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SIXPENCE

RADIO IN AUSTRALIA & NEW ZEALAND

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VOL. II — FEBRUARY 18, 1925 — No. 50

THE TWO VALVE PORTABLE RECEIVER YOU'VE BEEN WAITING FOR!

Within Mr. J. G. Reed tells you how to build it.

RADIO IN AUSTRALIA & NEW ZEALAND
Incorporating "Sea, Land and Air".

[Edited by N. H. THOMPSON.]

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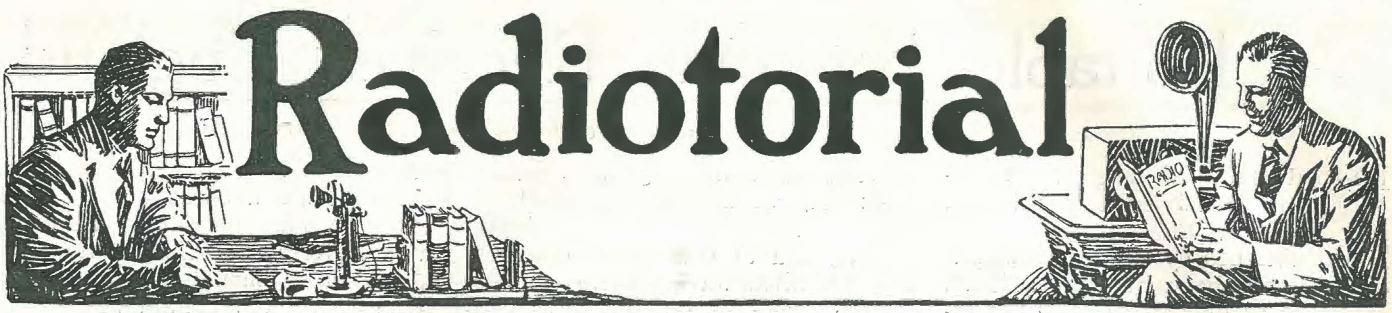

The Broadcasting Tests

NOW that the tumult and the shouting have died away it might be as well to consider, insofar as it is possible, when it must be remembered that they are hardly over, what has been the result and the effect of the experimental wireless broadcasting transmissions to Australasia carried out by several American stations during the earlier part of this month and the latter part of the last.

BEFORE going any further, however, it should be remembered that such conclusions as will be drawn in this article will be based on more or less incomplete data and, as such, will be, in effect, incomplete also.

AS far as those living in the eastern portion of Australasia—with the exception of New Zealand—are concerned, results secured can only be regarded as unqualifiedly successful. For example, reports have come to hand that at least one, and oftimes more, of the stations broadcasting were heard on single-valve sets, with those receivers employing an indoor frame aerial and, in several instances, that items came in strongly enough to actuate loud-speakers—no mean feat over a distance of, in one case, some ten thousand miles, when it is remembered that the average listener-in's set consists, on the average, but of two valves. Music, Morse and speech were all equally distinct, and the only barrier affecting perfect reception seems to have been the eternal "static." As soon as the atmospherics gave an opportunity, it was only a matter of sitting back at ease and taking what the American broadcast gods had sent.

AT the time of writing the most incomprehensible feature of the tests is the apparent failure of the New Zealanders to log any of the several United States stations engaged in the transmissions. For experimenters who have exchanged two-way communication with England on low-power and to whom short-wave work is a speciality, it is, to say the least of it, astonishing to find that their nightly vigils remained unrewarded.

NO doubt the eastern States amateurs will not neglect so excellent an opportunity to raise a subdued, but none the less triumphant "Cock-a-doodle-doo!" It is to be hoped that they do; there is nothing more conducive to progress in a movement like wireless than a little healthy rivalry.

KDKA's superb transmissions should have a very, very far-reaching effect on wireless generally in this country. It will demonstrate to that largest section of the radio community—the listeners-in—what they may expect in the near future from other stations—world-wide broadcasting. There is something more spectacular, appealing more to the public mind, in the transmission of actual speech and music over many thousands of miles than there is in the similar handling of Morse code messages. It fires the imagination more furiously. With the public's enthusiasm aroused, it would not be long before Australia would be experiencing that flood of prosperous popularity which wireless is enjoying in Europe and America to-day.

AS far as experiments go, it but further endorses the words and deeds of Senatore Marconi in connection with his famous communication feats.

WHETHER Australian broadcasting stations will be influenced to any practical extent by the success of KDKA is problematical. Yet there is no reason why Australian broadcast stations should not transmit half-way round the world any more than American stations.

ON PAGE 772 WILL BE FOUND CONSTRUCTIONAL DETAILS FOR THE MAKING OF A PORTABLE SET WHICH RECEIVES ENGLAND, WHILE ON PAGE 788 INSTRUCTIONS APPEAR FOR BUILDING THE SUPER-SONIC HETERODYNE.

OTHER FEATURES OF THIS ISSUE INCLUDE AN ARTICLE CONTAINING INFORMATION FOR THE CONSTRUCTING OF A GROUND CONNECTION THAT WILL CONSIDERABLY IMPROVE THE DX RECEPTION OF EXPERIMENTERS, AND ALSO THE "STORY" OF THE RECENT TRANSMISSION OF PHOTOGRAPHS BY WIRELESS, TOGETHER WITH REPRODUCTIONS OF SOME OF THE ACTUAL PICTURES "RADIO-ED" IN THIS MANNER.

A Portable Set that Receives England

By Joseph G. Reed.

EXPERIMENTAL work, when confined in its activities to one station, is apt to make the owner judge the results obtained by other experimenters in accordance with the conditions obtaining at his station, with the result that he cannot fully appreciate the advantages or disadvantages under which the others work. Very useful relative information can be obtained by taking a receiver from one station to another during visits to brother experimenters.

The standard receiver used in an experimental station is rather a bulky affair when it comes to carrying it about from place to place, and as the writer often has to carry out tests at points at a considerable distance from his home-station, a really portable receiver became an urgent necessity. This receiver had to be capable of covering all waves from 25 to 25,000 metres, and to function consistently over the whole wave range, regardless of the aerial to which it was connected.

The extreme wave range mentioned above made it impossible to use the conventional vario-coupler or other form of single layer inductance in the tuning unit, so it was decided to use the standard three-coil honeycomb coil mounting and employ honeycomb-coils for all waves above 250 metres, and specially wound spiderweb coils for the waves down to 25 metres.

When choosing the coil mounting, be sure and get a good one, for in addition to the better electrical properties it will undergo a fair amount of rough handling during use. One with a vernier control on the movable sockets should be chosen, for some very close manipulaton is required on the shorter wave-lengths.

The case for the receiver illustrated in Fig. 1 was specially made for the job, and has internal division for partitioning off the space for the filament lighting battery and the radio gear. Its dimensions are 13½in. x 8½in. x 7½n., with a lid 2in. deep (external dimensions). The internal sections are 9in. x 7½in. and 7½in. x 2¾in. for the radio gear and batteries respectively. It is not essential that a carrying case be made specially for the job, as an ordinary handbag or small

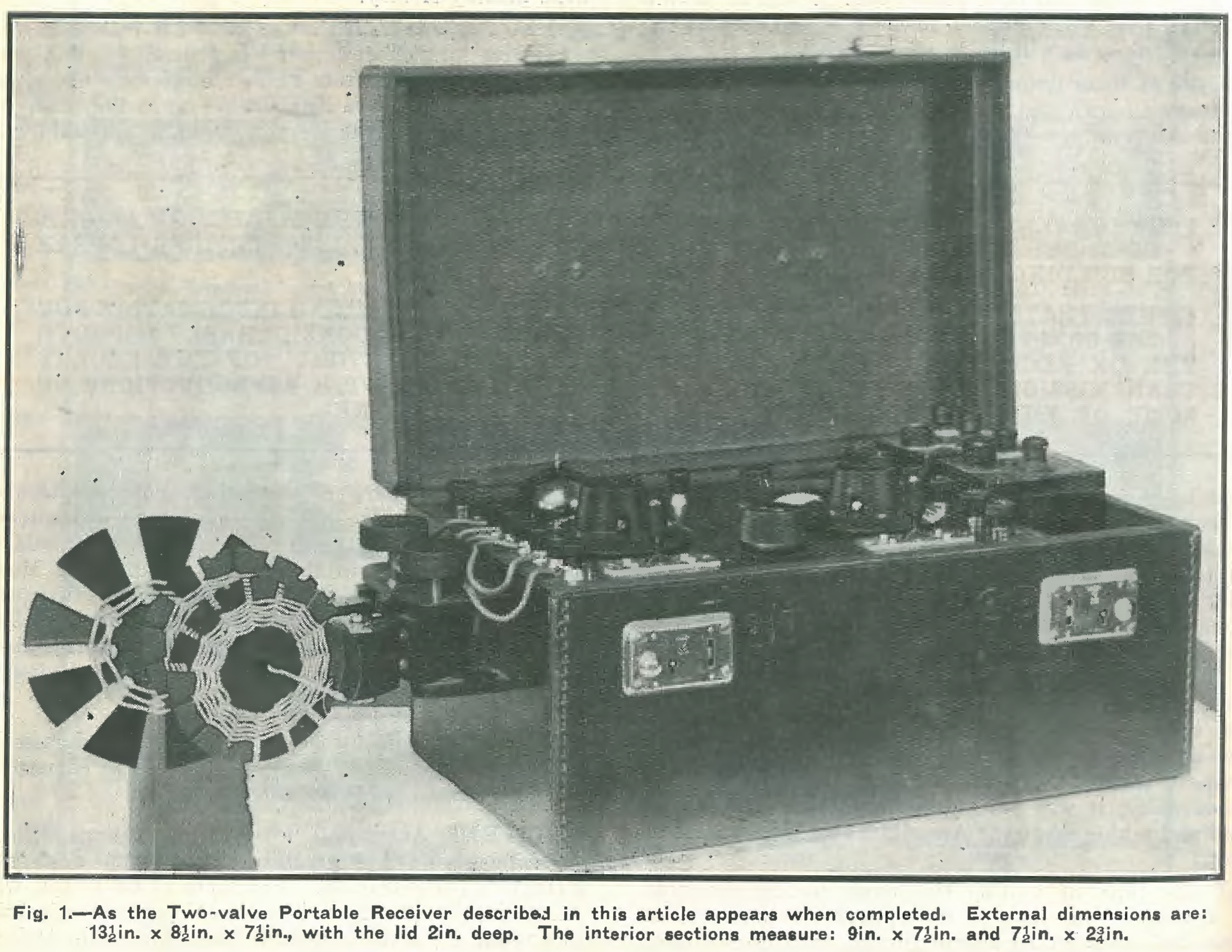

Fig. 1.—As the Two-valve Portable Receiver described in this article appears when completed. External dimensions are: 13½in. x 8½in. x 7½in., with the lid 2in. deep. The interior sections measure: 9in. x 7½in. and 7½in. x 2¾in.

suit-case can be made to serve the purpose quite as well.

As this receiver had to be capable of giving a reliable service under all conditions a complicated or freak circuit was out of the question, and the standard three-coil inductively coupled regenerative connection with one stage of audio amplification was employed.

For real work, where results are required instead of a perpetual fiddling with controls, this circuit cannot be beaten.

It might be thought that in the interests of portability and simplicity a single circuit or "P1" connection would have been employed, but, as previously stated, the receiver had to be capable of operation when connected to all classes of aerials. Very often when using a temporary aerial the earth resistance is very high, and, as this would be in the main oscillatory circuit of a P1 connection, a condition might arise, especially on low wave-lengths, where it is of so high a value as to prevent the circuit from oscillating. Another reason why the "P1" connection was rejected was on the score of its non-selectivity.

With the receiver described in this article the writer has reproduced 2BL on a loud-speaker without interference when it was connected to a 200 feet aerial barely 100 feet away from that used by 2FC, when the latter was broadcasting with an aerial current of nearly 25 amperes. No special wave traps were used on this test, merely the natural selective properties of circuits with very low losses and damping in the receiver.

If broadcast listeners would only make this change in their receivers, the complaints regarding interference from experimental stations far removed from the broadcasting wave-lengths would be no longer heard.

Referring to Figs. 2 and 3, it will be seen that the whole of the radio apparatus, with the exception of the three-coil honeycomb coil holder, is mounted as a removable unit between the main panel and the baseboard which is connected to the former by means of four brass rods. When the writer set out to construct this receiver, all the apparatus was mobilised and a full scale drawing plan, front and end-elevation was made to fit everything in its place. When it was completed, a full scale template on thin paper was made of the top panel, showing the exact location of all holes for condensers, rheostats, valves and terminals. A piece of ebonite was cut to this size with the edges trimmed square, so as to fit snugly into the section provided for the radio apparatus in the case.

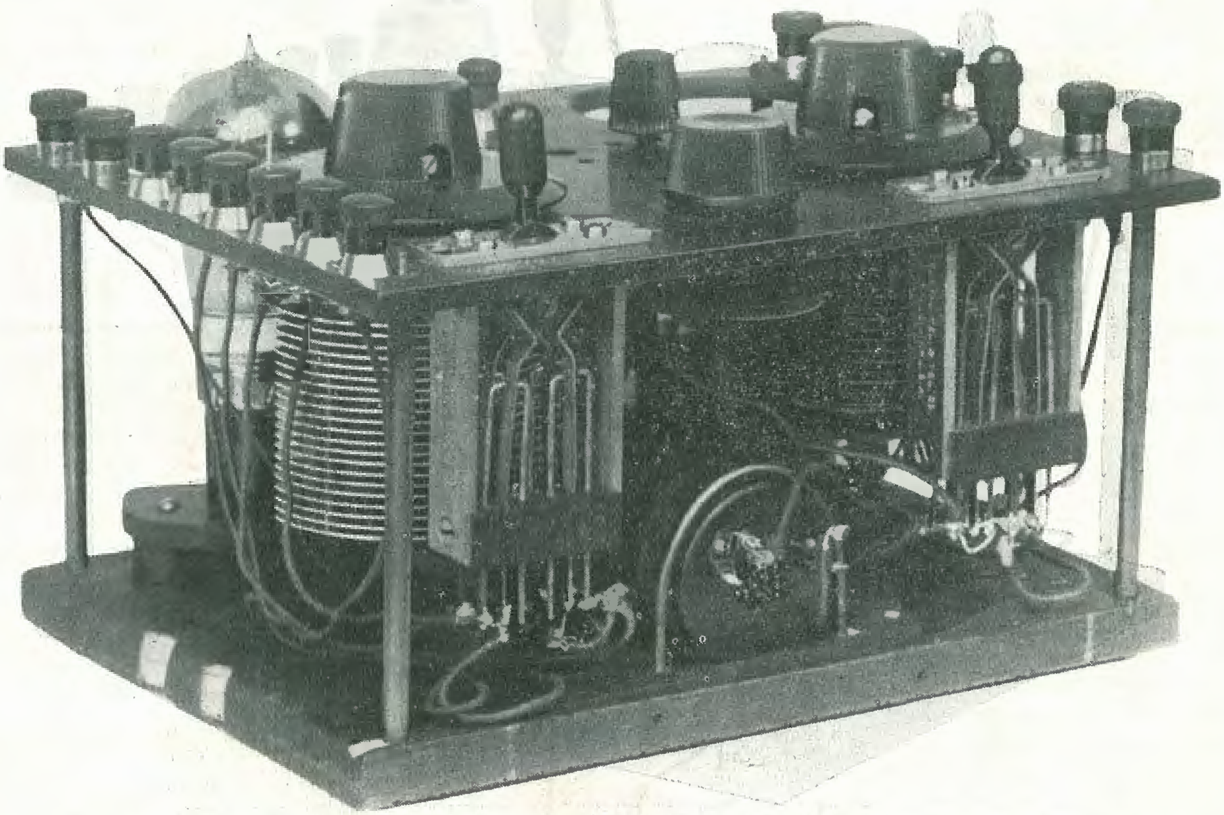

Fig. 2.—Front-interior view of the Receiver. Details, from left to right, are as follow: Aerial, Earth, Primary, Secondary and Re-actance Terminals. Back-left, Detector Valve. Centre left, Aerial Tuning Condenser and Series Parallel Switch. Centre, Vernier for Secondary Condenser, Filament Rheostat. Right, Amplifier Valve (not visible); Secondary Tuning Condenser; Filament and Telephone Switching Control for Detector and Amplifying Valves; Battery Terminals (see Fig. 3). Centre-foreground, Telephone Transformer.

CONSTRUCTION.

Attach the template to the ebonite with a few light touches of seccotine and centre-punch all places where holes have to be drilled. The ovalshaped holes for the valves were cut out by the aid of a fret-saw using coarse blades because the usual fine-toothed variety soon became blunt and choked up with ebonite dust.

If the panel is to be finished with a high polish, do all the drilling and filing to size when the material is in its rough state, because during the handling when on the workshop bench the surface receives innumerable small scratches which will mar the surface, if polished beforehand.

A rough try-out of the components which have to be mounted on and under the panel should be made before the final polishing, so that any small corrections can be made. When polished, wrap the panel up in a sheet of paper and place it aside until the other parts are completed.

The distance between the top panel and the baseboard of the removable unit is four inches. The latter is made the same length as the top panel but three-quarters of an inch narrower to allow it to pass by the two ledges provided on the inside of the carrying case upon which the radio unit rests and is screwed for stability in carrying. These two ledges are screwed on the inside of the case one quarter of an inch down from the top or whatever is the thickness of the panel employed. Do not allow the radio unit to simply rest on the bottom of the case, as it will shake about during transportation, and, in addition, there are likely to be irregularities which will make the top of the panel stand crooked with the top of the case.

For the supportng legs between the panel and the base cut four pieces of quarter inch brass rod and at each end drill and tap an eighth inch whitworth thread to a depth of about half an inch. These legs are held in position by means of one eighth-inch brass machine screws passing through appropriately-drilled holes in the panel and baseboard. Stain the baseboard black with a mixture of "nigrosine" dye dissolved in weak shellac."

Two condensers are used for tuning purposes, one for the primary and one for the secondary circuits. The former is an ordinary 0.001 microfarad pattern, commonly known as the "moulded mud" variety. It should be fitted with a pigtail connection between the rotary plates and the terminal on the end-plate. When using the condenser for the reception of long wave-lengths, the advantages of this pigtail connection are not very noticeable, but when the ultra high frequencies employed in modern experimental work are encountered the slightest introduction of irregular contact will cause the most terrible scratching noises in the receivers. This precaution regarding flexible connection to the moving plates applies with even more force to the

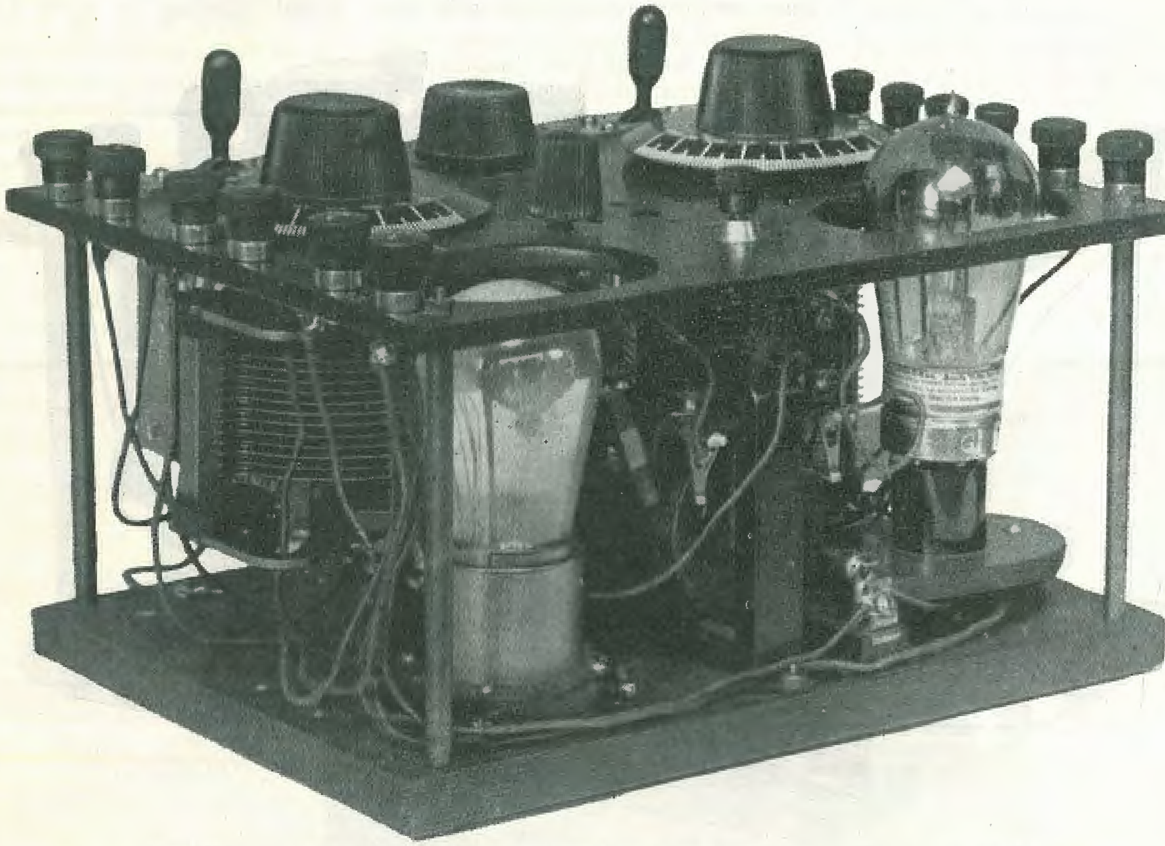

Fig. 3.—Rear-interior view of the Receiver. Details not particularised in Fig. 2 are as follow: Top-centre, Bias Battery Terminal. Centre, Inter-valve Transformer. Left, Amplifier Valve. Across the Primary of the Inter-valve Transformer is the .001 Condenser. Right, between Transformer and Detector Valve, Fixed Grid-leak Mounting. Battery Terminals, from left to right:— Positive High Tension Detector and Positive High Tension Amplifier; Telephone Terminals and Filament Terminals, the negative being common for the High Tension and Bias. The holes visible between the Condenser, Vernier and Grid Leak Terminal are for the Variohm Grid Leak Mounting (not installed).

condenser in the secondary circuit. In fact, it is almost impossible to carry out the reception of faint signals for there will be a continuous rustling noise all the time that the plates are being moved in the attempt to tune in the wanted station.

The secondary should be of the "Low Loss" type, mainly owing to the robust construction employed in this type of condenser. Much misleading information has been written regarding these low loss components, and, although they are all that the makers claim them to be as regards low loss, etc., when a condenser is employed in circuits carrying currents of high frequency, the only factor of any importance is the ohmic resistance of the plates and the leads used for connection thereto. All the data regarding the effective resistance at 1,000 cycles is so much bunk as far as practical radio engineering is concerned, for this factor varies inversely as the frequency. Even with a condenser having an effective resistance value as high as 1,000 ohms at 1,000 cycles, this value drops to about one ohm at 1,000,000 cycles (equivaler to 300 metres) and proportionally less for the higher frequencies. When the high resistances encountered in the inductances and other part of the circuits are considered, it will be seen that it is a waste of time and money to go to elaborate precautions to save a fraction of an ohm in the condenser when they are encouraged by the "haywire" methods of construction employed in the orthodox "low loss" inductance coil.

While on the subject of inductances it will be of interest and benefit to constructors to explode at least one of the pet superstitions regarding the construction of windings for use in very high frequency circuits. In experimental circles the assertion is often heard that absolutely no "dope" whatever should be used on the insulation of the wire, as such would so increase the effective resistance due to hysterisis losses in the distributed capacity, that the coils, figuratively speaking, would turn up their toes and die. It is recommended that the plain, double cotton insulation only be employed between turns, as its dielectric constant is very close to that of air. Cotton has the property of being slightly hygroscopic, and in humid weather will absorb water vapour from the atmosphere to such an extent that the losses caused by inter-turn leakage become so high as to make all the others seem small in comparison. This can be absolutely prevented by boiling the wire in paraffin wax before winding the coils. This treatment drives out the natural moisture and fills the pores of the cotton with an insulating material of low, specific inductive capacity and very high insulation resistance. In fact, the writer has used ordinary waxed double cotton and rubber-covered bell wire with excellent results on an inductance used for the reception of waves as low as 35 metres—corresponding to nearly 9,000,000 cycles per second.

The valves in the receiver under discussion were picked with regard to the service which they would have to render in use. There are no valves on the market which function efficiently for all purposes of reception and amplification. The saying, "Jack of all trades and master of none" holds true here, as elsewhere. A valve which has a characteristic rendering it an excellent amplifier will function anyways but satisfactorily as a detector. Such valves when employed in regenerative circuits re-act very harshly when regeneration is employed. They jump suddenly into oscillation without passing through that period of gradual regeneration which distinguishes any good detector.

The writer chose for his detector a Marconi DER valve, which operates with a filament current of 0.35 amps at 1.6 or 1.8 volts. The detector is a Radiotron UV201A, which is absolutely the best of its kind on the experimental market to-day. If a study of the characteristic curves of valves is made and the change in plate current with respect to grid volts noted, an excellent relative idea of the amplification can be obtained. The higher this factor the greater the amplification and conversely the lower this value, the better the valve will function as a detector.

If it is not desired to use this make of valve (DER), because of its high filament consumption the DE3, UV199, AWA33 or AWA99 will be found to function quite as well. The valve sockets should be mounted on sponge rubber sub-bases to absorb mechanical vibration which would otherwise cause annoying microphonic ringing noises, owing to the fact that the temperature at which the filaments of dull emitter burn is so low a value that the tungsten retains all its mechanical properties of vibration.

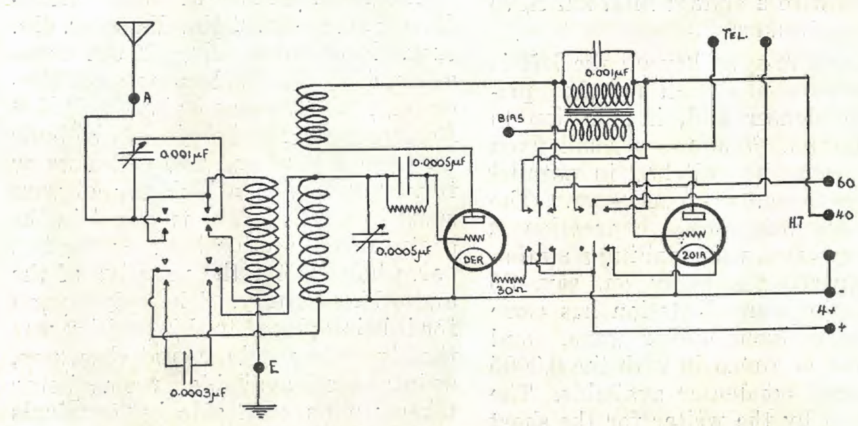

Fig. 4.—Circuit diagram, showing details for the Series-Parallel and Detector Amplifier Switch.

Mount the valves on the base of the radio unit, and directly under the centre of the space cut in the top panel. Filament control is provided for the detector only, and consists of a 30-ohm rheostat when using a four-volt filament battery. If one of the 60 m/a type valves is used an additional resistance must be used for they function most satisfactorily when they are operated below the normal rating. For this extra resistance one of the 20-ohm adjustable units sold for adding to 10-ohm rheostats should be used. The amplifier valve can be operated direct from the four-volt accumulator. In fact, the writer—in another receiver—uses a fixed resistance of two ohms in series with the filament, thereby reducing the terminal voltage to approx. 3.6. Under these conditions the valve works excellently and will operate a small loud-speaker quite well

The switching on and off of the filaments is controlled by means of the right-hand "Federal" switching key. When the knob is thrown to the left the detector only is energised and the telephone circuit is connected to the detector plate circuit. In the centre position, everything is "off," and when thrown to the right, both the detector and audio filaments are switched on and the telephones are connected into the plate circuit of the audio amplifier. The plate potential on the detector can be varied, irrespective of that on the amplifier, thereby allowing both circuits to be supplied with a voltage most suited to their requirements.

The similar-type key on the left is a series-parallel switch for the primary condenser and, in addition to this function, it allows a small fixed condenser to be switched in parallel with the secondary condenser. The reason for this special connection is that very often when calling a station and expecting a reply on, say, 85 metres, the wanted station has come back on a much higher wave, and could not be tuned in with the 0.0005 microfarad condenser available. The coils used by the writer for the short wave experimental stations cover from about 50 to 150 metres with a 0.0005 m.f. condenser, and the addition of a fixed condenser of 0.0003 microfarads allows the range to be increased to 190 metres for quick search work. The springs of the switch must be bent from their normal position to allow of the switch functioning in its centre position. When thrown to the left the primary condenser is placed in series with the primary inductance. In the centre it is connected in parallel, and when thrown to the right in addition to the parallel primary connection, the small, fixed condenser is switched across the secondary inductance.

For coupling the valves an "Amertran" transformer is used. Any good make can be used, however. The grid condenser is a Dubilier type, 601 0.0005 microfarad pattern, with a leak resistance of two megohms. The type 600 with clips for the grid leak resistance makes a much neater job. Across the primary of the inter-valve transformer is connected a Dubilier, 0.001 microfarad condenser, to provide a low impedance path for the radio frequency component of the detector plate circuit. A third condenser of as high a value as possible is connected across the high tension supply to the detector valve. The writer uses a 0.005 m.f. Dubilier to provide a direct path for the radio frequency currents instead of allowing them to wander around through the high tension battery.

In the receiver illustrated, as in all receivers made by the writer, a one to one ratio telephone transformer is used to protect the windings of the telephone receivers from the injurious effect of the steady plate current.

The main details of this transformer are:—Core, ⅝in. diameter, 4in. long. Primary winding, 10,000 turns of No. 40 B & S Beldenamel; and Secondary, 10,000 turns of No. 36 B & S Beldenamel. The bobbin can be built up from a tube and two end-discs or turned out from a Beldenamel wire spool in a lathe. The terminal in the centre of the section between the two valve holes is for the negative of the audio bias battery. The only reason for it being placed in this position was that it could not be found elsewhere, owing to all available room being taken up on each side by terminals connecting to other circuits. In place of the fixed grid leak resistance, one such as the "Variohm" can be used and mounted in the space between the filament resistance and the negative grid bias terminal. With the valve the writer is using for a detector such a refinement has not been found necessary, but with some makes of valves better results are often obtained by having this component under fine control. If variable grid leak resistance is used be sure and use a good one, such as the "Bradleyleak," "Variohm," or "Watmel." The type depending upon a rubbing contact are a never-ending source of trouble.

The honeycomb coil mounting is a separate unit and is screwed to the left hand outside of the case, with flexible leads connecting to the corresponding circuit terminals on the radio unit. This is preferable to placing the mounting on the radio panel for it allows the lid to be closed to keep out dust without removing the coils, as well as giving them more room in which to move—especially the 1,500 turn coils for long wave stations.

In the right hand partition is the filament lighting battery consisting of two "Exide" type DY4, non-spillable accumulators connected in series to give a supply of four volts. These cells fit nicely into the space allowed. Their capacity is 13 amp. hours continuous rating, and the cost is in the neighbourhood of 30/- each.

If the receiver is designed to use 0.06 m/a type valves for detector and amplifier the construction can be cheapened considerably by using a large ever-ready type 127 flashlight cell. A second battery is contained in the partition for the grid bias, and consists of a single, small Diamond Navy type dry cell. This is not visible in the photographs, as it is only a few inches in height and is hidden from view. The high tension battery is carried separately along with the supply of tuning inductances, telephone receivers and spares, such as light coil of aerial wire and two bullnose insulators for field work.

Regarding the tuning inductances required to cover a range of 40 to 20,000 metres, the writer uses the following:—

Range.	Primary (0.001 m.f.)	Secondary (0.0005 m.f.)	Reaction.
40-120 m	10 s.w.	10 s.w.	10 s.w.
100-300	25 h.c.	25 s.w.	25 s.w.
250-500	35 h.c.	50 h.c.	25 h.c.
500-1000	75 h.c.	100 h.c.	50 h.c.
1000-2000	150 h.c.	200 h.c.	100 h.c.
8000-20.000	1250 h.c.	1600 h.c.	750 h.c.

s.w.: Grodan Spiderweb Formers.
h.c.: Honeycomb Coils.

Coils for wave-lengths between 2000 and 8000 were not found necessary, as there is not much interesting work going on in that band, but if it is desired to be explored the coils necessary can be interpolated from the above table.

Using an aerial only 20 feet high and 100 feet long, the writer has no difficulty whatever in picking up American experimental stations, even as far as the East Coast of U.S.A., while in the other direction two English experimenters have been logged (g2NM and g2OD), as well as the short-wave transmitters at g2YT, POZ, KET and NKF.

In conclusion, the writer will be only too pleased to help experimenters along the lines covered in this article, if a letter be addressed, "C/o. the Editor, *Radio,* 97 Clarence Street, Sydney."

The American Broadcast Transmissions

SINCE the last issue of *Radio in Australia and New Zealand* appeared on the news-stands wireless broadcasting has seen another triumph—the transmission of music, speech and Morse from Pittsburg, Pennsylvania, United States of America, and its successful reception in Australasia. Programmes were transmitted from KDKA, the Westinghouse Electric Company's station on several evenings and were heard at Ballarat, Sydney, Perth, Newcastle, Melbourne, Brisbane, Rabaul, and, no doubt, many other points, reports from which, at the time of writing, have not yet come to hand.

A remarkable occurrence as a whole, those circumstances which surrounded it are no less so when a few of them are held in mind. Many listeners-in experienced no difficulty in hearing the transmissions on a one-valve receiver; numerous others enjoyed the items per medium of their loud-speakers; others, again, received the signals on indoor aerials, while KDKA itself transmitted on a wavelength of 63 metres, something in the way of an innovation for Australian broadcast listeners. KDKA has, of course, been heard by Australian experimenters on several previous occasions, but never before has there been known before such regular and consistent reception of an American broadcasting station situated some 10,000 miles away.

Of the beneficial affect of such a performance upon Wireless generally in this country there can be no doubt. It will tend to add considerably to that strong impetus which the science and means of recreation has already secured in Australia for, as an example, when it is realised by owners of crystal receivers who hitherto in their most sanguine moments only expected to receive over distances of, at most, a score of miles, can through the simplicity of relay transmission, reach out to the other side of the American continent, their enthusiasm will know no bounds.

That this system of relay can be carried out most satisfactorily has, as most people know been conclusively proved in other parts of the world while, to come nearer home, on one evening, at least, of the recent tests a Sydney amateur by placing his loud-speaker—on which were coming through the Pittsburg items—in front of his telephone connected to a Sydney broadcasting station enabled the latter to re-broadcast the items for the entertainment of many who, in all probability would have been unable to listen in to America.

Below we give the reports and comments of the transmissions made by several prominent Sydney amateurs and also the results secured by engineers of Amalgamated Wireless (Australasia) Ltd., who also listened-in to KDKA's programmes.

Mr. C. D. Maclurcan.

MR. C. D. MACLURCAN'S (2CM) REPORT.

OWING to my absence from Strathfield I was unable to follow KDKA's test, with the exception of Saturday night, when I took a set to Collaroy and "borrowed" Mr. F. V. Hilliard's small 20ft. aerial. I am therefore unable to say how Saturday's transmission compared with that of previous nights.

I had heard KDKA on 98 metres some months before both in Sydney and on the s.s. *Tahiti* in N.Z., and I can certainly say he was very much louder on Saturday using the 63 metre wavelength, though I am unaware of the actual power used on each occasion.

Practically the whole of the programme was heard, sometimes very loudly. Although static was bad it did not cause serious interference owing, no doubt to the small size of the aerial used, and the very loose coupling employed between the aerial and the secondary tuning coils. Mr. Elder's voice was not nearly as clear as the announcer's, and at times the modulation had the same "mushy" quality that I have previously noted with KDKA's 98 metre transmissions.

Portions of the message were dictated to a stenographer and, obviously, during the dictation, my voice effectively drowned the words immediately following.

I give the result below—for what it is worth. A marshmallow for the one who can fill in the missing words:—

"Westinghouse Station KDKA broadcasting from Pittsburg for Melbourne 'Herald' . . . Mr. McKenzie Elder, Trade Commissioner for Australia in the United States. . . .In the accomplishment of this wonderful feat 10,000 miles . . . privilege that they have afforded me . . . As I travelled through New York the scenery was very beautiful . . . snow . . . made of crystal.

'It won't be many years till we are asking one another . . . it was not very long ago that I remember . . . for the last 50 years . . . America by wireless. It will soon be possible to speak from New York . . . the hands of the English-speaking people . . . In the unison of friendship on earth . . . The feeling for America is a most interesting one . . . development of friendship between the two countries . . . must realise the message I am trying to convey . . . from a spiritual point of view . . . different generations have . . . most of them have tried hard to make money and settle down . . . the nation looks upon it as a sacred duty . . . was careful and ambitious . . . and after most of his struggle he became very rich . . . Professors, and instructors of workmen . . . his ministers and his . . ."

The receiving set used was my usual low-wave two-valve "affair" employing the standard three-coil circuit, and constructed on the so-called low-loss principle. The coils cover a range of from 22 to 75 metres. The detector valve was a Phillips D4 (shortly to be replaced by a QX), and the audio valve doesn't matter, anyway!

Mr. R. C. Marsden.

MR. R. C. MARSDEN'S (2JM) REPORT.

The first intimation that I had that speech was being modulated on 63 metres between KDKA and Australia was quite by accident.

One night while listening-in on the low wave-length bands, I heard snatches of short tests which emanated from KDKA. Naturally, the information was kept secret for obvious reasons—one has only got to mention the fact that a test is on, and our friends with regenerative receivers absolutely spoil reception.

KDKA during the whole week of testing was extremely steady, fading being practically unknown. Depth of modulation appeared at this end to be fairly large. The quality varied considerably.

The receiver used (2JM) was an ordinary low loss type employing one detector, and one audio. On the Saturday night of the test one extra audio was added to enable friends to hear this station on loud-speaker.

This test transmission has undoubtedly borne out the contention of many that the short waves for telephony will be the coming thing.

In conclusion it is hoped that this will be the fore-runner of international broadcasting. It will be a great thing for this country if it were possible, and no doubt it is, for KDKA to receive and relay 2LO, which in turn could be received and relayed locally. This type of broadcasting will tend to whet the public's appetite for super-broadcasting.

It is gratifying to know that many of Sydney's amateurs were the first, together with myself, to receive this short-wave telephony. It goes to prove that the much-maligned experimenter is always alive to the latest developments in short-wave reception —not forgetting some of the wonderful short-wave transmissions carried out by them recently.

Mr. F. W. Larkins, of Amalgamated Wireless (A/sia.) Limited, reports that several of the company's engineers, both in Sydney and Melbourne, received the transmissions of both speech and music.

The atmospheric conditions were, however, very bad, and only intermittent phrases of the speech of the Australian Commissioner of the United States could be understood. These, however, were very distinct and were reproduced at loud-speaker strength on two valves. A deal of interference to reception was caused by the radiation from near-by amateur receiving sets adjusted to KDKA's wave-length. Better reception was attained earlier in the week, especially in Melbourne.

There is little doubt that the success that has attended the transmission and reception of these messages over a distance of nearly 11,000 miles, marks a distinct stage in the sphere of short-wave wireless telephony, and serves to confirm the conclusions that have been arrived at by Marconi in his experiments with short waves.

The successful reception of the Pittsburgh messages marks a very important stage in the history of Australian wireless, and in later years will surely be regarded as a milestone in our progress.

It is of interest to note that experiments with short waves have been conducted by Marconi during the last eight years, culminating in the extraordinarily successful demonstrations that have taken place during the last twelve months. The experiments carried out by Marconi in October of last year, when messages were transmitted from Poldhu and received in New York, Buenos Ayres, and Sydney, were carried out on a 32-metre wave-length with a power unit of only

12 kilowatts, and when the whole of the great circle track that separated these places was exposed to daylight.

During a complete day transmission at fixed intervals was carried out with Sydney and the station received Poldhu signals for 23½ hours out of the 24. The tests to places south of the equator, such as Sydney, are particularly interesting as the waves have to traverse what may be called a "summer zone."

During November successful reception tests were also carried out in England from Mr. E. T. Fisks's low-power transmitting station in Sydney, and in these tests a wave-length of 87 metres was utilised.

Of the series of five broadcast tests sent out by broadcasting stations in the United States, the first two were not heard in N.Z.

Many listeners in various parts of the Dominion were standing by on January 14. Static was fair to strong generally, with bad bursts occasionally; and at the beginning of the test there was at least one and a half hours' of daylight intervening. Taken altogether, conditions were not favourable for a test from the United States.

No listener in Wellington received the concert. "Aerial" of the "Dominion" newspaper reported listening on an eight-valve Super-heterodyne receiver, but the only U.S. station heard above the howling valves and bad static was KGO.

At Rangiora, near Christchurch, two listeners stood by for the test concert; one using a detector and two stages of audio and the other a neutrodyne set. Four Californian stations were heard, and one which signed off KOA, Central Colorado; but nothing was heard of WEBH, although the wave-length was checked with a wave-meter. Stations heard were:—3AB, 2YM, 1YA, 2BL, 2FC, 3LO and 6WF.

The second test also brought negative results. An amateur in Rangiora again stood by on a receiver consisting of detector and two stages of audio, with which the ether was searched for two hours without result. Stations heard included KGO, 2FC, 3LO, 2BL and 1YA.

An amateur in Christchurch also stood by, with negative results. No favourable reports were announced from other centres.

DX CRYSTAL RECEPTION.

RECEPTION of 2YK, 3AQ, 2AQ, and 1YA on a crystal receiver is the feat accomplished by Master Newton, of Rangiora, near Christchurch, N.Z., whose successes have all been checked and confirmed.

When Radio 4YA (Dunedin) was on the "air" this station was received regularly by Master Newton, and since 4YA has ceased transmitting the above stations have been heard clearly. 1YA was the last capture.

The young experimenter attends the Rangiora High School, the headmaster of which is a radio enthusiast. The receiver is an ordinary crystal set, and was constructed entirely by its owner. The distance from Rangiora to 1YA, Auckland, is nearly 600 miles.

Round's Round Ground

Complete Directions for Constructing a Ground Connection that will materially improve DX reception

By FERD HUMPHREYS.

Reprinted by courtesy of "Radio," San Francisco.

THERE is no part of a radio receiving installation that is given less thought than the ground connection. This is probably because most of us think that one ground is practically as good as another, and that when we have connected a metal wire to a metal pipe entering the earth, all is well. Numerous experiments, however, have taught the radio investigator that there is a big difference between earth connections; that there are so-called grounds and real grounds.

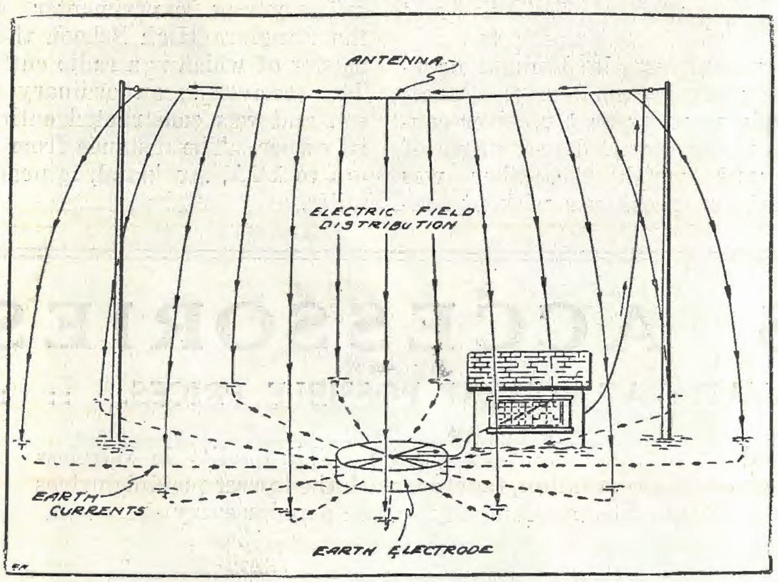

Fig. 1.—Showing the relation of the earth electrode to the antenna circuit. Note the uniform distribution of earth currents.

While an efficient earth connection is of perhaps greater importance to transmission than to reception, due to the considerably larger amount of power handled, the value of an effective earth connection to reception should not be under-estimated.

We have often heard that resistance is one of the greatest enemies to low loss reception. Low loss reception not only means strong signals from distant, as well as local stations, but also selectivity and freedom from interference. In the interest of securing low loss operation we wind our tuning and coupling coils with heavy wire to minimise resistance, we construct our antenna of stranded wire and run a heavy wire from the receiver to a clamp on the water pipe for the same reason. But do we give adequate thought to that part of our receiving system supplied by Nature, the earth beneath the antenna, and to the connection thereto? In most cases, we do not.

Let us consider, for a moment, the function of the ground and its relation to a receiver of any type. Aside from being the common medium which conductively binds together the transmitting and receiving stations, the earth beneath the antenna constitutes a large and important part of the antenna circuit. The antenna circuit consists essentially of the antenna beginning at its outermost end, the down-lead or lead-in, the antenna-receiver coupling coil (primary coil of vario-coupler), the ground wire, the earth electrode (water pipe) and the earth for a considerable area under the antenna.

When the waves transmitted by a radiocast station impinge on a receiving antenna, oscillating currents are induced in the antenna circuit which vary in intensity according to the power of the transmitter and its distance from the receiver, and according to the characteristics of the circuit and the locality of the receiving station. Generally speaking, if the receiving antenna is high, well insulated and of low resistance, reception from the desired station will be as good as the receiving instruments can permit. We cannot control the power of the radiocast station nor its distance from us and we cannot always alter local operating conditions, but we do often find it practicable to improve conditions which lie within our grasp. The ground is one of these.

The most common type of ground consists of the home water piping system. Although connection to the water system affords a fair ground because of the great buried length of water pipes, the system as an earth electrode is generally inefficient. That this is so is partially attributable to the fact that in very few cases does the water system lie under the antenna or anywhere near it. Hence, the oscillating currents induced in the earth beneath the antenna during reception or transmission, are compelled to travel far from the earth directly beneath it, where they might efficiently converge at a suitable electrode to the nearest portion of the water system. To put it another way, we might say that the earth currents have to travel through too much earth to reach the electrode. Apart from the above disadvantage, the area of contract between the piping system and the earth, in the region of the antenna, is too small to permit of a good electrical connection. Since the conductivity of average soil is very poor as compared to that of water pipe, which is none too good, it is obvious that the common ground just discussed must have a resistance too high to render it efficient.

Stuart Ballantine, a radio authority of recognized reliability, seems to be of the opinion that the most ideal earth electrode consists of a large metal cylinder of suitable proportions, buried in the earth beneath the antenna. The ground wire is made fast to the cylinder in a special way designed to give the best results. Such ground has recently been re-described by Capt. H. J. Round, and is referred to in some circles as "Round's Round Ground." A better name would perhaps be "Common-sense Ground," for it is older than radio itself and was used by Fessenden as early as 1910, and was also described by the Germans prior to that time.

In modern times it has received its greatest support by the experiments of D. John M. Miller, of the United States Navy Radio Laboratory.

Being compelled by virtue of circumstances to install an effective ground system for radio experimental work, I was inspired to try the "Common-sense Ground." It was decided to construct a galvanized-iron electrode 10 feet in diameter by two feet high, burying it one foot beneath the surface of the earth.

The antenna, a five-wire cage, 60 feet long by 65 feet high, had already been erected, running east and west over an addition to the house used as the experimental laboratory. The lead-in drops from the west end of the antenna to a lead-in insulator in the laboratory roof. Directly beneath the antenna and lead-in and at a point about 20 feet east of the west end of the antenna, the centre of the ground was located by driving a stake into the sod. With the aid of a piece of string provided with loops at the ends, a circular row of stakes was driven about the centre stake at a radius of 5½ feet. This was followed by an inner circle of stakes of four feet radius. The stakes describing each circle were spaced about 2½ feet apart and were finally encompassed by wrapping them with string.

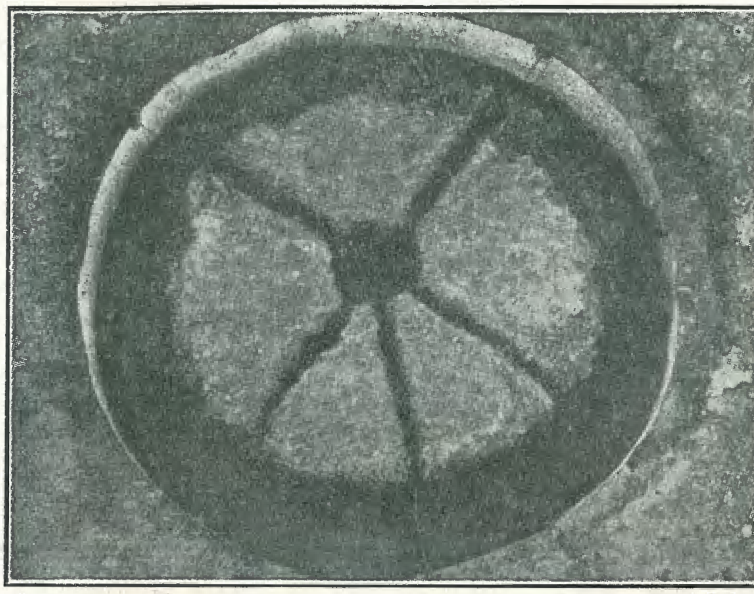

Fig. 2.—Installation of the earth electrode.

A trench three feet deep was then dug between the staked circles. This work required the removal of about 90 cubic feet of earth.

Upon the completion of the trench the construction of the cylinder was undertaken. This was composed of four pieces of 1/64in. galvanized-iron, measuring eight feet by two feet. The ends of the pieces were clinched and riveted with copper rivets. The seams were not soldered. Four ⅛in. copper soldering lugs were then secured with brass bolts and solder to the centres of the segments at the top of the cylinder. The lugs were mounted sleeve-up in order to facilitate soldering the ground wires later. The assembled electrode was next lowered into the trench where it was formed

(*Continued overleaf.*)

to a circle by packing a little earth at its foot around the outer side of the trench. The cylinder was then buried to within six inches of its top, care being taken during the process to maintain its circular shape.

At this point, attention should be drawn to the difference of connection existing between this ground and the one described by Ballantine. His ground wires are elevated above the earth on a central supporting insulator, while their outer ends make contact with the top of the electrode which is allowed to protrude above the earth's surface. This is done to prevent concentration of the earth's currents on the ground wires. In view of the unsightliness of such an arrangement and its liability to trip the trespasser, the writer decided to sacrifice this detail by burying the ground and its connecting wires completely. It was thought that what little current concentration might result from this practice, could be reduced by using heavily insulated wire for connecting purposes. Accordingly, two narrow trenches one foot deep were dug to join the diametrically opposite lugs of the four cylinder segments. A third trench of similar proportions was dug to accommodate the main ground wire, that which joins the cylinder wires and runs to the house. These trenches are shown in Fig. 2.

Two 10½ ft. lengths of No. 8 braided rubber-covered copper wire were then laid in the cross trenches and their ends soldered into the lugs. About 5in. of insulation was removed from these wires at their crossing point followed by the removal of about 10 ins. of insulation ground end of the main ground wire, which is of the same gauge and insulation as the cross wires. The main wire was then wrapped tightly about the cross wires and soldered. Several layers of rubber and friction tape were added to this union to exclude moisture and to minimize current concentration at this point. A coat of asphaltum varnish was also applied to the joint and to the lug connections to prevent corrosion, though this step was not really necessary. A porcelain tube was slipped over the main wire and taped in place at the point where the wire passes over the top of the cylinder. This was done to guard the insulation against rupture by pressure against the sharp edge of the cylinder occasioned by the earth packing, etc. The ground was completed by filling the trenches and pounding the loose soil with the back of a spade.

Fig. 1 shows the relation of the ground to the antenna. Here it is obvious that a uniform distribution of earth current is obtained over the entire surface of the electrode, due to its location within the field of the antenna and to its shape and generous surface. The current is drawn from the electrode by means of taps which have been so arranged as to lower the effective resistance of the galvanized-iron. Location of the electrode within the natural field of the antenna has the effect of shortening the average distance to be travelled by the earth currents as against that of the water system, thereby lowering the effective resistance of the earth to a minimum. All things considered, it must be admitted that theoretically this is

(*Continued on page* 798.)

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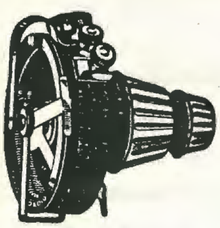

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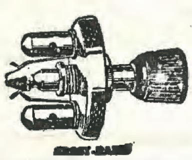

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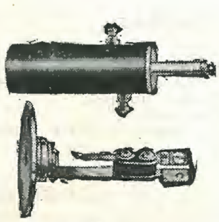

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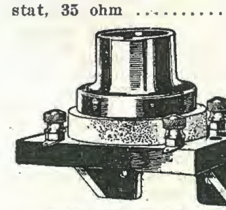

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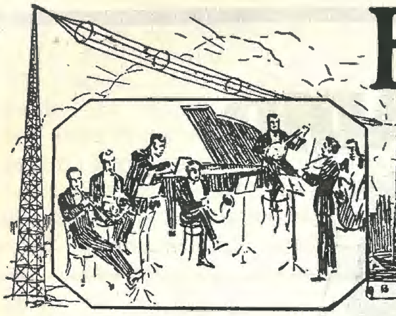
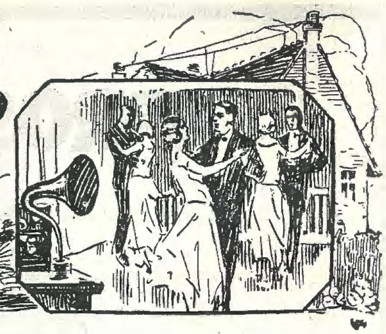


Broadcasting and Listening in



2FC

BROADCASTING TIMES.

Sydney Mean Time.
CALL SIGN 2FC, SYDNEY.
Wave Length: 1100 metres.
Power: 5 kilowatts.

Midday Session:

12.55 The Chimes of 2FC.
12.58 Time Signals from Farmer's Master Clock.
1.0 Coastal Farmers' Market reports, Stock Exchange information, Weather information, "Sydney Morning Herald" news service, Reuter's and Australian Press Association cables, "Evening News" midday news service.
1.30 Close down.

Educational Session:

3.0 The special Education Session, which has been arranged by the N.S.W. Department of Education, will be held on Mondays, Tuesdays, Wednesdays, and Thursdays of each week. Friday, Musical Programme from 3 p.m. to 3.45 p.m.
3.3 The Chimes of 2FC.
3.50 Musical Programme.
Afternoon Stock Exchange information, late Weather information, "Evening News" afternoon news service.
4.0 Close down.

Early Evening Session:

6.30 The Chimes of 2FC.
6.33 Children's Hour.
7.10 Dalgety's Market reports (wool, wheat, stock), fruit and vegetable markets, late Stock Exchange information, Weather News, Shippings News, late "Evening News" news service, Reuter's and Australian Press Association cables.
7.20 Close down.

NIGHT SESSION:

7.55 The Chimes of 2FC.
8.0 Musical Programme.

The evening entertainment broadcast from Station 2FC is varied and includes Theatrical transmissions from the Theatre Royal, Her Majesty's Theatre, The Criterion Theatre, The Palace Theatre, The Tivoli Theatre, Haymarket Theatre and the Prince Edward Theatre.

Jazz music provided by the Wentworth Orchestra is also broadcast direct, and high-class musical entertainments provided at the Studios of 2FC, in which Sydney's leading artists participate, are also features of the programme.

SATURDAY: Midday, early evening and evening sessions as on week days, afternoon session as follows:—

3.15 The Chimes of 2FC.
3.18 to 3.45: Late Sporting information.
3.45 Close down.

SUNDAY: No midday, afternoon or early evening session. Church Services from one of several Churches, commencing at hour appointed for Divine Service, according to the Church, and varied by some Sacred Concert from the Studio of 2FC.

10.0 Close down.

6WF

BROADCASTING TIMES.

Perth Mean Time.
Wave Length: 1250 metres.

Midday Session:

12.30 Tune in to gramophone.
12.35 Market Reports of The Westralian Farmers, Limited.
12.38 News Service.
12.42 Weather Reports.
12.44 Gramophone Items.
1.0 Time Signal.
1.1 to 1.30 Gramophone and Pianola.
1.31 Close down.

Afternoon Session:

3.30 Tune in to Pianola.
3.35 to 4.0 Special programme, comprising Talks, Gramophone, Pianola, Westralian Farmers' Studio Orchestra.
4.1 Close down.

Early Evening Session:

7.5 Tune in to Gramophone.
7.10 Bedtime Stories.
7.45 Market Report.
7.57 Weather Report.
8.0 Time Signal.
8.1 News Cables.

EVENING SESSION:

8.10 to — Entertainment. See list hereunder.

Monday: 8.10, Lecture: 8.45, Wesfarmers' Orchestra.
Tuesday: 8.10, Professional Concert.
Wednesday: 8.10, Theatre or Hall Broadcasting.
Thursday: 8.10, Professional Concert.
Friday: 8.10, Concert Evening and Lecture.
Sunday: 7.20, Church Service.
Saturday: 8.15, Wesfarmers' Studio Orchestra.

SATURDAY:

Midday Session:

12.0 Tune in to Gramophone.
12.5 Market Reports of The Westralian Farmers' Ltd.
12.10 News Service.
12.15 Weather Report.
12.16 Gramophone and Pianola.
1.0 Time Signal.
1.1 Close down.

Early Evening Session:

7.5 Tune in to Gramophone.
7.10 Bedtime Stories.
7.45 Market Reports.
7.57 Weather Report.

Evening Session:

8.0 Time Signal.
8.2 News Cables.
8.15 Wesfarmers' Studio Orchestra.

3LO

BROADCASTING TIMES.

Melbourne Mean Time.
Wave Length: 1720 metres.

MONDAY TO FRIDAY:

Midday Session:

12.55 Time Signals. "Argus" and "Herald" News Service, Reuter's and the Australian Press Association Cables.

Afternoon Session:

3.30 Musical programme.
4.45 "Argus" and "Herald" News Service.

Early Evening Session:

6.30 Children's Hour; "Billy Bunny" Stories.
7.0 "Argus" and "Herald" News Service, Reuter's and the Australian Press Association Cables.

Evening Session:

8.0 Theatrical Items, Lectures, Vocal and instrumental items.

THURSDAY NIGHT.

Carlyon's (St. Kilda) Dance Orchestra.

SATURDAY:

Midday Session:

12.55 Time Signals. "Argus" and "Herald" News Service, Reuter's and the Australian Press Association Cables.

Afternoon Session:

3.15 Musical programme.
4.0 "Herald" News Service. Results of Races and other sporting events broadcasted immediately details received.

Early Evening Session:

6.30 Children's Hour; "Billy Bunny" Stories.
7.0 "Argus" and "Herald" News Service, Final Sporting Results.
8.0 Vocal and Instrumental Concerts.

SUNDAY:

Afternoon Session:

3.0 Pleasant Sunday Afternoon Services from Wesley Church.

Early Evening Session:

6.30 Children's Hour; "Billy Bunny" Stories.
7.0 Church Service.

Evening Session:

8.30 Concerts from the Studio.

SENATORE MARCONI'S SHORT WAVE EXPERIMENTS.

THE experiments with Senatore Marconi's new system of short-wave wireless telegraphy, which he recently described in his inaugural lecture as Chairman of the Council of the Royal Society of Arts, have been continued, and during recent tests messages were transmitted from the Prince of Wales, the Right Hon. L. S. Amery, M.P., Colonial Secretary, and Viscount Burnham, to *The Cape Argus*, South Africa.

The messages sent were as follow:—

From the Prince of Wales:

"His Royal Highness has heard with great interest of the development of wireless between this country and South Africa."

From the Colonial Secretary:

"I gladly take an opportunity of sending a message to South Africa by means of this new experiment in wireless telegraphy. Cheap, rapid, and reliable communication is vital to the needs of the Empire, and I wish to offer my heartiest congratulations to all who worked to bring England and South Africa nearer together."

From Viscount Burnham:

"With my visit to South Africa freshly in mind, I am deeply interested by the successful experiments in short-wave wireless transmission between England and South Africa. I feel we are on the threshold of new and closer relations with the Dominions through this channel of communication, and as President of the Empire Press Union, I trust wireless telegraphy, as an alternative to cables, will enable a greater volume of Empire news to circulate."

2BL

BROADCASTING TIMES.

Sydney Mean Time.

Wave Length: 350 metres.

Midday Session.

12 to 2 p.m. Musical Programme, with News Reports supplied by "The Guardian."

Afternoon Session.

3 to 5 Musical Programme, with News Reports supplied by "The Guardian."

Early Evening Session.

7 Nursery Rhymes and Bedtime Stories.

7.45. Pitt, Son & Badgery Stock Exchange Reports.

Night Session.

8 Nightly Concert.

EVENING ENTERTAINMENT.

Monday:	"Jazz" night, with vocal items from the Studio.
Tuesday:	Classical Studio Concert.
Wednesday:	Dance Night.
Thursday:	Broadcasters' Popular Concert.
Friday:	"Jazz" night, with popular items from the Studio.
Saturday:	Popular Concert.
Sunday:	Classical and Operatic Concert.

7ZL

BROADCASTING TIMES.

Hobart Mean Time.

Wave Length: 390 metres.

MONDAY TO SATURDAY.

Morning Session—11 to 12 Noon:

11.0 "Mercury" News Service.
11.30 Musical Items.

Afternoon Session—3 to 4 p.m.:

3.0 Weather and Market Reports.
3.30 Educational Lectures as arranged.

Early Evening Session—7 to 8 p.m.:

7.0 Children's Stories by Uncle Nod.
7.30 (Saturday) Latest Sporting News.

Evening Session—8 to 10 p.m.:

8.0 Vocal and Instrumental Concerts from Studio. Orchestral Music.

SUNDAY.

Afternoon Session—3 to 4 p.m.:

3.0 Musical Programme.

Evening Session—7 to 9.30 p.m.:

7.0 Church Services as arranged.
8.30 Vocal and Instrumental Concerts from Studio.

3AR

BROADCASTING TIMES.

Melbourne Mean Time.

Wave-length: 480 metres.

MONDAY TO SATURDAY.

Morning Session:

11.0 Musical Items.
11.45 Weather Report, Stock Exchange Information.
12.0 Time Signal, Close Down.

Afternoon Session:

3.0 Musical Items.
3.30 Weather Report, Afternoon Stock Exchange News.
4.0 Time Signal, Close Down.

EVENING PROGRAMME.

7.0 Children's Corner, by "Uncle Rad."
7.35 Closing Stock Exchange News.
7.45 Weather and latest Market Reports. News Bulletin.
8.0 Vocal and Instrumental Concerts.
10.0 Close down.

SUNDAY.

Afternoon Session:

3 to 4 Musical Items.

EVENING PROGRAMME.

7.0 Children's Corner, by "Uncle Rad."
7.30 Vocal and Instrumental Items (Church Services announced).
9.30 Close down.

Our Letter Bag

(*To the Editor.*)

Dear Sir,—

Just a line in appreciation of your paper. I consider the old slogan, "Every day, in every way, *Radio* gets better and better," suits it down to the ground.

Since I started taking it last March, I consider *Radio* has improved over 100 per cent.

Your "hints" and "tips" are invaluable; I am becoming quite an expert on radio matters.

With my 2-valve set (DV3) I can bring in 3LO, 2BL, 2FC, 5CL, 7ZL, and, if the evening is in any way kindly, 6WF.

One thing I notice: 2FC is by far my plainest station, although nearly four times as far away as 3LO. 5CL is also better than 3LO. although further away even than 2FC.

My loose coupler takes the same setting for 5CL as for 3LO (1720 metres), a few degrees on the primary condenser being the only alteration.

Yours faithfully,

(Sgd.) W. ALLARDYCE.

Glenmaggie Weir,
Heyfield, Gippsland,
Victoria.

Australia Day, 1925.

(*To the Editor.*)

Dear Sir,—

Just returned from a trip to the city, "primed full of Low Loss." Having built me a "Low Loss, one-step," as we heard them called, the results should prove interesting. Last night a good, strong carrier wave was heard which, when brought out, was music. It was so loud, I thought it was some particularly efficient amateur on short waves (about 60 m.). Imagine my surprise when the announcer said, "Westinghouse Electric Coy.'s Station KDKA, East Pittsburg, broadcasting a special test programme for the Melbourne 'Herald,' Melbourne, Australia." He also remarked that the programme was being played on a portable phonograph. A message for Australia was then read out, being afterwards repeated in Morse. The Morse was quite audible with the aerial and earth switch lifted at 7½m. to 9m. He said, "It is now 6.57. It will be daylight in about half an hour. The temperature is 40 degrees." After this a male and female voice sang selections from "Rigoletto." A bad harmonic from a spark station drowned the latter part of this piece. At two minutes to 9 he announced, "Westinghouse Station KDKA broadcasting a test programme for the Melbourne 'Herald,' Melbourne, Australia. We will be broadcasting at 4 a.m. to-morrow morning. KDKA signing off. Good morning!" All this programme was very loud. With two pairs of 'phones in circuit the music could be heard all over the room with 'phones on the table. This is not supposed to be a detailed programme of what was sent. A lot was missed through static, excitement and inability to write fast enough. However, I think I've given enough of it to establish the fact that he was received on two valves without any radio-frequency amplification. Four people, one of them a J.P., can testify to the loudness.

Wishing your paper every success.

Truly yours,

(Sgd.) P. GRANT.

Gowrie Station,
Charleville.

January 25, 1925.

(To the Editor.)

Dear Sir,—

I thought it might interest you to learn of a little wireless 'stunt" we put up in the new year. A party of eight of us (all young men) went per motor cars ("Lizzies") and a motor cycle on New Year's Day up into the heart of the Warrumbungle Mountains for a camping picnic for a few days' rest after several weeks' strenuous work taking off a big wheat harvest.

After travelling about 25 miles over indifferent roads and the last 3 miles on no road at all, we got through the timber without trouble. Arriving at a sharp, horse-shaped bend in the Uargon Creek, with a beautiful spring of clear, cool water tumbling down over moss-covered rocks, we decided to camp. It being only an hour before dark, we soon got busy, the "Radio Bugs" rigging up the set and the rest fixing the camp ready for tea. One of us climbed a big 60ft. river oak for one end of the aerial, and the other end was attached to a 35ft. box-tree. Between these we stretched about 65ft. of 18-gauge copper wire, using the necks of two "D.A." bottles we picked up on the road for insulators between the copper and the fencing wire on to the trees. The lead-down was 18 S.W.C. insulated wire. The earth was some plain copper wire buried a few inches (we did not have a shovel to put it in deep) underground, which we kept wet. The end of the wire we nailed to the butt of a tree. No joints were soldered. The set was a 4-valve one of our own construction, consisting of 3 201A's and a Phillips detector in the usual three-coil circuit. After having a good tea we tuned-in but could not get anything until after a few minutes, when we found that some of the road bumps had broken a wire off one of the jacks and, not having a soldering-iron, we twisted it up temporarily, and after doing so everything worked O.K. We listened to 2FC, 2BL, and 3LO, who came in remarkably clear and loud on five pairs of headphones. We also used the loud-speaker (Amplion De Luxe), but the wind was blowing strongly and its howling through the timber and mountains drowned the loud-speaker.

Next morning while some of the members got the breakfast, we listened to 2BL giving health talks. We did this on three valves. We tuned-in various times and were kept up to the minute with the first Test cricket scores, in which we were all very interested. It seemed rather uncanny being up in the wilds and listening to all this. It surprised us how well it came in on a temporary aerial and earth, as we were very badly screened with high timber to within about six yards of the aerial all around us and with hills several hundred feet high on three sides of us and only a few chains back. Owing to heavy thunderstorms during the last two days, we did not "do" much wireless and our accumulator went flat. It has proved to us that in any future times when we go camping we can take our set and keep "up to the minute" in regard to news of the world.

Yours faithfully,

(Sgd.) G. W. ANDERSON.

"Bearbong,"
Gilgandra, N.S.W.

The Super-sonic Heterodyne Receiver

By Geo. Apperley.

IN the last issue of "Radio" the theory of Super-sonic Heterodyne Reception was briefly explained. Having studied the principle and outlined the advantages of this method, it now remains to be seen how the necessary conditions can be achieved.

RECENT rapid progress in the development of the Super-Heterodyne has created widespread interest and many articles have appeared in the overseas Technical Press setting out constructional details. Like other types of receivers there are many different circuit arrangements, the more modern of which call for considerable skill and experience in construction. As a starting point it is, therefore, proposed to deal with the most simple arrangement and at a later date to describe the refinements which are now to be found embodied in the modern commercial instrument.

The most important and valuable piece of radio apparatus to the home constructor is a wave-meter having a reliable calibration. Such an instrument may easily be built up from an inductance coil shunted by a reliable make of variable condenser provided with a good, open scale. The inductance coil may be of the honeycomb type, of such a size as to cover the desired wave range with a given condenser. Wave ranges for different coils shunted by condensers of different capacities are specified by makers and an accurate calibration for any combination can be obtained from some well-equipped laboratory. The coil should be mounted in a suitable socket, so that different wave ranges may be covered by using different coils. Across the coil socket terminals should be connected a shunted buzzer and dry battery in series for excitation purposes.

Fig. 5 shows a complete circuit diagram of the simplest form of Super-Heterodyne receiver. It consists of five sections: Local Oscillation Generator, First Detector, including the aerial- or loop-tuning elements, Intermediate Amplifier, Second Detector and Audio Frequency Amplifier.

The aerial tuning units should at first be constructed for the reception of the shorter broadcasting wavelengths for reasons already explained, and later, an attempt at reception on longer waves might be made by altering only the receiving loop and local oscillator coil.

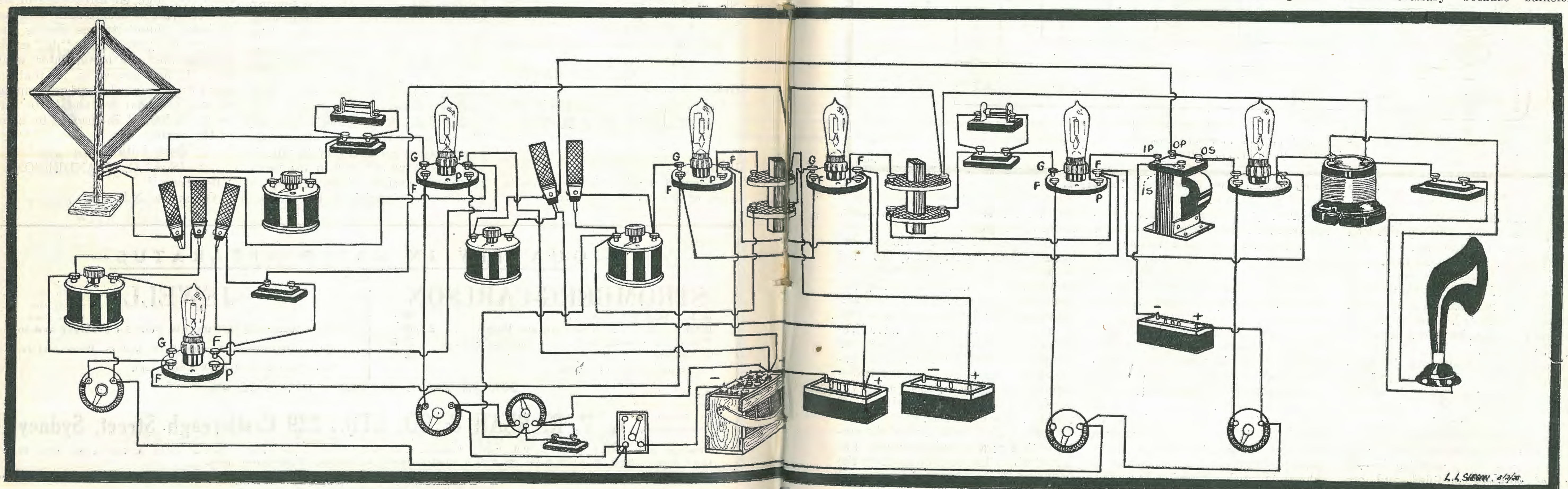
When operating this apparatus it must be remembered that the aerial circuits are strongly excited by the local oscillation generator and the system will readily radiate and interfere with near-by listeners-in unless great care is exercised. We will deal more fully with this question in a later issue, but in the meantime it should be noted that radiation may be reduced to a negligible degree by using a receiving loop in preference to an open aerial.

The receiving loop may be constructed of two pieces of light timber about 1½in. or 2in. wide, ⅝in. thick, each being 3ft. long. The two are screwed together to form a cross and one arm is provided with an extension piece riding in a suitable base for orientating the loop as required. To cover a wave range of about 300-500 metres with a .0005 mfd. variable condenser (C1), the loop should be wound with 11 turns of, say, 20 g cotton-covered wire, each turn spaced ¼in. down one side of the frame towards the centre. Small screws or tacks driven into the side of each arm of the wooden frame is a very quick and convenient method of supporting the winding. Associated with the loop circuit is a small coupling coil, L3, preferably built in with the local oscillation generator but connected to First Detector Unit by means of two terminals on the latter. The first detecting valve VI is provided with the usual grid condenser and leak GC1, GL1. The grid leak should preferably be variable, and so also the grid condenser because in practice some difficulty may be experienced in finding the correct values for stable operation. A good plan is to omit the grid condenser and leak and take advantage of the characteristic curve of the valve by using a high resistance potentiometer of about 2,000 ohms across a two-cell dry battery, the slider of the potentiometer being connected to the grid through L3 and the loop, and the positive terminal of the dry battery to the negative filament lead.

It is advantageous to use a potentiometer of high resistance, as the dry cell battery will then give long service. To enable valve V1 to be adjusted for best action it is provided with a separate filament rheostat.

The construction of the local oscillation generator should present no difficulties. There are several ways of making and mounting the coupling coils L3, L4, L5. Perhaps the most simple and convenient procedure is to obtain suitable honeycomb coils and accommodate them in a three-coil mounting. The mounting may be purchased or home-constructed and calls for no further comment.

The grid circuit of the oscillator is tuned by variable condenser C2 and a wave-range of 300-500 metres can be covered by a condenser (.0005 mfd. maximum capacity) and coil L4 of 50 turns. The size of coil L5 is not critical and may be the same as L4. The value of coil L3 should be sufficient to transfer the requisite amount of energy to the first detector valve circuit and may consist of about 25 to 30 turns. In many cases, the use of this coupling coil will not be found necessary because sufficient



Pictorial diagram of the Super-sonic Heterodyne.

energy from the oscillator will be picked up by the leads. If, however, the oscillator is metallically screened, coil coupling will be necessary.

The oscillator is supplied with high tension from a common source, but a separate battery may be used if desired. The condenser C3, of fixed value .0001 mfd. capacity, provides a by-pass across the high tension battery for the high frequency component of the plate current. A variable filament resistance F1 controls the filament brilliancy of not only the oscillator valve but also the intermediate frequency amplifiers V3 and V4, which should be of the same type. It is desirable to screen the oscillator in which case all control handles should, of course, be extended through the metal screen, the spindles being selected by the tuned circuit L1 C4 in the plate circuit of V1.

At this point we commence to deal with the new or what is usually known as the Intermediate Frequency. We have previously considered the advantages of using an intermediate frequency corresponding to a relatively long wave-length and we propose to select 6,000 metres as most suitable. In our diagram we have allotted valves V3 and V4 to function as amplifiers for the new frequency and V5 as the rectifier. The circuits L1 C4 and L2 C5 must therefore be tuned to select and transfer energy at this wave-length from the first detector to the intermediate amplifier.

We have also seen how the value of the intermediate frequency may cal journals. Air core transformers are sharply resonant about their fundamental periodicity as illustrated by the curve A, Fig. 6, and a combination of such transformers will give amplification at a relatively high ratio provided they are carefully matched to be resonant at the same frequency. In practice it is extremely difficult to construct a set of air core transformers, each tuned to the same frequency. Even were this condition obtained there is another important factor to be considered. In addition to sending out a constant frequency in the carrier wave a broadcast station super-imposes on this wave additional frequencies corresponding to the sounds transmitted. Musical vibrations cover a range of about 3,000 cycles per second and the harmonics

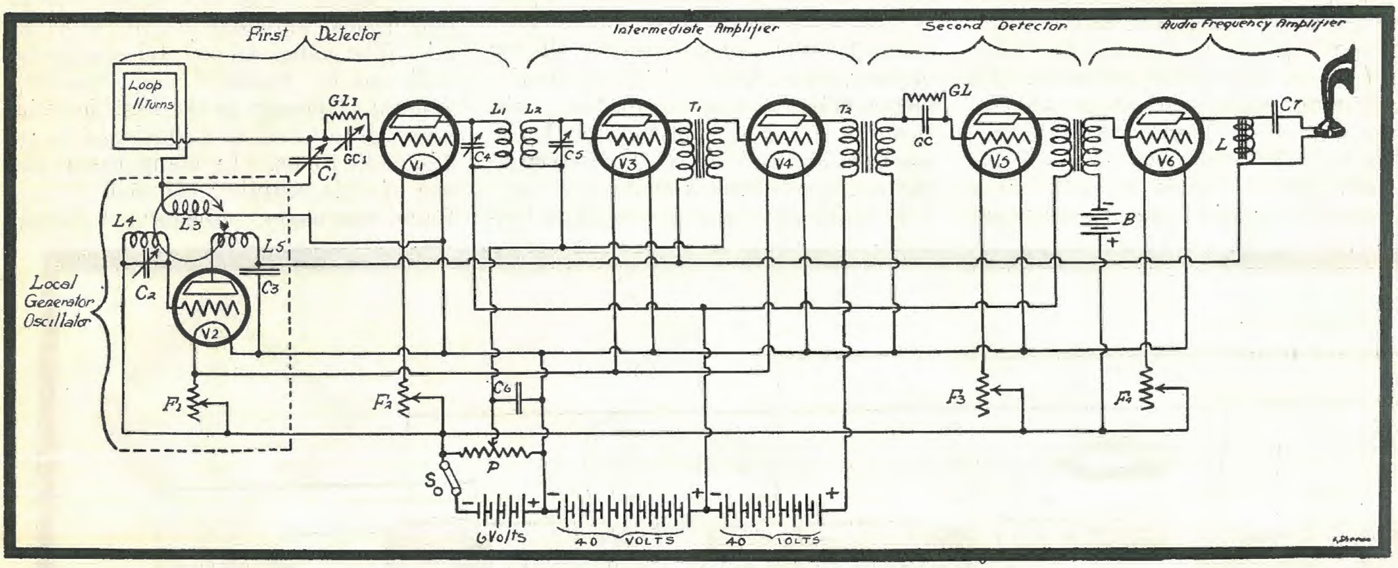


Fig. 5.—Wiring diagram of the Super-sonic Heterodyne.

connected so as to be at low potential in respect to earth. The negative lead of the filament should also be connected to the screen. If these precautions are taken, the effects of capacity introduced by the operator's body will be reduced to a minimum or totally eliminated. The valves V2, V3 and V4 should be chosen from the amplifying class.

We have now dealt with the Tuning and First Detector circuit and the local oscillation generator. It will be remembered that this combination gives rise to super-sonic beats, the locally generated oscillations beating with the incoming signals. The beats, in addition to being rectified by VI, are, of course, amplified and are be varied by the local oscillation generator, so the tuning of the selector circuits between V1 and V3 may be fixed. L1 and L2 may conveniently consist of honeycomb coils each having 600 turns and C4 and C5 condensers of .0005 mfds. capacity. The final tuning of these circuits should be made with a fairly loose coupling to give good selectivity by varying C4 and C5, when they may be permanently fixed. For this purpose the home-constructed wave-meter will prove very useful.

The question of selection of suitable transformers for the subsequent stages of amplification of the intermediate frequency is one which is subject to much discussion in techni- which characterise the various tones, about 9,000 cycles.

There are still higher harmonic frequencies but above 9,000 cycles they do not appreciably affect our sense of hearing. The result of adding the sound frequencies to the carrier wave is indicated by the shaded area in Fig. 6, where f is the carrier wave frequency and f1 and f2, the limits of variation caused by the sound frequencies. If now we make our transformers too sharply tuned, a certain portion of the shaded area is cut off which means distortion.

Curve b gives some idea of the amplification of a transformer, the tuning of which has been damped by the inclusion of an iron core as compared with an air core transformer. It will be noticed that, although the amplification ratio is not so high as the air core device, still, good amplification is obtainable over a very wide range of frequencies, and, provided the damping is not carried so far as to cover audible frequencies, faithful amplification is possible with stable operation. By using more than one amplifying valve coupled by transformers of this type, the curve can easily be raised along the amplification scale as shown by C. The

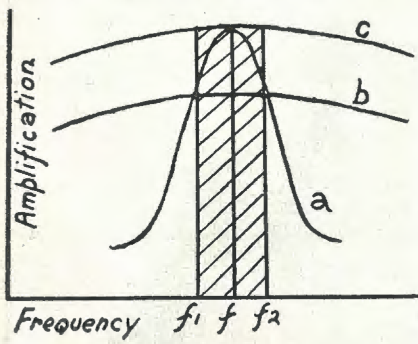


Fig. 6.

great advantage accruing from the adoption of iron core transformers for the subsequent stages in the intermediate frequency circuit is that they require no careful matching. In practice, therefore, it is usual to first select the intermediate frequency by means of an air core tuned transformer and then to use the iron core type in the succeeding stages.

Such transformers are shown in the diagram by T1 and T2. They usually consist of coils of many turns of very fine wire mounted on a small iron core. It is not recommended that the experimenter should attempt to make these but to purchase them for the desired wave-lengths at any good wireless store.

We have shown only two stages of amplification by means of these devices but additional valves may be coupled to V4, if desired. In order to ensure best operation of valves V3 and V4, a potential is applied to the grids from potentiometer P, shunted by the usual high frequency by-pass condenser, C6.

Valve V5 provided with a grid condenser and leak GC GL and controlled by a separate filament rheostat, F3, for obtaining best action rectifies the intermediate frequency which is then passed through a stage of audio frequency amplification. The valve V6 may be coupled to V5 by any good type of low frequency intervalve transformer and a grid bias battery B is furnished for distortionless amplification. The last valve may be of a larger capacity than the preceding ones and therefore a separate filament rheostat F4 is included in the circuit. In order to prevent the direct current in the plate circuit of the audio frequency valve from flowing through the loud-speaker or telephone windings a combination of iron core choke coil L and condenser C7 may be employed. The inductance should be about five henries and whilst allowing the direct current to flow through it offers a high impedance to the speech frequencies which find a better path through the loud-speaker and condenser. C7 may be a good quality paper condenser of about two mfds.

The high tension battery is divided in two sections to suit the detectors and amplifiers and may be varied as desired. It is preferable to enclose the whole receiver in a screened box which is so divided as to effectively screen the intermediate frequency stage from the first detector and audio frequency section.

To facilitate tuning in to any given broadcasting station, the loop circuit should first be calibrated by means of a wave-meter. The pre-determined adjustment can then be made and the local oscillation generator tuned until the beat frequency produced corresponds with the time period of the intermediate frequency selector circuit. With a little practice, these adjustments can be quickly and easily made and for future reference the adjustments for reception of any particular station should be noted.

In a subsequent issue we will deal with the many refinements which have been introduced into the commercial Super-Heterodyne, including the "Second-Harmonic" method of heterodyning and reflexing.

PRINTER'S ERROR.

IN the fifth paragraph of the first part of this article which appeared in the last issue of *Radio* it was stated: "For instance, if the incoming signal as before has a frequency of 500,000 cycles per second, we may combine with it a locally generated frequency of either a beat frequency of 100,000." The sentence should have read: ". . . . . combine with it a locally generated frequency of either 400,000 *or* 600,000 *cycles to produce* a beat frequency of 100,000." (Ed., *R.*)

QUERIES ANSWERED.
COUPON.
"RADIO
in
Australia & New Zealand."
February 18, 1925.

Transmission of Photographs by Radio

GENERAL interest in this branch of the Radio art has been aroused by the successful transmission of photographs by wireless from London to New York, some 2,000 odd miles.

As far back as 1847, experiments were carried out in the transmission of drawings and photographs over telegraph land lines, but, as the commercial incentive at that time was not great, the progress made was not as rapid as might have been.

In recent years, however, owing to the constant demand by the press for photographs of current events, rapid strides have been made, with the result that, to-day, photographs are transmitted by land lines over considerable distances.

It soon became apparent that the commercial success of photo-telegraphy depended upon the speed at which signals could be transmitted and that transmission between countries connected by submarine cable was out of the question, the capacity effect in cables so reducing the speed of working that a photograph which could be transmitted over ordinary land lines in ten minutes would take about 50 minutes over the submarine cable.

For the solution of this problem, attention was turned to wireless telegraphy and one of the first attempts was made by Mr. Hans Knudsen in 1908, while in more recent years apparatus was designed by Thorn Baker, Korn, Bellini and others.

Practically all the earlier systems of photo-telegraphy made use of the Selenium cell. Selenium was discovered by Berzelius in 1817 and possesses the property that its electrical resistance varies with the amount of light to which it is exposed. The drawback to these cells was their inertia or "lag" resulting in loss of definition in the transmitted picture. This was overcome by the use of the "photo-electric cell," which is capable of responding to rapid changes of light.

Radio telegraphy has proved the means of overcoming all the difficulties previously experienced in photo-telegraphy and a highly successful demonstration was conducted between Radio House, the centre of Marconi's world transmission services, London, and New York, on November 30 last year.

Some of the photographs actually transmitted during this demonstration are reproduced herewith.

The inventor of the system employed is Mr. R. H. Ranger, of the Radio

A photograph of the Statue of Liberty, as it was received in New York after being transmitted from London.

Corporation of America, with which is associated Marconi's Wireless Telegraph Co., which own the rights to the invention in Great Britain and the British Dominions.

This photograph of H.R.H. the Prince of Wales was another of the series transmitted.

The transmitting apparatus was installed at Radio House, London, and the recorder at the laboratories of the Radio Corporation of America, New York City.

A general idea of the principle upon which the system works is as follows:—

The film to be transmitted is secured to a revolving glass cylinder which is also capable of moving along its axis. Inside this cylinder is an electric lamp whose rays pass through a lens and are focussed on to the film in the form of a small spot of light. Outside the cylinder this spot or beam of light impinges on a photo-electric cell with which is associated a valve amplifier and relay.

When in operation, the cylinder revolves, and for each revolution moves along its axis 1/28th of an inch, so that the beam of light gradually traverses the entire film and according to its varying density, causes variations of illumination on the photo-electric cell and, consequently, current variations, or impulses, which are amplified and sent over approximately 200 miles of land line to the Marconi Trans-Atlantic Station at Carnarvon, where they are impressed on the main transmitter and so despatched across the Atlantic to the receiving station at Long Island. Here again, the impulses are amplified and sent over 70 miles of land-line to the recorder in New York.

The recorder consists of a similar cylinder to that at the transmitter—capable of being revolved in synchronism and carrying a sheet of plain paper. Resting on this paper is the point of a specially constructed fountain pen which is actuated electrically by the received impulses and makes a thick or thin line or a space, according to the strength of the impulse received. At the same time, the picture is recorded photographically and makes a new negative, as well as a pen-drawing of the original photograph.

The time taken to transmit a photograph of half-plate size is approximately 17 minutes. The whole apparatus works automatically and no special attention is necessary during transmission.

England's Prime Minister—Mr. Stanley Baldwin—as Radio sees him.

So successful were these transmissions deemed that Mr. G. W. Whitmore, Chief of Communications for Marconi's Wireless Telegraph Co., predicted the early inauguration of a commercial service and it is pointed out that not only will this service be of great value to the Press, but also to the banks for the transmission of signatures and the police for the transmission of finger-prints.

This represents another step forward in the Radio art, which is playing an ever-increasing part in our lives to-day, and we look forward to seeing in the very near future photographs of current events on the other side of the world being reproduced in our daily press within a few hours of their taking place and, perhaps, even a broadcast radio photo service right into our homes!

Tales of the Wireless Service

A Day in Canton

By E. A. Burbury.

MANY and varied are the experiences of the sea-going wireless operator and this is not to be wondered at when one considers the opportunities for sightseeing, adventure, yea, and even "romance," which come his way.

The average wireless man, during his sea-going career visits practically every country on the globe and in each foreign port met with he usually becomes "involved" in some interesting "incident." There are, however, exceptions; myself, for instance! I want to tell you in this article, however, of an extremely interesting stay in Hongkong and Canton which came my way not so long ago.

Hongkong, as most people know, is a small island, approximately one mile wide by eight or ten miles long, separated from the mainland of China by a narrow stretch of water, with a regular ferry service between it and Kowloon on the mainland.

Some say that Hongkong Harbour rivals "Our 'Arbour"—well, it will take a great deal of persuasion to even half-convince me of that!

After a stay of several weeks upon my first visit to Hongkong, I found I had explored the island from end to end and so, wanting to see something of the mainland, a trip to Canton was planned.

Together with a brother operator, a start was made per the s.s. *Kinshan* up the Canton River at 10 p.m.

We were the only European passengers aboard and our quarters were entirely isolated from the rest of the ship by means of iron bars with ugly spikes on their "business ends," while in our cabin we found a .303 rifle above each bunk! The reason for these elaborate precautions was to guard against possible attack by pirates who still reap a profitable harvest from unsuspecting craft in these regions. However, after locking the cabin door and depositing our wealth (!) under our respective pillows, we turned in and not even our dreams were disturbed.

The Author.

We reached Canton at 8 a.m., where we engaged a guide and two sedan chairs, each supported by three grinning sons of Confucius.

As usual, there was a war on (there generally is in China) and the streets, if such they could be called, were thick with soldiers in the brightest coloured uniforms, carrying rifles with fixed bayonets. On account of "big war" which was supposed to be "on" our guide was reluctant to make the trip but after a large argument and a small tip he was persuaded to proceed and off we started.

Canton is divided into two distinct sections; one side of the river is the European quarter known as Shameen, where the banks, agents, hotels, etc., are situated, while the other side is just plain Canton, which amounts to one seething mass of Chinamen.

There is no vehicular traffic, the main "streets" being only some eight or ten feet wide, while the width of the side "streets" varies from 3ft. to 6ft.!

Our first stopping place was a famous gambling den, of which there are hundreds scattered all over the city—where the national game of "fan tan" was in full swing. It was a sight worth seeing. Although we remained there to see several games played, not a word was spoken. The "banker," squatting on the end of a huge table counting out the dried, shining beans, four at a time, with a little piece of cane, worked like a machine, while seated round the table were twenty players with as many pairs of black eyes which never moved from the little heap of beans and the banker's cane. He never made a mistake. (Personally, I would not like to have been in his shoes if he had.)

While there, we risked a few dollars but I'm afraid our knowledge of the game was insufficient. At the same time, "fan tan" is considered one of the fairest gambles in the world.

From there we moved on to the ivory workers' "factory" (one small lathe in "John's" bedroom!). Here we saw some really wonderful work in ivory turning and carving being performed on the crudest of machinery. The processes amounted to patience personified.

From there we passed on to the jewellery maker. Here we saw made highly-coloured, glazed brooches, which appeared to be composed of minute spots of brightly coloured paint forming a mottled pattern, but on closer inspection each spot proved to be a tiny piece of plumage obtained from the highly-coloured feathers of small birds, each piece being less than the size of a pin's head. These pieces were cut by hand and mounted with the aid of an extremely fine brush

A street scene in Hong Kong.

moistened with gum. The workers engaged in this art eventually go

How I set out to see Canton.

blind, and after seeing the process we could easily imagine this to be true.

On moving on, our attention was attracted by the sound of hundreds of crackers being "let off," and a closer inspection revealed a huge commotion in the shape of a wedding. As we passed, the bride was leaving her home by means of a bamboo stairway constructed from the street to the window of her room on the first floor. The Chinese bride never leaves her home by the usual door, but directly from the room she occupies. The bridegroom does not join his wife until three days after the ceremony.

Our next stopping place was a temple or Joss house, containing no less than 300 shining brass gods. In front of each was a pot of earth in which John placed his joss sticks during his devotions.

The water front.

We also visited several other Joss houses, tombs, and the famous water clock and then decided to return to Hongkong by rail via Kowloon.

The only incident during the train journey was a compulsory stop of about an hour, concerning which the only information we could get was "engine spoilum."

On our return to Hongkong, the welcome news was received that my ship was soon to sail for some destination then unknown, so with visions of the *next* port of call in mind I duly sailed and as we passed Cape D'Anguilar I donned the 'phones and settled down to work once more.

DO not solder a crystal, heat spoils its sensitiveness.

WHILE single wire is good enough for a receiving set, stranded wire is best for a transmitter.

PICNIC AND CRICKET MATCH.

AN enjoyable day was spent at Sandringham (Sydney) on Anniversary Day, when a large number of the employees of Amalgamated Wireless (Australasia) Ltd. spent their first outing together. Excellent weather prevailed, and from every point of view the visit to Sandringham proved highly successful. The party numbered some 75 persons.

A cricket match resulted in a surprisingly easy win for "A.W.A.," who scored 85. Their opponents were dismissed for 32! An outstanding performance of the match was the phenomenal success of bowler Frank Handley. He secured nine wickets for five runs. Owing to the excessive heat the athletic programme was abandoned, but despite this the afternoon was not wasted. The beach was monopolised by the swimmers, while it was apparent that grassy slopes were favoured by many. It is hoped that in the near future other picnics will be arranged.

The Organizing Committee desires to thank both the Directors and Management of both firms for their kind assistance—financially and otherwise.

Cricket scores.—United Distributors Co.: S. Wales, 5; R. Cooper, 9; Stabbach, 0; Davis, 0; Alexander 0; Millard, 0; Thorpe, 2; Call, 6; Grace, 1; Jarmon, 2; Luton, 1; Weston, 3 (n.o.). Sundries, 3. Total, 32. A.W.A.: Thomas, 6; Brown, 4; Handley, 15; Baxter, 5; Hollingworth, 0; Farmer, 5; Borthwick, 10; Bodkin, 3; Freney, 9 (n.o.); Bones, 8; McIntyre, 3; Nankervis, 0. Sundries, 17. Total, 85. A.W.A. bowling analysis: Handley, 9 wkts. for 5; Freney, 1 for 20; Thomas, 1 for 4.

Round's Round Ground

(*Continued from page* 782.)

an ideal ground. The ground was next tested for practical worth.

Despite the shallow depth at which the electrode was buried for operation at the longer wave-lengths of the broadcast band, distant and local broadcast stations are received unusually well. With an ultra-audion regenerative receiver, employing a single stage of audio amplification, it is possible to pick up stations which, with an ordinary pipe ground, are inaudible. The antenna circuit also possesses real selectivity, owing to its low resistance. Transmission experiments at short wave-lengths (100 to 200 metres) and at low power (10 watts) have shown the electrode to be very effective for amateur communication. The writer is well pleased with the results of his labours and highly recommends "Round's Round Ground" to the enthusiast who wants a real ground system.

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guarantee you that thrill of satisfaction for which you are working—that moment of ecstasy when you try out your set and it works perfectly, very first time too. Ormonds never let you down. They are of British Manufacture—made for conscientious service and recommendation. The Home Constructor owes much of his enjoyment to the thoroughness of Ormond's Components.

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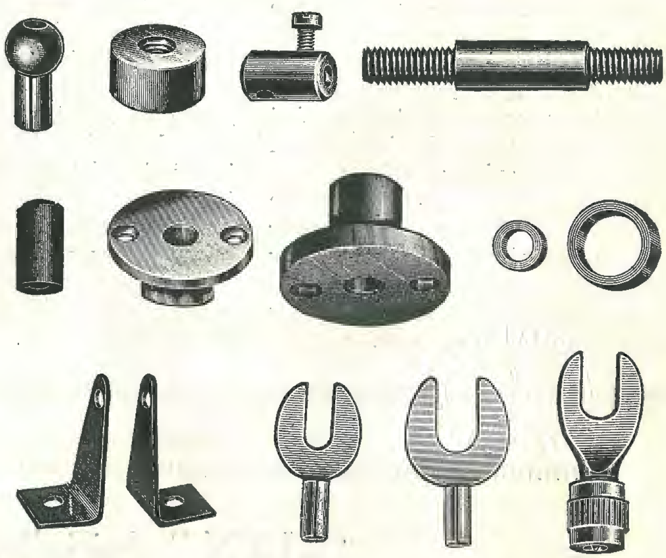
Ask your Dealer for Ormond's Components.



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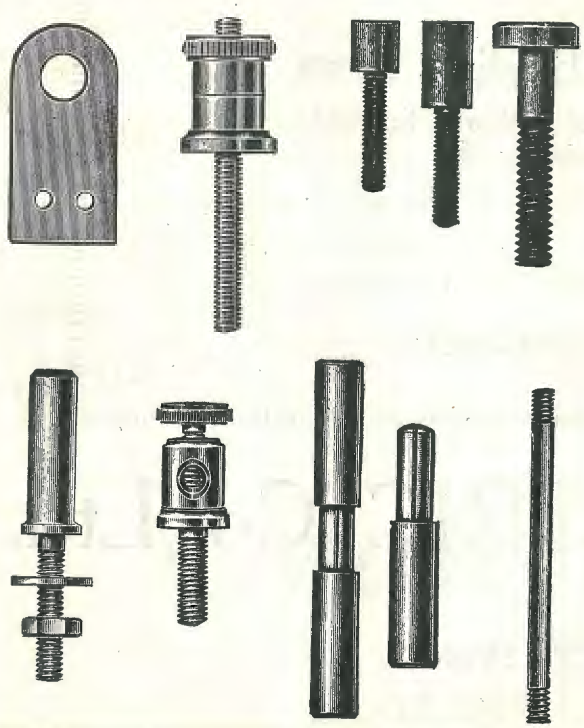
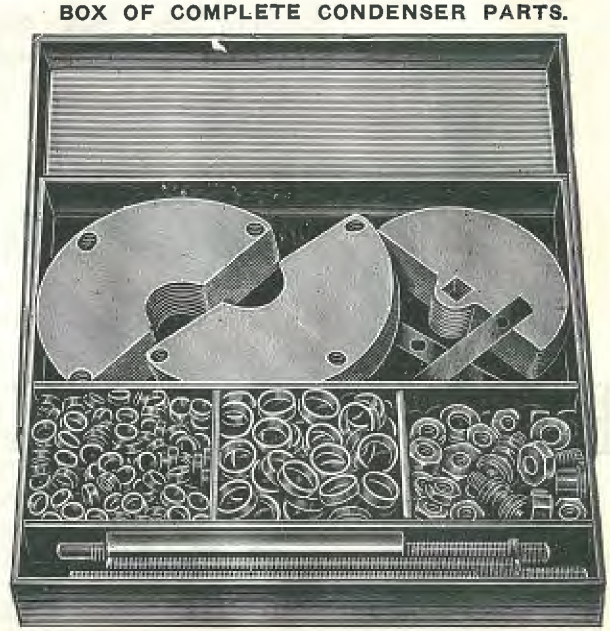


BOX OF COMPLETE CONDENSER PARTS.



Talks from 3LO

Accumulators: Their Operation and Up-keep

AN accumulator is an appliance which enables us first to transform electric energy into chemical energy and subsequently to transform this chemical energy into electrical energy. The simplest form of accumulator consists of two lead plates immersed in dilute sulphuric acid. If a current is passed through such a cell one plate (positive) becomes dark brown and the other a lighter grey than the original lead. If the current is cut off and the cell connected to a measuring instrument, a current will flow in the opposite direction to that applied to charge the cell and the plates tend to resume their original colour.

In the commercial accumulator the plates are built up of a large number of thin strips giving a considerably larger area in contact with the acid (called electrolyte) than flat sheets of apparently the same size.

The voltage of each cell, irrespective of its size is two volts. For radio work these cells are usually sold in banks of three connected in series giving six volts, and are then called six V accumulators. During charge, the voltage of each cell will rise to approximately 2.5 to 2.7 volts, and on cutting off the charging current, this voltage gradually falls to two volts, where it will remain steady until the cell is nearly discharged and the voltage again begins to fall. It is important to see that the voltage is not allowed to fall below 1.8 volts, otherwise the cell will be damaged. The internal resistance of an accumulator is very low, therefore accidental short circuits, even only momentary, should be carefully avoided, as the very heavy current which will flow on short circuit will damage the plates of your cell. To avoid this, when disconnecting the accumulator from your receiver, always disconnect the wires at the accumulator terminals. If you undo the wires at the receiver terminals the two ends are liable to flick together when you move the accumulator and cause a short circuit.

Perhaps the most important phase in the life of an accumulator is its initial charge and unless the makers' instructions, usually printed on each accumulator, are carried out to the letter, you must expect trouble before long.

Now, let us turn for a moment to the action of an accumulator. We will endeavour to explain as briefly and simply as possible what happens.

When a cell is put in discharge, that is, when current is taken from it, as when it is being used to heat the filament of your valves, the current is produced by the acid of the

electrolyte combining with the active material in the plates of the cell. As the discharge progresses, the electrolyte becomes weaker by the amount of acid used up and water chemically formed. When the cell is put on charge, current must flow through it in the opposite direction to the discharge and the reverse chemical action takes place when the acid will gradually increase in strength. The object of charging is to drive from the plates the acid absorbed during discharge. Always keep the level of the electrolyte from half to three-quarters of an inch above the plates by the addition of distilled water from time to time. Do not add acid unless some of the electrolyte has been spilled. The water in the electrolyte evaporates; the acid does not, so add water only.

When charging your accumulator, make sure you connect the positive terminal of the charging mains to the positive terminal of the accumulator, and negative to negative. An easy test for ascertaining the polarity of the mains is to dip the ends, keeping them apart, of course, in a cup of water to which has been added a little salt, when you will find that from one of the wires bubbles will rise to the surface. These are of hydrogen gas and this is the negative pole and the other, of course, will be the positive. The positive terminal of all accumulators is marked either with a cross or painted red.

Accumulators are subject to one or two little ailments which are quite easy to prevent but often very hard to cure. The most frequent ailment met with is sulphating. This can be detected by the appearance of a mouldy growth on the plates, white on the negative and reddish on the positive.

This is caused by:—

1. Allowing the cells to discharge below 1.8 volts.

2. Allowing the cells to stand idle too long.

3. Charging and discharging at too heavy a rate.

If caught in time, this can be cured by long charging at a very low rate, say $\frac{1}{2}$ or $\frac{3}{4}$ the normal charging rate or in bad cases, the plates should be removed and scraped.

Another ailment is known as buckling—that is, the plates become buckled or bent. This may be caused as a result of sulphating or charging at a rate heavier than that specified by the maker. Buckling generally causes short circuiting between plates, as where the plates bend particles become detached and cause a small bridge across to the opposite plate.

Finally, like any other piece of apparatus, to give good results, your accumulators must be kept clean. Apply a little vaseline to the terminals occasionally.

LONG DISTANCE RECEPTION OF 2FC

MR. L. H. JONES, who lately signed off the R.M.S. *Tahiti* as Senior Wireless Officer, reports excellent reception of 2FC when his vessel was within 200 miles of San Francisco. A few days later, when the ship was about 800 miles south of 'Frisco, 2FC's signals jammed Press messages transmitted on the same wave-length from VAE, a station a few miles North of Vancouver.

Queries Answered

G. W. S. (Preston). Q.: Using the five-valve receiver (*Radio* No. 47), would not two stages of tuned anode with the long leads, as shown in the diagram, produce a very unstable circuit with a strong tendency to "howl"? A.: Howling in tuned anode circuits is due to the bad lay-out of the components, causing stray fields between the leads. In this receiver the reaction coil is shown coupled to the first tuned anode coil, reducing the tendency of the circuit to oscillate. The reaction coil may be coupled to the aerial coil, if desired. The detector leads should be as short as possible. Q.: Has the circuit been tested with satisfaction? A.: Yes; this receiver has been thoroughly tested out and, in practice, gives excellent results. You should experience no trouble when using high-grade apparatus throughout.

A. K. K. (Corfield). Q.: Give circuit of a 3 or 4-valve receiver capable of receiving Sydney and Melbourne broadcasting stations, using UV199 valves. A.: Use the 3-valve receiver described in *Radio* No. 44. A further stage of audio amplification can be added, if necessary. Some excellent hook-ups are given in *The Amateur's Book of Wireless Circuits,* by Haynes.

E. R. W. (Pymble). Q.: Can filament control jacks be used with the P1 circuit with two stages of audio amplification, described in *Radio* No. 40? A.: Yes; connections for plug-in jacks are shown in the circuit of a 5-valve receiver (Page 669, *Radio* No. 47). A special jack, with additional contacts, is obtainable for breaking the filament circuit. Q.: Is this circuit suitable for long-distance reception, such as KGO, using good aerial and earth? A.: Use the 3-valve receiver described in *Radio* No. 44.

"*Static*" (Trundle). Q.: Using a UV201A valve, what should be the resistance of the rheostat? A.: 6 ohms. Q.: Will a Jefferson Star Transformer be suitable for adding a stage of audio amplification to the P1 circuit described in *Radio* No. 37? A.: Yes. Q.: What should be the ratio of the transformer? A.: 4½ or 5 to 1. Q.: Would aerial 40ft. high free end and 25ft. high lead-in end, single-wire, 125ft. long, be suitable for this receiver? A.: Yes; providing you do not want to receive on very short wavelengths.

G. T. G. (Carlton, Vic.). Q.: Would the 3-valve receiver (*Radio* No. 46) be better than the P1 with two stages of A.F. amplification? A.: Unless you particularly desire selectivity, use the P1 with two stages of audio. Q.: Would either of these receivers be satisfactory for receiving Australian and N.Z. broadcasting stations on 'phones, using single-wire aerial 100ft. long and 30ft. high? A.: Yes; you will, however, require larger size coils in addition to those mentioned in the article for receiving 2FC, 3LO, and 6WF.

READERS, PLEASE NOTE!

QUERY letters which are accompanied by our coupon and comply with the following directions will receive first preference.

MAKE your letter as brief as possible and write your questions on one side of the paper, one underneath the other. All letters must be signed in full, together with the address of the sender. For publication, the writer's initials will be used or a nom-de-plume, if desired, but on no account will any consideration be given to anonymous communications.

IF requested, answers will be forwarded by post, providing the letter of enquiry contains a stamped, addressed envelope and the coupon to be found elsewhere in this issue.

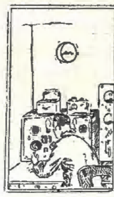
IT SHOULD BE NOTED THAT IT IS IMPOSSIBLE FOR US TO ANSWER QUESTIONS REGARDING THE APPROXIMATE RANGE OF EXPERIMENTERS' SETS.

V. H. (Dulwich Hill). Q.: Adding two stages of audio amplification to the "Long-Distance Receiver" (*Radio* No. 45), will it be necessary to include a potentiometer? A.: Yes; this will make the circuit more stable. Connections are shown in the 5-valve receiver (*Radio* No. 47). Q.: Would a UV199 valve be suitable as a R.F. amplifier? If so, what would be the most suitable plate voltage? A.: Yes; between 60 and 80 volts. The correct voltage will have to be found by experiment. Q.: Would this 4-valve receiver be reasonably simple to operate? A.: Yes. Use plug-in jacks on the detector and first audio valves to facilitate adjustments.

E. C. (Mosman). Q.: Using the "Long-Distance Receiver" (*Radio* No. 45), can condensers of different capacity be used in place of the .02 and 1 mfd. specified. A.: Through an error, C3 is specified as a 1mfd. Q.: What size coils are required for receiving 2FC and 2BL, using aerial 70ft. long with lead-in of 25ft.? A.: See article. Your aerial will make very little difference when using an aerial tuning condenser and a series-parallel switch, as shown. Q.: Should series-parallel switch be in series or parallel? A.: In series for short wavelengths, say, below 600 metres, and in parallel for long wavelengths. Q.: Are the unmarked terminals on B battery (sketch submitted) for varying the positive voltage? A.: Yes; the negative lead is connected permanently to the negative terminal, the positive voltage only being variable. The terminals not marked are intermediate positive voltages, such as 6, 15, 24, and so on, as with the marked terminals, the two sets of terminals giving a 3-volt variation.

G. T. (Tunbridge). Q.: Advise the correct H.T. battery connections, using the P1 (*Radio* No. 37). A.: See *Radio* No. 40. Through an error, no connection is shown between the A and B batteries, which should be between the negative of the B and the positive of the A. If only one stage of audio amplification is required, connect the 'phones in place of the primary of the second audio transformer. Q.: Would a "Brunet" L.F. Transformer be suitable for this circuit? A.: We do not know. Providing the ratio is not higher than 5 to 1, it should be satisfactory. Q: Is a Phillips B11 Valve suitable as amplifier with a UV199 as a detector? A.: Yes; providing the correct filament and plate voltages are used. Q.: Would it be advisable to use a 4-volt battery with a 1½-volt valve? A.: No. Q.: Using a small primary coil and a 50-turn reaction coil, what is cause of difficulty in getting valve to oscillate? A.: You omitted to mention the size of your aerial, which is probably large. Use a series-parallel switch for the aerial tuning condenser, which should be in series for short waves and parallel for long. For connections, see previous issues. Q.: Should a fixed condenser be placed across the 'phones when using the audio frequency amplifier? A.: Yes; usually a .001 mfd. Q.: Can any additions or alterations be made, with advantage to the 2-valve set referred to? A.: Using

(*Continued on page 806.*)



MOVEMENTS OF MARINE WIRELESS OFFICERS

JANUARY.

MR. J. R. Gilligan signed on s.s. *Chronos* at Newcastle, 15th.

Mr. G. Pow signed off s.s. *Karoola* at Melbourne, 8th.

Messrs. W. J. Croft and J. E. Hutchinson signed off s.s. *Barambah* as 3rd Operators at Melbourne, 10th.

Mr. W. C. Brown signed on s.s. *Kaituna* at Wellington, 7th.

Mr. N. Olsen signed off s.s. *Hobsons Bay* as 2nd Operator at Sydney, 16th.

Messrs. W. J. Peell and A. L. Eichstadt signed off s.s. *Taiyuan* as 2nd and 3rd Operators at Sydney, 15th, and signed on s.s. *Hobsons Bay* in the same capacity at Sydney, 16th.

Mr. T. O. Sexton signed off s.s. *Enoggera* at Sydney, 16th.

Mr. W. J. Martin signed off s.s. *Hobsons Bay* as Senior Operator at Sydney, 17th.

Mr. A. Stuart signed on s.s. *Hobsons Bay* as Senior Operator at Sydney, 17th.

Mr. W. C. Lucas signed off s.s. *Poolta* at Sydney, 19th.

Mr. W. H. Jowett relieved Mr. A. C. Hickey on s.s. *Iron Knob* at Melbourne, 16th.

Mr. G. J. Flynn signed off s.s. *Dilkera* at Sydney, 20th.

Mr. F. T. Neal signed off s.s. *Iron Age* at Sydney, 20th.

Mr. P. C. Gillon relieved Mr. V. B. Rippingale on s.s. *Barwon* at Sydney, 21st.

Mr. B. Bone signed off s.s. *Canberra* at Brisbane, 17th.

Mr. A. H. Jeremy signed off s.s. *Cooma* at Brisbane, 17th.

Mr. C. E. Robison signed off s.s. *Bombala* at Brisbane, 17th.

Mr. H. J. Byrne signed off s.s. *Urilla* at Brisbane, 17th.

Mr. M. F. Ryle signed on s.s. *Kangaroo* as 3rd Operator at Fremantle, 10th.

Mr. T. A. Jones signed off s.s. *Katoomba* at Sydney, 22nd.

Mr. G. Pow signed on s.s. *Canberra* at Brisbane, 27th.

Mr. J. C. Cleary signed on s.s. *Cooma* at Brisbane, 27th.

Mr. D. N. Quinn signed on s.s. *Bombala* at Brisbane, 27th.

Mr. M. A. Macgoun signed on s.s. *Urilla* at Brisbane, 27th.

Mr. J. H. Bennett signed off s.s. *Marama* at Wellington, 20th, and signed on s.s. *Tahiti* as Senior Operator at Wellington, same date.

Mr. L. H. Jones signed off s.s. *Tahiti* as Senior Operator at Wellington, 20th, and signed on s.s. *Marama* at Wellington, same date.

(*Continued from page* 804.)

two stages of audio instead of one will amply repay you by the increased strength of signals. Using the series-parallel switch will also be an advantage.

P. J. H. (Busselton). Q.: Using 4-valve receiver (circuit submitted), why has reaction coil to be placed at right-angles to receive 6WF, using primary, 100 turns; secondary, 150 turns; and reaction, 200 turns? A.: You are using far too large a coil for the reaction. Try one of 100 turns, with 150 and 200 for the primary and secondary respectively.

W. J. H. L. (Five Dock). Q.: When connecting up honeycomb coils to a 3-coil mounting, should the current flow in the same direction in each coil? A.: Only in the case of the reaction coil, if signals are reduced in strength when this is closely coupled to the secondary reverse the leads.

"Souta" (Sydney). Q.: In what issue of *Radio* was the list of N.S.W. Amateur Transmitting Licenses issued? A.: No. 40.

R. W. D. (Tighe's Hill). Q.: Advise if valve-crystal reflex circuit (submitted) is satisfactory. A.: Use, preferably, circuit as per fig. 4, page 315, *Radio* No. 39, employing three coils, which should be for 2BL, primary, 50; secondary, 75; and reaction, 50. For 2FC, 150, 200, and 100 respectively. Q.: Supply circuit used by Mr. Lawrence Deane mentioned in *Radio* No. 48. A.: We have no particulars, other than those mentioned. His address is Havilah Road, Lindfield. Q.: Would Ormond variable condensers be suitable for circuit referred to? A.: Yes.

H. W. S. (Conroy). Q.: Please supply circuit of the P1, employing 1 stage radio, detector, and 2 stages of A.F. amplification, using jacks for receiving from 2 to 4 valves. A.: Use the 3-valve receiver in *Radio* No. 44, with an additional stage of audio. Connections for jacks are shown in circuit of the 5-valve receiver published in *Radio* No. 47. Q.: Using an aerial with a natural wavelength of 200 metres, is it possible to receive below this wavelength using Spiderweb coils? A.: Yes; use a .001 mf. variable condenser in series.

V. W. (New Farm). Q.: Using primary and secondary honeycomb coils, each wound with 70ft. No. 16 d.c.c. wire, what is cause of interference from amateur stations transmitting on 250 metres when receiving on 600 metres? A.: The diameter of your coils is too large; the size of wire is also too large. See "Honeycomb Coils" (*Radio* No. 43). In addition to your secondary condenser you will find an aerial tuning condenser of great advantage and give you greater selectivity. Q.: What is cause of dull click in headphones and loud-speaker when adjusting condenser, causing signals to be distorted? A.: Due to the valve oscillating. It will be difficult to eliminate with the broad tuning you are using. Q.: When filling an accumulator with fresh acid, should it be fully charged, or discharged before the old electrolyte is emptied out? A.: Unless the electrolyte has fallen below the minimum specific gravity, there is no need for this to be replaced with fresh acid. Should this be necessary, electrolyte or acid should only be added under expert advice. Unless you have a hydrometer, take the accumulator to a battery service station.

B. A. B. (Zeehan). Q.: Using the "Three-Valve Receiver" (*Radio* No. 44), what is cause of difficulty in receiving Sydney and Melbourne broadcasting stations? A.: In view of the excellent reports received from many readers operating this receiver, we can only suggest you are using wrong size coils. Correct size of coils for the various wavelengths are given in the article referred to. Check up connection with the circuit shown. You will probably get better results using the P1 with two stages of audio (*Radio* No. 40). You will require for this two transformers; your Signal 5-1 will be suitable for the first stage and the Jefferson Star for the second stage. Q.: Can noise from engine exhaust 200 yards away, also induction from supply mains, be eliminated? A.: Cannot assist you to eliminate interference from engine exhaust. Methods for overcoming induction have been given in these columns in previous issues. Q.: Is there any difference between an A.F. transformer and an inter-valve L.F. transformer? A.: No.

C. R. M. (Haberfield). Q.: Using circuits as per Figs. 4 and 5, page 286 (*Radio* No. 38), are honeycomb coils coupled together? A.: Yes; preferably in a 2-coil mounting. Q.: Would connecting the P1 receiver to the 'phone terminals of a 2-valve A.F. amplifier give the same results as the P1 and two stages of audio amplification? A.: No; you cannot employ audio amplification before detection, except in the case of Reflex receivers.

J. F. O. (Leichhardt). Q.: Using a single-coil crystal receiver (diagram submitted), how can interference from other stations be eliminated when receiving 2BL and 2FC? A.: Use a coupled aerial circuit, such as Nos. 4 and 5, page 286, *Radio* No. 38. Q.: Could circuit of "Low-Loss Tuner" (*Radio* No. 46) be used in conjunction with a Crystal set? A.: No; suggest one of the crystal-valve circuits (*Radio* No. 39). Cannot understand your trouble with "current leakage" on panel when you are only using a Crystal. Do you mean "body capacity" effects?

E. A. (Paddington). Q.: Using 3-valve receiver (circuit submitted), what is cause of difficulty in receiving 2BL and amateur stations? A.: You have the secondaries of your transformers in series. These should be connected to the negative side of the filaments of the second and third valves respectively. Use the .001 condenser in series with the aerial for receiving on short wavelengths. Suggest you convert this to the P1 with two stages of audio amplification, as in *Radio* No. 40. Use coils for the various wavelengths shown in the table.

J. G. (Naremburn). Q.: What is the difference between a radio and audio frequency transformer, and what work does each perform in a receiver? A.: Amplification at radio or high-frequency is used for the purpose of increasing the receiving range. At short range, or when receiving from a powerful transmitting station, very little is gained by H.F. amplification, but when signals are weak, then suitable H.F. amplification circuits are required. The tuned anode method, described in previous issues, is the most popular and consists of a coil bridged with a tuning condenser. This is particularly applicable to wavelengths between about 200 and 1500 metres. In the tuned transformer method, the primary and secondary windings are tightly coupled and simultaneously tuned with a variable condenser. The most convenient type is that in which a valve socket mounting is used, with suitable pins, on the transformer. Amplification at audio or low-frequency is usually adopted when it is desired to operate a loud-speaker. L.F. amplification merely increases the strength of signals picked up by the detector, which may be either valve or crystal. Q.: Could either, or both, be used to advantage with circuit submitted? A.: Use a valve in conjunction with your crystal set. See "Crystal-Valve Circuits" (*Radio* No. 39), or use the 1-valve amplifier (*Radio* No. 37).

E. B. (Ashfield). Q.: Using the "Three-Valve Receiver" (*Radio* No. 40), with a UV199 as detector and UV201A's as amplifiers, will a separate filament and H.T. battery be necessary for the detector valve? A.: Yes; the UV199 being a "dull emitter," you will require 3 dry cells for the filament battery with a 30-ohm rheostat, the same high-tension battery, preferably with variable connections, may be used for the three valves. Q.: Are these valves a good combination, or would it be advisable to use a different valve as detector? A.: Use a UV200 as a detector, or all UV201A's, for which you will require one filament battery only. Q.: Would a Freshman grid-leak and condenser combined be suitable using this circuit? A.: Recommend the .0003 fixed bi-pass condenser specified. Q.: Could two 3½-1 transformers be used? A.: Use those specified, i.e., first stage 4-1, second stage 3-1.

W. J. (Longueville). Q.: Using the "Low-Loss Tuner" (*Radio* No. 46), how many turns are required on the secondary coil? A.: 18. Q.: Using this receiver, how many turns should the primary, secondary, and tickler require to tune on about 40 metres? A.: Approximately 2 to 4 turns on the primary; secondary, 5 turns; and tickler, 4 turns.

J. C. M. (Gretna). Q.: Advise where to obtain a good 350-volt D.C. generator for supplying the necessary plate voltage of a valve transmitter. A.: Apply either to Amalgamated Wireless (A/sia), Ltd., or the Australian General Electric Co., or place an advertisement in this paper. Q.:

(*Continued on page* 808.)

(*Continued from page 806.*)

Is it possible to wind an ordinary car dynamo to deliver 350 volts, and what would be the approximate cost? A.: Yes; but is not satisfactory, owing to the insulation between the commutator segments not being sufficiently high for the required voltage.

J. K. (South Singleton). See *Radio* No. 22, page 544, fig. 2. A variometer may be used in place of the anode coil and condenser. We do not understand your second query. The cause of your peculiar experience is apparently due to the 'phone leads being connected directly in the plate circuit, and the trouble should disappear if a telephone transformer is used. The circuit may be on the verge of oscillation. Try less reaction. We are not clear what you mean by using a honeycomb coil to convey the voice with full volume. Give us more details. Receiving at a distance of 500 miles with a frame aerial and crystal detector is excellent work. The circuit you refer to is commonly used and gives excellent results. Yes, "Vis" still sends press at 10.30 p.m.

B. V. T. (Wahroonga). Q.: How many turns are required on the secondary coil of the "Low-Loss Tuner" (*Radio* No. 46)? A.: See answer to *W. J.* Q.: Using this receiver, is it necessary to cut the condenser plates as shown? A.: No. Use a small, variable, square-low condenser with vernier of about .0003 mf. Q.: What effect would cutting the condenser plates have on the wavelengths? A.: This will reduce the wavelength with a given coil approximately 15 per cent. Q.: Would an "Ormond" condenser be suitable for low-loss work? A.: Yes.

R. M., Jnr. (Oatley). Q.: Using the Pi circuit, would a UV199, DE3 or DV3, valve be suitable? A.: Either the UV199 or DE3; both require three volts on the filament and twenty to eighty on the plate. Q.: How long should a filament battery of three dry cells last? A.: This depends upon the periods over which the cells are used; 200 hours would be a fair average. Q.: What is the average life of a valve? A.: With care, a valve should last 2000 hours. We have known instances where valves have been worked constantly for over 12 months; these cases, however, are exceptional. Q.: Should the circuit referred to, using a loose coupler, be capable of receiving local amateur stations? A.: Yes, providing you use a .001 variable condenser in series with your aerial. You will get better results using spiderweb coils. Q.: Would a Bradley-leak be satisfactory, and what should be the value of the grid condenser? A.: Yes; .0003 mf. Q.: Would a 42-volt B battery be suitable for the valves referred to? A.: Yes. Q.: Would a .00025 variable condenser be an advantage across the reaction coil? A.: Yes, particularly if you are troubled with interference.

H. A. L. (Pomona). You omitted to give sizes of the primary and reaction coils, which are evidently too large to enable you to receive on the lower wavelengths. According to your diagram, no grid-leak is used, and judging by your report, the Expanse "B" appears to be very critical to adjust. You will probably find an improvement replacing this with a UV200. It is not usual to use a secondary condenser of .001 mf.; this should be .0005 mf. variable. Shunting the H.T. battery with a .02 mf. condenser will assist you in overcoming your trouble.

J. B. (Clovelly). Q.: Using Crystal receiver (circuit submitted), would it be advisable to use a .001 variable condenser across the secondary coil? A.: No; for fine tuning use a .0005 mf. variable, and your .001 with vernier in the aerial circuit with a series-parallel switch. Q.: Using this circuit, could signals be amplified? A.: Yes; use the One-Valve Amplifier (*Radio* No. 37). Q.: Which would you advise, dry cell or accumulator valves? A.: Either will be satisfactory, preferably standard English or American. Q.: In circuit No. 4, page 286, *Radio* No. 38, you show two .0005 condensers. Is this correct? A.: A .001 may be used across the primary coil instead of the .0005 shown.

SHORT WAVE TRANSMISSIONS.

NKF—U.S. Naval Radio Research Laboratory, "Bellevue," Anacostia, D.C.:—

54.3 metres: Mondays, Wednesdays and Fridays, 8.0 to 8.10 and 9.0 to 9.10 p.m., E.S.T.

72 to 82 metres: Mondays, Wednesdays and Fridays, 8.30 to 8.40 and 9.30 to 9.40 p.m., E.S.T. Exact wavelength will be announced during each test.

54.3 and 32 metres: Simultaneous transmission, daily except Sundays, beginning at 10.0 p.m., E.S.T., working traffic with NPL.

1XAM—J. L. Reinartz, 371 Hartford Road, South Manchester, Conn.:

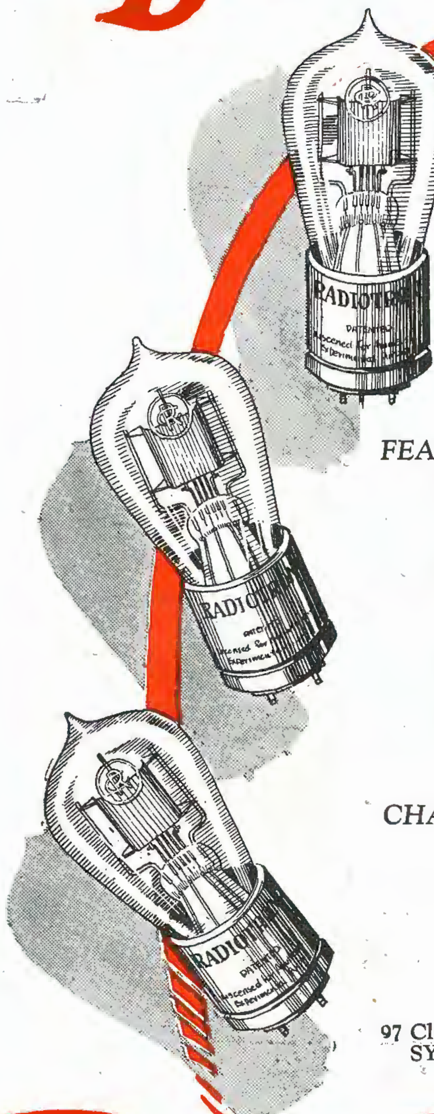
25 metres: Daily from 6.0 to 7.0 p.m., E.S.T.

55 metres: Daily from 7.0 to 8.0 p.m., E.S.T. Both transmissions by semi-automatic transmitter.

Observation reports to be sent to the above addresses or "QST" or A.R.R.L. headquarters.

Reports should cover date, hour and minute, wave-length, audibility, steadiness, QRM, QRN, QSS and weather. Please make the reports as complete as possible.

Distance and Volume



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UV-201-A is a high vacuum tube which, while suitable for a detector, is intended primarily to be used as an amplifier of either radio or audio frequencies. It contains a New Tungsten Filament, the characteristics of which are Long Life, Low Power Consumption and Low Operating Temperature.

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(3) It has a very high vacuum. This ensures uniform characteristics and quiet operation.

(4) As a detector or amplifier it is exceptionally independent of filament adjustment. Critical values of grid leak and condenser are not required.

CHARACTERISTICS: Filament potential, 5 volts.
Filament current, 0.25 amperes. Plate potential, 20-100 volts.

PRICE: £1/10/-

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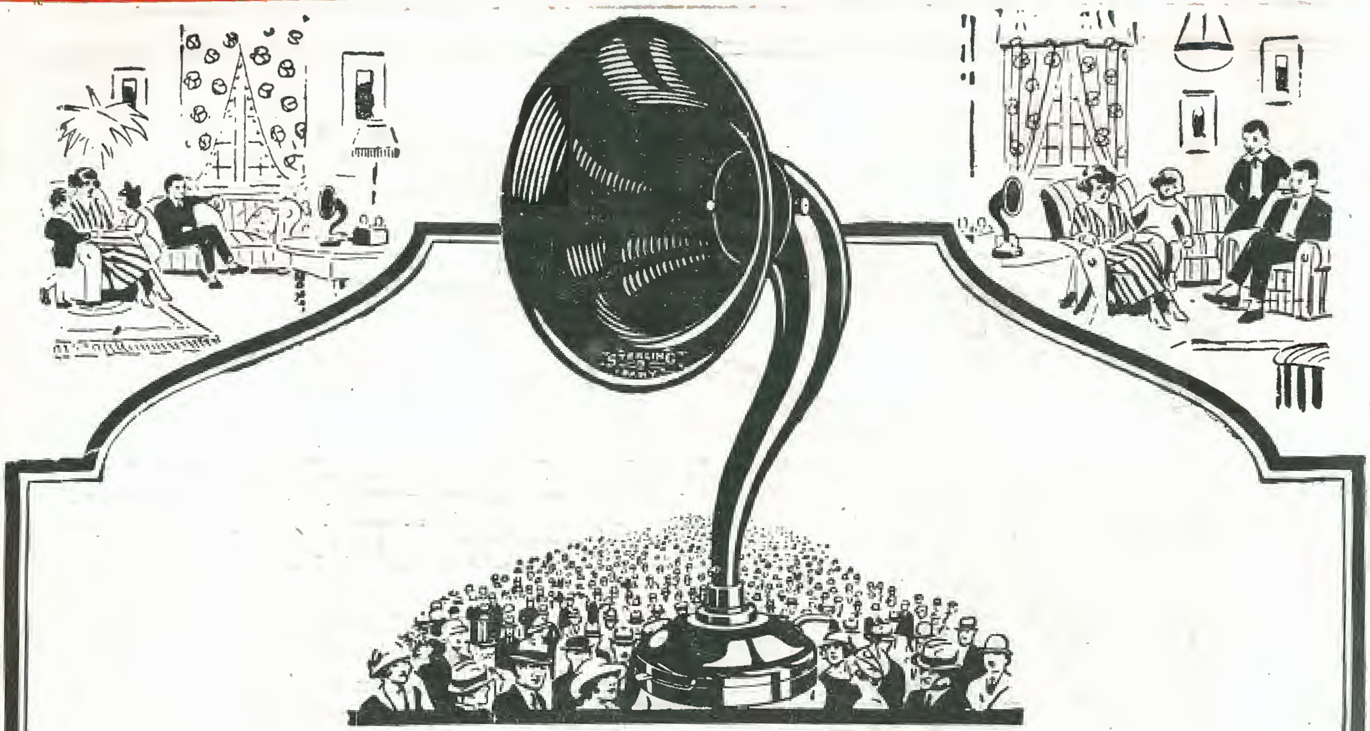

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