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SIXPENCE

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IN AUSTRALIA & NEW ZEALAND

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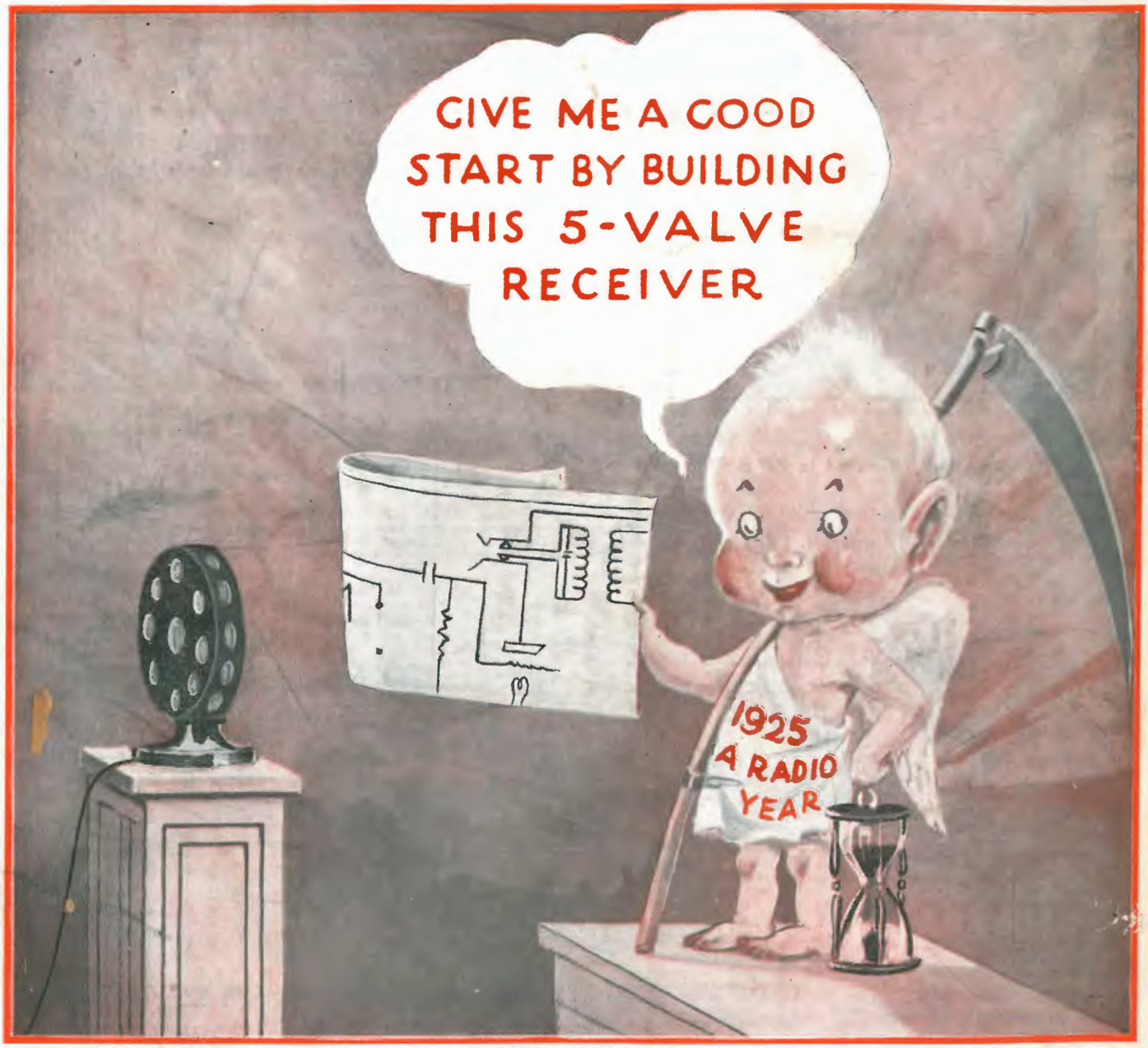

A WONDERFUL SWITCH AND CONTROL CIRCUIT: PARTICULARS WITHIN.

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

CONTENTS

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Pirates

THE prosecutions launched by the Postmaster-General's Department lead us to think of the position of unlicensed listeners-in. In such a community as ours they are naturally of a varying types and until mature consideration is given to the subject, we are apt to extend varying degrees of sympathy to those who are caught and regard lightly the existence of those who escape. They are, however, all pirates, and this fact should not be overlooked.

THE small boy who makes up for himself a workable receiving set deserves every encouragement, right up to the point where he begins to break the law. Encouragement should not stop here, however, but at this point it should take a turn. This small boy is rather like the youngster who makes up for himself the dress, sword, pistols, and such like appurtenances which we associate with the calling of the seafaring buccaneer, and adopts the black flag with its skull and cross-bones and obtains interest and lots of fun from his game. If, however, the time should come when the lad tires of make-belief and is no longer satisfied with a toy pistol but desires a real one and sets forth in earnest to break the law, it is then time to check him and bring him to a realisation of his responsibility to the community and to a regard for the law of the land. It is so seldom that the boy who makes his small radio set is the only one in the house to use and obtain pleasure from it that we need hardly give this section consideration, but where grown-up people are also obtaining something from the boy's effort and ingenuity they can surely assist and encourage him with the financial contribution necessary to keep him upon the right and proper track.

THE other classes of pirates hardly deserve the same consideration. There is the one who turns pirate without knowing. W. S. Gilbert would have naively explained that "the intention was to apprentice him to a 'pilot' "; but, just as the mistake was made in the case of Frederick, all the trouble could be avoided if he would only find out what should be and what should not be. He purchases his radio apparatus and sets it up in accordance with printed directions and, so far as he concerns himself, that is all that is necessary. He does not worry who provides the programmes nor how they are paid for. Thus he drifts into piracy without being fully aware of what he is doing.

ANOTHER without a full regard for the different factors considers the license fee is too high. Therefore, instead of doing as people have to in similar circumstances when that which they desire costs more than they are prepared to pay, he sets out to steal this thing he wants, and if his conscience would sometimes raise within him the question, right or wrong, it is stifled, and he prefers not to stop and consider at all. This type of buccaneer generally intends to take out a licence later on and he may be likened to the merchantman who indulges in piracy only when circumstances are favourable and a prize can be captured with little risk attaching to the venture.

ANNOUNCEMENT!

THIS ISSUE'S SPECIAL CONSTRUCTIONAL ARTICLE WILL BE FOUND ON PAGE 668.

THE fourth type is neither as brave nor bold as the others. He is the cut-throat sneak at whose capture all decent people rejoice. Here is something which he sees the opportunity to take without payment and quite knowingly he uses it. When he is caught, the law is not leniently applied and it is generally regarded as serving him right.

IN all cases these pirates have to face punishment sooner or later. Those who are caught receive theirs more heavily than those who escape. Those who escape, like the pirate of the storybook, who could not settle down and enjoy the fruits of his piracy because of an uneasy conscience, suffer in the fact that because of their actions the quality of the programmes is poorer than it would otherwise be.

UNFORTUNATELY, the just suffer in this regard equally with the unjust and, therefore, all pirates should be discouraged as all are a menace to the community.

The Experimenters' Corner

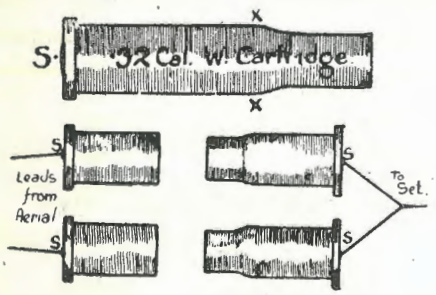
BELOW are published practical suggestions for a collapsible wireless antenna, a molybdenite detector and a series-parallel switch. These have been received from readers of "Radio" who have constructed the various apparatus and, as they have been tried out under actual conditions they should prove of considerable worth to other experimenters.

IN order, then, to encourage readers to let their fellow-experimenters benefit by the knowledge they have gained through investigation, it has been decided to award, each issue, a prize of £1/1/- to the author of the best suggestion received, providing that there are no less than three entries. In the case of no entries being received, or it be considered that none is worthy of the prize, this will be held over until the next issue, when the prize will be doubled.

IN all cases the Editor's decision will be final.

A NOVEL ANTENNA.

THE suggestion which has been awarded the first prize for this issue is a particularly happy one and has emanated from a Boothulla (Q.) reader, who, evidently from a sense of modesty, desires to remain anonymous. The idea submitted embraces details for constructing a portable and "collapsible" antenna and, as will be seen from the accompanying

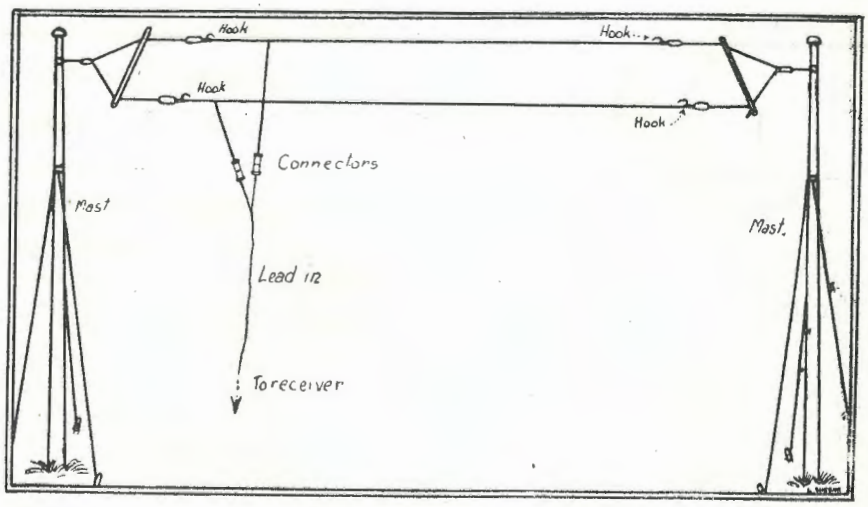


diagrams, it is a particularly novel one, especially when one considers the time saved in its erection and dismantling—a handy feature in these days of country and seaside listening-in.

The connections consist of four .32 cal. Winchester rifle cartridge shells. Two are cut down at the point X and the other two then fit in. The aerial lead-in wires are soldered to the primer pocket S.

Insulators should be of the type that have a small ring attached at either end.

A small hook is bound or soldered on to each end of the aerial wires themselves and the hook is then slipped into the ring on each insulator.



With such arrangements as these described above the work of erection or dismantling should prove but a matter of minutes instead of that of hours. Of course, it should be understood that, although aerial poles appear in the diagram, these are not necessary, and in the case where none are available their place can be taken by a suitable tree or other support.

A SIMPLE AND EFFICIENT SERIES PARALLEL SWITCH.

ANOTHER mounts his switch on a piece of panel bakelite about 4 by 1½ inches. In the centre is a brass bush (5) held by a lock-nut and projecting about ½in. behind the panel, so as to make contact with two blades of hard brass (A, B, Fig. 2). These are held in place by terminals 2 and 3, and partly cover hole in bush as at C, Fig. 2. Two more blades, D and E, similarly held by terminals 1 and 4, are bent as shown in Fig. 2 to clear the blades A and B, near C, by about

⅛in. Fig. 3 shows shape of blades A and B. Fig. 4, blades D and E, as at back of panel.

From Fig. 2 it will be seen that when the plug "P," which is made of insulating material, e.g., end of bone knitting needle, is *out,* terminals 2 *and* 3 *are connected,* while 1 *and* 4 *are not in use.*

When plug "P" is *in,* terminals 1 *and* 2 *are connected* but *insulated by the plug from* 3 *and* 4, which are *also* connected.

Now to follow the diagram:—

Assuming the switch is connected to aerial, variable condenser "VC," tuning coil "TC," earth "E," as shown in diagram Fig. 1—if plug is *out,* condenser and coil are in series; if plug is *in,* condenser and coil are in parallel.

If preferred, terminals may be placed at back of panel for use with concealed wiring.

Fig.1.

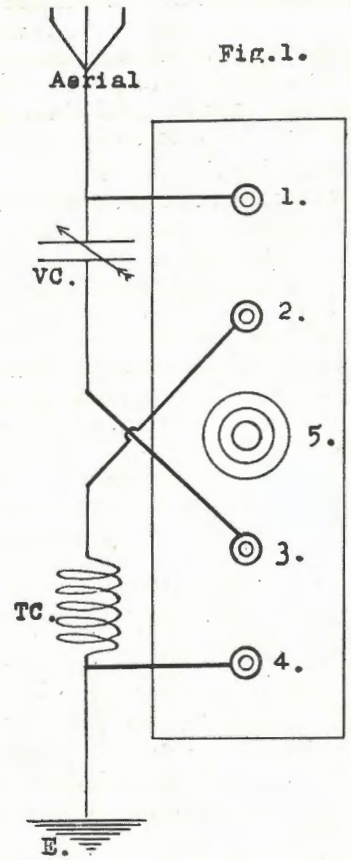


Fig.2.

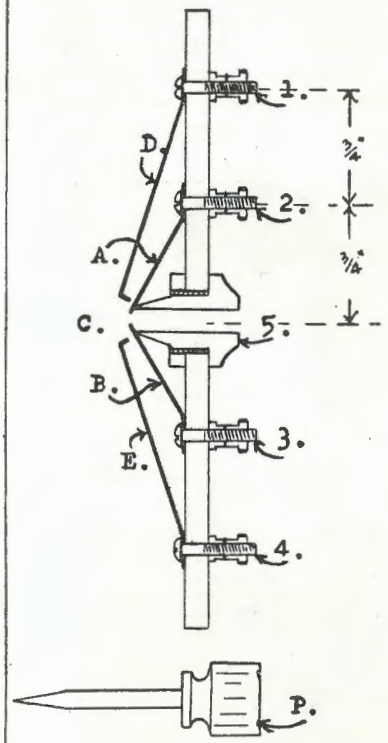
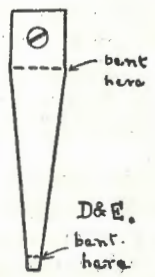


Fig.3.

Fig.4.



used in conjunction with a series parallel switch.

The good points in this series-parallel switch are:—1, simplicity of construction;; 2, snap action; 3, small panel space; 4, low capacity (suitable for low-loss tuner); 5, neat appearance, and 6, cost: four terminals, one bush (brass) and some spring brass for the blades. N.B.—Most of the above points are not found in the usual type of D.P.D.T. switch.

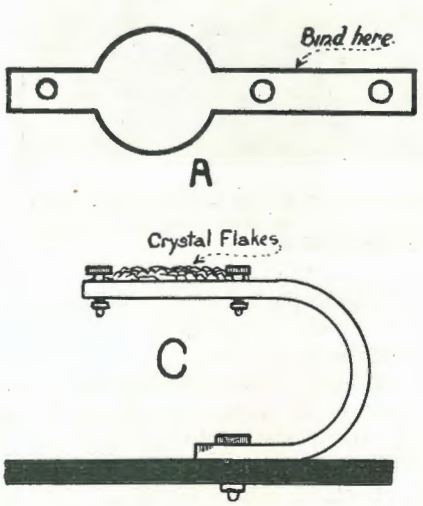
MOUNTING MOLYBDENITE.

MR. HERBERT R. HUTCHENSON, of 11 Brightmore Street, Neutral Bay, Sydney, has forwarded an idea for the suitable mounting of molybdenite crystal. He has found that special mounting facilities were necessary on account of the softness of the mineral.

For mounting molybdenite in the manner described, 1/16 inch sheet brass is required.

A and B illustrate the form in which two sections of the brass should be cut out, while the holes allow for the passing through of nuts. A is then bent at the point indicated and screwed to the base of the set. A portion of the detector mineral is then placed on top and B screwed over this. The whole is enclosed in the usual dust-proof glass tube.

Mr. Hutchenson finds that the advantage of this type of detector mounting is that it gives a good,



Some amateurs may not know that a much wider range is obtainable with any individual coil and condenser if springy contact when a solid silver point is attached to the contact bar instead of the usual cat-whisker.

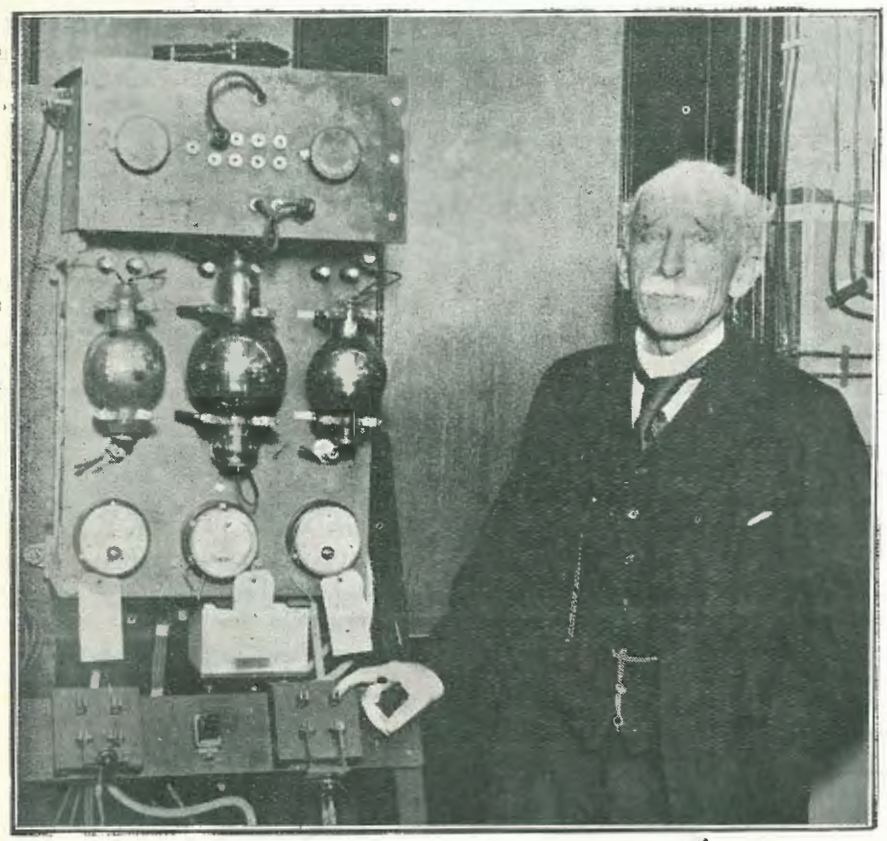
DX Notes—and Other Things

By C. D. Maclurcan.

AT last—and about time, too—New South Wales has silenced the merry "Ha! Ha!" by working U.S.A. and England.

It started with 2CM working 9EKY and 6AHP, then 2DS worked 6CGO. Next 2DS worked English 2OD, and was followed by 2CM also working 2OD.

Talking of power, this is interesting, chaps. One night recently, when 2CM was QSO, U.S.A., using a 250-watt Radiotron with about 400 watts input (maximum power), a test was tried reducing the input. The time was about 5.30 p.m., wanting still about an hour and a half to darkness. When the power was reduced to about half (200 watts) my man (6CGO) reported a marked improvement in signal strength, and a much better note.



Dr. J. A. Fleming, Professor of Electrical Engineering at the University College of London, 1885 to date, and the inventor of the original Thermionic valve that made Radio broadcasting possible.

Since then 6CGO has been worked on a 10 watt set, all U.S.A. (except third district), and three Englishmen. Next stop, North Pole.

After this orgy of DX working 2CM is done to a frazzle and is giving radio a spell for a couple of months.

2DS has installed a 50-watt Radiotron, and will work with this until his replacement 250-watt Phillip's tube arrives. It was with the 50-watter that 2DS worked 2OD.

On reducing to minimum power (approx. 70 watts) he reported signals about the same strength as on 200 watts, and the note very good. In short, it comes to this. If you crowd your bottle (this is nothing to do with prohibition) your note gets bad and signals fall off in strength. 2CM will therefore work in future on half power. After this test I'm quite convinced that a 50-watter is all that is required for working Mars, and when we get down to still lower wavelengths, p'raps the good old V24 will come into its own again.

Regarding that power leak at 2CM. It was located alright, but alas! it is quite another matter to remove it. The City Council have been very obliging in carrying out any suggested tests, and on one occasion we thought we had definitely found the remedy. It was arranged that the Council were to cut out the suspected transformer at 10 p.m., and connect it up again at 8 a.m. next morning. Exactly at 10.3 p.m. the noise stopped in 2CM's receivers — great joy and popping of corks! Next morning Mrs. 2CM kept watch, and, according to the log, the QRM commenced again at about 9 a.m. Our joy was replaced with gnashing of finger nails when we found out that the transformer was not re-connected till 3 p.m. that day. A gum drop to the one who can find the remedy for this trouble; in fact, two gum drops, because 2DS now has something of the same sort out his way.

Say, can you beat those Victorians? They are not satisfied with altering our wireless history, but now they want to alter the English language. Listen to this, folks. It comes from page 12 of the *Melbourne Experimental Radio and Broadcast News*—in the "Owl's DX Notes." Who can translate it? Perhaps its Gum Arabic.

> "G2NM is louder than a number of Australian inter-State hours after dawn, and the signals CMFWYPETAOI were quite loud then."

I've met several inter-State hours after dawn lately, but they did not use words like that; at least, N.S.W. hours don't. They have had better home training. Maybe Cox thought of this word when that howling valve held him up from working Timbuck-three.

At the last general meeting of the Wireless Institute (N.S.W. Division) a very interesting film was shown, illustrating the action of the valve.

Two more films (one a comedy) followed. It was certainly a very entertaining evening. Mr. Renshaw, when addressing the meeting, remarked that the Council were endeavouring to make the meetings more attractive, and it was hoped that in future still more enjoyable nights would be arranged.

Well, why not let us have a nigger minstrel show (being a wireless society) something like this:—

"The Wireless Wigglers," or "Why Willie Wouldn't Wobble."

Curtain rises showing members of the Council sitting round in crescent formation. At the extreme right is Brudder Bones Crocker (2BB) and Harry Ha! Ha! Stowe. On the left is Pierrot Perrett and Basilrazzle Cooke (tambourines).

In the centre is President 2CM (don't you CM) disguised as the famous character from Scott's Emulsion's "All skin and no juice." Then comes Secretary Phil Renshaw looking very philosophical—oh, horrid—and Maxwellton Braes Cutts, 2JM and Syd. Colville—all dressed in pink tights and fluffies.

Brudder Bones Crocker: "Say, Brudder Cookie, can you tell me how fur it is fum a cat's head to a cat's tail?"

Brudder Cookie, F.R.A.S.: "No, I can't tell you how fur it is fum a cat's head to a cat's tail. How fur is it?"

Brudder B.C.: "Why, yo silly nigger, it's fur all the way."

Chorus: "Dit-dit-da-da-dit-dit."

Sister Cutts (with sudden rush of brains to face): "But 'sposin' he ain't got no tail, sposin' he's a Manxwell cat wot den, Brudder B.B.?"

B.B.C.: "Well, den it ain't half so fur!"

Chorus: "Dit-dit," etc., etc.

But enough of this frivolity, and back to—other things.

Our good friend, Miss Wallace, has returned from America. She did not see the President, but went very close to it—she actually talked with Victor Hugo Gernsback. Just before she departed she was presented with one of those little sparkling bands that go round the third finger of the left hand. Though little, it meant a lot—at least so friend Mackenzie told her.

2GR is about to forsake his old love on 240 metres and try lower down. He is now busy with the erection of a new aerial of rather startling design. 2GR has done some remarkable distances, for low power telephony. One report says good reception at Port Morseby way up in New Guinea.

2BB reports working A3NE. Says his note was very good, though a bit unstable. A3EM and 3TM have also been received on the lower wavelengths, though not very strongly.

This last week (at time of writing) has been very bad for DX work. Several hams are wondering where the Yanks have gone to.

It seems to me that the wonderful DX work recently accomplished is developing on altogether wrong lines. I have lately listened to several stations (N.Z. please note) working U.S.A., and the one desire appears to be to simply run up a score of stations worked. One chap I heard called CQU raised a 6, said "Ur sigs FB, NM hr nw gb" and immediately called CQ again.

This is no good, fellows; you won't learn anything in this way. I'd much sooner hold my man for an hour and carry out some genuine experiments with him than crowd in ten of the "FB QSA NM nw gb" kind.

2BK is almost ready to split holes in the "all-surrounding" with his new 50-watt bank account reducer. Only needs a big condenser or two to clear its throat.

2YI also has the same tendency. I believe he has a young power house motor generator many yards long, and daily expects to increase his electricity bill.

2YG has got going with a 250-watter—well going, too, judging by a report that I have just read. He has succeeded in working G2OD and U5WD. Many congratulations! That makes the third N.S.W. Ham to work both U.S.A. and England.

2LO has been off the air for a long time, though he tells me that he has had several reports of his signals during that time. This means that someone has been using his call. He is entirely re-designing his station, and will soon come on the air with a big bottle on a low wave-length.

2CM will be off the air for a couple of months till the end of February—the usual exodus to the seaside. It will probably be some job to catch up with events that are bound to take place with all these super-ham stations on the air.

Has anyone had the same trouble that I get with their electrolytic abominations? After the cells have been made up and used for about three weeks a white deposit creeps up above the liquid, climbs the electrodes and escapes down the side of the jar. A marshmallow to anyone who can suggest a remedy.

2OI is a new one on the air. I heard him for the first time last night calling U.S.A. He has, I think, the finest note I've ever heard, and he should have no difficulty in raising U.S.A.

2AL is down on the low waves also, with a very rough 50 cycle note.

2GQ, Armidale, has come up wonderfully in strength since I last heard him. Unfortunately, he has anchored among the Yanks—I hope he drags his anchor.

2RJ, Mandurama, continues to put out fine signals on 'phone, good modulation, too, considering the QRM he must get from all the little Jumbucks, jumbucking around. Here's one for you, 2RJ; put it over the air:—

THE SHEARER'S LAMENT.

You smell to me, you darned old smelling ewe,
Exactly as these other woollies do.
I can't detect the slightest little dif.
Between you and the others—sniff for sniff
You sheep are all the same.
Yet some fool lamb, whose judgment in my world ain't worth a dam,
Can tell you in the dark from all the others
In this big bunch of newly-barbered mothers.
It isn't that I care about your smell,
Of that it would enlighten me to tell
One sheep from all the rest in this big herd;
But, man to sheep, I give my honest word,
It gravels me to know that in one way,
In what is christened this enlightened day,
Your silly lamb—as anyone can see—
Is that much more intelligent than me.

Had a crack with 3TM last night. His sigs were at times very strong and tone good, but sometimes faded badly.

3BM comes in well on the low wave, though not very strong. Note like the gay locust.

Heard 3JU again last night. First time for many moons. He is on low waves, signals good strength, though a bit rough; and Ross, me boy, you

(*Continued on page* 673.)

"This Wireless"

By G.J.W.

"IT'S wonderful!"—at least, so everybody who has the opportunity to listen-in to a broadcasted programme says, but to the expert who has reduced this phenomenon to commonplace mathematics, the wonder of wireless easily takes second place to the marvellous grip which wireless has taken of the public mind.

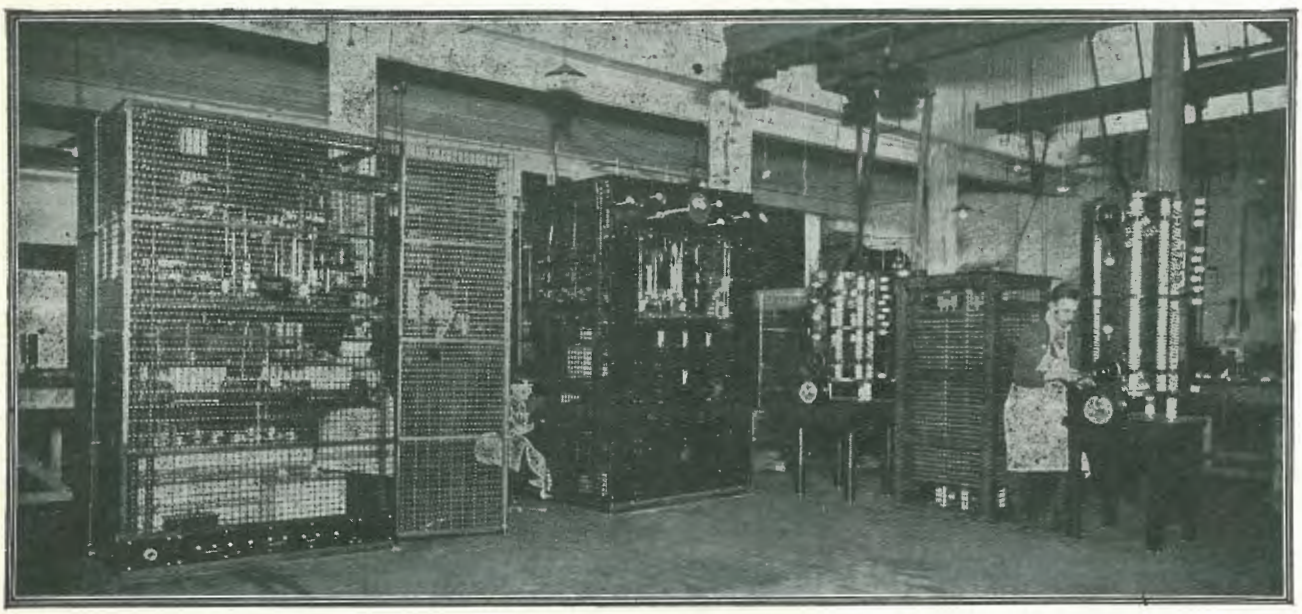
One of the wonders of wireless is the marvellous fascination compelled from everyone who comes into contact with it. Young and old, male and female, all fall victims to its wiles. Without entering into psycho-analysis or physiology of any other "ology," the fascination of wireless is due to the same cause as that in the case of the recalcitrant donkey and the carrots. There is always something ahead—just out of reach. Yet achievement is so constant that there is always hope that the "out of reach" can be obtained by just a little more effort.

And this is true of all the devotees of wireless. The schoolboy whose activity enables him to climb to the top of a neighbouring tree to swing his aerial, gets some more or less successful result with his crystal, but is always absolutely convinced that his results would be immeasurably improved by single valve amplification. Next to the schoolboy comes Mr. Suburbia, with his delicately swung aerial from the chimney-pot to the clothes post in the yard. He may be the proud possessor of a two-valve set which gives him very excellent results from the local broadcasting station, and enables him to entertain his neighbours occasionally. What odds a few interruptions—such as howling valves or a noisy bunch of statics. His learned discourse on "capacity" and "inductance" and his positive assurance that this temporary set on which "we are listening" will be replaced by a three-valve set, as soon as possible, carries conviction to the visitors.

And so on: The operator at the wireless telegraph station, to whom wirelss is a business, is not exempt from the attraction of the "carrots." Statics or bad operating may conquer for a time, but he is convinced that "if"—etc.—he could do a hundred times better.

Finally, there is the professional wireless engineer, who, through patient and laborious effort, has evolved the apparatus which to-day provides communication under conditions which no other known method of communication can meet. He has just that little, tiny obstacle, the mounting of which will, he hopes, achieve perfect success. But alas, he only finds that, after that bridge is crossed, there is yet another tiny little obstacle just so far in front.

The development of wireless in the past twelve or fourteen years has been immense. One wonders at the feats of the wireless operators with the apparatus then available, yet some tremendous successes were recorded—such as successful communication over thousands of miles, with a crystal detector, and a three to five horse power spark transmitter. To-day communication has been effected half-way round the world, which is the greatest distance possible on this sphere, with the expenditure of less than 1/10th of a horse power. Still more marvellous is the spread in the use of wireless: for many years it was considered that its only sphere of usefulness was telegraphic communication between ship and ship, or between ship and shore—that is, where either or both



A 5Kw. Broadcasting Set in course of construction.

of the communicating points moved relatively to the other. To-day it is rapidly becoming so essential that soon no home will be complete without wireless.

One convincing experience based on years of daily association is that it is utterly beyond the capacity of the human mind at the present time to suggest the ultimate end of wireless development. The transmission of power by ether waves is almost sure to be an early development. Illumination of houses and streets is by no means remote, and electric motors in factories, energised by radio transmission, is not far ahead of us to-day, as we are ahead of the wireless of ten years ago. The problem of wave-lengths is being solved, and it is now possible for a station to receive two waves of practically similar frequency, and separate them after reception--thus the threatened limitation of wireless communication through overlapping wave-lengths is being mastered. Slowly but surely the difficulties are being surmounted, but, as with the fabled donkey, the "carrots" will always be just out of reach.

DX

7AA, the well-known Hobart experimenter, has again been making a name for himself in DX work. Recently he conducted a series of remarkable DX experiments on short waves, in the course of which he succeeded in getting into touch with 94 American transmitters within the space of 3¾ hours.

All the stations were carefully copied in 7AA's log, so that there was no possibility of an error having occurred. Most of the stations were situated in U.S.A. territory, but two Canadian and two Mexican stations were also heard.

The complete list is as follows:—
1KC, 1LW, 1AAC, 1KJ, 1ARE, 1HL, 1AYU, 1CMP, 1PL, 2AAV, 2BZR, 2CVU, 2BRD, 3AB, 3CHG, 3GM, 3AU, 3AUV, 3CHG, 4OA, 4TJ, 4FG, 4BQ, 4FS, 4SB, 5UK, 5AMW, 5AHD, 5ALR, 5CN, 5OD, 5QY, 5UX, 5NW, 5IN, 5RHL, 5RH, 5ZL, 5AFU, 6AKW, 6ZP, 6AWT, 6ADT, 6LJ, 6BLW, 6TRJ, 6CGO, 6ARB, 6BON, 6KA, 6TJ, 6BWN, 6CTO, 6AJI, 6OI, 6BJX, 6GT, 6VC, 6AHP, 6AO, 6CGW, 6AME, 6PD, 6SLO, 6CN, 6GG, 7RZ, 7AR, 7PM, 7AFN, 7ZZ, 7BJE, 7LN, 7JQ, 8BU, 8TU, 8CYI, 8XAV, 8DGP, 8NG, 8CY, 8CK, 8BAU, 8CYI, 9BFG, 9AL, 9HK, 9CJC, 9EFZ, 9DQU, 9DQ, 9HT, MBX, NKF.

The station NKF announced that it would shortly commence a series of tests with the oscillating crystal. As this will mark a new departure in wireless development, Australian experimenters should get to work and see what they can do in the way of reception.—(Ed. *Radio.*)

GET signals first and then experiment to improve your set.

IF you expect to put in a sending set, be prepared to pass a Government examination before a license is granted you.

Crystal Versus Valve

WHILE we are firm believers in the good qualities of the crystal detector when used with radio frequency amplification, we do not want it understood the crystal is better than a valve detector without amplification. One of our readers wrote in and asked if he should replace his valve detector with a crystal on his one-valve single circuit regenerative set.

Where two or three stages of radio frequency amplification are used, you will get better tone quality and reproduction of signals with a good crystal detector than with a valve. In cities where there is a large broadcasting station, a crystal detector is better than a valve and with a stage or two of audio, loud-speaker operation is practical, but where the station is out of your city, it usually requires radio frequency amplification to build the signal up enough to properly work the crystal.

Another thing in favour of a good crystal detector is it does not require any upkeep as does the valve. The valve costs twice as much as a good crystal, you also have to buy A and B batteries for it, or, if you have radio frequency amplification, the batteries will run down so much sooner when using a valve detector and must be renewed from time to time. A crystal lasts as long as the average valve, in fact, if the crystal is kept clean and free from dust, there is no reason why it will not last indefinitely. You hear a lot about strong signals killing a crystal but from our personal experience, a crystal does not "die," even though strong static shocks paralyse it.

It is claimed the adjustable type of crystal detector is best, but we have found that while it is more sensitive than the fixed type, it requires constant adjustment and sometimes must be adjusted in the middle of a good programme. It is better to have one not quite as sensitive and one not requiring adjustment. Radio frequency amplification will make up for the difference.

A crystal detector without amplification should only be used on local stations. At times, you may be able to hear stations several hundred miles distant on a crystal detector, but for night in and out you will only get locals.

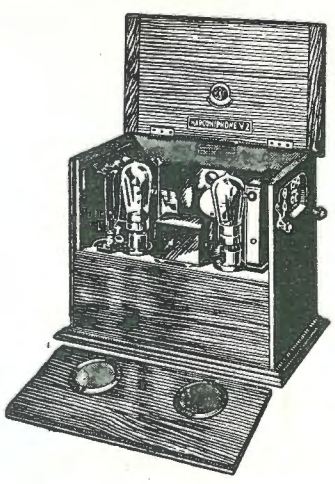
If you desire to copy out-of-town stations and use a crystal detector, you will require radio frequency amplification with the detector. One stage will give you a fairly good range but two stages will be much better. The latter will pick up stations between 500 and 1500 miles distant on average cool nights. For the operation of a loud-speaker, it will be necessary to add two stages of audio on out-of-town stations. Loud-speakers have been operated on just the detector and on one stage of audio but conditions have been ideal and this occurred when stations came piling in.

The Marconiphone

AN English broadcasting receiver which is now being placed on the Australian market is the Marconiphone, manufactured by the Marconi Company of England.

These sets are noted for their volume, quality of tone and range, and introduce many features distinctly unique in wireless receivers. An efficient system of double tuning is employed by means of "tuning-spades," which ensures the freedom from outside interference. The circuit employed is of the reflex type, with a modified system of reaction.

The Marconiphone is exceptionally simple of adjustment, the necessary controls having been reduced to the minimum consistent with fine tuning, stability of adjustment, and efficiency. It is thus possible for those who possess no technical knowledge whatever to work the



instrument with perfect confidence.

By means of the interchangeable range blocks and regenerator units, broadcasting from Australian stations may be received on wavelengths from 250 to 1750 metres.

A system of non-interchangeable and non-reversible plugs and sockets prevents the possibility of connections being made incorrectly.

The two-valve set can be used with headphones, or when near a broadcasting station it is sufficiently powerful to operate a loud speaker. Should the distance from the broadcasting station be considerable, loud speaker volume can be had by the addition of the Marconiphone two-stage voice amplifier.

The sets are being demonstrated daily at the showrooms of Amalgamated Wireless (A/sia), Limited, and their novel features appeal to all who see and hear them.

Wireless Telegraphy Abbreviations

Abbreviation.	Question.	Answer or Advice.
P R B	Do you wish to communicate with my station by means of International Signal Code?	I wish to communicate with your station by means of the International Signal Code.
Q R A	What is the name of your station?	This station is ———.
Q R B	How far are you from my station?	The distance between our stations is ———nautical miles.
Q R C	What are your true bearings?	My true bearings are ———degrees.
Q R D	Where are you bound?	I am bound for ———.
Q R F	Where are you coming from?	I am coming from ———.
Q R G	To what company or line of navigation do you belong?	I belong to ———.
Q R H	What is your wave-length?	My wave-length is ——— metres.
Q R J	How many words have you to transmit?	I have ——— words to transmit.
Q R K	How are you receiving?	I am receiving well.
Q R L	Are you receiving badly? Shall I transmit . . . — . 20 times for you to adjust your apparatus?	I am receiving badly. Transmit . . . — . 20 times for me.
Q R M	Are you being interfered with?	I am being interfered with.
Q R N	Are the atmospherics very strong?	The atmospherics are very strong.
Q R O	Shall I increase my power?	Increase your power.
Q R P	Shall I decrease my power?	Decrease your power.
Q R Q	Shall I transmit faster?	Transmit faster.
Q R S	Shall I transmit slower?	Transmit slower.
Q R T	Shall I stop transmitting?	Stop transmitting.
Q R U	Have you anything for me?	I have nothing for you.
Q R V	Are you ready?	I am ready. All is in order.
Q R W	Are you busy?	I am busy with another station (or with ———). Please do not interrupt.
Q R X	Shall I stand by?	Stand by. I will call you at ——— o'clock (or when required).
Q R Y	What is my turn?	Your turn is No. ———.
Q R Z	Are my signals weak?	Your signals are weak.
Q S A	Are my signals strong?	Your signals are strong.
Q S B	Is my tone bad? / Is my spark bad?	The tone is bad. / The spark is bad.
Q S C	Is my spacing bad?	Your spacing is bad.
Q S D	Let us compare watches. My time is ——. What is your time?	The time is ———.
Q S F	Are the radiotelegrams to be transmitted alternately or in series?	The radiotelegrams are to be transmitted alternately.
Q S G	———	The transmission will be in series of 5 radiotelegrams.
Q S H	———	The transmission will be in series of 10 radiotelegrams.
Q S J	What is the rate per word to ——?	The rate per word is ———.
Q S K	Is the last radiotelegram cancelled?	The last radiotelegram is cancelled.
Q S L	Have you got the receipt?	Please give a receipt.
Q S M	What is your true course?	My true course is ——— degrees.
Q S N	Are you communicating with land?	I am not communicating with land.
Q S O	Are you in communication with another station (or with ——)?	I am in communication with ——— (through the medium of ———).
Q S P	Shall I signal to ——that you are calling him?	Inform ———that I am calling him.
Q S Q	Am I being called by ——?	You are being called by ———.
Q S R	Will you despatch the radiotelegram?	I will forward the radiotelegram.
Q S T	Have you received a general call?	I have received a general call for all stations.
Q S U	Please call me when you have finished (or at —— o'clock)?	I will call you when I have finished.
Q S V	Is public correspondence engaged?	Public correspondence is engaged. Please do not interrupt.
Q S W	Must I increase the frequency of my spark?	Increase the frequency of your spark.
Q S X	Must I diminish the frequency of my spark?	Diminish the frequency of your spark.
Q S Y	Shall I transmit with a wave-length of —— metres?	Let us transfer to the wave length of ——— metres.
Q S Z	———	Transmit each word twice. I have difficulty in receiving your signals.
Q T A	———	Transmit each radiotelegram twice. I have difficulty in receiving your signals; or, Repeat the radiotelegram you have just sent. Reception doubtful.
Q T C	Have you any traffic to transmit to me?	I have traffic to transmit to you.

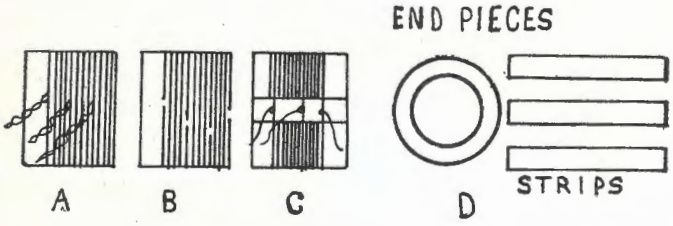
In addition to these signals, which, it will be observed, are uniform in construction, the following signals of the International Telegraph Code may be used in these communications:

. . — — . . Repeat sign (as well as mark of interrogation).
. . . — . Understood.
. — . . . Wait.

Coil Winding

A GREAT many of the coils used in radio sets are far from being of the low loss type, some of those you buy being very poor from a high frequency viewpoint. You can do much better by building your own coils in most cases.

A good cardboard tube makes a very good form for winding coils on, and can easily be procured. It may be waterproofed by dipping it in hot paraffin. If the coil is to be tapped, it may be done in any of the following ways: The taps may be taken off in the easiest manner by winding on a certain number of turns, and the wire twisted together at that point so as to make a 5 or 6 inch loop, and a certain number of turns again wound on the tube, and the next tap made in a similar manner. Or, you can make a neater looking job by winding on a certain number of turns before making a tap, and then allow six inches for a tap; push a hole in the tube, and push the wire through it; push another hole in the tube about a quarter inch from the other, and close to the last turn of wire, and allow six inches for a tap and join the two six inch ends together on the inside of the tube. Another good-looking job is done by using the same size cardboard form and using a half inch hard rubber strip. Wind ten turns on the tube, and on the tenth turn slip the hard rubber strip under that turn; the 11th to 19th turns are wound on the tube as before, and the 20th turn wound over the rubber strip and so on until the coil is wound. The rubber strip is used as a base so the taps may be soldered to turns on top of the strip. The insulation is removed from the turns, where they pass over the strip and leads soldered to them to be run to switch points.



The various ways of making taps are shown in drawings A, B and C. In the first, insulation should be removed where the taps are twisted near the cardboard tube, and also on the ends so they may be soldered to the switch contacts. In the second method if the insulation is removed near the coil after the taps have been passed through, it will only be necessary to carry one wire through the inside of the tube. A neat way would be to solder the two wires together where they pass through the tube, and use a flexible wire connection for the tap. The quickest way of the three is that of A.

A better form than solid cardboard, hard rubber or composition is that of a skeleton form shown in the drawings at D. This should consist of two end rings and 6 or 8 flat strips to support the coil on. Hard rubber is a good material to use, although any other good dielectric may be used. The idea in a good coil is to use the least supports possible. If a coil can be made self-supporting, all the better, because air is a good dielectric. When coils are wound on a form, it is a good idea to separate the turns. This can be done by winding two turns on at the same time, but only using one of the turns, the other being a dummy that is discarded when the coil is wound. You can also make a good coil by using heavy insulated wire, such as double cotton covered number 22 or 24.

3AR.

THE Associated Radio Co.'s station, 3AR, has made a start in the new studio in Elizabeth Street, Melbourne, and whilst improved modulation is noticed, a drop in signal strength is apparent. However, this station intends shortly to increase its power to 2KW, when this latter defect will probably be overcome. Arrangements have been made with the Victorian Railways Commissioner for the broadcasting of interesting items of railway news every Friday evening at 8 p.m.

Various Connections for Dry Cells

IN another article we tell the voltage used and current consumed by the various valves, and here we show how the dry cells should be connected when used with the standard valves sold to-day. There are dozens of other valves sold, but complete data on them is lacking. Whichever you purchase, be guided by the instructions usually contained in the carton with the valve.

We will start out with the WD type of valve, because they will operate on one dry cell. This arrangement is shown in Figure 1. Directly under it is shown two dry cells connected in parallel, which is the most economical way with WD valves. By this is meant, tests have shown that one dry cell will last about 75 hours, and two in parallel will last more than twice as long or 175 hours. In this way you get 12½ more hours service from each dry cell, or about 16 per cent. more for your money. The arrows point to the filament circuit containing the rheostat which is connected in the negative lead.

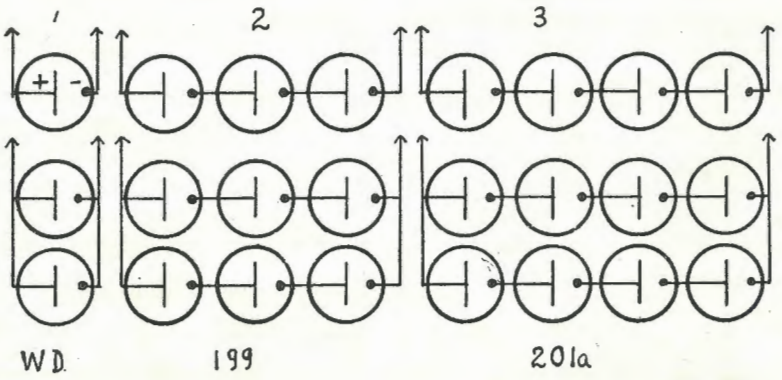


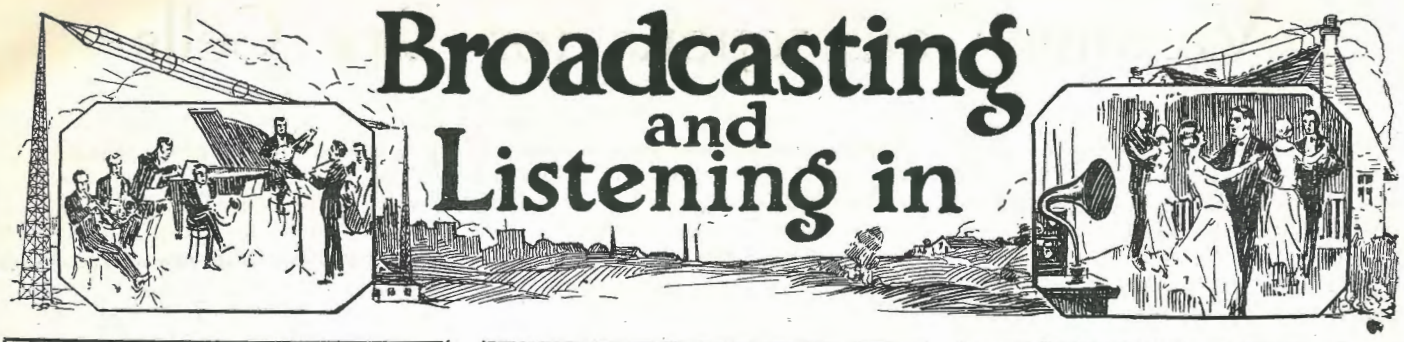
Figure 2 is that of three dry cells in series for use with UV199, C299 and DV1 valves. Three cells in series give you 4½ volts. Directly under this is shown two such groups in parallel, but there is no economy in such an arrangement when one valve is used.

Figure 3 shows 4 dry cells connected in series so as to give us 6 volts for the UV201a, C301a and DV2 valves. Directly under them is the two groups in parallel to give us the most economical discharge rate for the dry cells. The same arrangement is used for UV200 or C300 when you have not a storage battery, but they will not last long. Probably three or four nights.

If more than one valve is used in your set, you should add twice the number of dry cells for each valve. When a set uses several valves, it is economy to get a storage battery. If the WD valves are used, a single storage cell of two volts is enough. When a single storage cell is used, you will have to be careful of the rheostat and not turn it on as much as usual. In fact, the first turn of wire is sufficient, but, better still, use a 10 ohm rheostat. Or, if you do not wish to change rheostats, put a fixed resistance in series with the filament line to make up the difference.

The rheostats to use with the various valves are as follow:—WD type, 6 ohms; 199, 299 and DV1, 25 to 30 ohms; 201a, 301a and DV2, 25 to 30 ohms; while for the 200 and 300 is 6 ohms, and should be a vernier for critical filament current adjustment.

By series connection is meant the positive or centre terminal of the dry cell is connected to the negative or outer terminal of the next cell, and so on. When the groups are connected in parallel, we connect the negative of one group to the negative of the next, and the positive of the groups together. Some beginners think the cells are short circuited when that happens, as there appears to be a continuous connection of the cells, but they forget, or do not know, that when you connect the negative to negative, current does not flow, due to the law that like poles repel and unlike attract.



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.

TUESDAY 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.

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 Stndio.
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.

THE GROWTH OF WIRELESS.

(From "The Telegraph and Telephone Age," New York.)

A LITTLE over two years ago the United States had one broadcasting station. Now it has 548 stations, 3,000,000 radio receiving sets in the country, 10,000,000 listeners-in day after day and night after night, 1,000,000 directly or indirectly connected with or employed in the wireless industry, 3,000 manufacturers of radio supplies, 1,000 wholesale distributors and jobbers of radio, 25,000 dealers of wireless of all kinds, 1,000 newspapers which carry radio programmes and radio news columns, 1,000 weeklies with radio sections, 30 radio periodicals, 50 radio magazines carrying radio sections, 250 popular and technical books written on radio, seven radio trade papers circulating among jobbers and manufacturers only, 1,000,000 dollars estimated expenditure by the American public during the year 1923 for radio material of all descriptions and make by the radio amateurs, radio enthusiasts and radio fans.

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.

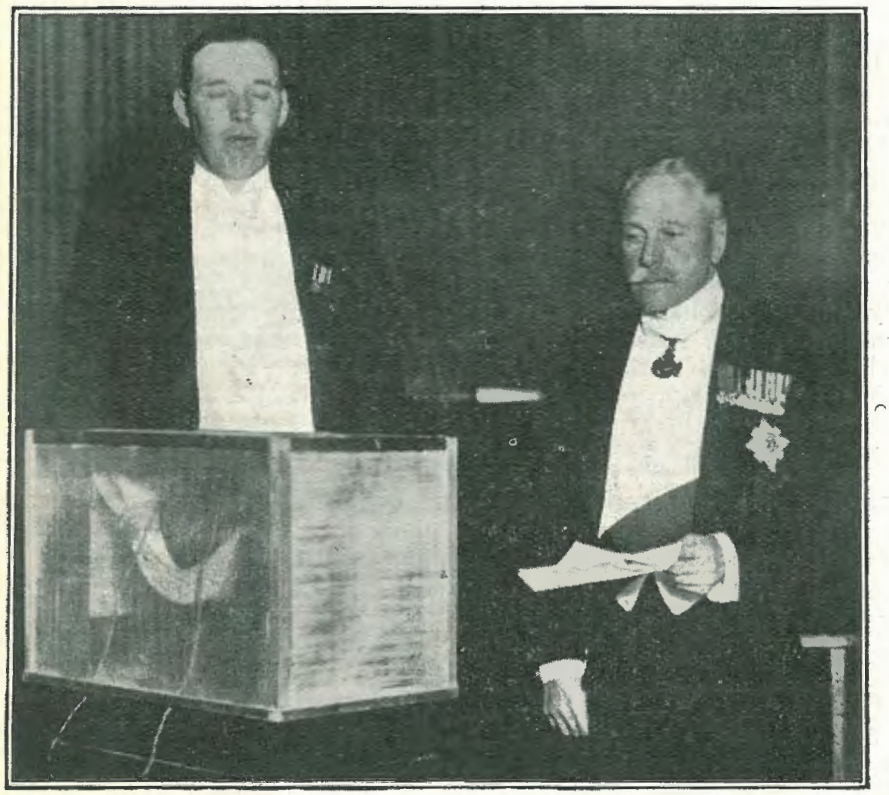
Our London Letter

(By Our Special Correspondent.)

THE WIRELESS EXHIBITIONS.

THE two recent wireless exhibitions have provided a good start for the British winter season, although the trade has really had no genuine cause for complaint this summer. The radio trade naturally expects to drop off slightly during the warmer months and longer evenings, but this summer the falling-off has not been as great as anticipated.

In spite of the bad weather, wireless sets have been used more and more outdoors this year. Probably this is in no small way caused by the introduction of dry battery valves which enable a set to be more portable than if accumulators were carried.



Earl Haig, at right, photographed at 2LO, London, during his radio broadcasted appeal to the Nation, asking English people to assist ex-soldiers who have been out of work since the Armistice.

However, the two wireless exhibitions have done good in that they have brought before the public the fact that the wireless season—the winter—is upon us and that it is now time to think of buying a wireless set to while away the long winter evenings. Attendances at the two exhibitions were, also, quite reasonably good, which shows that wireless enthusiasm has come to stay and is not —as so many of the critics prophesied —a mere passing fancy.

THE HIGH POWER STATIONS.

The high power station at Chelmsford, 5XX, which works on 25 kilowatts and has been heard all over Europe, it within a few months to be moved to another site in the Midlands. At the moment of writing, the definite spot has not been settled, and will be somewhere "between Gloucester and King's Lynn," which, of course, may be practically anywhere in the Midlands.

There is no doubt that the high-power station has been a tremendous success—from both the public and the British Broadcasting Co's. view. Its crystal range of at least a hundred miles has enabled listeners to buy crystal sets which would otherwise be out of range and obviated the necessity of investing in valve apparatus were they dependent on the ordinary local broadcasting station.

The removal of the high-power stations to the Midlands will enable a far larger number of prospective listeners to be included within the hun-

dred miles range, as the present position of the station at Chelmsford is so near the coast that a large section of the hundred miles circle consists of sea.

For this high-power station one hundred miles is by no means a generous estimate of its crystal range. Under normal conditions good reception can be obtained on a crystal at this range and audible reception can be obtained at a distance of two hundred miles or more.

LONG DISTANCE RECEPTION

Reports have reached the British Broadcasting Co. of reception of 5XX from all parts of Europe, both on crystal and valve sets, while notice has arrived of crystal reception even in Spain, a distance of about eight hundred miles. With the winter coming on, the question of long distance reception will come into prominence once more and a few of last year's long distance records are sure to be exceeded.

One of the latest reports of long distance reception in this country is the reception by an amateur at Herne Bay, Kent, England, of signals from an amateur in Australia. The signals were weak, but readable, in spite of atmospheric interference.

This is Mr. W. B. Magner, of San Pedro, Calif., who recently worked two-way radio communication with Mr. Frank Bell, of Waihemo, N.Z.

Another feat of long distance reception is the two-way signals exchanged a week or so ago between two amateurs, one in England and the other in New Zealand. These signals were carried on in Morse code, of course, but this forms a record to date for amateurs' achievements.

A distance of over 7,000 miles has also been covered by wireless amateurs in Johannesburg, South Africa, who, after several months of experimenting, have received signals from Pittsburgh, U.S.A. A five-valve set was used in this case.

These examples all point to the increased distances which are being covered by wireless amateurs all the world over and it is to be hoped that the approach of winter, and its dark evenings, will help the good work forward of spanning the world.

A Super Five-Valve Receiver

Switch and Jack Controls Permit of any Combination from One to Five Valves

Two Stages of R.F. Amplification, Detector and Two Stages of L.F. Amplification

THIS unique receiver is a combination of nine circuits. It consists of a one-valve detector circuit;; detector and one stage of A.F. amplification; detector and two stages of A.F. amplification; one stage of R.F. amplification and detector; two stages of R.F. amplification and detector; one stage of R.F. amplification, detector and one stage of A.F. amplification; one stage of R.F. amplification, detector and two stages of A.F. amplification; two stages of R.F. amplification, detector and one stage of A.F. amplification; two stages of R.F. amplification, detector and two stages of A.F. amplification.

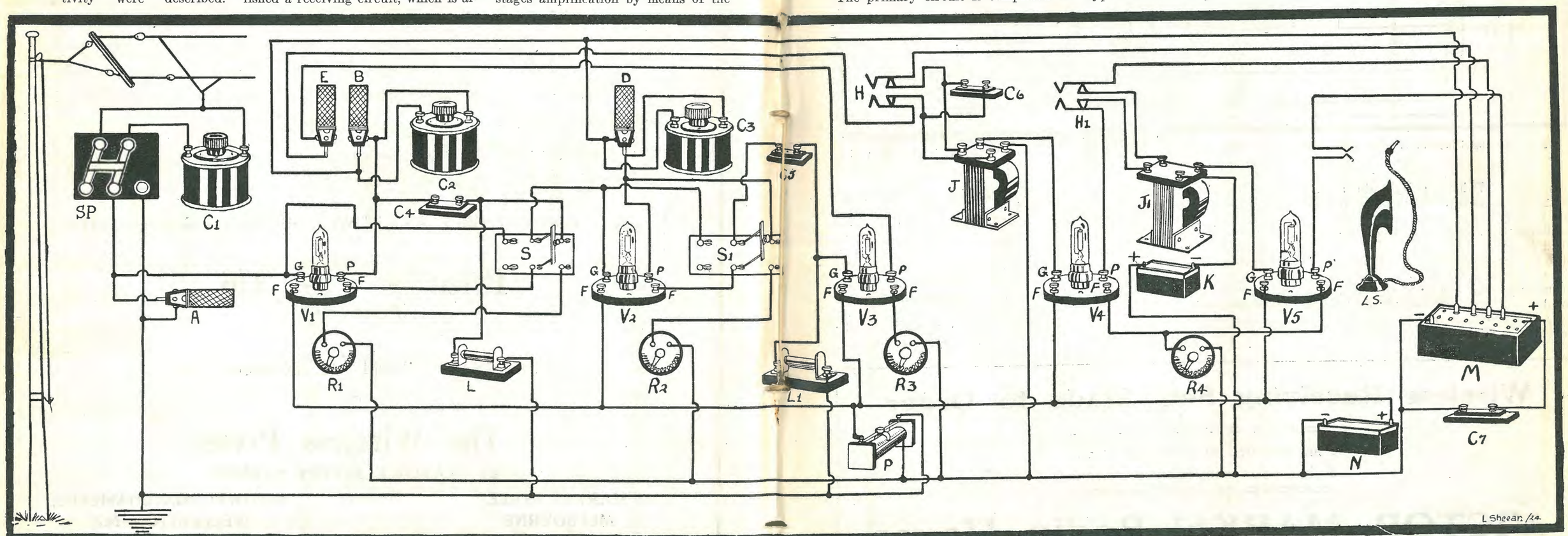
IN previous issues two receiver circuits which have become famous for their high efficiency and selectivity were described. The steady advance of wireless telephony has, however, brought with it quite a multiplicity of circuits and principles, but herewith is published a receiving circuit, which is already practically a standard for broadcast reception and general receiving purposes.

It employs in the high frequency stages amplification by means of the "Tuned Anode Method," which consists of connecting into the plate circuit of each valve a tuned circuit comprising an inductance shunted by a tuning condenser.

Tuned anode amplification is the invention of Dr. Alexanderson, of the Radio Corporation of America, and is covered by Commonwealth Letters Patent No. 18404/20. It is particularly applicable to amplification on wave-lengths between 200 and 2000 metres, and is useful in even shorter waves. For wave-lengths greater than 2000 metres, it is usually replaced by partially tuned or resistance-capacity coupling methods which give easier manipulation.

Before describing the principle of tuned anode amplification, we will refer to the circuit diagram, Fig. 1. The primary circuit is comprised of a single coil, which may be of the honeycomb or some other approved type, and a tuning condenser connected to a suitable switch by means of which they may be connected either in series or in parallel in the aerial circuit. This, of course, is very convenient, since a maximum band of wave-lengths can be covered with a minimum number of inductance coils. Connected directly across the aerial inductance coil is the grid and filament of the first valve, the latter through a potentiometer, the use of which is described later. Between the positive terminal of the high tension battery and the plate of the valve is joined the tuned anode element consisting of an inductance and variable condenser. With the plate circuit is associated a two-pole two-way switch of the anti-capacity type which when placed in the left-hand position, cuts out of circuit the first valve and connects the second valve direct to the aerial inductance. When it is placed in the right hand position, however, it connects the grid circuit of the second valve to the plate of the first through a suitable grid stopping condenser which is provided with a resistance leak to the negative pole of the filament battery in the usual way. In this position of the switch, the first valve acts as a detector and amplifier of the high frequency oscillations induced in the aerial and passes them over to the second valve for further amplification.

To obtain efficient amplification, the difference of potential set up across the tuned circuit connected to the plate of valve 1, and, therefore, between the grid and filament of



Pictorial diagram of the Five-valve Receiver herewith described. Details of component parts are as follow:—SP, Series-parallel Switch; C1, Aerial Tuning Condenser (variable .001 mfd.); A, Aerial Coil; C2, 1st Anode Condenser (variable, .0002-.0005 mfd.); B, 1st Anode Coil; C3, Second Anode Condenser (variable, .0002-.0005 mfd.); D, Second Anode Coil; E, Re-action Coil; C4, Stopping Condenser (.00025); S and S1, Switches for Radio Frequency Valves; C5, Grid Condenser (.0003 mfd.); L and L1, Grid Leaks (2 megohms); H and H1, Cut-out Jacks; C6, By-pass Condenser (.001 mfd.); J and J1, Audio Frequency Transformers; K, Grid-Bias Battery; LS, Loud-speaker; M. High Tension Battery; C7, High Tension Battery By-pass Condenser (1 to 2 mfds.); N, Low Tension Battery; R1, R2, R3, R4, Filament Resistances; P. Potentiometer (300 ohms); V1 and V2, Radio Frequency Amplifying Valves; V3, Detector Valve; V4 and V5, Audio Frequency Amplifying Valves.

valve 2, should be as high as possible. The ohmic resistance of the inductance coil in the tuned circuit is, of course, very small, as is also the current in the plate circuit of the first valve; thus, the variation of potential created across the inductance by the variation of the plate current, calculated by Ohms Law, will be very small indeed. The principle depends entirely on the phenomena of electric resonance. Without going into a mathematical proof of the principle it will be sufficient to state that when an oscillatory circuit is tuned to an applied frequency, provided the inductance and capacity is suitably proportioned, its impedance to that frequency may be made extremely high, so that, although the circuit offers very little resistance to the direct current flowing through it, a considerable difference of potential is set up across it by the high frequency passed on from the aerial. This difference becomes greater, the greater the value of inductance and the smaller the condenser capacity. The ratio of inductance to capacity is, however, limited by the range over which the circuit is required to be tuned with one value of inductance coil. The grid stopping condenser previously referred to is necessary to prevent the positive potential from the high tension battery from reaching the grid of valve 2, which, of course, would prevent the latter from functioning.

Having briefly considered the principle of tuned anode amplification, we may now return to the circuit diagram. The connections of the second valve are similar to those of the first, and with the two intervalve switches placed in their right hand positions each serves as radio frequency amplifier. The third valve, when connected to either the first or second by means of the second switch, functions as a detector. The remaining two valves act as audio frequency amplifiers, and are coupled by means of iron core transformers, the primaries of which are connected to suitable jacks, so that the telephones or loud speaker may be plugged into the plate circuit of either or of the rectifying valve as desired. Regeneration is provided between the rectifying valve and the first tuned anode circuit, although this may be introduced between the aerial or the second valve if required. The operation of the switches between the first and second and the second and third valves will facilitate the

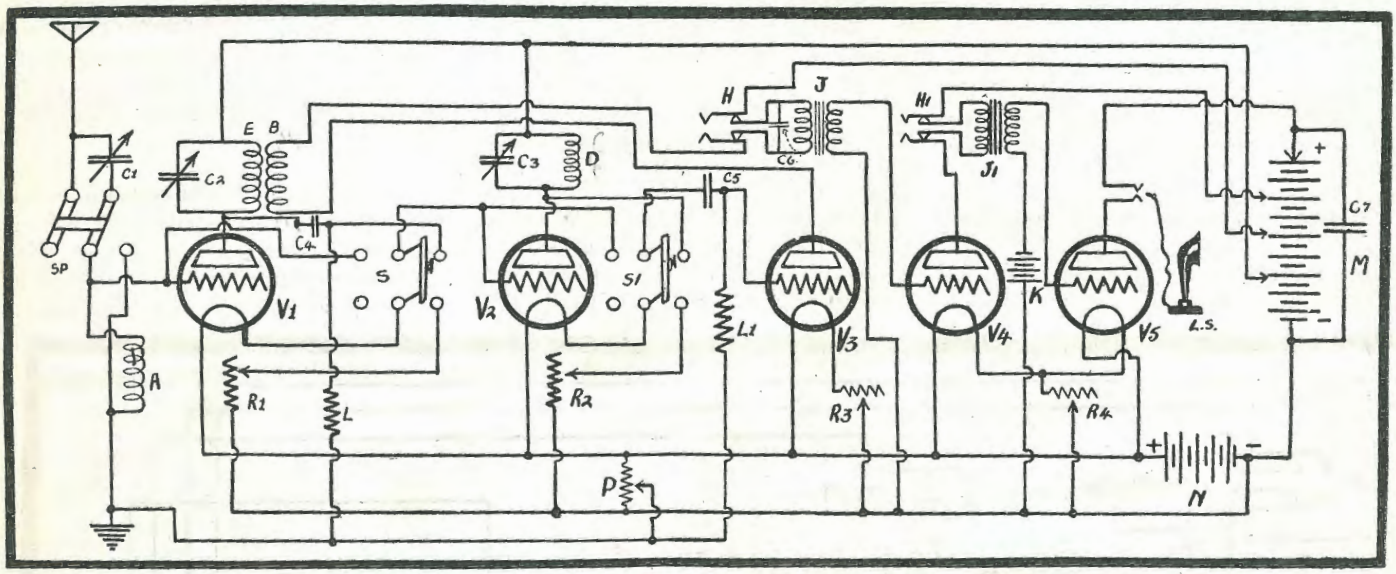


Fig. 1.—Wiring Diagram of Five-valve Receiver herewith described. The lettering in this circuit diagram is identical with that in the pictorial.

(*Continued on page* 672.)

A Super-Five Valve Receiver

(*Continued from page* 670.)

tuning of the two anode circuits. In wiring, care should be taken to make the grid leads to the switches as short as possible, and connections should be made with stiff, well-spaced wires. At first, a little difficulty may be experienced in tuning the high frequency stages, particularly when employing the first two valves, but a little experience and the use of the switches will soon enable this to be quickly accomplished with ease. It will be noticed that a potentiometer across the filament battery enables varying potentials to be applied to the grids of the first three valves. For a certain adjustment of this potential tuning becomes flattened, thus rendering the circuits easier to manipulate, although this will be accompanied by some loss in signal strength. The filament brilliancy of each radio frequency amplifying valve, and of the detector valve, is controlled by a separate filament rheostat, whilst a fourth controls the two audio frequency amplifying valves in parallel. This provision enables one or more to be switched out of service without affecting the filament supply current to the remainder. The flexibility of this circuit should appeal to every experimenter who desires a combination receiver suitable for nearby or long distance work. A table of the required aerial circuit inductance coils and condenser for various wave ranges appeared in *Radio*, No. 44.

Additional particulars of apparatus required are:—

Tuned anode condensers .0002 to .0005 mfds.

Bi-pass condenser across H.T. Battery, 1 or 2 mfds.

Grid stopping condensers, .00025 mfds.

Tuned anode coils, according to wave-length.

Grid leaks, 2 megohms.

Filament resistances, 10 ohms for bright valves, 30 ohms for .06 amp dull emitters.

BEARS LISTEN-IN.

DO bears like radio music? According to the caretaker of the lodge on the icy rim of Crater Lake, Oregon, they do when the broadcasting station announcer's work is "short and snappy."

From his isolated snow-bound position, almost a mile and a half above sea level, John Malsy, caretaker of the lodge, has written to KGO, the Pacific Coast General Electric Station. "Two wild bears come to the lodge for food," his letter reads, "and I have named them 'Hans' and 'Fritz.' To-night, after locking up my ham and bacon, I let them into my living quarters, and switched on the loudspeaker. They didn't like 'HM,' your announcer, and became nervous when he spoke. But when the Arion Trio came on they sat down and were as quiet as mice."

DX Notes and Other Things

(*Continued from page* 655.)

are right among the Yanks. Do make a noise like an egg—and beat it.

2DE has been away trapping the wily mackerel at Mackerel Beach.

2CX is building another transmitter to use 2 20-watt Phillip's tubes. One will be used as modulator and the other as oscillator. He hopes to commence the standard frequency transmissions early in the new year.

2AY has been sending out some very fine "fone" stuff lately. The modulation is as good as anything I've heard — including our broadcasting friends.

The audibility readings have been discontinued this month. 2CM is only listening on the low waves at present, and the stations down there are mostly the same half dozen each night. Later on, when new stations chirp up, I will start these measurements again.

NORTHBRIDGE RADIO CLUB.

THE usual weekly meeting was held in the club rooms at the corner of Strathallen Avenue and Sailor Bay Road, Northbridge, on Wednesday, December 10.

During the evening, Mr. Beard gave an interesting address on coils and tuning. A further phrase of coil inductance was then proceeded with, after which it was decided to construct a set of efficient coils to conform with the results obtained by the experiments with coils and tuning to date. These coils would be used for the working of the club's set, when constructed.

The idea of constructing a club receiving set a step at a time, and proving by experiment the efficiency of each component part before being installed, should result in a most efficient wireless receiver.

Intense interest has been shown in the club's activities, and the Hon. Secretary (Mr. Cameron, of Clanwilliam Street, Chatswood) would be pleased to reply to all enquiries, as new members are welcome.

QUERIES ANSWERED. COUPON.

"RADIO in Australia & New Zealand."

January 7, 1925.

Mr. H. B. Wolfe, Radiotelegraphist, Perth Radio, has been transferred to Port Moresby Radio as Officer in Charge.

Mr. L. Luscombe, Radiotelegraphist, Port Moresby Radio, has been transferred to Townsville Radio.

Mr. H. I. Moore, Radiotelegraphist, Townsville Radio, has been transferred to Sydney Radio on completion of his term of tropical service.

Mr. K. McLennan, Hobart Radio, Radiotelegraphist, has been transferred to Cooktown.

Mr. J. S. F. Slattery, Radiotelegraphist, has been transferred from Cooktown Radio to Sydney Radio on completion of his term of tropical service.

Mr. A. G. Kempling, Radiotelegraphist, Adelaide Radio, has been transferred to Hobart.

STAFF CHANGES.

Mr. M. B. Todd, has been appointed Radiotelegraphist at Darwin Radio.

Mr. J. H. Carty, ex the Marine Radio Service, has been appointed Radiotelegraphist at Darwin Radio Station.

Mr. F. Barclay, also ex the Marine Service, has being appointed Radiotelegraphist at Thursday Island Radio.

Mr. C. A. Sandell, Radio Mechanic, has been transferred from Esperance Radio to Thursday Island Radio.

Mr. R. C. Austin, Radio Mechanic, Perth Radio, has been transferred to Esperance.

Mr. C. R. Stanfield has been appointed Radio Mechanic at Port Moresby Radio.

Mr. E. C. A. Wise, Radio Mechanic, has been transferred from Port Moresby to Brisbane.

Mr. A. Harrower, Radiotelegraphist, Thursday Island Radio, has terminated services with the company.

Mr. H. W. Hedges, Radio Mechanic, Brisbane Radio, has terminated services with the company.

Mr. G. Walters, Darwin Radio, Radiotelegraphist, has been transferred to Hobart Radio on completion of his term of tropical service.

Back Numbers of "Radio"

The following interesting articles appeared in previous issues of "RADIO." Copies may be had on application to this office.

Characteristics of Valves—No. 28.

Receiving Circuit Used by Mr. A. E. Wright, Scarborough; Some Theoretical and Practical Considerations in Condenser Designs; Call Letters of Australian and New Zealand Ships—No. 29.

Valve Constants—No. 30.

Experimental C.W. Transmitters—No. 31.

Loop Aerials and Direction Finding; Valves for Every Purpose—No. 33.

Efficient Crystal Receiving Sets—No. 34.

New Wireless Regulations; Simple Circuits for Beginners—No. 35.

How to make Simple Crystal Receivers; An Efficient One-Valve Receiver; Lengthening the Life of Dry Cells—No. 36.

How to make a Loose Coupler; Two-ways to Erect an Aerial; Changing Single Circuit to Two Circuit; A Good One-Valve Amplifier—No. 37.

A Two-Valve Broadcast Receiver; How to Sensitise Galena Crystals; Wireless Terms and Definitions —No. 38.

Graphical Symbols used in Wireless Diagrams; Crystal Valve Receivers; Several Uses for your Vario-Coupler; Pig-tail Connections; Morse Code Simplified; Tools Required for Building your Set—No. 39.

Single Valve Receiver; Howl-less Regenerative Set; Special Three-Valve Receiver; Making a "B" Battery; How and When to Use Crystal Detectors; Amateur Transmitting Licenses; Jacks and Switches —No. 40.

Use of a "C" Battery in a Two-Valve Receiver Wave Trap; Construction and Erection of Aerial Masts; Something about the Super-Heterodyne; Efficient Two-Valve Receiving Circuit; Two-Valve Fixed Coupler Set; Using Alternating Current for Filament Lighting—No. 41.

Carborundum Crystal Receiver; Construction of Plugs and Jacks; An Inductive Wave-Trap; How to Increase Range and Selectivity; Changing Variometer-Vario Coupler Set to Reflex; Three Methods of Using Audio-Frequency Amplification—No. 42.

Oscillating Crystal Receiver; Aerial Mast for £8/12/-; Microphonic Noises in your Set; Swinging Aerials; Honeycomb Coils; How to Make and Use Them—Shielding—No. 43.

Three-Valve Receiver; 3 LO.—No. 44.

Receiving Triodes: Their Operation in Commercial Practice

(By H. Coffey, Officer in Charge, Thursday Is. Radio Station.)

THE excellent results herein outlined were obtained on a single DE3 Valve (Dull Emitter) using only .75 watt, filament consumption, and 40 volts on anode, fixed adjustment, being the optimum value for the valve under review.

The results outlined herein have been obtained under the most adverse conditions in Australia's most northerly station, Thursday Island Radio Station.

The operating characteristics of the DE3 are wonderful in their uniformity, entirely eliminating the objectionable features of "soft valve operation." I found that end cell switching, or potentiometer control, for anode regulation, was not required in the successful operation of this valve.

On November 18, the DE3 was tested out against the R type Bright Emitter, UV200 and a V24. In all cases it proved superior for long distance reception during daylight, with strong static prevailing.

Morobe and Kaewing radio stations, Mandated Territory, were copied on a single valve at 9 a.m., although this station was "earthed" at 8 a.m. during a local thunderstorm.

The normal performance of this valve during daylight on an elevated aerial is approximately 1000 miles on 600 metre waves, and 2000 miles on the middle band, whereas most of the world's high-powered stations can be copied on a single DE3 in daylight.

With correct plate and filament control, this type of valve will remain persistently oscillating, yet so feebly as to be almost incapable of detection to the operator, rendering the reception of long distance signals of weakest intensity to be accomplished with ease and precision.

As an amplifier the DE3 is equally efficient. Owing to the internal proximity of the electrodes good low frequency amplification is obtained with an anode potential of 50 volts, or even lower. Using a LF transformer—A.W.A. $3\frac{1}{2}/1$ ratio, parasitic noises are entirely eliminated, signal tone and speech being received distortionlessly on the second valve.

The cardinal points observed in the construction of the tuner used in these tests were the employment of coils of the correct inductance, low distributed capacity shunted by condensers of .003 mf. variable, without vernier control.

The DE3 seems to be the ideal valve for broadcast reception, owing to its low consumption, reliability and remarkable efficiency, even on the lowest type of aerial. Tests carried out here on a single wire aerial 80ft. long, with an effective height of 8ft., brought in Moresby, 430 miles, QSA; whereas the s.s. *St. Albans* and s.s. *Tasman,* 480 and 530 miles respectively, were copied QRK at 11 a.m. in tropical sunlight, static being very moderate, although strong to fierce on the main elevated aerial.

A Quantitative Study of Regeneration by Inductive Feed Back

(From "Scientific Papers of the U.S. Bureau of Standards, No. 487.")

By C. B. JOLIFFE and MISS J. A. RODMAN.

ABSTRACT.

THE use of inductive coupling between the tuned grid circuit and plate circuit of a radio receiving circuit network employing an electron tube has been extensively used for the amplification of received signals since its discovery by E. H. Armstrong. Using simple alternating-current theory this paper shows that the amplification produced by this type of regeneration in an amplifying circuit network can be considered as being caused by a reduction in the resistance of the tuned circuit. The current amplification produced in the tuned circuit for any value of impressed radio-frequency signal is

$$\frac{I_1}{I_0} = \frac{R_1}{(R_1 - a) - \frac{\mu M}{C_1 R_2}}$$

where

R_1 is the resistance of the tuned circuit,

M is the mutual inductance which produced the feed back,

μ the voltage amplification factor of the tube,

R_2 the total resistance of the plate circuit,

C_1 the capacity in the tuned circuit across which the tube is connected,

a the reduction in resistance produced by the capacitive feed back through the tube.

The voltage of the grid was assumed to be negative at all times.

The above equation was completely confirmed by experiment. The current in the tuned circuit with and without regeneration was measured by means of an electron-tube voltmeter which measured the drop of potential across the capacity C_1 in the tuned circuit. The reduction in resistance a caused by capacitive feed back was obtained experimentally by the resistance variation method.

INTRODUCTION.

The electron-tube circuit network by which received radio signals may be strengthened materially by coupling the grid and plate circuits of the tube were first described by E. H. Armstrong. The principal methods used for obtaining this regeneration are (1) capacitive coupling, using usually the capacity of the tube itself, (2) inductive coupling where a coil in the plate circuit and a coil in the tuned grid circuit are inductively coupled. A short time after the discovery of this phenomenon the idea was advanced that regeneration in

effect introduced a negative resistance in a tuned circuit. This idea has been variously interpreted, and at times questioned.

Miller studied theoretically and experimentally the case of capacitive coupling, and showed that because of the capacities between the elements of an electron tube the input impedance of the tube depends on the nature of the load in the plate circuit. If this load in the plate circuit is inductive, it was shown that the input impedance can be characterised as a negative resistance, in which case the resistance of the tuned circuit is apparently reduced. The equations for calculating the amount of reduction of the resistance are given.

Very little quantitative data are available concerning regeneration, which is obtained by inductive coupling between the output and input circuits of a tube, and this work is to show by experiment that the results of regeneration by inductive feed back may be calculated from simple alternating-current theory.

THEORY.

The circuit network as ordinarily used is shown in Figure 1. L is the total inductance in the tuned circuit, C the total effective capacity, and R, the total resistance. In order to isolate the effect that it is desired to study, it is assumed that the grid of the tube is maintained at such a voltage that it absorbs no power, and that μ is a constant in the relation

$$Ep = \mu Eg$$

Ep = alternating plate voltage,
Eg = alternating voltage applied to the grid,
μ = voltage amplification factor of the tube.

That is, the tube functions as an amplifier only or that the operating point remains on the straight portion of the grid voltage, plate current curve.

Considering the circuit LR_1C,

$$Eg = \frac{I_1}{jwC_1} \qquad (1)$$

C_1 = the capacity of the tuned circuit included between the grid and filament of the tube,
$\omega = 2\pi \times$ frequency.

$$Ep = \mu Eg \qquad (2)$$

$$I_2 = \frac{Ep}{R_2} = \frac{\mu I_1}{jwC_1R_2} \qquad (3)$$

R_2 = total resistance of the plate circuit.
Then the voltage EM fed back into the tuned circuit.

$$EM = jwMI_2 = \frac{\mu MI_1}{C_1R_2} \qquad (4)$$

This voltage is in phase with the current in the circuit LR_1C. Then

$$I_1R_1 - \frac{\mu M_1}{C_1R_2} + jI_1X = E \qquad (5)$$

where E is the voltage induced by the antenna or other means, and X is reactance of circuit LR_1C.

Then

$$I = \frac{E}{\sqrt{\left[R_1 - \frac{\mu M}{C_1 R_2}\right]^2 + X^2}} \qquad (6)$$

If circuit LR_1C is tuned to resonance with the impressed signal E, $X = 0$
and

$$I_1 = \frac{E}{R_1 - \frac{\mu M}{R_2 C_1}} \qquad (7)$$

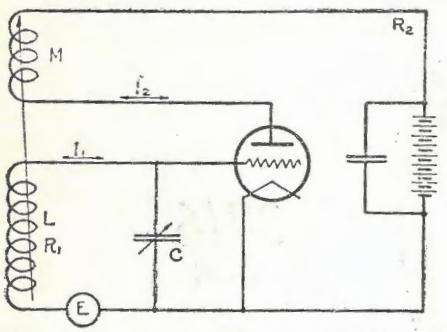


Fig. 1.—Simple Regenerative Amplifying Set.

That is, the resistance is apparently reduced by an amount equal to $\frac{\mu M}{R_2 C_1}$. This same result may be obtained from the equations given by Hazeltine.[6]

METHOD.

In order to test this equation experimentally, a circuit similar to Fig. 1 was constructed. The actual circuit network used is shown in Figure 2. The electron tube voltmeter measures directly the voltage impressed on the grid of the tube, and this voltage is proportional to the current flowing in the tuned circuit. The voltmeter was calibrated by measuring the voltage drop produced by a measured radio-frequency current flowing through radio-frequency link resistors of various values. There was no perceptible loss produced in the tuned circuit by connecting the tube voltmeter across the condenser. This was shown experimentally by noting the point at which self-generation set in with and without the voltmeter connected. No measurable difference could be detected. The capacity of the first tube of the voltmeter added to the capacity of the tuned circuit, but since it was always connected no error was introduced. The capacity C_1 between the grid and filament of the tube was kept constant. The feed back was obtained by means of varying the distance between a coil in the tuned circuit and one in the plate circuit. These coils were coaxial and separated by a grounded screen. The adjacent edges of these coils were always separated 5cm. or more. This mutual inductance was calibrated with all associated apparatus in place. The signal was introduced into the tuned circuit by coupling a small part of inductance L to a radio-frequency generating set which was enclosed in a grounded screen box and located at considerable distance from the other apparatus.

A signal was introduced in the circuit LR_1C_1 and the circuit tuned to resonance with this signal. The inductor could be disconnected from the plate circuit by switch S. The voltage drop across the condenser C_1 was measured by means of the electron-tube voltmeter. The inductor was inserted in the plate circuit, and with no coupling (coils at right angles and separated) to the tuned circuit the drop across the condenser was again measured. Then the mutual inductance was varied and the drop across the condenser measured nearly to the point of self-generation. The mutual inductance required for self-generation was noted. The tuned circuit was maintained in adjustment at all times. This procedure was repeated for different resistances in the tuned circuit, different values of E, and for various frequencies.

The distributed resistance of the tuned circuit R_0 was measured by means of the resistance-variation method.

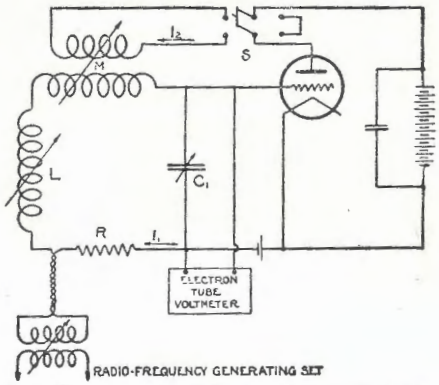


Fig. 2.—Circuit used for Measurements.

RESULTS.

From equation (7) it is evident that if I_0 is the current in the tuned circuit without regeneration and I_1 with regeneration, then

$$\frac{I_1}{I_0} = \frac{R_1}{R_1 - \frac{\mu M}{C_1 R_2}} \qquad (8)$$

that is, the amplification of the signal should be independent of the impressed voltage. Figure 3 shows the relation between $\frac{I_1}{I_0}$ and M for various values of impressed voltages. This

curve is continuous and the points show that $\frac{I_1}{I_0}$ is independent of E for any value of M used, the resistance remaining constant. Figure 4 shows the same relation with various values of resistance. The curves are similar and are displaced along the axis of M by an amount depending on the resistance in the tuned circuit. The curves shown were taken at a frequency of 320 kilocycles per second. Curves at other frequencies are similar.

TABLE 1.—ACTUAL AND CALCULATED SLOPES AND INTERCEPTS OF CURVES IN FIGURE 5.

Curve number	R_1	Intercept.	$\frac{R_1-a}{R_1}$	Slope.	$\frac{\mu M}{R_1C_1R_2}$
1	R_0	6.25	6.3	—0.0480	—0.0488
2	$R_0 + 10$	7.2	7.25	— .0368	— .0364
3	$R_0 + 20$	7.75	7.8	— .0297	— .0282

$C_1 = 480\ \mu\mu f.$ $R_2 = 10.400$ ohms. $R_0 = 29.5$ ohms. a = 10.9 ohms.

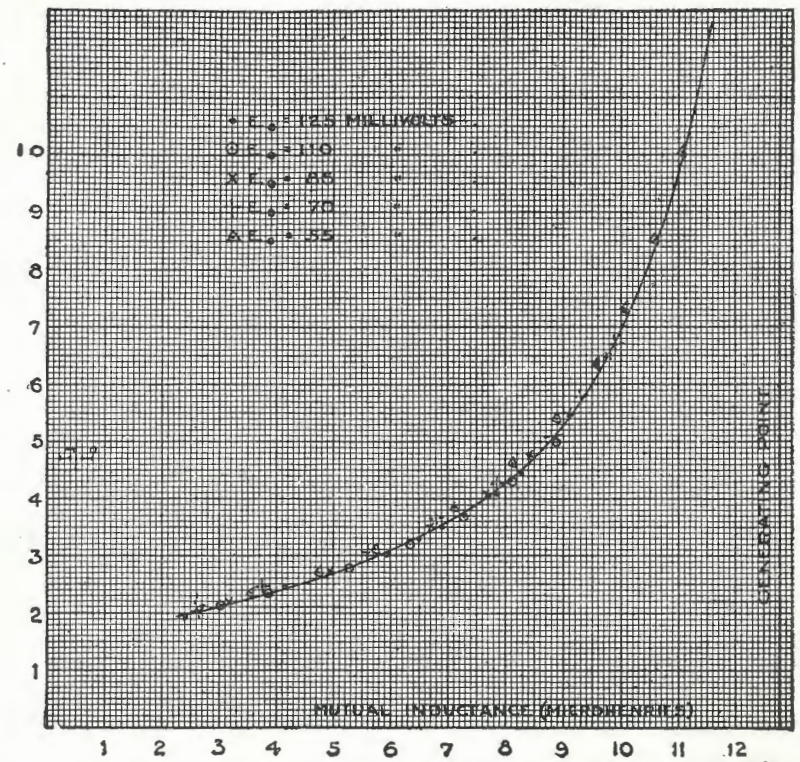


Fig. 3.—Current amplification in tuned circuit produced by regeneration for various applied voltages.

In order to test quantitatively equation (8) $\frac{I_0}{I_1}$ was plotted against M for the various values of resistance. These curves should be straight lines, and from equation (8) their equation should be

$$\frac{I_0}{I_1} = I\frac{\mu M}{R_1C_1R_2} \qquad (9)$$

The results are plotted in Figure 5. As seen, the $\frac{I_0}{I_1}$ intercept is not unity, but the curves for various values of R intersect at unity and a negative value of M. In plotting these curves the effect of the inductance in the plate circuit was neglected. (Diagram.) This inductance should cause a reduction of the resistance in the tuned circuit, the magnitude of which may be calculated from the equations of Miller.[7] It was simpler, however, in this case to determine this reduction experimentally by means of the resistance-variation method. The curves for this determination are shown in Figure 6. For this case

these curves show a reduction in resistance of 10.9 ohms from this cause alone.

If "a" is this reduction of the resistance in the tuned circuit caused by the capacitive feed back through the tube, the equation of the curves of Figure 5 should be

$$\frac{I_0}{I_1} = \frac{R_1 - a}{R_1} - \frac{\mu M}{R_1 C_1 R_2} \qquad (10)$$

The intercept on the $\frac{I_0}{I_1}$ axis should be $\frac{R_1 - a}{R_1}$ and the slope should be $\frac{\mu}{R_1 C_1 R_2}$. The numerical values for the slopes and intercepts measured from the curves of Figure 5 and the values calculated from the constants of the circuit are given in Table 1.

If instead of I_0 the value of the current I^1_0 in the tuned circuit with inductance in the plate circuit and M = O is used and $\frac{I^1_0}{I^1}$ plotted against M for the same data as used for Figure 5, the equation of the curves obtained should be

$$\frac{I^1_0}{I_1} = I - \frac{\mu M}{(R_1 - a)\, C_1 R_2} \qquad (11)$$

Figure 7 shows $\frac{I^1_0}{I_1}$ plotted against M. The intercept on the $\frac{I^1_0}{I_1}$ axis is unity

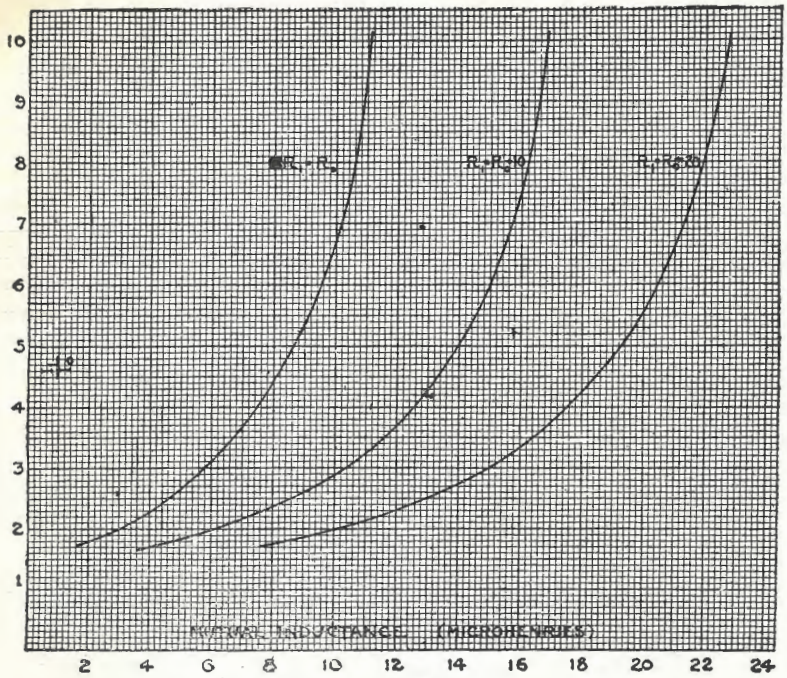


Fig. 4.—Current amplification in tuned circuit produced by regeneration for various values of resistance.

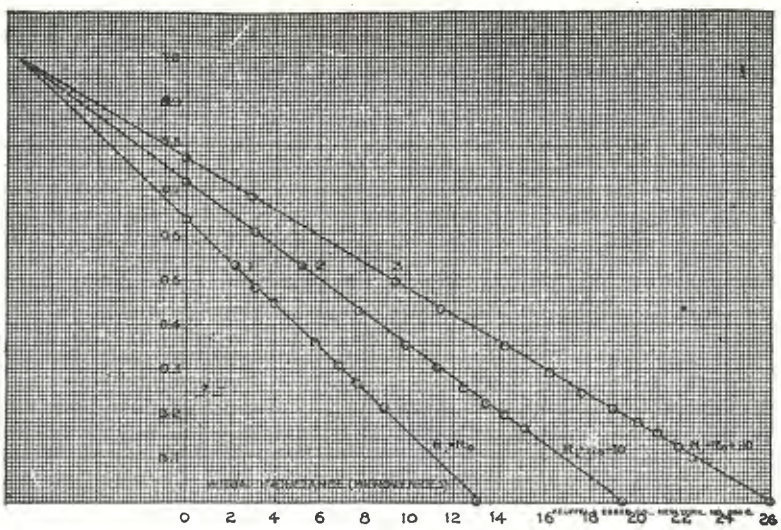


Fig. 5.—Graphical test of equation (9). Effect of capacitive feed back neglected.

in each case. Table 2 gives the numerical values of the actual and calculated slopes.

TABLE 2.—ACTUAL AND CALCULATED SLOPES OF CURVES IN FIGURE 6.

Curve number.	Slope.	$\frac{\mu M}{(R_1-a)\,C_1R_2}$
1	—0.0763 ..	—0.0775
2	— .0508 ..	— .0504
3	— .0382 ..	— .0374

These results are in good agreement with the theory and show that in order to calculate the current amplification that may be produced in a tuned circuit by regeneration by inductive feed back the following equation should be used

$$\frac{I_1}{I_0} = \frac{R_1}{(R_1-a) - \frac{\mu M}{C_1R_2}} \qquad (12)$$

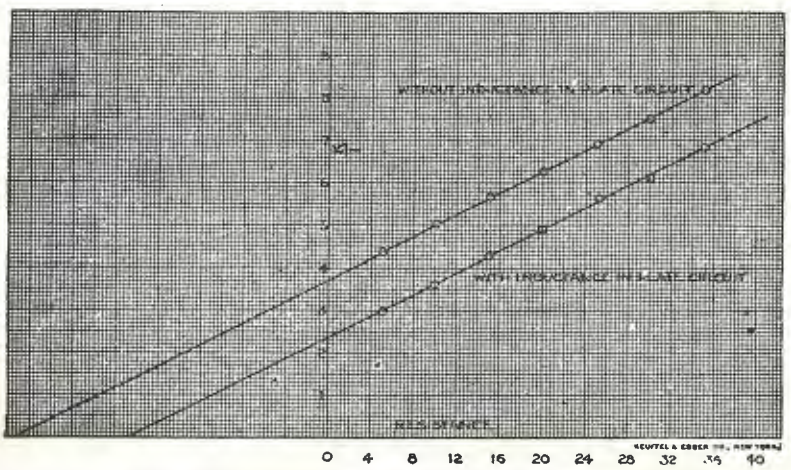


Fig. 6.—Determination of reduction of resistance caused by capacitive feed back.

where "a" may be calculated from the formulae given by Miller[8] or obtained experimentally.

It should be pointed out that this work covers only the amplifying effect of the tube and takes no account of what happens when the usual method of detection, using grid condenser and leak, is used. However, the effect of this may be superposed on the equations given, and the effect produced by it calculated.

SUMMARY.

For regeneration produced by inductive coupling between the grid circuit and the plate circuit of an electron tube circuit network, it is shown that the amplification of a signal introduced into the grid circuit can be calculated from simple alternating current theory.

The result of regeneration is an apparent decrease in the resistance of the tuned circuit. The equations derived are verified experimentally.

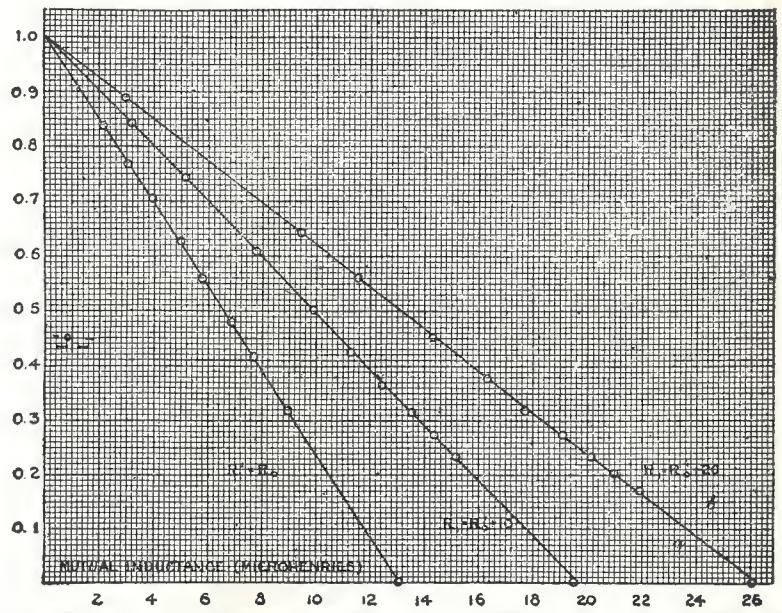


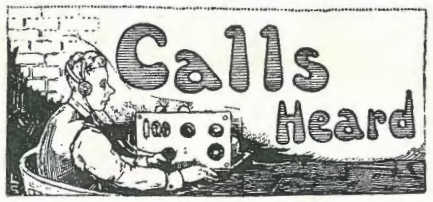
Fig. 7.—Graphical test of equation (11). Effect of capacitive feed back included.

A VERNIER condenser will allow you to tune closer and get better results on otherwise weak signals.

VARIABLE condensers are placed in series with the primary and in shunt to the secondary.

MR. C. BRYANT, of Dubbo, writes that, using a crystal receiver, Mr. Atkins, of the same town, can, under anything like favourable conditions, tune in 2FC strongly enough to work two pairs of ear-phones, and without in any way seriously affecting the signal strength. On "good" nights not a note or a word is missed. The receiver is an ordinary single coil with slider and crystal detector.

WRITING from Surprise Bay, King Island, Mr. Max A. Gatenby says: "It may interest some of your readers to know that I have been receiving the English telephony station at Chelmsford 5XX." He finds their transmissions to be very irregular, particularly during two recent weeks, when he only heard 5XX about four times. Two valves are employed to secure the above results—a Marconi DER and a Radiotron 301A as an amplifier. Mr. Gatenby finds that the whole secret of these results is contained in the DER. "Connect the grid leak to the bottom of the reaction," he says, "and make the grid condenser much smaller than usual. With these alterations the amplification will be found astounding. This applies only to long waves, say, above 600 metres. If the valve could be made to oscillate on the short waves, great things could be expected, the very small capacity of the grid condenser having this effect. The plate voltage should be about 36 and grid leak fairly low, although not so low as to make the valve



too critical in tuning; this will give a good indication as to the value of the leak. The above alterations will be found to apply only in the case of the Marconi DER valve. The wave-length I take to be about 1,600 metres, and the time of their transmissions is from 5 to 5.30 a.m. (local time), when after this they fade out. I would advise those trying for 5XX to tune to a wavelength a little lower than 3LO. If both stations are transmitting at the same time the "edge" of both carriers may be heard on the one adjustment." (Hearty congratulations, Mr. Gattenby! We shall be pleased to hear from other experimenters who succeed in hearing this station.—ED., *Radio*.)

MR. J. M. McCARTHY, of the Royal Park Mental Hospital Reserve, Melbourne, writes that he has secured loud speaker results with a crystal receiver. The circuit is that of an ordinary loose coupler. The primary coil is wound with No. 24 enamel wire, and the secondary with No. 28. A variable condenser (.0005 mfd. capacity) has its movable plates connected to ground. Two fixed condensers (.001 mfd.) are used; one is shunted across between the crystal and the 'phones, while the other is connected across the headphones only. The crystal itself is a piece of particularly sensitive galena, with a 3 amp. fuse wire as cat-whisker. Mr. McCarthy states that with this circuit he has secured exceptionally good results on the 'phones, and also where a loud speaker has been used in conjunction with two pairs of telephones. The signals come in very clearly and strongly, and are audible 15 feet from the loud speaker—a "Baby Sterling." Condensers, etc., are home-made, and no batteries are used.

MR. GEORGE PRATTEN has forwarded to us a list of DX stations that he logged on the night of November 27, between 7 and 9 p.m. Received on one valve and on wave-lengths between 70 and 120 metres, all stations came in "with wonderful strength, especially the Americans." Calls heard were as follow:—U.S.A.: 6ARB, 6BON, 6CNL, 6AKW, 6CGO, 6AGK, 6RN, 6AO, 6LJ, 2ANM, 2BRB, 3CHG, 1FJ, 9EKY, 6AAN (doubtful). N.Z.: 4AG, 4AK, 4AN, 2AP, 2AC. V.: 3BQ. N.S.W.: 2CM, 2ZN, 2DS, 2HM.

AT a recent meeting of the Brighton section of the Wireless Institute of Australia, Mr. K. Trood delivered an interesting lecture on the Thermionic valve, and had with him 63 different types of valves.

Queries Answered

B.E.S. (Elsternwick). Q.: If two aerials were forty feet apart would it in any way weaken the signals received by both sets? A.: Depends upon the direction of the transmitting station; if both receivers were tuned to the same wave-length, and the aerials the same height, that nearest the transmitting station would probably absorb a large part of the radiated energy, and correspondingly weaken the signals received on the other aerial. Q.: Would it be better to erect the aerials at right angles or parallel? A.: If possible, at right angles. Q.: What capacity condenser should be used for primary tuning (circuit submitted)? A.: .001 m.f. variable. Q.: What type of crystal would you recommend? A.: "Sacrystal," "Q.S.A.," or "A.W.A." Galena. Q.: Would adding a one-valve amplifier to a crystal set be better than a single valve? A.: Yes.

G. C. (Brisbane). Q.: Would 3 valve set comprising 1 stage radio, detector and one stage of audio frequency amplification bring in 2FC on a loud speaker, and what size panel would be required? A.: Use the 3 valve receiver comprising detector and two stages of audio in *Radio* No. 40. You should be able to fit this in a panel about 15 inches long and 9 inches high. Aerial is apparently O.K.

"*Talofa*" (Epping). Q.: Supply wiring diagram and instructions for constructing a low-loss tuner, employing detector and 1 stage of audio amplification. A.: See "Low-loss Tuners" in *Radio* No. 46. Q.: What type of dry cell valve would you recommend with the above set? A.: For greatest efficiency use high-grade apparatus throughout, either standard English or American valves, such as Marconi DER, DE3, UV199, WD12, AWA99 or 33. Q.: Could you sell one 4-volt 60-amp. accumulator and 3 Mullard Ora valves, all nearly new? A.: Place an advertisement in this magazine; no doubt, some of our readers would be interested. State price required.

H. S. (Cooroy). Q.: Using a 4 valve receiver, comprising 1 stage radio, detector and 2 stage of audio amplification, would a potentiometer prevent receiver oscillating? A.: Yes, this, however, should not be less than 300 ohms. to effectively control the grid voltage. Q.: Is reception of 2BL and 2FC every night on loud speaker good work? A.: Yes. 2FC did not send any pipe organ items on the night you mention. Q.: Could the Melbourne broadcasting stations be received, and what coils should be used? A.: Yes, providing receiver is selective. Assuming you have a 3 coil circuit, use for 3AR primary 50, secondary 75, and reaction 50, with aerial condenser in series. For 3LO, 150, 200 and 100 respectively, with condenser in parallel. The correct size of the primary depends upon the size of the aerial. Q.: What is cause of "whistling" in 'phones? A.: See "Receiver Noises" in *Radio* No. 45.

T. C. (Guildford). Q.: Will you kindly publish information for making honeycomb coils, such as diameter of formers? A.: See "Honeycomb Coils—How to Make and Use Them," *Radio* No. 43.

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 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.

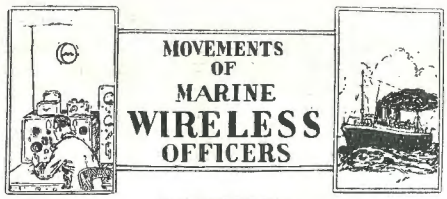
L. G. W. (Parramatta). Q.: Using the P1 circuit described in *Radio* No. 38, what should be the value of grid condenser and leak? A.: .0003 and 2 megohms respectively, the latter preferably variable. Q.: What should be the value of the 'phone condenser? A.: Generally .001 mf., variable.

H. B. (Kureelpa). Q.: Using a 4 valve set (circuit submitted). why is reception difficult unless on oscillation point? A.: Probably due to high resistances placed across the secondaries of the transformers, of which you omitted to state the ratio. Shunting the H.T. battery with a 2 mf. condenser will probably overcome your trouble. Try a potentiometer in conjunction with the grid leak; this will obtain either a positive or negative bias, which ever is found to be most efficient. Q.: Should the filament rheostats be adjusted when tuning in? A.: Yes, adjustment of the plate voltage is most essential to obtain maximum efficiency.

R. V. D. (Tighe's Hill). Q.: Using a crystal set with a valve amplifier, what is cause of difficulty in receiving 2BL, although 2FC can be received quite satisfactorily (particulars of aerial submitted)? A.: Tuning coil in conjunction with aerial is too large to be able to get down to the lower wave-lengths. Use an aerial tuning condenser of .001 mf. (variable), with a series parallel switch, which should be in series for 2BL and parallel for 2FC. Owing to dead-end losses, you will get better results on the lower wave-lengths using spiderweb coils. Q.: Can you recommend a single valve circuit, using reaction? A.: The P1 in *Radio* No. 38. Q.: Is an Ediswan ARDE suitable for this circuit? A.: Yes, providing you use the filament and plate voltages stipulated by the makers, *i.e.*, 1.8 and 20-50 respectively.

W. F. S. (East Richmond): Herewith particulars required for a step-up transformer to 1,000 volts. The core and winding you intend to use is far too small for work on 200-240 volt 50 cycle circuits. With a winding of 1,250 turns of No. 24 D.C.C. we recommend a core 1½ inches by 1½ inches, cross section external dimensions 6½ inches by 5½ inches, internal dimensions 3½ inches by 2½ inches. Using laminations 16 mls. thick, you will need 160 5½ inches by 1½ inches, and 160 4½ inches by 1½ inches. The secondary should consist of two sections of 2,750 turns each of No. 30 D.C.C. wire. The primary former should be 1 inch wide and 1¾ inches by 1¾ inches in cross section, while the secondary should be ¾ inch wide. Impregnate all windings with wax, and cover with several layers of empire cloth tape.

D. B. C. (Melbourne). Q.: Which will give best results in strength, clearness and purity of signals, and distance, the crystal circuit published in *Radio* No. 36, with the one valve amplifier shown in No. 37, or the P1 given in No. 38? A.: The crystal-valve combination. Q.: What particular type of valve would you recommend using the P1 circuit? A.: Any standard English or American, either dry cell



DECEMBER.

MR. R. P. GINDERS relieved Mr. G. Vincent on s.s. *Moeraki* at Melbourne, 1st.

Mr. E. T. Prentice relieved Mr. H. S. Chown on s.s. *Waikouaiti* at Sydney, 5th.

Messrs. F. A. Cook, H. S. Chown and R. B. Lowry signed on s.s. *Moreton Bay* at Sydney, 6th.

Mr. H. M. Watson signed on s.s. *Franklin* at Sydney. 8th.

Mr. F. Barclay signed off s.s. *Iron Prince* at Melbourne, 3rd.

Mr. G. Vincent signed on s.s. *Iron Prince* at Melbourne, 5th.

Mr. F. L. Davies relieved Mr. W. J. Washbourne on s.s. *St. Albans* as Senior Operator at Sydney, 9th.

Messrs. C. Gray and R. G. C. Roberts signed on s.s. *St. Albans* as 2nd and 3rd Operators respectively at Sydney, 9th.

Mr. C. R. Waite signed on s.s. *Ooma* at Melbourne, 9th.

Mr. O. A. Sutherland signed off s.s. *Kaitangata* at Wellington, 1st, and signed on s.s. *Manuka* at Wellington, 2nd.

Mr. P. H. Matthews signed on s.s. *Kaitangata* at Wellington, 1st.

Mr. J. C. S. Flanagan relieved Mr. M. L. Robertson on s.s. *Jervis Bay* as 2nd Operator at Sydney, 13th.

Messrs. J. C. S. Flanagan and H. J. Edwards signed off s.s. *Boonah* as Senior and 3rd operators respectively, at Sydney, 13th.

HINTS.

YOU cannot copy straight CW signals on a set that is non-regenerative.

WHEN you charge your battery, remember you cannot take out all the "juice" you put in it.

THE way to learn to operate a set properly is to sit with someone who does know how.

A GOOD aerial and good receiving set is the best combination.

A POOR connection of any kind means failure in a crystal detector set.

LIGHTNING may never strike your aerial but, like accident insurance, you are prepared for the worst.

IF your detector valve will not oscillate, try changing connections on the tickler coil.

THE best way to charge batteries is with a regular battery charger.

AERIALS do not attract lightning.

GLASS has many times the dielectric of paraffin.

WHEN you put up an aerial, insulate it thoroughly.

or accumulator. Dry cell valves are cheaper to install, and do not require so much space as when accumulators are used.

F. M. (Nowra). Q.: Can you supply circuit of a 4 valve receiver employing 1 stage radio, detector and 2 stages of audio frequency amplification, using the P1 circuit? A.: Use the 3 valve receiver in *Radio* No. 44, which should give satisfactory long distance results. If required, an additional stage of audio may be easily added. Q.: What is cause of "roar" experienced when using detector and 3 stages of audio? A.: It is not usual to employ 3 stages of audio in a 4 valve set. If satisfactory results are not obtained with 2 stages of audio add, preferably, a stage of radio. It is possible the ratio of the third transformer and plate voltage on the last valve is too high. Using circuit suggested you should not experience this trouble.

L. R. (Alexandria). Q.: Give diagram for adding another valve to the circuit as per Fig. 2, *Radio* No. 39, without using a transformer. A.: You cannot add another valve without using a transformer. Modify this to the P1 with 1 stage of audio, or other 2 valve circuits published in previous issues.

A. T. (Roseville). Q.: Using a crystal receiver, is it advisable to connect 'phones in series or parallel? A.: In parallel.

J. S. R. (Crow's Nest). Q.: Which circuit would you recommend to receive Melbourne broadcasting stations on 'phones and 2FC and 2BL on loud speaker, cost being a consideration? A.: The 3 valve receiver published in *Radio* No. 40, comprising the P1, with 2 stages of audio amplification. Use high-grade apparatus, which is more satisfactory in the long run. Unsatisfactory results are in most cases due to inferior apparatus.

A. D. M. (Bankstown). Q.: Using the oscillating crystal circuit, as per Fig 1, page 467, *Radio* No. 43, what are connections for aerial and earth? A.: Figs. 1 and 2 show methods of producing audio and radio frequency oscillations respectively with a crystal. Use circuit as per Fig. 3 for receiving.

H. B. W. (Melbourne). Q.: Recommend a 4 valve circuit employing 1 stage radio, detector and 2 stages of audio frequency amplification, capable of receiving Sydney broadcasting stations, showing input and output transformer connections; also positive and negative battery connections. A.: Unless you desire to receive on loud speaker, the 3 valve receiver described in *Radio* No. 44, employing 1 stage radio, detector, and 1 stage of audio amplification should give satisfactory results, providing you use high-grade apparatus and efficient aerial. If necessary, a further stage of audio may be easily added.

W. J. L. (Five Dock). Q.: Using 4 valve receiver (circuit submitted), can you explain why it has only been possible to receive Sydney broadcasting stations? Suggest improvements to enable reception of Melbourne, Perth and long distance stations. A.: According to the connections of your 2 plate jack you are only using 3 valves; furthermore, you should have the two honeycomb coils connected to a 2 coil mounting and not ten inches apart as stated. This will account for the interference you have experienced when receiving from 2FC and 2BL, no coupling being provided. As you are using a series-parallel switch, you should not require a primary coil of 250 turns to receive 2FC. With your aerial and condenser in parallel these should be 150 and 200 respectively. Check up your transformer connections with circuit shown on page 515, *Radio* No. 44.

W. S. C. (Merrylands) submits circuit of a 3 valve receiver capable of tuning between 200 and 550 metres, and wishes this modified to receive up to 1,720 metres. A.: As this circuit is designed for reception of stations on short wave-lengths, you would not get satisfactory results on the higher wave-lengths, even with dead-end switches, which would eventually reduce the efficiency of the receiver. Use the 3 valve receiver described in *Radio* No. 44, using honeycomb coils. It will be decidedly easier to operate.

E. N. S. (Pine Creek). Q.: Is aerial 150 feet, single wire, 60 feet high at the far end and 36 feet at the lead-in suitable for the 2 valve receiver described in *Radio* No. 41? A.: To cover the wave-lengths you desire reduce this to 100 feet in length with the lead-in, if possible, taken from the higher end. Q.: What size honeycomb coils are necessary for receiving on 350 to 1,720 metres? A.: For 350 metres the approximate size of coils required will be 20, 50, 75 and 50, for 1, 2, 3 and 4 respectively. For 1,100 metres 75, 175, 250 and 175. The correct size of coils is found by experiment; these are given as a guide only. Q.: Should a choke coil with a laminated core be used? A.: No. The circuit is designed for radio frequency amplification with tuned anode. Q.: Are DE3 valves suitable? A.: Yes. Q.: Which gives best results, series or parallel wiring of the aerial condenser? A.: Use a series parallel switch, which should be in series for short waves and parallel for long.

C. B. (Heyfield). Q.: Using the P1 circuit with grid coil of 150 turns and reaction coil of 250 turns, I have picked up a station which closes down at midnight. Would this be Perth? A.: Possibly, but this station only closes down at midnight (Victorian time) on Saturdays. Q.: Why can my neighbour, whose aerial is only 20 yards away at right angles, hear me tuning in, although receiver is not oscillating, and how can this be rectified? A.: You are evidently mistaken. If your receiver is not oscillating your neighbour will not be able to hear your tuning in. To ascertain is this the case, tap the aerial terminal of your receiver, if a dull thud is heard in the 'phones your receiver is oscillating. Q.: Using a grid coil of 35 turns, and a reaction coil of 250, why are signals from 2BL faint? A.: Too large a reaction coil; try a 50 turn, and reverse the connections to the coil holder.

J. E. S. (South Kensington). Q.: What is cause of difficulty in receiving amateurs on short waves (particulars of aerial and circuit submitted)? A.: Aerial too large to allow you to get down to the low amateur wave-lengths. Either reduce this to 75 feet, or place an additional condenser in the earth lead. Using coils of 20 and 25 turns for the grid and plate coils respectively, and a .0005 variable condenser shunted across the latter, you should experience no difficulty in getting down to within 200 metres. It is also advisable to use a series parallel switch for the aerial tuning condenser when receiving on the higher wave-lengths. For 2FC use 100 and 150 turn coils. Q.: What is cause of continuous hum in the 'phones, no telephone lines or high tension mains being near? A.: There is evidently a bad connection in some part of your receiver, probably in the coil holders; open out the pins on the holder and coil until they make a good firm contact.

J. H. (Hobart). Q.: Kindly recommend a 3 valve circuit, comprising detector and 2 stages of audio frequency amplification; also 4 valve circuit comprising one stage untuned radio frequency, detector and 2 stages of audio frequency. A.: For the former, we recommend the P1 with 2 stages of audio amplification, published in *Radio* No. 40; circuit for the latter posted. Q.: Will condensers shunted across primaries of transformers eliminate distortion? What capacities should these be? A.: Yes, .001 mf. Possibly the ratio of the transformers is too high. These should be 5-1 for the first stage and 3½-1 for the second.

W. G. E. N. (Lismore). Q.: Supply information for constructing a direction-finder. A.: Obtain a copy of "Direction and Position Finding," by Keen.

T. M. F. (Barcaldine). Q.: Is the wire screen used as a reflector in Marconi's beam antenna connected to earth? A.: No. Q.: What is difference between a single stage of low frequency amplification and one stage power amplification? A.: The latter employs special power valves for loud speaker work. Q.: Is the UV201A valve an efficient detector? A.: This type of valve may be used either as a detector or amplifier. When used as an amplifier, a UV200 is usually used as a detector.

L. S. (Marrickville). Q.: Using circuit comprising 1 stage radio and detector published in *Radio* No. 45, what size coils should be used for 2BL and 2FC, aerial 200 feet long and 30 feet high? A.: Aerial is too long to cover the wave lengths desired. Reduce this to 100 feet. Coil sizes

Dry Cell or Storage Batteries ?

"SHALL I use dry or storage batteries with my set?" is a question frequently asked by enquirers. Which you shall use depends on yourself, because a valve that will work from dry cells will also give the same results when operated from a storage cell or battery. The battery itself has nothing to do with the way the tube works, if it will deliver the proper voltage to the valve.

The first tubes offered the listening public required a storage battery to operate them as they each consumed one ampere. They were the UV200 and UV201 detector and amplifying tube. The former being an excellent detector is still in use, while the latter has been superseded by the 201a type, being a better amplifier and drawing only ¼ ampere compared to 1 ampere for the 201. This means that four 201a tubes can be operated from a battery as long as one 201 could.

The next big advance was the 1½ volt valve with low current consumption of ¼ ampere. This was really the forerunner of dry cell tubes, as it could be operated from a single dry cell, such as used for door bell ringing, or ignition on motorboats. Later came the 199 type that only drew ¼th as much current as the WD type, but required 3 times the voltage. Other manufacturers (all standard) also brought out tubes that correspond to these types. Note the table.

The tubes that really can be operated economically from dry cells are the following: WD11 and 12, UV199, C299, DV1. The UV201a, C301a and DV2 can be operated on dry cells, but not as economically as on wet batteries. The others consume too much current for dry cell operation.

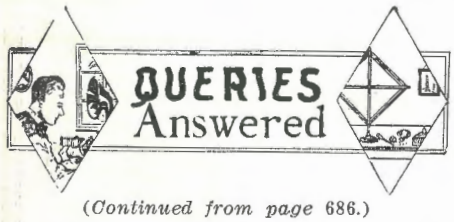
Tubes.	Fil. Volt.	A Battery.	Current.	Resist. Rheo.
UV200	5	6	1	6
C300	5	6	1	6
UV201a	5	6	.25	25
C301a	5	6	.25	25
DV2	5	6	.25	25
UV199	3	4.5	.06	30
C299	3	4.5	.06	30
DV1	3	4.4	.06	30
WD	1.1	1.5	.25	6

The WD type operates on a dry cell of 1½ volts, and each valve consumes ¼ ampere. This drain is not the most economical, so the dry cell manufacturers tell us: so two cells should be connected in parallel for each tube, thus cutting the drain on each dry cell to ⅛ ampere. On one tube, two dry cells in parallel ought to last about 175 hours.

For the UV199 and DV1 type of valves you require 3 dry cells in series for 4½ volts, and the tube will consume only .06 ampere, against .25 for the WD type. Battery (dry cell type) manufacturers tell us there is no economy in going below the ⅛ ampere rate, therefore the life of the three batteries when used with the 199 or DV1 tubes would be about the same as when two were used with the WD type.

The 201a, 301a, and DV2 each consume ¼ ampere, the same as the WD type, but require a 6 volt battery to operate them. Using the economical ⅛ rate would mean that you would require 8 dry cells, 4 cells in series, and two groups in parallel.

The 200 and 300 are detector tubes, and require a full ampere for operation. As this would require 4 times as many dry cells as the 201a type, operation from this source of supply is out of the question. A storage battery should be used for them.



(*Continued from page* 686.)

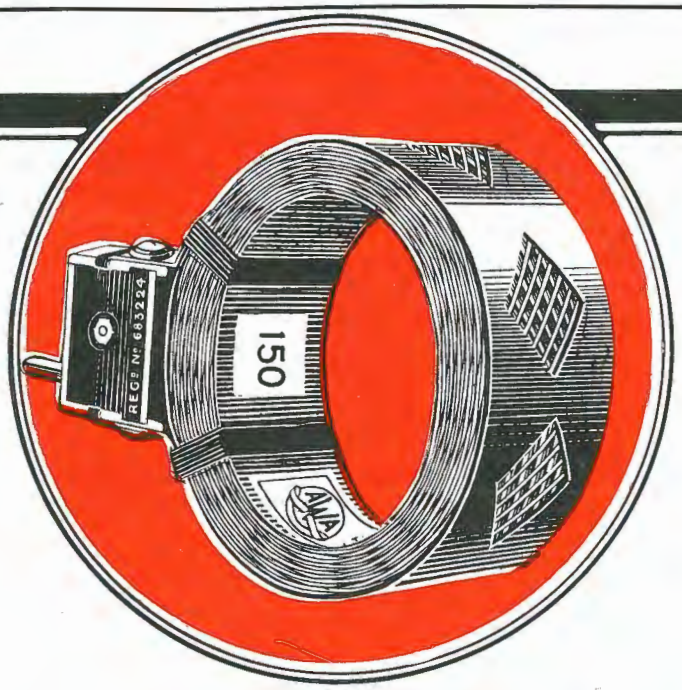
for the various wave-lengths are given in the above article. Q.: You state that for loud speaker work it is necessary to add a stage of audio frequency. What are the connections for this? A.: Connect the primary of the transformer in place of the 'phones in circuit as per Fig. 1. Complete connections for an audio amplifier are given in *Radio* No. 37. Q.: Would .001 and .0005 condensers be satisfactory? A.: Yes, for tuning the aerial and coil L3 respectively. Q.: What is a grid leak of 2 megohms? A.: This is a resistance for controlling the grid voltage, and should be preferably variable. Q.: Can coils other than honeycomb be used? A.: Not for the wavelengths over which you desire to receive. For short wave-lengths. basket coils or other forms of inductance will be satisfactory.

KGO Heard in Northern Canada

ON the Arctic Divide, far north in the Canadian ice-wilds, a party of explorers, equipped with radio, shivered and listened to grand opera produced in San Francisco, as it was being broadcast by KGO over two thousand miles away.

The enthusiasm for radio of Lewis R. Freeman, former Stanford University tennis star, led the party to carry a Radiola IIIA, specially packed in a mule case. Despite the fact that the little set was smashed, dropped into a creek and submerged, fished out, dried out, repaired and rehooked up, it gave excellent results.

Freeman says that to him the most thrilling moment of the whole journey was when he sat on the edge of a glacier and heard his own name pronounced over the air from KGO. Joseph Henry Jackson, literary editor of *Sunset Magazine,* was reviewing a Freeman travel book on that evening. "The world series baseball games came in from KGO louder than any other station," said Freeman. "We were in the ice-wilds ten weeks, returning with radio records, seven thousand feet of film and 400 photographs from a country which never saw a camera, a radio, or a white man's pack before. There seem to be no especially 'dead' radio spot on the Arctic Divide. With unfailing regularity our little set tapped the outside world with big or little antenna," continued Freeman. "Once we swung a wire clear over a river and most of the time it never went higher than the tent pole or a tree branch."



TUNING-IN!

In thousands of homes people are tuning-in on their radio sets.

Scarcely a sound; a slight turn, a faint noise; another adjustment, and then clearer and clearer comes music from the air.

Is your nightly "tuning-in" as simple as this?

If you want simple, quick and more selective tuning use A.W.A. Honeycomb Coils.

No. of Turns.	Wavelength with .001 Condenser.	Mounted.	Unmounted.
20	50-260	6/9	2/-
25	100-375	7/-	2/2
35	150-525	7/6	2/2
50	190-675	7/9	2/4
75	240-925	8/-	2/6
100	340-1340	8/3	2/9
150	500-1960	8/6	3/-
200	650-2675	9/-	3/6
250	725-3575	9/9	3/9
300	1050-4200	10/6	4/3
400	1600-6000	11/8	5/-
500	2000-7500	13/6	7/-
600	3000-9000	15/6	9/-
750	4000-11000	16/9	12/-
1000	4500-16000	£1/-/-	14/-
1250	6310-18240	£1/4/-	16/-
1500	7635-22210	£1/8/-	18/-

AWA Honeycomb Coils

are mounted on Igranic Honeycomb coil plugs with a black celluloid diamond strip, and then the shoulders are specially bound with black-waved thread, which holds the coil rigidly in position.

AWA coils offer very low radio-frequency resistance, and self capacity is at a minimum. They may be used as tuning, loading, coupling, or wave-meter inductances, ensuring the highest degree of efficiency for your set.

Made in sizes to suit your requirements. Each AWA Honeycomb coil is attractively boxed, and the wavelength table printed on the carton; also supplied unmounted.

AT ALL RADIO STORES.

Amalgamated Wireless (Australasia) Ltd.

97 CLARENCE STREET, SYDNEY. COLLINS STREET, MELBOURNE.

AWA

I am DINKIE—you'll like me

I am the mascot of the latest Sterling Loud Speaker—"The little fellow with the Loud voice." My "Dinkie" Loud Speaker will go into the homes of tens of thousands of those who love Radio. It's small in size but big in volume—small in price but big in value. And as to its reproducing powers? Well! whether it is music, song or speech, "Dinkie" gives perfect reproduction, true in tone and ample in volume! The "Dinkie" will be widely advertised, and is destined to become the greatest seller radio has ever known. Costing little more than good headphones, what can stop it?

STERLING DINKIE Loud Speaker

The Sterling "Dinkie" Loud Speaker is supplied in a Brown tinted finish, complete with flexible cord.

DIMENSIONS:

Height over all, 13 in. Diameter of Flare, 7 in.
Diameter of Base, 4 in.

Ask your Dealer to Demonstrate.

STERLING TELEPHONE & ELECTRIC CO. LTD.
Manufacturers of Telephones and Radio Apparatus, etc.
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