, and a DX Contest to take part in, if the letters that have been rolling in lately from all parts of the Commonwealth are anything to go by! This letter, from Leon S. Stone, of Gordon, N.S.W., is typical of dozens more:—

"I must say the Membership Certificate is certainly a neat one. I must also compliment you on the badge, which I consider exceptionally striking and effective. It looks and is a high-class job that anyone would be proud to wear. It is really much superior to what I expected.

"Re the Club. It is a worthy organisation of great value to the dxer to run hand in hand with A.R.W., and I am sure it is going to be—if not *already*—most popular.

"Thanks for the specimen report form—a very useful idea indeed and a wonderful time-saver for any dxer. It is also very handy, as it sets the seal of an 'Official' report on any sent to stations, with an increased chance of getting an acknowledgment. For this reason the idea of giving each member an Official Receiving Station Call Sign is an excellent one, of which I heartily approve."

★

The Right One At Last

Another reader, writing from Ipswich, Queensland, says: "The All-Wave All-World DX Club is just what has been needed in Australia for a long time. I have wasted no end of money in buying different magazines and at last I have come across the right one. I can say it is very popular here in Ipswich. I have been praising it to everyone I see or talk to about dxing, and have given my newsagent a permanent order for it."

It goes without saying that support as enthusiastic as this is always highly appreciated, not only because it proves that a magazine like the "Radio World" was badly needed in Australia, but because the more support that is forthcoming, the greater is the service that can be given to readers.

More Members Wanted

This applies particularly to the All-Wave All-World DX Club. Every application for membership that is received means that just a little more can be done for those who have already joined. If every dxer who has joined or who is about to join persuaded several friends to send in applications too, the Club would have a thousand or more members in no time. With the membership at this figure, there would be no end to the competitions and little "stunts" that could be arranged for members.

All-Wave DX Contest

In the conditions governing the Contest, published last month, it is stated that "the Contest is an all-wave one, but broadcast stations only count —not commercials or amateurs." A correspondent asks whether the word "commercial" includes "B" class stations, which are run along commercial lines. The term does not apply in this case—what is meant are stations whose broadcasts are purely commercial in character, such as ship and aeroplane stations, etc.

ALL-WAVE ALL-WORLD DX CLUB

Application for Membership

The Secretary,
All-Wave All-World DX Club,
214 George Street,
Sydney, N.S.W.

Dear Sir,

I am very interested in dxing, and am keen to join your Club. The details you require are given below:

Name.....

Address.....

[Please print both plainly.] .....

.....

My set is a.....

.....

[Give make or type, number of valves, and state whether battery or mains operated.] .....

.....

I enclose herewith the Life Membership fee of 3/6 [Postal Notes or Money Order], for which I will receive, post free, a Club badge and a Membership Certificate showing my Official Club Number.

(Signed).....

[Note: Readers who do not want to mutilate their copies of the "Radio World" by cutting out this form can write out the details required.]

DX Champion Logs 600 Stations in Five Years

Following a recently-held New Zealand-wide DX contest, Mr. J. R. Bain, of Marton, was declared DX champion of N.Z. In the following article, written specially for the "Radio World," he tells readers how he built up his 600-station log.

A reception report from the author to this station at Wilno, Poland, brought this photograph in return as a verification.

I first started dxing early in 1931, just after purchasing my first set—a four-valve t.r.f. Ultimate. It was a battery-operated model, as I was living in the backblocks of Taranaki then, where mains power was not available. Valves used were a 442 screen-grid r.f. stage, 415 detector, 409 first audio, and 443 power valve.

The aerial was an inverted "L", 100 feet long, 45 feet high, and running north to south. The earth consisted of a five-foot pipe driven well down into moist soil.

As is usual with the owner of a new set, I was keen to see what my new four-valver would do, and after logging all the New Zealand and most of the Australian stations, I concentrated on the weaker signals. To avoid disturbing other members of the household when I was dxing late at night, 'phones were sometimes used.

After several months, I started dxing in earnest. My first overseas report was sent to KFOX, Long Beach, California, and the next two to 3KZ and 3GL in Victoria. From then on I was kept busy making out reports, and looking forward to the arrival of overseas mails.

Most of the world's broadcast stations are located in U.S.A., and my locality must have been a good one for them, because in six months I had sent reports to 100. On occasions, when conditions were good, I would stay up all night to pick up Eastern stations or other stray ones that might have been testing, or on a special programme. I would consider it a very poor night's dial-hunting if I didn't get at least three or four new loggings.

Towards the end of 1933 I shifted to Marton, an inland town about 200 miles north of Wellington. Mains power was available here, so I bought a six-valve a.c. Ultimate superhet, and carried on dxing. Like the battery set, this also gave excellent results, so that last year I was able to win the "N.Z. Radio Record" DX Challenge Cup with a verified log of 603 overseas stations. Previously, while operating the battery set, I won the "N.Z. Radio Times" Battery Cup twice.

Some Hints for Newcomers

After one becomes keenly interested in dxing, one soon finds which months of the year are most suitable for the reception of stations in each country. For instance, during the winter months the Americans are heard at good volume from 4.30 till 7.30 p.m., but in the summer they are heard better from 11.30 p.m. till 3 a.m. European stations come in well during the spring and autumn, but at other times of the year they are hardly worth bothering about. On the other hand, the Eastern stations are heard practically all the year round, so it will be seen that one can be on the lookout for new loggings all the year round.

When reporting to stations, to ensure a verification one must give every detail that will be of interest to the station engineers, and I can advise nothing better than the use of the All-Wave All-World DX Club report forms. These forms cover everything, and the station officials can see at a glance just how the transmission was received.

It is always advisable to enclose return postage to the New Zealand and Australian stations. In the case of more distant stations, I have sent an I.R.C. only on very rare occasions; in fact, several stations have returned the coupon, saying that they did not accept postage when a detailed

Another Polish station logged by the author—Lwow, which operates on 380.7 metres (788 k.c.) with a power of 21.5 k.w.

Ultimate...

Choice of a DX Champion!

And it will be YOUR CHOICE TOO, if you are satisfied with nothing but the best.

Mr. J. R. Bain is shown here operating his stock model "Ultimate."

"ULTIMATE" WINS BLUE RIBAND OF NEW ZEALAND DXING.

Mr. J. R. Bain of Marton, New Zealand, put up a record-breaking DX performance against leading DX experts of New Zealand, when he logged and verified 603 overseas stations with his stock model "Ultimate."

"ULTIMATE" SETS A NEW STANDARD

These imported "Ultimate" Receivers set a new performance level—you have only to hear them to acknowledge their supremacy. You will be surprised at the extremely low noise level, while the sweet, full singing tone is a revelation.

"ULTIMATE" FEATURES INCLUDE:

Patented wave-change switch with colour indicator, volume and tone control colour indicators, chassis mounted on sponge rubber. Special and exclusive quiet tuning control for use in localities where electrical interference is prevalent.

Ample oversize factor on all vital parts. Battery sets equipped and fitted with economy switch which greatly extends the life of the batteries.

These features are provided in no other receiver than "Ultimate," regardless of price.

"Ultimate"—the radio receiver carried by Admiral R. C. Byrd on his recent expeditions to the Antarctic. No higher tribute could be paid to any radio than this.

6-VALVE ALL-WAVE MODEL.

In this latest "Ultimate" chassis an extra short-wave band has been provided to give complete coverage on the short waves from 16 to 130 metres.

This model incorporates the new Mechanical Micrometer Tuning Dial, with a special "logging" pointer that makes stations on the short waves as simple to tune in as those on broadcast. Each wave-band is automatically illuminated in a different colour, while another exclusive feature is the use of colour indicators for the volume and tone controls. This is the model on which 603 verified stations were logged on the broadcast band alone.

There are three console cabinets to choose from—that illustrated above being the "Baby Grand."

Messrs. G. R. Brown & Co. Ltd.,
267 Clarence Street,
SYDNEY, N.S.W.

Dear Sirs,

Please forward me, post free and without obligation, your illustrated booklet giving full details of the amazing new 1936 "Ultimate" all-wave a.c. and battery radios.

Name.....

Address.....

.....

report was sent, as they were only too pleased to know how their transmissions were getting out.

Then again, one must not be disappointed if an occasional station fails to acknowledge a report, as several circumstances must be taken into consideration. For instance, a powerful station such as KFI has a daily mail running into thousands of letters. Is it any wonder if one gets overlooked? Or, in the case of a foreign station, a letter may be lost in transit, or perhaps no one at the station can read or write in English. Then again, there are one or two stations that definitely refuse to "verify reception"; but these, I am pleased to say, are few and far between.

I have found it a good idea to enclose a folder or booklet of views with each report. Distant stations are always interested in anything of this nature, and very often send in return some photos or views of their station or locality. I have built up a very fine collection of cards, letters, and photos, all received from B.C. stations. In addition to the pleasure I have had from dxing I have also made many friends in all parts of the world, and regularly receive letters from them. Also, I have built up a fine collection of stamps.

In conclusion, to be a successful dxer and build up a good log, one must have a good receiver and a good locality, plenty of patience and a tolerant family.

Anyone seeking information on broadcast band stations need only drop me a line at 97 Princess Street, Marton, N.Z., and I will do all in my power to assist them.

"Card Collecting" is Not Sole Aim of Dxing

Simple Rules for Beginners

By M.T.H.

IN the early days of radio, a broadcasting station was very seldom heard at a distance greater than some 500 miles. Under such circumstances the owners of radio stations were very interested in receiving information concerning both strength and the steadiness of reception at distant points. It enabled them to determine the extent of their "area of effective service," and also, the effect of atmospheric conditions upon this service. It can be readily seen from these considerations that the tireless efforts of early enthusiasts were of great importance to the success of radio entertainment.

To-day, the supplying of such information is a hobby which yearly gains more enthusiastic adherents. Most broadcasting stations send a "Reception Verified" card to all those who give them helpful information, and the collection of such cards has become a matter of keen competition.

Reports Must be Complete

There is a danger to-day, however, that this hobby may degenerate into a form of card collecting, and nothing more. As an instance, stations occasionally receive reports running something like this: "I heard your station last night; it was coming in like a local. Please send me a card, etc." Needless to say, this sort of thing debases the hobby, and could ultimately lead to its extinction.

It is necessary, therefore, that every report sent to stations should be of service to them and to radio as a whole. This is the whole aim of dxing. The verification card is a reward for service rendered, and should not be regarded as the sole object of dxing.

Preparing a Report

Intelligent and accurate reports are undoubtedly of great assistance in determining the occurrence and duration of fading, the intensity of signal strength, and, perhaps, most important of all, the quality of speech and music. In forwarding reports to distant stations there are several essentials to be borne in mind.

1. Set down the time and date of reception, and also the frequency if possible. It is quite unnecessary to give every item you hear, but make sure you get at least half a dozen if conditions permit. If possible, quote titles in preference to saying that a "piano item" was heard, "a lady was singing," or "a band was playing," etc. Station engineers prefer to get the name of the item itself, the name of the orchestra, the composer, or the artist which enables them to verify definitely.

2. Next comes the readability (QSA) and strength of signals (R), as well as the quality. Many are apt to exaggerate when giving these particulars. Do not tell a station you heard them at R8, when in reality they were only R4. Misleading reports concerning strength are useless. The object of a report is not to let the engineers know what a wonderful receiver you have for DX, but to inform them how their signals are getting out. Weak and disturbed signals may not be due to your receiver, but to several other things; e.g., the time at which you hear the station or the local climatic conditions. Both these factors affect reception to some extent, hence the importance of stating as nearly as possible the volume and clarity of signals.

3. Pay particular attention to fading, and mention whether the carrier wave is steady or swinging at the same time, being careful to make sure your own aerial is not swinging.

4. Describe as accurately as you can the weather conditions at the time of reception, giving temperature and barometer readings (if available), direction of wind, and other details.

If dxers follow the above instructions and give some details as to the set used, length and height of aerial, etc., they will have the satisfaction of knowing their report is a helpful one. Postage should be enclosed where possible.

Some Shortwave DONT'S.

Don't expect to log all the stations in the world the first day you have your set. You must become used to your receiver and know just how to tune it, and this takes time and patience. It is best to try for the more powerful stations first, as they will be the easiest ones to pull in.

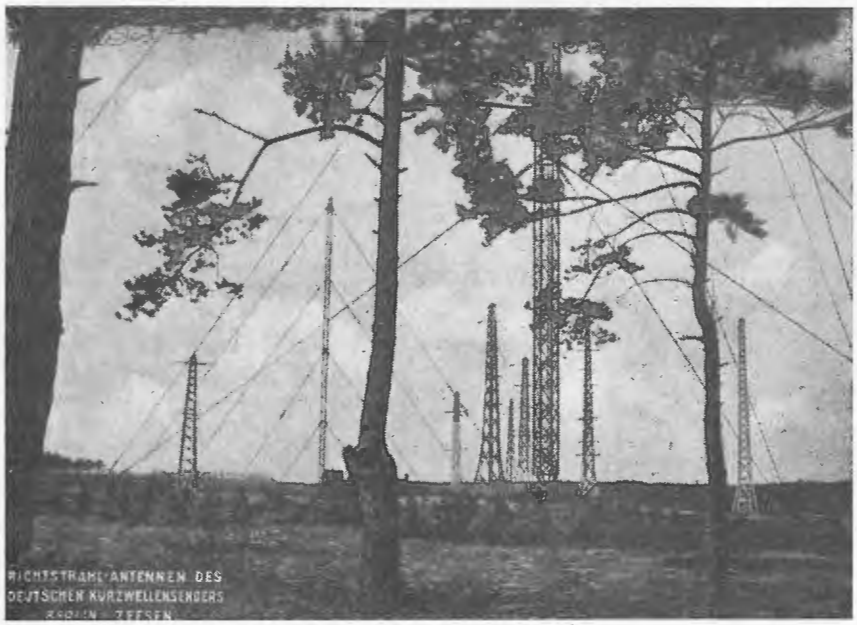
Don't expect to receive the same station every day, as conditions in the upper reaches of the earth's atmosphere cause reception conditions to change constantly. There are occasions when you will pick up a station with excellent volume, but perhaps a few days later you will not be able to bring in the station at all.

Don't expect to get stations instantly. A station may be coming in well one minute, but during the next you may scarcely hear it. This is one reason why patience and slow tuning are necessary.

Don't use a make-shift aerial. Only the best and most carefully-installed types will bring in shortwave stations satisfactorily. A doublet is always well worth while on the short waves.

Don't become discouraged. Every new shortwave listener, before he has become familiarised with the vagaries of short waves, is apt to become disheartened when trying out a new set.

Identifying Shortwave Stations



A view of the directional aerial arrays used for the German world shortwave service. The interval signal used by all stations consists of eight notes of an old German folk song.

—Photo. sent in by Leon S. Stone.

Chimes, bells, horns, cuckoo calls—these are just a few of the many and varied interval signals used by shortwave stations throughout the world to enable listeners to identify their transmissions easily. A list of these signals used by the more powerful stations is given below.

By H. I. JOHNS.

LISTENERS often find it difficult to identify foreign shortwave stations, especially those where the English language is very little used. For instance, some of the South American stations do not announce their actual call-signs in English, but in Spanish. Similarly, French and Russian stations use their own languages when announcing. Fortunately, however, most of these stations now use what are known as interval signals which enable listeners to identify them easily. A list of these signals used by the more powerful stations will now be given.

From the Empire stations (Daventry) a tuning whistle is sounded for at least fifteen minutes before the opening announcement. Next, Big Ben will be heard, and then the announcer will inform listeners that "This is London calling you." These well-known stations, which always close with "God Save the King," will be found on the 19, 25 and 31-metre bands.

When tuning into a German station one will hear chimes, consisting of eight notes of an old German folk song, frequently repeated, for about fifteen minutes before the station's announcements. Then follows: "Dear friends and listeners abroad."

These stations also announce in Spanish, and close down with the German national anthem and Nazi hymn. Finally, the chimes will be heard once again.

The French station, "Radio Coloniale" (FYA) and now known as TPA2, TPA3 and TPA4, always opens up with the "Marsellaise." The call-sign will not be heard, but instead the announcement, "Ici Paree, Radio Coloniale." The station closes with "Bon soir, mesdames, bon soir, mademoiselles, bon soir, messieurs," followed by the "Marsellaise."

From Paris we go to 2RO, Rome, which announces "Radio Roma Napoli." This is given by a lady announcer, the interval signal being a nightingale singing. The station closes with the Fascist hymn.

Another station in Rome is HVJ, Vatican City, which opens with a metronome beating for five minutes. Then will be heard the striking of the bells of St. Peter's, followed by the announcement, "Pronto Radio Vaticano. Wave length 50.26 metres. Laudetur Jesus Christus." The station remains on the air for fifteen minutes only.

A well-known station in Portugal is CT1AA, Lisbon, which uses three cuckoo calls as an interval signal. The announcement is, "CT1AA, Radio Coloniale." This station can be heard on Wednesdays, Fridays and Sundays, on the 31 m. band, but only during the winter.

Turning next to Switzerland, we have HBL and HBO, which together with several other stations are known as "Radio Nations," Geneva, Switzerland. Announcements are made in English, Spanish and French.

ORK, Belgium, which transmits interesting programmes heard daily in

One of the aerial masts used by the well-known Dutch short-wave station at Hilversum.

—Photo. sent in by J. R. Bain.

the early morning, is known as "Belradio." The announcement is, "Ici Bruxelles emission specials pour la Congo par la station de Ruysselede," and the station closes with "La Brabaconne."

Station OER2 in Austria can also be heard in the early morning. The announcement is, "Hello, Hier Radio Wien," and also "Hello, hello, this is radio station OER2, Vienna, Austria." A metronome is used for the interval signal.

Station EAQ (30.4 m.) in Spain, announces in English and Spanish after every item, the announcement in Spanish being—"Estacion Ay-Ah-Coo (EAQ), Madrid, Espana." This station is on the air daily, but is heard only during the winter.

Perhaps the best-known station throughout the world to shortwave listeners is PHI, Holland. Announcements are made in English, Dutch, Malay, German, French, Spanish and Portuguese, all by the same announcer. Listeners will hear, "Hullo, hullo, PHI, Holland," also "This is Huizen." This station, which is known as the "happy station" among shortwave listeners, closes with the Dutch national anthem.

PRF5, in Brazil, is known as "La Presse Nacional," the announcement being "You are listening to shortwave station PRF5—F for Friday." They also give the station's longitude and latitude.

RNE, the Russian station, on 25 metres, always opens and closes with the playing of the "International." You will hear, "This is Moscow calling on a wave length of 25 metres, 12,000 kilocycles, Workers of the World."

All American stations can be identified by the prefix "W." The call-signs are given every fifteen minutes, preceded in nearly all cases by the striking of three gongs. Shortwave stations in America which operate from or in conjunction with a broadcast station, give announcements as follows: "Westinghouse stations WBZ, WBZA and shortwave station W1XK."

W2XAF on 31 metres is known as "The Voice of Electricity," the announcement being, "This is WGY and W2XAF." Each programme is opened with a broadcast from the noise of a discharge of 10 million volts.

W8XAL's announcement is, "The Nation's Station, WLW, and shortwave station W8XAL."

W9XF—"Your station is W9XF, Chicago, Illinois, operating on 6,100 kilocycles." The call-sign, etc., is also given out in several different languages.

VK2ME, Australia, is known as "The Voice of Australia," the identifying signal being the well-known laughter of the kookaburra, Australia's famous bird. The station always closes with "God Save the King."

VPD has no interval signal, but the announcer will be heard to say, "Hullo listeners, this is station VPD, Suva, Fiji," before almost every item.

VK3ME opens with clock chimes and closes with "God Save the King."

The South American stations are the hardest to identify, as the majority do not give their call-signs in English but only in Spanish.

HJ1ABB is known as "La Voz de Barranguilla," the call-sign in Spanish being "Acha hota und ah bey, bey." The interval signal consists of three chimes.

HJ2ABA will be heard as "La Voz del Rais."

HJ3ABD—the name of this station is "Ecos de Calle," and the announcement is "Atcha kah effch." The identifying signal consists of strokes on a gong.

HJ5ABD's call will be given by the announcer as "Achay jay sinks ah bay day."

HCJB, which is heard daily broadcasting in English and Spanish, is "Le Voz de los Andes" (the Voice of the Andes). It can be identified by a two-tone chime.

HC2RL, known as "Quinta Riedad," calls "Hullo America" both in English and Spanish. It closes with the Ecuadorian national anthem.

OAX4D is heard well on Thursdays and Sundays on 51 metres. The announcement, "La Voz de Peru, Radio, D.U.S.A." is given in English and Spanish.

XEBT is another well-known station and can be easily identified by the blowing of a motor horn, like very fast cuckoo calls, repeated twice. Also listeners will sometimes hear a siren blowing, similar to that on a fire engine. The station signs off with that beautiful sacred song, "Ave Maria."

Universal Time Conversion Indicator

How to Assemble and Use It

EVERY radio enthusiast will find the Radiotron Universal Time Conversion Indicator issued as a free supplement to this issue, invaluable in obtaining time differences between various parts of the world.

To assemble it, the large circle should be carefully cut out around its outside edge. The small circle is also cut out, just inside the red line forming the circumference. Two discs of fairly heavy cardboard are also required, of the same diameters as the cut-out circles. The latter are then glued to the discs, the smaller one placed evenly over the larger, a paper fastener passed through the centre, and the Indicator is ready for operation.

Alternatively, both discs can be fastened to a convenient spot on a wall with a drawing-pin passing through their centres.

Using the Indicator

To obtain the time in any country when it is, say, 8 p.m. in Sydney, set "N.S.W." opposite 8 p.m., and then times in other parts of the world can be read off. For example, the Indicator shows it is then 7.30 p.m. in South Australia and Northern Territory, 7 p.m. in Japan, 6 p.m. in West Australia, and 9.30 p.m. in New Zealand.

The only country of any importance from a radio point of view that is ahead of Sydney in regard to time is New Zealand, which is 1½ hours ahead during winter. During summer, when Daylight Saving is in force, the time difference increases to 2 hours.

Some Further Examples

In big continents there are several divisions of time. In the United States there are four belts—Pacific, Mountain, Central and Eastern. These are 18, 17, 16, and 15 hours behind Sydney time, respectively. Australia has three belts, Western Australia and Central Australia being two hours and half an hour respectively behind Sydney time. All these differences are shown by the Indicator.

Allowance For Summer Time

Summer time is observed in some countries, notably Argentine, Belgium, Brazil, France, Great Britain, Holland, Portugal, and Roumania. During the Australian winter, the time in these countries is advanced one hour, for which due allowance should be made.

All-Wave DX Contest Arouses Widespread Interest

List of Prizes Given Below Includes Kit-Sets, Multi-Range Tester and Aerial Kits.

First prize is this latest "Moneysaver" kit-set—Radiokes' star release for 1936.

THE announcement of the All-Wave DX Contest in last month's "Radio World" has brought in dozens of letters from readers anxious to take part in the competition. Judging by their enthusiasm, station officials in all parts of the world are going to have a busy time during the next few months checking up on reports and sending back verifications!

Thanks to the generosity of leading advertisers in the "Radio World," over thirty pounds' worth of prizes have already been donated for distribution among the winners. There will be two sections in the Contest, one for Australian and one for New Zealand dxers. Details of the prize list are as follows:—

AUSTRALIAN SECTION.

First Prize: ..... **Radiokes "Moneysaver" Kit-Set (value £9/17/6).**

(Kit donated by Radiokes Ltd., except for condenser gang and wave-change switch, given by Stromberg-Carlson (A'sia) Ltd.)

Second Prize: ..... **"1936 Master Five" (Complete Velco kit of parts, value £6).**

(Donated by Messrs. A. J. Veall Pty. Ltd., Melbourne.)

Third Prize: ..... **Palec Nine-Range D.C. Multi-Tester (value £5).**

(Donated by the Paton Electrical Instrument Company, Sydney.)

Fourth Prize: ..... **Noisemaster All-Purpose Aerial Kit (value 52/6).**

(Donated by Antennex (A'sia) Agencies, Sydney.)

Any dxer would find this nine-range multi-tester invaluable for set-building and trouble tracking. The owner of the third best log in the contest is going to win it.

NEW ZEALAND SECTION.

First Prize: ..... **Kit of parts for complete receiver (type will be published next month).**

(Donated by Messrs. F. J. W. Fear & Co., Wellington, N.Z.)

Second Prize: ..... **Noisemaster All-Purpose Aerial Kit (value 52/6).**

(Donated by Antennex (A'sia) Agencies, Sydney).

Further additions to both prize lists may be published next month.

Every prize-winner will also receive an Award Certificate in two colours, printed on parchment, while six Certificates of Merit will be awarded for the six best logs entered, apart from those of the prize-winners.

Two of these signal-boosting "Noisemaster" aerial kits will be awards in the contest.

DX News and Views

A page for letters from DX readers

★ ★ ★

Wants To Exchange QSL Card

I would like to congratulate you on your fine paper "Radio World." I look forward to getting my copy of it every month. I have a QSL card of my own, and would like to exchange it with anyone anywhere. Wishing the "Radio World" every success in the future.—C. R. Londrigan (Camperdown Road, Terang, Vic.).

★

Fine 10-Metre DX

Following is a list of loggings for the past week—mostly on 14 m.c. (20 metres) c.w.:—W6CXW, W6ITH ('phone Q5, R9), W6LDP, WEIEA, W7BUB, W9POS, OZ2M, J2CL, UK3AA, PACE, G5RS, G6OS, U9MF, KAISP (7 m.c.), XU3RY, OH5MR, OZ5BK, EI8B, W2LU, KAIER (7 m.c.), W2HSD, U2ME, PAHG, W6HR, K6AKP, W410, F8NY, W9KJP, K6LBH.

Some time ago I heard the following on 28 m.c. (10 metres):—ZLIGX, W6GZU, ZL3AB, VK3YF, ASIH, VK6SA, HJ3AJH, J2HJ, and VK6MN. Also, VK6FO used to be regular, but have not heard him for some time.

My total log, including VK's and ZL's, must be around about 1,000 stations. I have not sent many reports out, but have about 30 cards. I have received from ZBW, Hong Kong, a very nice card, showing views of the studio, station and transmitter.—Len. Burston (Wangaratta, Vic.).

★

Airways Station Heard

The stations which I have heard with my 4-valve battery set, with an aerial 60 feet long and 30 feet high, are as follows:—

Daylight stations: 3AR, 2FC, 5CK, 2CO, 7NT, 5CL, 2BL, 3LO, 3GI, 5RM, 2GB, 3UZ, 3BO, 2UE, 2GZ, 3HA, 2KY, 3DB, 2CA, 2UW, 2WG, 3KZ, 2CH, 2NC, 2WR, 2SM, 3AW, 2GN.

Night: 2YA, 1YA, 4YA (New Zealand from about 5 p.m. onwards), 6WF, 4QG, 5DN, 6AM, 5PI, 7LA, 2HD, 4MK, 3TR, 6IX, 4BK, 5AD, 2MO, 2KO, 3XY, 4CA.

These are the stations which I have noted down as having heard their calls since I bought the set in September last. Amateurs I have received include VK2YW, Wagga; VK2EI, Leeton, and VK2KD, Temora. Recently I picked up a station on about 5PI's wavelength. I heard a male announcer asking—"How long before you will be landing? Over, over." A little later—"You will be landing in about 15 minutes; see you later; OK, ———," a name which I could not get; possibly the name of the machine. A few days later I saw by the papers that an Airways 'plane had to return to Cootamundra aerodrome on account of bad weather, so, possibly, that's what I heard. Also, a station has been heard near 2FC—I think it is KZRM, Manila. I picked it up on Sunday night at about 10.45 p.m.; it was QSA4 and R6, for about half on hour. No call was given, but the announcer spoke with an American accent.—C. D. Moller (Coolamon, N.S.W.).

★

Two-Valve Battery Shortwaver

My receiver is a two-valve battery s.w. receiver, 30 detector, 32 output, using resistance coupling. It is of my own construction. The antenna is of the inverted "L" type—25-foot lead-in around the skirting-board, and a 25-foot flat top, 10 feet high, pointing to N.W. I use no earth. Since winding the 20-metre coil three days ago I have heard several stations, the best being VPD (22.94 m.) and W7AL2 calling 4JU and W6FQY. W6FQY can generally be heard at 4.20 p.m. The W6's come in best here. I use "cans" for s.w. reception.

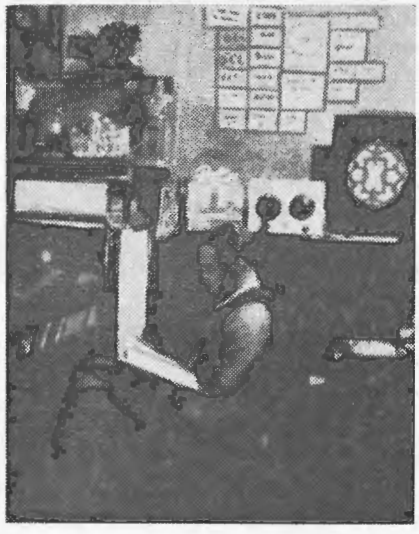
Wishing your excellent radio journal all the best.—Jack Harrower (Seddon, Melbourne, Vic.).

★

500 Stations In Six Weeks

I have received over 500 stations in the past six weeks—mostly amateurs on 20 metres, but including a couple of Japanese stations, XGOA, and KZRM on broadcast band.

I wish to congratulate you on the "Radio World," and here's hoping you keep up the good work. It is the best radio book I have seen, and I have a standing order for it at my newsagent.—W. Pearson (Malvern, Victoria).



The "Radio World" certainly seems to be popular in this DX den, which belongs to George Notley, of Moonah, Tasmania. Mr. Notley is a very keen dxer, and has logged plenty of S.W. and broadcast stations on the battery three-valver shown in the photo.

★

Foreign Stations On 49 Metres

"I wish to acknowledge having received my Club Certificate and Badge, and to commend you on the smart design of both badge and certificate. Also, the Report Forms are just what the DX fans have looked for for ages.

Well, the most notable items in the DX line here lately have been on the short waves. XE2AH, Mexico, W6ITH and W6MGJ, California, W6BY, Whittier, California, have all been heard on 20-metre 'phone at R8-9, QSA4-5. They can be heard around 4 p.m. till 5 p.m. South Australian Time. There is a station on approximately 49 metres which plays all the latest recordings with vocal refrains in English, and also a lot of Hawaiian music and songs, but announces in a foreign language. It does not give a call-sign, and is on the air from about 7.30 p.m. till 2 a.m. At intervals a chime is heard. This station comes in at R9, QSA5.

I have just received a verification and programme from Russia with the information that all reports will be answered, and that programmes may be obtained in any language on request. All reports should be addressed to the Editor, Inna Marr, Radio Centre, Moscow.—R. H. McColl (Semaphore, S.A.).

★

Sixty-Foot Aerial Mast

Just a few short lines to let you know how I am getting along in the way of dxing. So far things have not been the best, on the broadcast band it certainly has been very hard, the trouble being local interference. Though during June I received 80 odd cards from Australian stations, and hope to have a good collection in a very short time.

So far I have only sent cards to TPA4, DJQ, GSB, VBD and to a few American hams. I have tried various forms of aerials here, because conditions here in the North are not so good. At present I have under construction a sixty-foot three-corner lattice mast, and will gladly send photo of same when completed.

Wishing the "Radio World" and DX Club every success.—C. Watts (Bowen, Q'land).

★

Interested In 5-Metre DX

I have just bought the June issue of your remarkable magazine, which is certainly one of the best, and I enclose P.N. for one shilling and stamps to cover postage of the May issue.

I have had a radio since 1925—you know, the days of knobs, dials and squeals. At the present time I am very interested in 5 metres and would like to suggest that the "Radio World" publish as soon as possible a 5-metre receiver.

By doing this you would give those of us who are interested on this side of the Tasman a chance to bear the first signal from Aussie on a "Radio World" receiver; what could be better?

I will in the near future join the "All-World DX Club." I take this opportunity of wishing the "Radio World" the best of success—and it is a success.—Vince Hanstock (Denniston, N.Z.).

[Details of a.c. and battery 5-metre receivers are published in the July and August issues. Best of luck in your 5-metre DX work. Glad you like "R.W."—Ed.]

★

Logged Nearly 3,000 Stations!

I have an eight-valve all-wave job, and only operate it on an indoor aerial at present, but in the near future I intend to erect two 60-foot poles, so I ought to drag them in. I am in a very bad locality owing to the Railway Rock, and two sets of high powered mains pass in the next street. I have had the set about 16 months and have logged near the 3,000 mark of world-wide stations. I received a card yesterday from OA4R, Peru.

I would also like to mention I have my own card and have sent out dozens and dozens to different VK's, but have got about one dozen in return. I have never missed including return postage and thought I might be doing

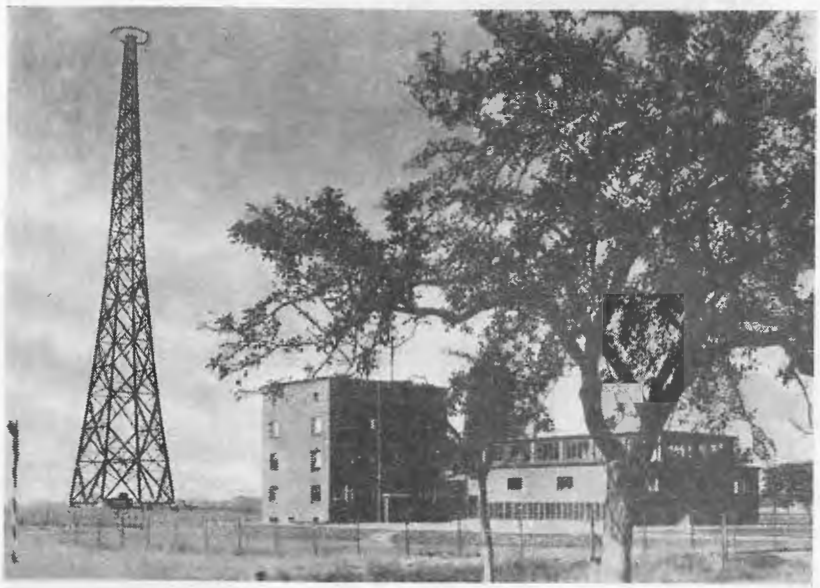
(continued on page 52)

Logging South American Stations

★ ★

During any Sunday afternoon dxers in good locations can, by careful searching, pick up quite a few South American broadcasters at good volume. In the article below over two dozen of the more powerful stations are listed, together with frequencies, powers, and best times to look for them.

By D. N. ADAMS



This high-powered broadcaster at Breslau, Germany, can generally be heard at fine volume in the spring and autumn. During the early morning is the best time of the day to try for him. Frequency is 950 k.c., and power, 100 k.w.

THERE are quite a few powerful stations in the Argentine, which can sometimes be heard in Australasia during the winter from about mid-day onwards. Sunday is a good day to try for them. Some go off the air at about 1.30 p.m., but others carry on, and these would probably be the best for Australian dxers to search for.

Published on this page is a list of the more powerful of the South Americans together with the approximate times (E.A.S.T.) at which they close down. Try for them before the more powerful of the U.S.A. stations start to come in, or there will be plenty of heterodynes with which to contend.

A good way of ensuring a verification from any of these stations you may pick up is to send a copy of your report to Mr. Hector Rivola, c/o Radio Station LR8, Radio Paris, Buenos Aires, Argentine, and ask him if he would mind seeing the management of the station in question regarding a verification for your report. Enclose some used or unused Australian stamps for his collection and he will be pleased to help you out. I have received back several verifications through his kind assistance.

Other stations in South America which have been heard here are:

TGK, Guatemala City, Guatemala, on 1,210 k.c., 10,000 watts. Broadcasts DX programmes on Sunday nights till about 6 p.m. E.A.S.T.

CP4, La Paz, Bolivia, on 1,040 k.c., 10,000 watts, is sometimes heard on till 6 p.m. with DX broadcasts.

CX26, Montevideo, Uruguay, on 1,050 k.c., 2,000 watts, is often heard on DX broadcasts.

CX24, Montevideo, Uruguay, on 1,010 k.c., 10,000 watts, is often heard on DX broadcasts.

CE76, Valparaiso, Chile, on 765 k.c.,

Argentine Broadcast Stations.

Station	Freq. (K.C.)	Power (Watts)	Remarks
LS10	590	6,000	Heard till 3 p.m. Sundays, sometimes after that.
LV2	620	2,000	Has been heard till 3 p.m. (E.A.S.T.).
LS3	630	5,000	Heard till 3 p.m. Sundays.
LS4	670	7,000	Closes at 3 p.m. Sundays.
LS1	710	5,000	Closes about 3.30 p.m. Sundays.
LR7	750	15,000	Heard on Sundays till U.S.A. stations drown it, which would be about 4 p.m. (E.A.S.T.).
LT1	780	4,000	Closes about 4 p.m. Sundays.
LR10	790	10,250	Is heard on Sundays till U.S.A. stations drown it out; very good station.
LR5	830	29,000	Is heard till 3 p.m.—sometimes later—on Sundays. A wonderful station.
LR6	870	26,000	Heard on Sundays till U.S.A. stations drown it. Wonderful volume last winter.
LR2	910	12,000	Closes at 2 p.m. usually, but has been heard later and is a good station to log.
LR3	950	31,000	This is one of the best. Is heard until 4 p.m. Sundays and verifies promptly.
LR4	990	12,000	This is another good station—is like LR3.
LR9	1,030	9,000	Heard best on Saturdays till 3 p.m.
LR1	1,070	50,000	Wonderful station. Heard till U.S.A. stations drown it out on Sundays.
LT3	1,080	4,500	Closes at 2 p.m. (E.A.S.T.).
LS5	1,110	5,000	Heard on Sundays at good volume till U.S.A. stations come in.
LR8	1,150	7,000	Heard on Sundays at good volume till U.S.A. stations drown it. Welcomes reports and verifies all that are correct.
LS2	1,190	30,000	This is usually the first S.A. station to be heard. On till after 4 p.m. on Sundays.
LS8	1,230	20,000	Is easily R6 here at 2 p.m. your time Sundays.
LU7	1,240	2,000	Is heard on Sundays till U.S.A. stations drown it. Comes in well and verifies promptly.
LS9	1,270	6,000	Is also heard on Sunday at good volume, but will not verify.
LS7	1,310	10,000	Another station which is heard well.
LS6	1,350	6,000	Should also be heard, but it has not verified reports.

10,000 watts, is heard on Sundays till the U.S.A. stations come in. A very good station.

Listed below are the stations in South America which have verified my reports. This will give dxers a good idea of the stations to report to, providing, of course, they are picked up:

Argentine: LS2, LS8, LR3, LR5, LR4, LR8, LS10, LT3, LU7, LV1. **Uruguay:** CX26. **Bolivia:** CP4. **Venezuela:** YV1BC.

DX News And Views

(continued from page 50)

these chaps a good turn, but they evidently do not appreciate reports.—C. E. Neill (Ipswich, Queensland).

[Congratulations on your card—a very neat job. Hard to understand your not getting replies from "hams," who generally are only too pleased to send a card if postage is included.—Ed.]

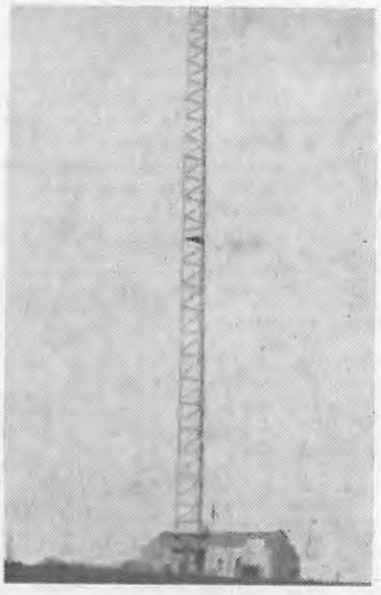
★

"Glorious Fourth" Celebrations Heard

Have had a Stromberg-Carlson D.W. only for five or six weeks, but have logged a number of overseas stations and also many amateurs. GSD and GSB, Daventry, from about 2 p.m. till 4.30 p.m., have been excellent on 25 and 31 metres—but cannot get them above a whisper on the 20-metre band. Radio Colonial, Paris, from 10 a.m., and 12RO, Rome, on 25 metres, were very good from 1.15 a.m. early in July. Also, at between 9 and 10 a.m. on the same day I heard 12RO give their "American Hour" request numbers in English.

On July 4 at 10.20 a.m. on 25 metres, I heard part of celebration at the United States Great Hall, Paris, of the "Glorious Fourth." Readability was fair to good, but there was some fading. I can recognise only the French and German languages (and perhaps Spanish and Italian), so unless the call is heard, it is difficult to tell what station one is listening to.—Mrs. E. M. A. A. Heathorn (Smithton, Tasmania).

[The list of interval signals published this month will help you considerably in identifying s.w. stations.—Ed.]



This aerial mast belongs to 1YA, Auckland, which operates on 650 k.c. with a power of 10 k.w.

—Jack M. Flower (Tauranga, N.Z.).

Frequency Re-shuffle for Japanese Broadcasters

New Stations: Higher Powers

By our Japanese Correspondent

THE operating frequencies of many Japanese stations will be changed soon, the new allocations being given below. At the present time these stations are on the air on their new frequencies for test after 10 p.m. J.S.T. It is expected that the new frequency allocation will become effective after July 1, 1936.

Two new stations — JBBK1 and JBBK2—are located at Heijo, Chosen (Korea). They are now testing with 50 watts, but power will be increased to 500 watts soon. Also, the power of JODK2 will be increased to 50 k.w. soon. The transmitter is already completed and will be on the air after autumn.

New transmitters for JOAK1, JOAK2, JOJG, JOKG, JOLG, JONG and JOOG are now under construction. They may be on the air this year.

The new station at Shinkio (Hsinking) is MTCY2; it will be opened this year. The antenna power is 10 k.w.

Two transmitters will be established at Seishin, Chosen (Korea). The antenna power of them is 10 k.w. each. —Akifusa Saito (Kumamoto, Japan).

K.C.	CALL.	LOCATION.	POWER. (K.W.)
560	MTCY	Shinkio (Hsinking), Manchukuo	100
580	JFCK	Taichu, Formosa	1
590	JOAK1	Tokio*	10
600	JONG	Miyazaki†	.5
610	JOJK	Kanazawa	3
630	JOKK	Okayama	.5
640	JODG	Hamamatsu	.5
650	JOUK	Akita	.3
670	JOTK	Matsue	.5
674	MTFY	Harbin, Manchukuo	3
680	JOVK	Hakodate	.5
690	JOBK1	Osaka	10
700	JOCG	Asahigawa	.3
710	JODK2	Keijo‡	10
720	JORK	Kouchi	.5
720	JFBK	Tainan, Formosa	1
730	JOCK1	Nagoya	10
740	JOSK	Kokura	1
750	JFAK	Taihoku, Formosa	10
760	JQAK	Dairen	.5
770	JOHK	Sendai	10
780	JOPK	Shizuoka	.5
790	JOGK	Kumamoto	10
800	JOKG	Koufu†	.5
810	JOIK	Sapporo	10
820	JBBK2	Heijo, Korea§	.5
830	JOFK	Hiroshima	10
870	JOAK2	Tokio*	10

This photograph of Mr. Akifusa Saito, the "Radio World's" Japanese correspondent, was taken with one of JOGK's masts in the background. Mr. Saito is a noted Japanese radio engineer, and so knows the kind of news that dxers want.

890	JOLG	Tottori†	.5
890	MTBY	Hoten (Mukden), Manchukuo	1
910	JOLK	Fukuoka	.5
920	JOQK	Niigata	.5
930	JOAG	Nagasaki	.5
940	JOBK2	Osaka	10
950	JONK	Nagano	.5
970	JODK1	Keijo, Korea	10
980	JOXK	Tokushima	.5
990	JOCK2	Nagoya	10
1000	JOBG	Maebashi	.5
1020	JOFG	Fukui	.3
1030	JBAK	Fusan, Korea	.15
1040	JOJG	Yamagata†	.5
1050	JOHG	Kagoshima	.5
1060	JOIG	Toyama	.5
1070	JOOK	Kioto	.3
1080	JOOG	Obihiro†	.5
1090	JBBK1	Heijo, Korea§	.5

* Will be increased to 150 k.w. this year.
† Will be opened this year.
§ Already opened.
‡ Will be increased to 50 k.w. this autumn.

Visiting DX Stations. 2

Left: Studio A—largest of WLW's many studios — is completely sound-proof. At the end can be seen the console and grill of the large pipe-organ that is often heard during programmes from this station. This studio will accommodate the largest of orchestras, together with several hundred guests.
Right: WLW's 831-foot vertical steel aerial is held in position by eight two-inch cables, totalling more than a mile in length.

WLW
CINCINNATI . . . . OHIO

The second of a series of articles on overseas stations, written for the "Radio World" by

. . . . . "ETHER-SEARCHER" . . . . .

STATION WLW, Cincinnati, Ohio, which operates on 700 k.c. with a power of 500 k.w. is known as the world's most powerful broadcast station.

More than a decade ago, Powell Crosley, Jnr., president and founder of the Crosley Radio Corporation, envisioned super-power broadcasting stations that would reach out and supply every radio-equipped home in the nation with high-quality programmes at all times. And so, becoming engrossed in radio research, Mr. Crosley was granted an experimental broadcasting license, with the call letters 8CR. This original Crosley broadcasting station made its debut in April, 1921. It operated with a power of 20 watts, and programmes were put over from the living room of Mr. Crosley's home.

From 50 to 5,000 Watts.

The experimental work advanced steadily, and in March of 1922, the first WLW, destined some day to dominate the broadcasting world, became an actuality. It used a power of 50 watts until September of the same year, when the power was increased to 500 watts.

As radio progressed, WLW kept pace with it, and in January, 1925, the first remote control transmitter came into being with the opening of the WLW 5,000-watt transmitting plant. In 1927—four years after the opening of the first Crosley broadcasting station—WLW was granted a cleared channel on 700 k.c.

In May of 1928, the Federal Radio Commission authorised the Crosley Radio Corporation to construct a 50,000-watt transmitter for WLW, and in the October following, the new transmitter was officially opened. Since WLW was the first commercial station to operate on a regular schedule, it became known as America's first really national broadcasting station, and has held the title of the "Nation's Station" ever since.

With the passing of time, WLW once more increased its power to 500,000 watts—enabling programmes to be sent out to radio listeners throughout the whole of the United States, Canada and Mexico, and under favourable conditions, throughout the entire world.

831-foot Vertical Radiator.

One of the world's highest structures is the gigantic 831-foot vertical radiator antenna of WLW. It is 273 feet higher than the Washington Monument in Washington, D.C., and only 153 feet short of the famous Eiffel Tower in Paris.

The antenna is 35 feet wide at the centre and only 30 inches in diameter at the base, with the diameter of the base of the insulator only 6½ inches. This extremely small base rests on a seemingly fragile bit of cup-shaped porcelain 1½ inches in thickness, and

this hollow porcelain base supports a total stress load of 450 tons, which includes 135 tons of structural steel. Eight two-inch cables, totalling more than a mile in length, hold the tower in position.

The transmitter plant is located at Mason, Ohio—a distance of 25 miles from the studios, which are situated at 1,329 Arlington Street, Cincinnati.

Crystal-Controlled Transmitter

In the transmitting room, energy is generated at the required frequency of 700 k.c. at low power, the frequency being held constant by a quartz crystal, the temperature of which is controlled by a thermostat, accurate to a hundredth degree centigrade.

The twenty giant 100,000-watt amplifying tubes used represent a small fortune. In addition, 73 other tubes of smaller size are used in the transmitter. One million gallons of water is required daily to cool these tubes, additional cooling being provided by the use of 1,350,000 cubic feet of air per hour.

After the signal is amplified to its required power, a tuning unit takes the energy from the tubes and transfers it to the huge vertical radiator antenna. From this tower the signal goes out in all directions to receiving sets all over the world.

Elaborate Studios

The studios of the "Nation's Station" occupy practically the entire eight floors of the Crosley Radio Corporation building in Arlington Street. WLW maintains eight special broadcasting studios at the Crosley plant as well as several downtown studios, and in addition has many remote pick-up points throughout the city.

The studios are beautifully decorated and completely sound-proof, and are all air-conditioned.

Mr. Crosley also operates station WSAI on the broadcast band, and shortwave station W8XAL.

WLW is often heard in Australia, and closes down at 6 p.m. E.A.S.T.

Systematic Servicing

(continued from page 20)

than + or — 10 per cent. should be discarded. Volume and tone controls are included as resistors, and should be checked and replaced if faulty.

Test No. 4 includes an accurate check on all voltages and currents. This is best done with a multi-range meter, with plate break adapters for measuring plate current. It is of course important, especially with non-A.V.C. sets, to have the volume control full on. This test should take very little time, because by now it is established that valves, condensers and resistors are in perfect order.

Test No. 5 is purely a loudspeaker test. Intermittent faults are sometimes caused by a break in the field coil or a break in the primary of the matching transformer. For the speaker test, use a 400-volt power supply, with a 0-100 m.a. meter and 10,000-ohm heavy duty potentiometer in series, and pass a heavy current through the field coil and transformer primary. Any intermittent fault should show up immediately.

The speaker should now be tested for rattles, using a good baffle for the purpose. If there is even the slightest rattle, dismantle the speaker, clean out any dust or dirt, re-assemble it, and re-centre the cone. Elusive rattles may sometimes be cured by applying a thin coat of glue over the voice coil and its assembly. Also inspect voice coil connections for breaks.

The speaker should be in perfect order before it is returned to the cabinet.

Test No. 6 includes a complete line-up of the receiver. An all-wave signal generator is necessary for this test, preferably one with its output calibrated in microvolts so that the actual sensitivity of a receiver may be measured and passed as normal for a receiver of the type. Alignment should be perfect, and if the dial is frequency calibrated, the stations should come in on the correct readings.

When sensitivity and calibration are finished, the receiver should be passed to test No. 7.

Test No. 7 is for the purpose of checking. The receiver should be checked for tonal quality, sensitivity, selectivity, dial calibration, speaker rattles, and for a slipping dial, as well as for other loose parts about the chassis. When passed as O.K. it should be replaced in the cabinet, checked again for dial position and loose knobs, and the cabinet polished.

Test No. 8 is merely running the receiver for a period of time—preferably as long as possible, on a line voltage slightly higher than that to which it is accustomed. Country areas, particularly, have high line voltages, and this test is really more of a check on all the parts, to make sure that none will break down. The writer uses a transformer having a 230 v. primary and tapped secondary up to 270 v.

(To be continued next month.)

DX Club Report Forms

Great Time-Saver For Dxers

In the May issue of the "Radio World" an article was published showing readers how to fill in the new Official Report Form of the All-Wave All-World DX Club, which is now available. All the information appreciated by stations is given, and all that is necessary to complete a report is to fill in the blanks provided.

By using these forms, dxers can not only be certain of supplying every detail wanted by the station, but also they are identifying themselves with an established Club, and so are far more likely to receive back replies than if an ordinary letter were sent.

These forms are sold to members only at a price of 1/6 for 50, post free.

A simple way of carrying an earth connection across a concrete path is to use a thin strip of copper about an inch wide instead of an earth lead.

China to have High-Power S.W. Station

Some Shortwave News Flashes

By A. B. McDonagh *

Africa Launching Out

A new building of eight stories, and with 13 studios—the most ambitious radio building outside of Daventry—is now being erected. Look for ZSR, 9.18 m.c., and the shortwave relay station of ZTJ on 6.09 m.c.

China's Contribution

The Administration of Chinese Broadcasting has placed an order with the Marconi Co. for a shortwaver of higher power than that used by the B.B.C. It will relay the 75,000-watter XGOA, and advice states it will take two years to build. Meantime, Chinese radio engineers will study at the Marconi College in England, and also in America, to learn modern shortwave technique.

New Venezuelan Station

Caracas, Venezuela, is going to have a new station on 6.27 m.c.—YV14RC. YV7RMO is on 6.07 m.c., and is located at the end of Lake Maracaibo nearest the sea.

'Plane and Police Stations

Just a shade under 5 m.c. at about 11 p.m. N.Z.S.T., an aeroplane station may be heard. Some of the U.S.A. police stations, which are above 100 metres, can be heard round about 9 p.m. N.Z.S.T.

Shortwave Jottings

RAN (?), Moscow, 31.6 metres, is testing daily from midnight G.M.T. This is the same transmitter as used for the 9 p.m. G.M.T. sessions.

Java (said to be PMO) is on approximately 26 metres with the same programme as YDB on the 31-metre band.

It is hinted that New Zealand's proposed shortwave station may be erected alongside the 60-kilowatt national station now being built near Wellington.

Higher in frequency, and about a degree from the 6.5 megacycle mark, a rapid foreign voice is often heard about 11 p.m. N.Z.S.T. I heard the call as JTAS, calling WWV and others.

This is evidently a Japanese ship, as several of them use telephony when nearing U.S.A.

Many people do not know that Moscow has an English session on 25 metres (12 megacycles) between 2.30 and 3.30 a.m. N.Z.S.T. on Monday mornings.

It will ease the minds of Australian listeners to know that Shanghai has been heard in N.Z. at midnight on the 31-metre band.

A new station, with speech in Italian, is on Abyssinia's wavelength of 25 metres.

Watch Geneva for different relays; they test at odd times.

* Australian listeners who wish to be introduced to pen pals in New Zealand should write A. B. McDonagh, Secretary N.Z. Short Wave Club, 4 Queen Street, Wellington, E.1, New Zealand. The same applies to exchange of QSL cards or stamps. Kindly enclose a penny stamp for reply.

DX Notes And News

By Gilbert S. Hayman

At 2 a.m. E.A.S.T. on July 12, 2UW, Sydney, called for reports from all members of the All-Wave All-World Club.

VK2QY, Paddington (N.S.W.) also called club members.

2QY "Specials" For N.Z. DX Clubs

VK2QY, which operates on 1290 k.c. (232.5 metres), is featuring experimental tests for N.Z. DX clubs. These take place at 1 a.m. E.A.S.T. the last day of every month. 2QY promptly acknowledges reports, and if return postage is enclosed will always send a station card. The address of VK2QY is 45 Oxford Street, Paddington, N.S.W., Australia. Trunk line calls are always appreciated by 2QY. F2845 is the telephone number.

"Simplified Moneysaver" Is Fine Performer

Some Reports from Readers

That the Radiokes a.c. "Moneysaver" described last month is one of the finest receivers of its class for DX listening it would be possible to design has been proved conclusively by tests carried out in several locations since publication of last month's issue. On each occasion, the "Moneysaver" pulled in dozens of DX stations with the ease and selectivity of many modern commercial sets using one and even two valves more.

Some Amazing Reports

Already some fine reports on the set's performance have come to hand from "Moneysaver" builders. One reader in Bulli gives a glowing account of the set's DX capabilities, his list of stations logged including nearly every broadcast station in Australia and New Zealand, as well as a Chinese station. On the short waves he has logged practically all the principal international shortwave stations as well as many amateurs in all parts of the world. The report concludes: "The set shows absolutely uncanny selectivity, separating without the least difficulty some of the most distant 'B' class stations."

Another reader states: "When I first tried the set out, I was amazed at the number of stations I could receive. I didn't think there were so many on the air."

It is certain that anyone building the receiver from the Kit-Set should not have the least difficulty in duplicating these performances. The construction is made easy by the instructions and diagrams; the alignment is easily carried out, very little adjustment being necessary. To assist the amateur builder, the intermediate transformers and padder have been tested under operating conditions and set to the correct alignment positions at the facory.

Iron-Cored I.F.'s Used

An important fact not mentioned in the descriptive article last month is that the latest Radiokes iron-cored intermediate frequency transformers (type SIC-465) are supplied with the kit. These new intermediates are highly efficient, and their use in both the a.c. and battery "Moneysavers" is largely responsible for the exceptional gain and high selectivity that are outstanding features of both models.

"Air-Commodore Dual-Wave Five"

(continued from page 4)

overhead wire approximately one hundred feet from the receiving aerial, and with a large power distributing sub-station about three times that distance away.

Here the set gave a true indication of its worth by receiving 74 stations on the broadcast band, and all the shortwave stations that could be heard on a highly efficient seven-valve short-wave superheterodyne.

The third and final test was made on the South Coast approximately one hundred miles from Sydney by air line. Here not only were 82 Australian and New Zealand stations received in one night, but also two American stations (KFI and possibly KSL). The shortwave conditions were not particularly favourable at the time of the test, but the "Air Commodore" received every station that could be heard on a six-valve set, and eliminated fading to a greater extent.

The automatic volume control system incorporated in this kit-set, while simple, is highly efficient, and holds any programme worth listening to as steady as a rock.

Another very remarkable feature of the "Air Commodore" was its entire freedom from "double spots," even when operated in close proximity to very strong local stations.

PRIZES FOR DX NEWS.

THIS MONTH'S WINNERS.

In this month's DX News Competition, H. I. Johns and J. R. Bain have been awarded 12/6 each; "Ether-Searcher," D. N. Adams, and L. S. Stone 7/6 each; and A. B. McDonagh 5/-. Six-monthly subscriptions to the "Radio World" have also been awarded to M.T.H. and G. Hayman.

Wrongly-Marked Resistor in A.C. "Moneysaver" Diagram

Radiokes Ltd. advise that the value of a resistor was wrongly indicated on the diagram of the resistor panel accompanying the description of their latest a.c. "Moneysaver" in the July "Radio World." The .1 megohm resistor shown between terminals "H" and "E" should have a value of .05 megohm—as indicated in the circuit diagram.

New South American

On Saturday afternoon, July 18, at 5.18 p.m., I logged a new station on 31.58 metres (9500 k.c.). The call-sign was given in English and Spanish as HJ1ABE, and reports were requested. The address was given as Box 31, Cartagena, Republic of Colombia, South America. Signals were heard at about R6, QSA5.

Ronald E. Keegan (Leeton, N.S.W.).

All-Wave All-World DX Club

List of Life Members

CLUB No.	NAME AND ADDRESS
AW 1 DX	Graham Cumming, Meyer St., Donald, Victoria.
AW 2 DX	F. H. Stacey, c/o Mrs. H. Murphy, 80 Princess St., Petrie Terrace, Brisbane, Queensland.
AW 3 DX	Noel Jenkins, 80 Bannister St., Masterton, N.Z.
AW 4 DX	Robert E. Foothead, Newlands, Johnsonville, Wellington, N.Z.
AW 5 DX	J. Bisceop, Allison Road, Cronulla, Sydney.
AW 6 DX	F. G. Richards, 15 Dalley St., West Kogarah, N.S.W.
AW 7 DX	H. M. Downes, Bell Street, Penshurst, Victoria.
AW 8 DX	H. C. Major, 45 Nirvana Ave., Malvern, S.E. 5, Victoria.
AW 9 DX	C. G. Arnold, McDowall Street, Roma, Queensland.
AW10 DX	Ken Scott, 12 Mitchell St., Stockton, N.S.W.
AW11 DX	E. Davison, Box 4, P.O., The Entrance, N.S.W.
AW12 DX	W. L. Barry, c/o J. Hall, Esq., 11 Gloucester Street, South Brisbane, Queensland.
AW13 DX	Jack Glew, 203 Centre Road, Bentleigh, S.E. 14, Victoria.
AW14 DX	Eric K. Webb, 297 Mitcham Road, Mitcham, Victoria.
AW15 DX	A. T. Baxter, Casterton, Sandford, Victoria.
AW16 DX	Frank Keirsnowski, Acheson Street, Rockhampton, Queensland.
AW17 DX	James Laing, 85 Moncur Street, Woollahra, Sydney.
AW18 DX	Douglas Pearsall, 512 Macauley Street, Albury, N.S.W.
AW19 DX	Jack M. Flower, Norris Street, Tauranga, N.Z.
AW20 DX	R. H. McColl, 32 Esplanade, Semaphore, South Australia.
AW21 DX	E. A. Glenie, 41 Ashworth Street, Albert Park, Victoria.
AW22 DX	C. T. Frost, P.O. Box 44, Seymour, Victoria.
AW23 DX	V. Smith, 350 Wellington Street, Collingwood, Melbourne, Vic.
AW24 DX	F. C. Collins, Hot Springs Hotel, Te Aroha, N.Z.
AW25 DX	James Brooks, "Athelstan," Wamberal, N.S.W.
AW26 DX	R. P. Veall, 38 Eildon Road, St. Kilda, S. 2, Melbourne, Victoria.
AW27 DX	B. Beauchamp, 83 Ira Street, Miramar, Wellington, N.Z.
AW28 DX	R. C. Watts, Box 91, Pode Street, Bowen, North Queensland.
AW29 DX	Cecil Howard, 219 Ellena Street, Maryborough, Queensland.
AW30 DX	Len R. Burston, 93 Rowan Street, Wangaratta, Victoria.
AW31 DX	F. J. Davis, Mount Battery Station, Mansfield, Victoria.
AW32 DX	W. H. Emanuel, 109 Bathurst Street, Hobart, Tasmania.
AW33 DX	G. L. Ford, 129 Curzon Street, North Melbourne, Victoria.
AW34 DX	A. Spriggins, Navy Wireless Room, Victoria Barracks, Melbourne, Victoria.
AW35 DX	J. T. Jarvey, 520 Elizabeth Street, Albury, N.S.W.
AW36 DX	J. M. Burke, Lyster Street, Coff's Harbour, N.S.W.
AW37 DX	Dave Adams, 35 Bowker Street, Timaru, N.Z.
AW38 DX	C. Jarlett, 23 Queens Road, Hurstville, N.S.W.
AW39 DX	G. Billings, Wattle Bank, 251 Murrumbeena Road, Murrumbeena, S.E. 9, Victoria.
AW40 DX	G. Notley, 37 Main Road, Moonah, Tasmania.
AW41 DX	F. C. White, 24 Prentice Street, Elsternwick, Victoria.
AW42 DX	A. M. Branks, 67 Robertson Street, Invercargill, N.Z.
AW43 DX	E. R. Service, 81 Ettrick Street, Invercargill, N.Z.
AW44 DX	D. Morath, Box 11, P.O., Narromine, N.S.W.
AW45 DX	K. Morehead, Chatsworth Street, Mt. Druitt, N.S.W.
AW46 DX	E. Morehead, Chatsworth Street, Mt. Druitt, N.S.W.
AW47 DX	N. W. Lumby, 228 Oberon Street, Coogee, Sydney.
AW48 DX	G. F. Thompson, 104 Bambra Road, Caulfield, S.E. 8, Victoria.
AW49 DX	F. H. Hagedorn, Ambrose, North Coast Line, Queensland.
AW50 DX	K. Moyes, Mani Arm, Mullumbimby, N.S.W.
AW51 DX	A. H. Graham, 258 Lower Plenty Road, Rosanna, N. 22, Melbourne, Victoria.
AW52 DX	R. Doyle, 24 Baden Powell Street, Rockhampton, Queensland.
AW53DX	William H. Pearson, 10 Soudan St., Malvern, S.E.4, Victoria.
AW54DX	Clive Holland, 32 Railway Crescent, Maryborough, Victoria.
AW55DX	M. Temby, 1 John St., Mordialloc, S.12, Victoria.
AW56DX	Jack Reedy, Scarba St., Coff's Harbour, N.S.W.
AW57DX	Sidney Hayward, Wimble St., Seymour, Victoria.
AW58DX	Ron Gurr, c/o Port Stephens Canning Co., Pindimar, N.S.W.

(To be continued next month.)

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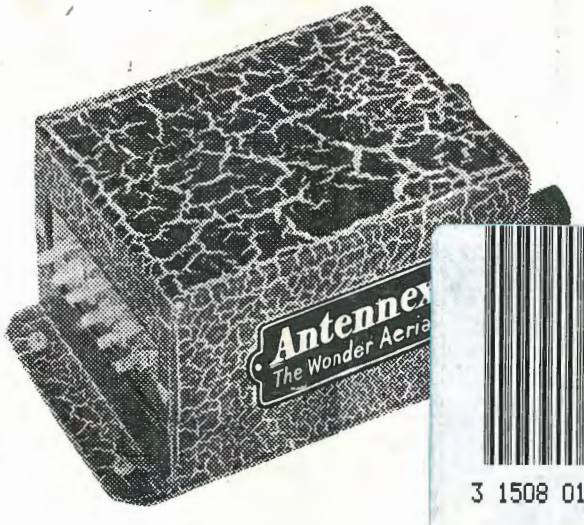
Thousands Marvel at New SHORT-WAVE IMPROVEMENT

Disappointment turns to Delight as new wonder Aerial "Antennex" Pulls in Stations Galore!



NOW—the wonder aerial . . . "ANTENNEX"—a sensational, marvellous new American invention which has swept America and has just reached Australia.

Already its fame is spreading . . . for it ends the disappointment of those many owners of short-wave and dual-wave receivers who have not got the overseas reception they expected and should get. "ANTENNEX" allows PERFECT reception of overseas stations! Stations spring up on places on the dial where there were none before . . . others roar in twice as strong as previously. Read below the marvellous offer which allows you to test this wonderful invention in your own home—without one penny risk to you!

MILLIONS SOLD IN U.S.A.

The marvellous improvement "ANTENNEX" makes to short-wave reception explains why it has swept America from coast to coast. Literally millions have been sold—which definitely proves that "ANTENNEX" is the outstanding invention since short-wave became popular. "ANTENNEX" is so simple to instal . . . a few minutes' work in fixing the aerial wires . . . then connecting the "ANTENNEX" terminal to the aerial terminal of your receiver—and that's all you have to do to get a sensational improvement in overseas signals. Now "ANTENNEX" has arrived in Australia—now YOU, too, can enjoy the perfect short-wave entertainment that millions in U.S.A. are enjoying, and that you yourself expected when you installed your short-wave set.

What is "Antennex"?

"ANTENNEX" is a complete unit sealed in a container of battleship steel, finished in a very attractive mottled blue-gold design, with provision for mounting on side of cabinet. All terminals are bakelite insulated. "ANTENNEX" is simple to install—just a matter of rearranging the aerial wire and connecting the "ANTENNEX" terminal to the set aerial terminal. Nothing can go wrong with "ANTENNEX." Nothing can fail. It has proved itself thousands and thousands of times over. It is GUARANTEED in every possible way. Read these convincing testimonials below.

Convincing Proof

Mr. R.E. (North Sydney) writes: "I used 'ANTENNEX' with my four-valve T.R.F. set and short-wave converter . . . eight short-wave stations, particularly London, Paris, Berlin and Japan—were as loud and clear as locals! It was a wonderful thrill . . ."

Mr. S.S. (Cremorne): "I didn't think such reception of overseas stations was possible on my new Dual-wave Superhet. . . . 'ANTENNEX' is certainly a WONDERFUL invention. . . ."

Mr. R.B. (Broken Hill): "On my —— dual-wave 'ANTENNEX' was nothing short of marvellous. I've heard stations I never even heard before and static has vanished. I can hear American stations every day on the broadcast band."

Leading Manufacturers Say Special Aerials Essential

Leading American radio manufacturers recommend special short-wave "ANTENNEX" type aerial outfits, for perfect reception—even with receivers costing more than a thousand dollars! "ANTENNEX" will improve signals on any receiver—broadcast, dual-wave, short-wave, or broadcast sets with short-wave converters.

Satisfaction Guaranteed or Money Refunded

Sydney Radio Shops clamoured for the agency of "ANTENNEX," but the inventor (an American) is in the meantime dealing direct with the public, so as to protect his rights. Test "ANTENNEX" on your own receiver. Send a special order form with the wholesale price, 30/-, for a week's free trial. If by any chance reception is not improved your money will be refunded. There's no risk—no doubt—"ANTENNEX" is GUARANTEED to improve reception in an amazing way—prove it to yourself and your friends by hearing stations you never heard before. And don't delay—this wonderful offer lasts only until special agency arrangements are completed. Retail price will then be higher—post order form NOW!

Short-Wave Reception Made Worth-while

The secret why "ANTENNEX" has met with such sensational success is this: It improves the strength of the signals of every station—broadcast or short-wave—at the same time reducing local static. Stations, therefore, come in stronger and clearer than ever before. Reception with "ANTENNEX" has to be heard to be believed—read the next column for details of the wonderful offer, how you can test it out in your own home—without one penny risk to yourself!

POST THIS SPECIAL ORDER FORM NOW!

Antennex (A'sia), Corporation,
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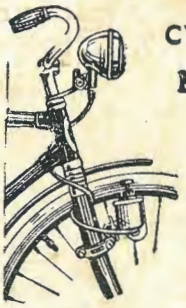

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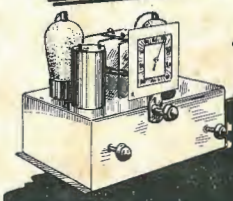

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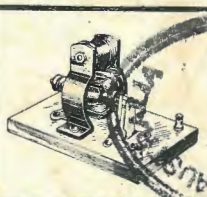

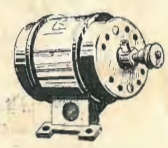

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