WIRELESS WEEKLY

Registered at the G.P.O., Sydney, for transmission by post as a newspaper.

VOL. 5. No. 4. 3D FRIDAY, NOVEMBER 21, 1924

FEATURE

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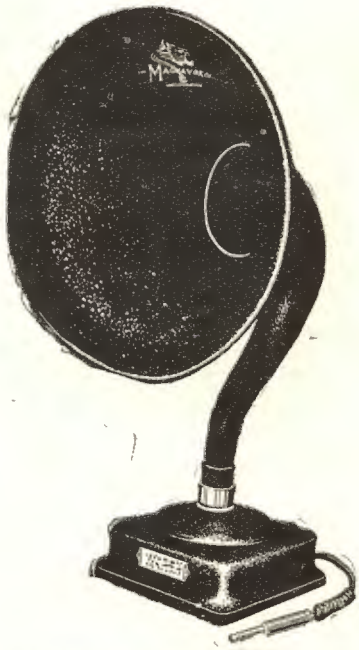

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Official Organ of the New South Wales Division of the Wireless Institute of Australia, with which is incorporated the Affiliated Radio Societies and the Australian Radio Relay League.

VOL. 5. No. 4 FRIDAY, NOVEMBER 21, 1924

CONTENTS:

EDITOR: A. W. WATT — The Editor will be glad to consider Technical and Topical Articles of interest to Australian Experimenters. All Manuscripts and Illustrations are sent at the Author's risk, and although the greatest care will be taken to return unsuitable matter (if accompanied by stamps), the Editor cannot accept responsibility for its safe return. Contributions should be addressed to the Editor, "Wireless Weekly," 12/16 Regent Street, Sydney, N.S.W.

SUBSCRIPTION RATES — Twelve months (52 issues), 13/-, post free. Six months (26 issues), 6/6, post free. Single Copies, 3d. each, or post free, 4d.

QUESTIONS and ANSWERS DEPT. — Except in the case of subscribers, all Technical Questions, or those entailing research work or drawings, must be accompanied by a postal note or stamps to the value of 1/-.

ADVERTISING — Advertising Rates may be had on application to the Advertising Manager. Copy must be in the hands of the Editor by the Friday preceding each issue. If copy is not received in time, the previous week's advertisement will be repeated.

All accounts should be made payable to Publicity Press Ltd., 12/16 Regent St., Sydney.

Agents in Great Britain: The Colonial Technical Press Ltd., Dudley House, Southampton Street, Strand, W.C. 2.

EDITORIAL

2C.M. Over.

FOLLOWING swiftly upon the success of 3BQ in getting through to America, 2CM has now added a further record to his already long list in establishing two-way communication with 9EKY and 6AHP, U.S.A. When we consider the difficulties and problems that 2CM has been up against, it merely serves to make our congratulation the more sincere. No one but will admire the patience and persistence that has characterised the efforts of this experimenter during the months and months he has been trying to get across; had he not stuck gamely to his task, it is safe to say that N.S.W. would have been allotted a back seat in long distance working. As it is, with a certain amount of pardonable pride, we can turn to Victoria and say, "Well, what about it?" The following message was sent from 2CM via 6AHP, to the President of the American Radio Relay League: "H. P. Maxim—Greetings from the Wireless Institute — Maclurcan, President." Thus was the first link in the Australia-America portion of the world-wide chain of amateur stations completed. The round-the-world relay is already in sight.

2CM's first CQ call on the night of November 12th, was answered almost at once by 9EKY and three or four others, but unfortunately, just as contact was made, the hum of induction which has been interfering with reception at 2CM for some time, suddenly became evident. Previous investigations had located the source of trouble in a transformer used by the Electric Supply Department. An iron ladder leading up to this was being shock excited by the transformer, and was radiating nicely on 20 metres, with a pet little harmonic on about 78 metres, right on the American Amateurs' wave length. It requires only a little thinking to appreciate the trouble that 2CM must have gone to in pinning this pest down. After earthing the iron ladder, no further nuisance was noticed from this source, although fresh inductive effect from other directions has since been hampering the work at Strathfield, especially on the three or four night following the "hop over" to the States.

When these nuisances have been eliminated we may confidently expect something even better from 2CM.

IN the universal attention directed particularly during the last few weeks towards the startling developments amongst New Zealand and Australian amateurs, we are apt to overlook the fact that, while amateurs have been reaching out for fresh worlds to conquer, events of much more far reaching importance are happening in the world of Australian commercial wireless. The announcement that Amalgamated Wireless A/sia. Ltd., have successfully transmitted signals to England, is of deep significance in view of the proposed erection of a station in Australia for direct commercial working with England. There is a good deal of satisfaction in the fact that the work of erecting this station is to be carried out by an all Australian company, especially when it is considered that quite recently the contracts for several other big undertakings have been let out to other than Australian concerns. There is added satisfaction in the fact that Australian Wireless Engineers wholly trained in this country have been successful in transmitting to England on power a great deal lower than that to be used in the Beam station. The signals recently transmitted to England constitute the first successsful attempt from an Australian station, an achievement that will take its place with the many other ventures successfully carried out by this concern.

LEICHARDT AND DISTRICT RADIO SOCIETY.

Members of the Leichhardt and District Radio Society held their one-hundredth-and-seventh General Meeting at the club-room, 176 Johnston Street, Annandale, on Tuesday, Nov. 11th.

The attendance was good, and the main business of the evening was the delivery of two lecturettes, both combining to comprise the seventh lecture of the sylabus. The subject dealt with was "Amplification," and Mr. F. Thompson delivered the first portion of the lecture—"Audiofrequency Amplification" being the subject of his talk. Mr. H. F. Whitworth followed with a discourse on "Radiofrequency Amplification," and both he and his predecessor dealt excellently with their subjects. There was no shortaage of questions at the con-

clusion of the lecturettes, and a vote of thanks followed.

On Wednesday, Nov. 12th, the Society conducted a Dance at the Dispensary Hall, Petersham, for the purpose of raising funds to be used to re-decorate the club-room, and the function was a success in every way. It was well attended, and well conducted, and all present spent a very enjoyable evening. Another social function in the form of a launch excursion is to follow shortly, and particulars will appear in these columns in due course.

Next Tuesday night the Society will hold its 109th general meeting, when the eighth lecture of syllabus No. 2. will be delivered by Mr. E. J. Fox, who will have something very interesting to say about Batteries. The following meeting—to be held on December 2nd—will be the 25th monthly business meeting, and on December 9th there will be a reading of short papers written by members in connection with the prize of one guinea donated by "Wireless Weekly."

This competition is open to all financial members of the Society, who are invited to write short papers on any subject connected with wireless. The reading of each paper must not exceed ten minutes, and all papers must be in the hands of the Hon. Secretary not later than December 2nd.

Inquiries regarding the activities of the Society are always welcomed, and should be addressed to the Hon. Secretary, Mr. W. J. Zech, 145 Booth St., Annandale.

STRATHFIELD AND DISTRICT RADIO CLUBS

The ordinary weekly meeting of the above club was held at the Club Rooms, corner Albert Road and Duke Street, South Strathfield, on Thursday evening, 6th inst. At short notice we were advised that Mr. Malcolm Perry would come along and give a lecture under the auspices of the Institute. Due to the fact that we received such short notice, and the inclement nature of the weather, only a few members turned up. However Mr. Perry kept his appointment and delivered a very interesting lecture, entitled, "Wireless Activities, Past, Present and Future," which was much appreciated by those present.

He touched briefly on Marconi's and other scientists' early experiments, and talked interestingly on the doings of experimenters, including himself in the early days in Sydney. The present conditions, particularly as regards broadcasting were also well explained—the lecture was rounded off by Mr. Perry making a few interesting forecasts what he considers revolutionary changes which are likely to take place in the coming years. At the conclusion of the lecture a considerable number of questions were dealt with and the evening's entertainment concluded with a hearty vote of thanks to Mr. Perry. Lecturers of Mr. Perry's ability should find a ready welcome at any progressive club. We are hoping that the Institute will be able to include our Club in the regular roster of lecturers henceforth.

Inquiries regarding the Club's activities addressed to the Hon. Sec., Mr. K. Campbell, 44 Bayard St., Mortlake, will receive prompt attention.

NOTICE TO READERS.

In a recent issue we published a letter from Mr. F. Schuman asking the address of 2XA. Unfortunately we added a note to this letter that we did not have any record of 2XA. This was an error, because in a recent issue we published particulars of 2XA as follows:

H. R. James, Rosemount Avenue, Summer Hill.

Correspondence

(To the Editor)

Sir,—On November 2nd, I had the pleasure of listening in to two amateurs carrying on a "test." I don't know who they were as I did not catch their call signs, but one could easily have been in this town for the clearness with which he came in except for part of his 'phone which was a little blurred — but perhaps static was the cause of that. I do not know what wave length they were on but I had three honeycomb coils plugged in when I caught them, aerial 25 turns movable 100 turns and the other 50 turns. I first got them at about a quarter to eleven at night and followed their phone until about half past, but I was unable to read the Morse although it was very slow at times, but the dots and dashes seemed much alike.

I am forwarding part of their conversation

(Continued on Page 16.)

THE

Wireless Institute of Australia

N.S.W. Div. Inc.

Incorporating the Affiliated Societies and The Australian Radio Relay League

HEADQUARTERS
Room. 24 2nd Floor
82 Pitt Str.
SYDNEY N.S.W.

Phil Renshaw Hon.Sec.
Box 3120 G.P.O Sydney
Phone B 2235
A.H.Perrett Publicity Officer

Delegates' Council Meeting.

THE Delegates' Council Meeting, held at Headquarters, on Thursday, November 13, was not attended by as many representatives as could be desired. Particularly is this to be deplored on account of the very important nature of the business transacted, and the late arrival of some of the delegates was a matter which called for comment by the Chairman. Probably the most important matter in connection with the experimental movement at the present time is the question of licenses, and as this matter was very thoroughly discussed, those clubs who were unrepresented have lost the opportunity of either putting forward their suggestions or of co-operating in the decisions which were arrived at, and this is a loss which cannot be over estimated. Full details of the action decided upon will be forwarded to the various affiliated clubs in the minutes of the meeting, and members of these clubs should make a point of seeing that these minutes are communicated to them and that their delegates explain fully the purport of them, It is a significant fact that the resolution passed at the last Delegates' Council meeting was considered by a special Executive Council Meeting, and that as an outcome of this Executive Council meeting certain action was decided upon. When this was communicated to the Delegates' Council meeting it was found to be almost identical with the spirit and wording of a recommendation brought forward by the delegate from Croydon Radio Club. It is quite evident that the matter has been taken very seriously by the Affiliated Clubs, and there is not the slightest doubt that the Wireless Institpte itself will pursue it vigorously to a satisfactory conclusion.

The question of Club lectures was also thoroughly discussed and certain steps have been decided upon which will put the roster on a more secure footing and will lead to more satisfactory results. The roster published in these columns some time ago is now practically run out and at an early date a new and comprehensive syllabus, which is already under consideration, will be published.

In connection with the meeting night of the Delegates' Council, although Thursday was chosen as being the most suitable night at the previous meeting, it is apparent that some hitch has occurred, and unrepresented affiliated clubs are to be circularised asking which would be the most suitable night for their representative to attend the meeting. However, if any unrepresented clubs should fail to receive an enquiry to this effect this intimation that such information is required should observed and details should be forwarded at an early date to Hon. Secretary, Box 1320 G.P.O., Sydney.

Queensland Division.

Since Mr. Renshaw's return from Queensland, things have been happening. The reconciliation movement is well in hand, both of the interested parties being at work with the same object in view. It has been very clearly indicated to the Queenslaid Division of the Institute that following the reconciliation the Institute as a whole will give its support to the development of the present division in Queensland. The point of view of the Radio Association of Queensland is that when they desired to amalgamate with the Institute arrangements could not be made because of certain people allowing their own private differences to interfere with the negotiations. Consequently negotiations were abandoned and the matter ended. At the present juncture an enormous amount of the old feeling still exists, and as the feeling runs fairly high there is nothing for it if the association desire to have official representation on the Federal Convention of the Wireless Institute, but to get over these differences even if some slight sacrifice has to be made by both parties as the Wireless Institute of Australia in the remaining portion of the Commonwealth, cannot admit to its convention any outside body which has not got its full support. It must be clearly understood that the Institute throughout Australia is more anxious than ever at

this juncture to see a reconciliation affected, and it behoves the Queeslanders to finalise the matter at the earliest possible moment one way or the other

Tasmanian Division.

The negotiations of the Tasmanians can be said to have reached the final stage. The Hobart Radio Experimenters' Club which absorbed all the old members of the Tasmanian Division and is now working in conjunction with the Launceston Radio Society, has advised Headquarters that together they have completed arrangements to act as the Tasmanian Division of the Wireless Institute of Australia, altering the title of their societies to conform with the new arrangements. It is regretted that a similar state of affairs is not existing in Queensland, which would have simplified matters very much.

All Experimenters' Night.

With a view to gathering together all the various experimental interests in Sydney and suburbs it has been decided to hold another all experimenters' night. This has been arranged for Tuesday, December 2, and the meeting will be held at Royal Society's Hall, 5 Elizabeth St., Sydney, and the subject will be, "The Exhibition of a Film showing the actual working and functioning of the Thermionic Valve." This will be a most interesting subject, and although details of the meeting are not yet finalised this early opportunity is taken of announcing the engagement so that all experimenters may keep this night free and roll up in good numbers.

Experimenters, Take Note!

When you visit another State or another town in your own State get in touch with the local trade men. They will have a fraternal feeling towards you and in 99 cases out of every 100 will receive you most cordially, and will gladly welcome an interchange of views and a yarn on wireless generally. Make enquiries whilst there what club or society your host belongs to and do your utmost to forward the combined interests in connection with club and Institute work as every brick laid in the structure shows a step towards completion. We have just had 2CS, Mr. L. T. Swain, from Newcastle on a visit to the experimental stations in Sydney and suburbs. He is amazed at what he has seen, and left again for Newcastle on November 13 a convert to short wave and low loss transmitting and reception.

Have you tried a low loss receiver? If not make one. Get in touch with 2JM, 2YI, 2DS, 2CX, 2BK, 2YG, 2ED, who are a few whom we can note at the moment who will give you all the advice they possibly can. You will find there a new field, investigate it. You will be rewarded.

A group of three of our prominent experimenters in Sydney have commenced work on 15 meter stuff. Just imagine measuring the length of the wave with a foot rule. It is absorbing. The gear used is ridiculously simple and developments are taking place daily.

Great Removal Sale.

One often sees the above notice plastered on the shop windows of the city and suburbs, but it would hardly be applicable to the Wireless Institute. Nevertheless we are going to remove and sail to our new premises at the beginning of December, as announced in these columns last week. The Wireless Institute of Australia, N.S.W. Division, have secured more convenient and better accommodation in the Royal Society's House, 5 Elizabeth Street, Sydney. This will make no difference to the postal address which will still be Box 3120, while the telephone number will still be B2235.

Q.R.M.

The long lost chairman of the Delegates' Council of the Wireless Institute of Australia, N. S.W. Division, has at last got out of his shell. After enduring the hardships of a vigorous campaign with the Railway Royal Commission, he has emerged scathless and unharmed. He has travelled 10,002 miles in two months, but as a Wireless man we would suggest that had he travelled by radio at the rate of 186,000 miles per second, he might have accomplished more in the limited time. However, the comfortable carriages provided for the use of the commission have proved beneficial to him, as he is now looking better than ever. 2JM Mr. W. H. Newman, Chairman of the Delegates' Council, was in his appointed place at the last Delegates' Council Meeting.

2CM has been at it again, but the working of 6AHP for two hours on short wave length has not turned his brain. He says that better has been done before, and he is now going back to his old stunt of doing the job with a more ridiculously low power than ever before. We wish him every success. In communicating with 6AHP (Mr. H. P. Maxim) the following message was passed:—"Greetings from N.S.W. Division, Wireless Institute, of Australia. C. D. Maclurcan, President."

What has become of F. Basil Cooke, F.R.A.S.? We trust that his retirement from the strenuous activities of public life will only be the precursor of a more active campaign in wireless interest.

Heard over the telephone: "I am now charging £5 for advice."

Our detective department has discovered that the great idea exercising the mind of commercial radio in Sydney, today is "Reduce the length of the broadcasting wave." Come down! Come down! Once again they are following the experimenter whose slogan for the past 12 months has been "use the lower band, reduce all the time."

2DE spent a Sunday afternoon recently on his rectifier. It has been reported that signals are now distinct, hum reduced to a minimum, and note pure. (Who said it was scratchy?) It has been heard in the street that he has a W.E. microphone. Where ded he get it?

2ED is very much annoyed. His previous valve smashing recorl has been eclipsed. 2XA has done in nine five watters in three weeks, four of them going in one hit. We would suggest that 2ED put his five watters across a 240 volt main.

2JT reports that recently he was working with 3XX with .4 of a watt. We believe this is now even reduced to .2 of a watt.

Morse Code Practice.

Mr. H. K. James, Summer Hill, 2XA, notifies us that he will be transmitting Morse Code practice every night from 6 to 6.30, instead of 7.15 to 7.45.

A. H. PERRETT,
Publicity Officer.

(Continued from Page 13.)

which I would be glad if you would publish as I am anxious to know who these amateurs are. My set is a four valver having one stage radio, one detector and two stage amplifier. This is a portion of what I received:

"Hello, hello—I got that alright—you said the C.W. was good strength but couldn't———Try a bit of phone——Your microphone is pretty good. —Yes, I get that—if you put the buzzer right on the microphone——faded right out—— Let's know ——Could't find a coil suitable——Well, eh——— Wouldn't interfere with any———Harmonics, 600 Broadcasters and Farmers——I am not using any myself—touched it with a file—right over. Hello —Hello! I say—you can—the reason—didn't get me was—coil choke——400V generator——Well I had better send some Morse code——for the Lord's sake send slower. I don't know if its 2, 3 or 4, as I get it I will repeat—I will send you something out of a book about Signal assembly sets——you were sending fairly well that time."

Hoping that you will find space for this in your valuable journal.

Yours etc.,

C. FELTON.

Belleview St., Goulburn.

"SIMPLEX" CRYSTAL DETECTORS

(To the Editor)

Sir,—I would like to inform N.S.W. Transmitters that from November 15 to December 5, "The Experimental Radio," Melbourne are carrying out a test to find the longest range (average) receiver in Australia, Fone only, and if N.S.W. transmitters could give three weeks to some good fone work it would be very much appreciated by the local (Vic.) hams, similar to what 2YI, 2HM and 2RJ are doing at the present time.

The following fone stations have been logged here:

N.S.W.: 2RJ, 2HM, 2ED, 2BL, 2FC, 2RA, 2YI, 2BK, 2JM, 2ZN, 2DE.

South Australia: 5DN, 5AB, 5BQ, 5AI, 5OO, 5BG.

U.S.A.: KGO.

Stations 2RJ, 2ED, 2BL, 2FC, 2JM and KGO were received in daylight. Receiver, 2 valves, 1 stage tuned R.F. and detector.

Yours etc.,

H. W. B. BOWERS

153 Derby Street,
Kew (Vic.)

(To the Editor)

Sir,—I was listening in this evening and at 6.15 heard a weak C.W. station. He sent the following three or four times: NUZ and the letter T, or perhaps meant for a final signal.

The wave length was about 400 metres and I was using one detector tube. I would be pleased if you, or any of your readers can place the station, as it is not in my list. Thanking you.

Yours etc.,

E. B. WHITE.

57 Alt St., Waverley.

(Not known to us.—Editor.)

(To the Editor)

Sir,—I shall be glad if you would kindly let me know your opinion of a valve crystal set, using a dull emitter tube. Do you think such a set is worth while? Maybe some of your readers would be kind enough to send me particulars of their experiences should any of them be using this particular kind of set. I am aware that such a set has been described in Wireless Weekly, but information from an actual user would be very acceptable. Yours etc.,

MAX CARLTON.

12 Gordon Street, Paddington.

(This, of course, depends entirely upon what function is expected of such a receiver. We have ourselves had excellent broadcasting results on a valve crystal set using alternately a W.D.12 and a UV 199—quite probably other types of dull emitters would be quite O.K. However, we would be glad if someone would get in touch with Mr. Carlton.—Editor.)

WHEN SIGNALS FADE

By R. GINDERS

YOU have invited a number of friends to listen to a special wireless concert on your new receiver. Everything is going splendidly when suddenly the voice of some star artiste (it is sure to be the most important item) grows fainter and fainter until it gradually dies away altogether. Hurriedly, you try a little re-tuning; but to no purpose, for the voice persistently dies away and is not heard again for perhaps some minutes when it swells louder and louder, probably exceeding its previously normal strength. But only to fade again—and so it goes on, much to your exasperation.

Not at all New.

Why do signals fade? This question has been receiving the attention of wireless scienststs for the last twenty years, but so far no satisfactory explanation has ben put forward. There are, however, many theories on the subject, all of which have numerous adherents.

By experiments which have been carried out recently at a number of stations, it has been found that fading takes place when the re-action coil of one particular station is tightened up to oscillating point; but this must be put down as merely a local phenomenon, for fading has been experienced on reception stations situated hundreds of miles from any other receiver.

A number of people consider that fading is due entirely to some unknown factor in the valve when used either for transmission or reception. This however, is unlikely, for in the early days of wireless, when the coherer, and later, the magnetic detector were used as detectors, fading was proportionately quite as apparent as it is to-day.

As a matter of fact it has been proved that fading takes place whether the detector happens to be a coherer, magnetic detector, interrupter, crystal or valve, and also whether transmission is carried out by spark, continuous wave or telephony. So it is safe to say that fading occurs whatever type of wireless set is used.

Effect of Clouds.

The question now arises—is fading due to the action of the receiving or the transmitting station? It is said that the most likely offender is the transmitter, for it is certain that very few transmitters can possibly maintain an absolutely even output of energy at all times. For there are bound to be minute variations in the output of the generator, and loss of energy owing to the heating up of the various parts of the circuit at certain periods. It is also thought, in the case of broadcast telephony, that slight alteration of the wave length may be caused by artistes moving about the transmitting studio; but this is hardly likely to be the actual cause of fading, for retuning—as signals begin to fade—does not, as a rule, bring them back again, so that fading is not a matter of wavelength.

On the other hand, it has been found that signals from one particular transmitter while fading at one receiving station, do not necessarily fade at another only a short distance away, and if fading is due to the variations in the output of a transmitter it is only natural to conclude that signals would fade at all receiving stations at the same time, which is not the case. Another section attribute the cause of fading to atmospheric conditions. They say that if a heavy rain cloud passes between the transmitter and receiver, a certain amount of energy is absorbed.

Experiments have proved however that intervening clouds do not decrease the strength of signals. But, of course, it can be argued that there are clouds and clouds. It may have happened that in these particular experiments mentioned, the clouds passing between the transmitter and receiver were merely light clouds, such as the "woolpack," and there is no reason why these should affect the wireless waves; but clouds such as the gigantic thunder clouds in which every raindrop contains a heavy charge of disruptive electricity, may possibly have something to do with fading. In addition to this, meteorologists tell us that certain ordinary-looking clouds sometimes descend to earth with a velocity for which neither wind nor gravitation can account. This is thought to be due to the cloud being attracted to earth, owing to its high electrical charge, and such clouds may be huge absorbers of wireless waves.

Climbing over Mountains.

It has been demonstrated—in order to prove that clouds do not cause fading—that signals from aircraft flying above clouds are frequently stronger than signals from aircraft below clouds. For

the higher an aeroplane is in the sky, the stronger are the signals emanating from it, more often than not. A more probable suggestion is that fading is due to the variations in the ground over which the wave is radiated, combined with very minute fluctuations in the output of energy from the transmitter. From reliable observation it has been certainly ascertained that mountains or hills near the receiving station affect the signal strength to a greater extent than do mountains near the transmitter. This is thought to be due to the fact that radiated waves are propagated upwards from the transmitter, and then slope down to earth again some distance away.

Yet another theory is that fading is due to the movement in the reflective surface of the Heaviside layer.

Adherents to this theory state that, normally, waves on leaving the transmitter travel upwards into the atmosphere, and on striking the surface of the Heaviside layer are reflected down to earth again. But any movement or eruption in the surface of this layer is bound to cause irregular reflection, and this produces "freaks" (i.e., signals which are received over an exceptionally long distance when transmitted by a low power station)). Now, says this theory, if the Heaviside layer causes freaks, is it not probable that it causes fadings?

If, for instance, the surface of the layer is disturbed, wireless waves which, in the ordinary way would be reflected back to earth, might strike the disturbed part of the layer in such a way that they would pass through the layer into outer space. For it is thought probable that owing to the composition of the layer, waves which strike it at an angle of 90 degrees will be bound to penetrate through the layer instead of being reflected and thus that particular portion of the waves would be lost, thus causing fading.

Why It Cannot be Proved.

After a certain period the Heaviside layer would resume an even surface, which it would usually tend to do, especially at night, owing to its high kinetic viscosity, and this reflection of wireless waves to earth would again take place, when reception would once more be normal, until another movement took place in the Heaviside layer. Therefore, fading would be experienced every time an eruption took place on the surface of the layer.

Of all the theories the last to be described is undoubtedly the most probable; but it will be impossible to establish any definite proof until more is known of the mysterious reflector of wireless waves which is situated many miles above the earth's surface.

It remains at present, one of the fascinating "unknown quantities" that lends to modern science the ever-present element of romance in impending discovery.

THE ELECTRON

By "FLOW"

THE electron is being referred to more and more in technical and semi-technical publications, and it is the object here to point out some of its more unusual characteristics, with the hope that those who take interest in the many developments of science will find an incentive to investigate further this most fascinating branch of the electrical art.

The electron is defined as the unit charge of negative electricity and plays a most important part in the composition of all matter. Those of us who have studied chemistry, even in its most elementary form, know that all materials are composed of atoms, the atom being defined as the smallest particle of any material which retains the characteristics of the material. So that there are atoms of iron, of copper, of oxygen, and of all the elements.

The First Shell.

For a great many years it was believed that the atom was indivisible, and that in itself, was the smallest possible subdivision of matter. More recently it was discovered, however, that the atom is composed of a number of units, the number depending upon the material of the atom.

It has been shown that all atoms consist of a nucleus which is called the Proton, which is in reality a positive charge of electricity. Surrounding this nucleus are a number of electrons, the number and arrangement of which depends upon the material of the atom. The structure of the atom is frequently referred to as a constellation, and may be pictured as resembling our solar system, the positive nucleus being represented by the sun, and the electrons surrounding it being represented by the planets.

The arrangement of electrons about the positive nucleus has been the subject of much investigation; and while there are differences of opinion as to the specific number of electrons and their exact arrangement, it is commonly agreed that one series of atoms, representing a number of materials, have from one to eight electrons surrounding the nucleus in what is referred to as the first shell,

all of the electrons lying on the surface of a sphere.

Ultimate Analysis.

The atoms of the next series of elements have, in addition to the first shell of electrons, a second shell which includes from one to eight electrons in addition to those in the first shell, also lying on the surface of a concentric sphere. Another series includes a third shell, and still another a fourth shell, so that the number of electrons associated with the positive nucleus varies from one in the hydrogen atom to as many as a hundred or more in the atom of the heavier metals.

It is contended by some scientists that the electrons have definite orbits about the positive nucleus, which still further brings the modern conception of the ultimate form of matter into a system similar to our solar system. Quite recently, it has been shown that the positive nucleus itself, is very probably complex and may consist of a combination of two or more units. The probable formation of this structure is, as yet, unknown. From the foregoing it is apparent that all matter consists, in the ultimate analysis, of the same thing —that is, of positive and negative electricity, and that different materials, as we know them, have their varying characteristics due to differences in the arrangement and number of electrons in their atomic structures.

Cause of Electron Emissions.

In any material there is practically an infinite number of atoms, associated with which there is a still greater number of electrons. These atoms are in constant motion except when the material is at a temperature corresponding to absolute zero, and while in such motion they collide with each other continuously. Such collisions result in electrons being freed from many of the atoms so that all materials include a number of so-called free electrons, which are moving back and forth in the material at extremely high speeds. These electrons are the carriers of electricity in any material; in fact, they themselves, are electricity. Materials which we know as good conductors of electricity, such as copper, have a comparatively great number of free electrons. Those materials which we know as insulators, such as glass and porcelain, have a very small number of free electrons. When an electric current flows there is a progression of the free electrons through the material making up the circuit.

If the temperature of the material is increased, the speed of the electrons is increased, if the temperature is made sufficiently high, as in the filament of a receiving vacuum tube, the electrons break through the surface of the material into the space surrounding the material.

Why We Can't See Electrons.

The characteristics of the electron are extremely interesting. These characteristics are not assumed, but have been established by the most painstaking kind of research work. The electron is so small that we can never hope to see it directly, for it is much smaller than the shortest wave length of light, and therefore is incapable of reflecting light. Its diameter, when expressed as a fraction of an inch, is so small as to be meaningless, but some conception of its size may be had from the following:

If a drop of water, which consists of hydrogen and oxygen atoms, and therefore includes a great number of electrons, were magnified to the size of the earth, and all the electrons associated with it magnified in the same proportion, even then each electron would only appear as large as a grain of sand.

The number of electrons associated with various materials is also startling. For example, when a conductor is carrying one ampere of electricity, ten billion billion electrons pass each point in the conductor every second.

The third characteristic of electrons, which is unique when compared with our ordinary conception of materials, is the velocity of its travel. Those of us who use vacuum tubes in our receiving equipments know that electrons are given off at the filament, travel across the intervening space between the filament and the plate, and finally enter the plate and then travel through the conductors of the circuit. The current in the vacuum tube is composed of electrons, being referred to as the electron current, or to differentiate it from currents flowing in conductors, which are also electron currents, it is more specifically referred to as a thermionic current. When electrons leave the filament of a vacuum tube and start their travel toward the plate, they are moving at a speed of approximately 500,000 miles a second. In practically all libraries will be found articles and books dealing with the electron and its characteristics. Since explanation of a growing number of scientific phenomena are based upon its properties, it is urged that those who are interested in the advancements being made in science familiarise themselves with, at least, its fundamental characteristics.

"I understand you are helping to hold an investigation."

"Not strictly speaking," answered Senator Sorghum. "This investigation has got past the place where anybody can hold it."—Washington Star.

FAULT TRACING AND MAINTENANCE

A PRACTICAL GUIDE.

By C. L. HARRIS

THE faults which occur in connection with the average amateur wireless receiver do not manifest themselves in a very great variety of ways. Complete failure to obtain signals of any description is one of the commonest ways in which a fault is made known. Sometimes, however, a fault will only cause a diminution of signal strength without actually destroying signals altogether, whilst, at other times, a particular kind of fault may give rise to an intermittent interruption of signals.

We may therefore note three main classes of faults. They are those which cause (1) no signals; (2) weak or unsatisfactory signals, and (3) intermittent signals. Generally speaking, these three primary manifestations of trouble may originate in the same instruments under different conditions.

In certain instances, however, they may each be due to some special kind of fault peculiar to one particular instrument. For purposes of clarity and simplicicy it will therefore be best to treat each class separately as a group by itself. For the same reason it will be advisable to regard each receiving equipment as comprising three main systems; (1) the aerial-earth circuit; (2) the detecting and amplifying circuits, and (3) the telephone circuit. Commencing with the first main class of fault, we may say that when no signals are heard the fault may lie in either of the three above-named systems. This will be obvious when it is remembered that a break in the continuity of any of the circuits is sufficient to prevent the flow of the small electric currents that are induced in the receiving aerial by the passing wireless waves. If the cause of the trouble is confined to the aerial-earth circuit, it may be looked for in the following forms:

Watch Dirt and Dust.

(1) A loose or dirty connection at either the aerial or the earth terminal. The terminal itself may be coated with a thin film of dust, or the ends of the wires may not present a clean surface. The latter is frequently the cause of trouble when sufficient care has not been taken to remove the rubber or varnish insulation from the wire preparatory to making contact.

Make Good Connections.

(2) An unsatisfactory joint between the aerial horizontal wire and the aerial down-lead, or between the earth wire and the metallic substance to which the connection to earth is effected.

Both these joints should be soldered. This is of special importance in the case of the aerial connection, which is exposed to all kinds of weather conditions. It is also desirable in the case of the earth connection, although, if sufficient care be taken, this may be performed satisfactorily by means of a strong metal clamp. When soldered connections are used, the wires should first be thoroughly cleaned. Careless soldering may result in insulating one wire from the other.

The Aerial.

(3) A complete break in the horizontal aerial wire or in the earth wire. Although the latter rarely happens, the former is a not infrequent source of trouble. Aerial wires are made to take a good deal of strain, of course; yet they sometimes break gradually, one strand at a time. When this happens unnoticed, it is not unusual for the last strands to give away suddenly when some undue pressure is exerted upon them, as, for instance, in a heavy gale of wind.

The same trouble might also be brought about by omitting to "trim" the masts during excessively wet or dry weather. The expansion or contraction of the rope stays and halyards which are used in connection with most amateur installations, may result in bending the masts out of their true position to such an extent that the aerial is unable to withstand the extra strain imposed upon it.

Short Circuits.

(4) A direct short circuit between the aerial and the earth. This may arise from one or more causes. If the aerial wire is allowed to make contact with the neighbouring tree or wall, for instance, the incoming signals may be conducted straight to earth instead of going through the receiving instrument. This may not necessarily result in no signals being heard, though in many cases it will do so—particularly during damp weather. Again, if suitable insulators are not employed at the extremities of the aerial wires, a thin layer of moisture on their surfaces can easily result in shorting the receiver by affording a conductive path to earth via the staying rope and halyards.

The A.T.I.

(5) A break in the aerial inductance coil inside the receiving instrument, or in any wire which would be directly connected to it.

The two ends of this coil are soldered to the aerial and earth terminals inside the container box. Should these terminals become loose, it is customary to tighten them from the outside of the box, and, in doing so, the internal connections of the inductance coil are sometimes broken off. Occasionally, in fact, rough handling of the receiver will effect this, without any tuning of the terminals in their sockets. Sometimes this coil is variable and sometimes not. Even when it is not variable it may be directly connected to some other part of the receiving circuit, and this connection can also become loosened or broken by jolting the receiving box. When it is a variable inductance there are usually numerous points at which contact between the wires may be broken. Every fourth or fifth wire for instance, may be connected to one of a semi-circular rows of studs, over the face of which a contact arm moves. The tapping lead is thus soldered at both ends and if there are, say, 20 tappings, it means that there are 40 soldered joints connected with this particular piece of apparatus. It does not necessarily follow that, if one of these joints is broken, it will be impossible to hear any signals. The fracture may only result in no signals being heard on that particular tuning; on the other hand, the break may have the effect of cutting out all signals.

Movable Contacts.

(6) The end of the contact arm may not be pressing on some of these studs. This may be due to the studs having become very worn; or to the spring which is usually employed with such an instrument having become too weak to secure a good firm contact between the studs and the end of the revolving arm; or to a loose or broken connection between the contact arm and the single wire which connects each of the tappings in turn in series with the aerial. Moreover, the old trouble of dirty connections may also be met with here. Sometimes, even though the revolving arm makes quite good contact with the studs, the presence of a layer of dust on the surface of the latter may be sufficient to prevent electrical continuity.

Condenser Troubles.

(7) A faulty condenser, when used parallel to, or in series with, the aerial inductance.

The faultiness of the condenser, in either case, may take a number of different forms. It may, for instance, arise from the two sets of plates being shorted inside the condenser, owing to one plate from one set being in steady contact with one plate from the other set.

When condensers employ an "air dielectric" trouble of this kind is constantly encountered. The plates, which consist of very thin metal sheets revolve at a distance of a fraction of an inch from each other, and should two adjacent plates become warped from any cause, it is almost certain that contact will be effected between them at some point or other. This, of course, may only result in a "short" for one particular position of the plates and even in that position it may be possible to hear signals. More usually, however, a shorted condenser leads to permanent trouble, especially if the false contact occurs between the spindles which carry the two sets of plates. The whole trouble, on the other hand, may be caused by the old problem of dirty or loose connections.

Insulation Faults.

(8) Faulty insulation at any point in the aerial-earth circuit where insulation is needed.

The aerial down-lead should be carefully insulated for some little distance before it is brought into the room in which the receiver is installed and right up to the aerial terminal. It is usual to employ some kind of insulating tube for conducting the down-lead to the receiver. If bare wire be taken through this tube, however, the latter may, in wet weather, be the means of providing a highly conductive path to earth for the received signals.

As already stated, the wire should be insulated before it is taken through the tube. The insulation of the inductance coil is of equal importance, whilst particular attention should be paid to the insulation of whatever loose connecting wires are used to link up the various instruments with each other.

To sum up, when no signals are received it may be due to any of the following faults arising in connection with the aerial-earth circuit:

Loose or dirty connections, unsoldered or badly soldered joints in the aerial or earth wires, a complete break in either of these wires, short circuit between aerial and earth, a break in the aerial tuning inductance, faulty connection between contact arm and studs of inductance or condenser, a short between two or more condenser plates, bad insulation at any point of the circuit where insulation is required.

All these points are liable to interfere more or less seriously with the activities of the experimenter, who, in nine cases out of ten, has loose wire strewn over a table and whose connections are often made hurriedly and carelessly.

BRINY REMINISCENCES

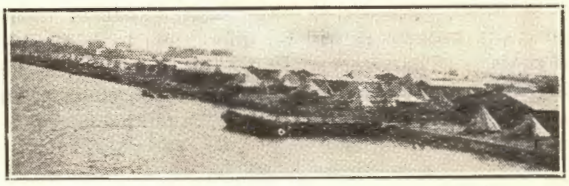
By "BRASSO."

ARMISTICE found the countries lying to the east of Italy badly up against it for the want of food. Eats, and yet more eats was the cry from the lips of millions of the proletariat in Greece and Turkey, and particularly in the unhappy nations called collectively, the Balkan States, comprising Serbia, Roumania, and Bulgaria. As for the hordes of unfortunate Armenians, massacred in thousands by their hereditary enemies, the Turks, their plight could not even be imagined—hunted-like animals, half starved, and ravaged by those terrible diseases peculiar to that portion of the globe, they lived in misery too awful to describe.

A great deal of fine work was done by the Americans who, with two cruisers going constantly, conveyed thousands of Armenian refugees down from Smyrna to Alexandria. Later in the war, a huge camp was established on the Suez Canal banks, just across from Port Said, and French and British cruisers took over from the Americans the job of filling it up with refugees. It was quite a common sight to see these cruisers disgorging their human freight.

However, on the peaceful mission of "food relief" just after Armistice, I found myself on the good ship "Bulla" lying at Smyrna. The ship which was an ex-German, was laden with Australian wheat destined for the grateful tummies of hungry heathens. She was a "one man" ship, meaning only one operator was carried, and was almost entirely Australian manned. The exceptions were the 2nd and 3rd officers who hailed from Glasgow, the former, by virtue of his statue, dubbed Big Mac, and the latter, cursed with a chronic and permanent absence of loquacity, quite naturally fell heir to the expressive title of Silent Bill. Captain Pascall, adequately described as the "whitest man in the world" was (not within hearing distance) referred to affectionately as "Pas."; he hailed from South Australia, which isn't a bad little place.

The wireless installation was what might be termed a Ford, and was a continual drain on my technical, engineering and verbal resources. Technical because it rarely acted in accordance with recognised wireless theory; engineering because I had frequently to pull the whole she-bang to pieces and rebuild it, invariably being left with a couple of dozen nuts over, and no place to go; and verbal—well, who wouldn't use language under such circumstances? The set developed peculiar characteristics that have never been equalled in history, and under operation, seemed to take a devilish delight in emitting sparks from various portions of its anatomy—my usual procedure when starting up was to hitch my chair back a few feet, reach out gingerly, press the key, and hope for the best. Queer crashes, rattles and bangs were usually the result, and I felt I could never call my life my own and that one day the thing would get really peeved and hurl itself bodily at me. It had a rotary spark gap, and the spark instead of occurring exactly between the fixed and the moving electrodes, chased the gap around on its journey, so that the result was a circular spark, with a family of smaller sparks flying off it, like a catherine wheel.



Portion of Armenian Camp.

The complete transmitter was mounted on the table, and its arrangement was so convenient that in order to get at any one part of it was usually necessary to take the whole thing to pieces. The rotary spark gap, instead of being mounted direct on the shaft leading out of the rotary converter, was an independent shaft This was bolted by a kind of universal joint to the R.C. shaft, and as they were both out of alignment, you could imagine the effect when the machine was running at top speed—just like a motor lorry laden with empty beer casks running over a bumpy road.

Early in the piece, the thing took up a determined stand; it would not function at either more or less than 100 volts from the D.C. mains.

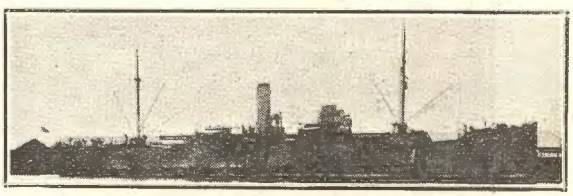
Under the hundred it would deliver a noise like a packet of crackers exploding—over that voltage, it kicked up a racket that caused the firemen in the foc'stle to come out and bang tins and buckets with great gusto. So, to keep the voltage absolutely steady, the engineer on watch had to stand by the throttle until I had finished, and his remarks were unprintable.

When any traffic had to be sent I used to stand at the top of the engine room ladder, bawl out, "Say, Art" (Art was the only one who used to take the wireless set seriously, barring myself), and hold my hands up in an attitude of prayer, whereat a grimy face away down among the whirling machinery made horrible contortions at me, and I went back and proceeded with the dirty work.

The note emitted when conditions were perfect was distinctly original—one might almost say Oriental. The end of a dash was always several octaves higher than the beginning, and with a series of dashes such as the letter O, full orchestral effects were obtained. I hate to think of some of the remarks which were hurled at me by fellows on other ships. A Yank once requested me to "can that Banshee" and one night when I was trying manfully to shoot some code to Aden Radio, he trod heavily on my corns by saying, "Turn off that fan thing and use your set." I simply turned the other cheek and wept into the W.P.B. That outfit was variously called a jazz band, an Indian yell, a scream, and so on. Yes, I had my own name for it, but editors have feelings. Its alleged power was ½ K.W. but it was just as likely to deliver 5 K.W. as nothing, and I found the normal range with a bit of luck about 200 miles. On one memorable occasion I worked Perth at 1200 miles, but all the traffic around the Australian coast was hung up for an hour while I did it—and next day the main condenser blew out. This became a habit as time went on and I got accustomed to regarding it as the set's way of taking revenge for the things I said about it.

It was manufactured in Australia at the Randwick workshops when that much abused place was under the chaotic control of the Royal Australian Naval Radio Service. I never learned the name of the ENGINEER (large type please) who designed it, but the worst punishment that could have been inflicted upon him for his crime would have been to force him to work it. So, harnessed body and soul to this accursed thing, I spent quite a lot of time in a sort of brooding melancholy—that is, when I wasn't playing poker. The tuner was one of those frightful balanced carborundum affairs with an effective range of about one hundred yards. One long look at it and I stowed it carefully away where it could never commit any further nuisance, and hooked up a nice little one valve circuit which used to bring them in with a thump. My only pleasure was in tuning in the heterogeneous mass of coast stations along the Mediterranean and listening to the continual stream of traffic. Somewhat strange to relate, for lack of proper materials, the coils of my tuner were wound in an almost identical manner to the low loss coils of the present day, so quite without my realising it, they were extremely efficient, although unwieldy to gaze upon. With this receiver I achieved most remarkable reception distances. For instance, on the same night I copied Perth, Durban, Hong Kong and Malta—our position was just east of Aden—all, of course, on 600 metres.

However, after three days at Smyrna, during which the authorities considered the important question of which people needed the wheat most, we departed for Constantinople, arriving there in the thick of the Anglo-American war. At that time there were some half dozen or so American destroyers in the Mediterranean, assisting in the work of sorting things out after the fracas. Their base



"The Bulla"

was Constantinople, at which port were also gathered British cruisers. The bluejackets from these ships when ashore appeared to devote considerable time to hunting each other up; having made contact with the enemy, the subject to be debated was invariably the old argument which was exhaustively discussed by all the magazine writers, "Who won the War?" Having been privileged to witness more than one of these interesting and learned discussions between British and American tars at Constantinople, I was agreeably surprised at the celerity and despatch which were characteristic of the proceedings. About ten minutes usually sufficed to settle things, and the mere fact that bottles, bricks, chairs and fists were introduced as arguments only served to throw a novel and delightful strain into the proceedings—from the spectators' point of view. After the battle, the mopping up gangs came round and removed the human de-

bris. Blithely, they would grab the helpless ones, friend and foes alike, and chuck them into a cart like so many bags of potatoes, greatly to the edification of the fez topped Turks, who were always very careful not to join in the fun while it was on. During the daylight hours I spent long periods standing on the famous bridge leading across to Stamboul, watching the thousands of figures passing and repassing. Some pock marked, some gay, some shrouded in gloom, the lame, the halt, and the blind, moving slowly across in countless hundreds like so many sheep. Now and again a couple of armed British Tommies sauntered across, blase and cool in surroundings that would absorb anybody else. There seem to me only two other places where the study of humanity has such a peculiar fascination: the Howrah Bridge at Calcutta and the streets of Hong Kong.

Anyway, it having taken the Commanding Officer four days to chew over the matter of wheat versus hunger, we got sudden orders to depart, and accordingly sauntered down the Bosphorus and in due course hit the very interesting burg of Salonika, at that time the centre of much international controversy. Just before arrival, "Pas" sent a message to the British Officer Commanding, asking him to arrange for a pilot. A fortnight after, while we were somewhere near Brindisi, reply came dated the same day—great minds, they say, think slowly.

At Salonika, ships are moored stern on to the main street and we just walked down the plank into the front door of an open air cafe where we were wont to gather in the evenings and watch the passing throngs, as we sipped Macedonian coffee—and other things. As in the other Continental cities, the whole population seemed to come out and air itself after dinner, and from the many sidewalk cafetarias came the sound of American jazz, played by Greek musicians, with effects by clinking glasses and cutlery. To my mind, there seems very little difference between the Turk and the Greek, with the exception of the ladies, who are in a class all by themselves and would certainly not be shown a back seat in the little old beauty contest. However, to return to more solid things. About half the inhabitants of the city appeared to be American salesmen who had descended in a body just as soon as the last shot was fired; the air reeked with Americanese twang, and no matter into what cafe we wandered there were always a bunch of them gathered around a table, clutching long cigarete holders and looking as if they had been there for years

(To be Continued)

Waterfront at Salonika.

INTERSTATE NOTES

VICTORIA

The Ubiquitous 3BQ.

AS was only to be expected, Mr. Max Howden (3BQ) of Box Hill, Victoria, has duly achieved two-way communication with American amateurs. He did it on Monday before Cup Day, and so keeps his long distance laurels evergreen. 3BQ has the precious gift of doing things just a little better than they have just been done, and then keeping on doing them. His work is solid, not a mere flash in the pan. He does not merely grope around in the dark, but reaches out into the universal ether with the deliberate intention of causing the star spangled banner to wave furiously in response, and accordingly it waves. Now, of course, everybody will be copying his circuits and clicking into touch with hams and other American by-products, until Max suddenly remembers that Great Britain is also on the ether, and takes a night off to rule the waves in that direction also. Concerning the output of 3BQ and his circuits, and all the acts he did, are they not written in the daily press, but there are other points that are not so easy to imitate. Apart from his vigorous personal qualities 3BQ has also a location so favourable to the

Max Howden (3BQ), the first Australian amateur, to effect two-way communication with America.

furtherance of his long distance aims that no doubt with his usual foresight he selected the position deliberately. On the hill in Hill Street, Box Hill, his aerial towers up to 80 feet and catches the first rays of the sun and moon as they rise over the Dandenong ranges on their journeys from America. All around is open country. Small farms and orchards, and bushlands only enhance the serenity of the oulook and no ampler ether or sublimer air for wireless purposes could be found anywhere. Transmitting on 86 metres with half a kilowatt behind them he sends out 3½ million waves per second with an amplitude of .9 ampere, and if he is not heard in England and Mars it must be because those important places have turned conservative or don't understand Morse. The exact reason why 3BQ has only this moment done it, and not months ago, we shall doubtless hear shortly, but at present the great thing is that it is now done. There is no doubt that it was well worth doing. There may be two opinions as to whether the short wave merely flitted into the customary receivers of American and local amateurs, most of whom are innocent of long wave tuners, except in super-heterodyne sets.

There may also be two opinions as to the choice of code rather than telephony, for the first intercommunication with America, but doubtless speech will soon follow, as KGO has shown it to be possible from there to here. The only trouble is that probably for the next ten years the ordinary amateur will be imitating Max Howden at an immense distance by rushing off to America every night and talking Americanese in the day time and so retarding the clock of progress so speeded up by 3BQ.

Broadcasting Quality.

The quality of Victorian Broadcasting has not been raised to any giddy level by our acquisition of 3LO. It is true that the really intolerable output of scratched phonograph records supplied by 3AR as morning and afternoon transmissions is no longer the housewife's only resource when she switches on her "wireless," since 3LO gives a fair studio concert on occasional afternoons, varied, however, too often by incidental music from picture theatres that is quite too dreary in its interminable consecutiveness. 3AR has recently "boosted up" its power with fatal results to its modulation, and now its aforetime pleasant chamber music has degenerated into the screeching of altos, male and female, and the curious sounds emitted by freak orchestras.

3LO contributes to the ethereal din by the cacophon of Carlyon's Jazz Orchestra, that makes Thursdays a "silent night" for those who prefer music. Also the week-end breakdown threatens to become a custom with 3LO, due no doubt to the extraneous shortcomings of the G.P.O. It is significant that 3LO publishes no apologies in the papers for its failures, but it is most irritating to settle down for an evening that promises something extra from the Musical Society or the Salvation Army and in the midst of the exciting scene to hear the announcer's voice faint and far away announcing that the land lines have failed again. The one bright spot in the lives of some listeners-in is the hope that on some glorious Thursday night the land-line from Carlyon's will fail or a breakdown will occur when Uncle Bunny is pawing the ether with his kissing intermezzos. The tendency to make vain repetitions is also unfortunately a characteristic shared by both stations. When one has heard "O Lonely Night" and Rubinstein's Melody in F about four times in one week—well the old phonograph in the corner is seen solemnly to wink and heard to murmur in the words of the well known poster, "Alas! my poor brother."

The Children's Hour.

Comparisons between 3AR and 3LO are inclined to be odious and invidious, but in one respect criticism may bracket the two, and that is in respect to the "Children's Hour." What sort of "children" listen in at that time it would be hard to visualise from the sort of stuff transmitted to them by their wireless, but presumably by not wicked Uncles. Uncle Rad has been longest at the game and has some endearing qualities of his own, while Uncle Bunny will perhaps get rid of the mawkish drivel he pours into the microphone hitherto, but both of them want to realise that there are real flesh and blood Australian children listening-in to them, and not mere dream children in another planet. Of the two Uncles, the Bunny one is most liable to drivel, and this is rather amazing when one looks at his published photo. The shameless cadging for crosses to be brought to the studio is not good form for Uncle nor good training for such "nieces" as may accept the invitation. Both "Uncles" also forget that their audience is not exclusively suburban.

High Frequency and High Voltages.

"Calling names" is one of the delights of our earliest years. It is not confined to the calling of things by their right names. Everybody has experienced process of calling or being called names in his schoolboy days, and the names were generally unpleasant. As we grow up we occasionally meet humorists who call every boy "Horace", irrespective of his baptismal designation, and there

are humorists or persons of that ilk who similarly persist in calling things as well as persons by any old name other than the right one. These notes may probably be found to bristle with instances. One can hardly take up a magazine or a catalogue or gaze into a dealer's window without seeing names that do not fit the thing. Sometimes, of course they are given out of sheer ignorance, and at other times through a desire to keep things uniform. When we divide transformers into the two classes of Radio Frequency and Audio Frequency, for example, these names do not apply at all, since frequency of the circuit is not involved in the transformation. The only frequency transformer in a wireless circuit is the crystal or valve when it acts as a rectifier or detector and shears off the higher oscillations, leaving only the trimmings more or less imposed by the modulations of key or microphone. This, of course, is not transformation in the exact sense, any more than it is in the so-called frequency transformers of the power stations. It is more like a process of filtration, but at any rate it is concerned with the frequency of the circuit whereas the transformers properly so-called are not. What the names are intended to convey is merely that one sort of transformer is suited to function in circuits of frequencies over about 10,000 and the other sort in circuits of lower frequencies. The frequency after transformation is exactly the same in the secondary as in the primary. The voltage and amperage are reciprocally stepped up or down, but the frequency remains unchanged. A proper appreciation of the difference between high frequencies and high voltages is one of the refinements of one's wireless education.

Transmutation of Energy.

Conversation with lay readers of technical literature reveals many shortcomings in the explanation employed by scientific writers. A dip into popular scientific literature makes further revelation of the same tendency. An interesting little book called "The Romance and Reality of Radio," lately added to Melbourne Public Lending Library, make the following characteristic but wholly inaccurate statement: "The conversion of waves of one form into waves of another kind is not difficult," and illustrates this by the alleged conversion of light waves into sound waves by means of the selerium photo-electric cell. Now as a matter of fact, no such conversion is made or can be made. When mother uses a spoon to stir the jam she is obviously not converting the spoon into jam, but merely uses it to set the oscillatory motions in the sacchoriferous content of the culinary utensil employed. In exactly the same way wireless waves are not converted into sound waves in a receiving set, but are only used to set in motion the waves of sound. This confusion of thought expressed in the above quotation from a very excellent little book is widespread and undoubtedly lends to dead-ends in thought.

That one form of energy can be transmuted into another form is not necessarily untrue, but to bring it about, if ever done, is extremely difficult, especially in forms of energy that are manifested in wave motion in the ether. Here is a nut to crack for such readers as like a pretty controversy; the light emitted from an electric lamp is not "electric" light nor is the heat from an electric radiator "electric" heat. They are just the same sort of light and heat as are derived from any other non-electric source. Yet you will meet scores of folk who firmly believe that there is some mysterious and uncanny difference. Probably they also believe that the sound from a loud speaker is "electric" sound! It certainly is at times "shocking."

Current and Voltage.

There is a tendency in many minds and also in some books which it may be pardonable to term "current literature," to confine the above two electrical terms. Whenever an electrical condition exists there must always be a difference of potentials between two points in space or in some occupant of space. This difference can be measured and expressed in volts. But unless these points are so connected as to produce a fall of potential or in other words "a drop in volts," there is no current involved. You can have voltage without current involved. You can have voltage without current, but never current without volts. Hence, it is wrong to speak of current overcoming resistance. Current is the consequence of resistance being overcome by volts. Batteries and generators provide and keep up the electrical potential or voltage that when allowed to drop down through resistances or more properly speaking, through conductors, produces the effects of an electric current. Current is the effect. Voltage is the cause. Resistance is the medium.

Morse versus Music.

Long distance transmission and reception of code signals have such a distinct function to perform in public utility that any remarks made in these notes that might seem to belittle "sparks" and his confreres of the brazen key must be taken literally. The noble army of amateurs who can read 12 words a minute is not a large one, and certainly their enthusiasm in learning the Code is more admirable than that of those whose idea of experi-

menting is to make tuneless gramophone music more untunable by bad tuning. But a fellow who sends code to the next suburb is not necessarily a grade above one who uses telephony with the same laudable and more or less audible object in view. Unless an amateur transmitter is at least an expert as a commercial operator he has no right on the ether at all. There is no room for any improvement in wireless telegraphy that is likely to be effected by the aimless experimenting of the average amateur, whereas telephony is yet in its teens, and is a proper subject for popular investigation, since, after all, it is of more universal interest than the clickings of code.

What for some reason our experts insist on calling "traffic" between stations a considerable distance apart has a marvellous fascination for the Morse operator, for transcending any of the exhilaration felt by the average listener-in who hears opera for the first time from a thousand miles away. Anyone who can proudly exhibit the shattered remnants of what was once a signal and restore its outlines as learned professors restores some prehistoric froglodyte unearthed from the mush of ages, feels that he has deserved well of his country. Unfortunately when the same mind turns for relief to some idle dalliance with mere music he employs the same drastic methods of resuscitation from the ether, and, after all, music that is not musical is far, far worse than what in polite literature is represented by dots and dashes, and in American language is known as jazz.

WESTERN AUSTRALIA.

A PICNIC PARTY recently adjourned for the week-end to the North Beach; each member took a crystal receiver, and obtained quite excellent results from 6WF. Observing an old fisherman wonderingly looking on, one of the holiday makers thought to let him in to the mysteries of wireless, and therefore started to explain how things worked. When the old fisherman could get a word in, he told the party to come over to his cabin. There, was a four valve set.

He explained to them how he got Sydney, and there and then switched on 6WF at loud speaker strength.

The Subiaco Radio Society held a social evening last Tuesday. Members of the Society turned up in full force, with their wives (those that had them), supper was provided, and terminated a very successful event. 6WF was received on the loud speaker, and between broadcasting items, several local artists contributed vocal items.

Another big exhibition is in the hands of the Subiaco Committee, and will probably take place in the King's Hall, Subiaco, at an early date. Dancing will be arranged, and altogether it should overshadow the event stalled last year by Subiaco, which appears to be the only live club here.

The transmission of the church services by 6WF has now apparently taken the form of a permanent fixture for Sunday evening broadcasts. The voice of the minister is wonderfully clear, ditto the singing of the congregation. The boundaries of wireless broadcasting embrace all creeds, and there are many wireless users, who don't go churchwards, and others, who perhaps, are ill or bed ridden, and the reception of a church service with its attendant homily or sermon, is something that can be an inspiration.

The sick soldiers in the military ward of Claremont Hospital have been presented with a radio set by the United Ancient Order of Druids. A successful programme was broadcasted from the Westralian Farmers' Station, 6WF, on Monday, when speeches by several officials of the "Druids" were also put on the air. The Metropolitan Gleemen contributed several vocal numbers.

The authorities evidently intend to make things hot for the great unlicensed. A circular has been issued to every State, and no doubt "Wireless Weekly" readers have already heard the announcement broadcasted from 2FC, 2BL and 3LO.

Mr. Scott, Radio Inspector for W.A., delivered an address from 6WF last Thursday, requesting all to take out licenses immediately.

HOW FAR HAVE YOU HEARD.

Have you ever picked up a really distant station on your crystal receiver and there was nobody else with you to share your enthusiasm?

Have you ever been listening on your crystal set on 600 metres and heard a ship a couple of thousands miles away?

Do you know that the world's record for crystal reception was put up by a P. & O. steamer off Melbourne when signals were received clearly from a station at Jask in the Persian Gulf—and the time in the ship was 5 p.m.? Yes, of course it was a freak and could not be accounted for—but at some time or other YOU probably get freak results; if so, write and tell us. Anyway, freak or no freak, what is the longest distance you have received in your crystal set?

Drop us a line so that we can compare notes.

The Design and Construction of Tuned Anode Receivers

2HF AMPLIFIERS, DETECTOR AND 2 AUDIO FREQUENCY AMPLIFIERS.

(The second of the Wireless Weekly series for the more advanced experimenter. We shall be very pleased to deal with any queries in connection with these articles.—Editor.)

THE tuned anode method of radio frequency coupling is one of the most efficient known methods and probably the most practical method of radio frequency coupling for medium and short wave lengths below say 2000 metres.

The principle of operation of the tuned anode is probably well known to some of the readers of Wireless Weekly, but to make what follows the clearer, it may be well without entering into unnecessary theory to touch upon this briefly first of all.

The tuned anode is simply a resonant rejector circuit excited by incoming high frequency currents just like the aerial circuit itself, except that of course the H.F. currents have been amplified by passage through the valve to which the anode belongs and are, therefore, able to excite the second tuned circuit more strongly than the aerial circuit was excited by the original un-amplified current.

The strong excitation of this second circuit gives rise to increased potential differences across the inductance therein, which are passed on to the grid of another valve for the repetition of the process or for rectification or both, the function of the valve thus being current amplification, and of the tuned circuit, the conversion of this into voltage amplification. The inductance acts as an auto-transformer.

If you compare the tuned anode and transformer coupling you will find that they are identical except that the actual intervalve coupling itself is in the latter case inductive or magnetic, whilst in the former it is static, and herein lies the great practical difference that, whereas in the one case an extra tuned circuit is necessary for full efficiency, in the other it is not, and this is where the tuned plate scores.

In fact, transformer coupling is nothing more nor less than a tuned anode to which has been added another circuit simply for intervalve coupling purposes, some break in the electrical continuity of the intervalve circuit being, of course, necessary so far as the continuous current component therein is concerned so that the H.T. battery shall not be impressed directly upon the grid of the valve.

The simplicity of handling the tuned anode as compared with transformer coupling is obvious, unless of course the transformer is of the aperiodic type, the best of which, the writer has found very inefficient in comparison with tuned plate.

Practicability is after all one of the first and foremost essentials of the standard receiver. In this article the sliders and straight wound coil are suggested, not because they are more efficient than the honeycomb coils, but because they are more practicable change of wave lengths can be made quicker and with less trouble. We are labouring under disadvantages here that no other country has, viz., that our broadcasting wave lengths cover such a large band.

There is a great deal of interesting work to be done in the field of reception, but this concerns the present article in so much as the more this is done at any given experimenter's station, the more need will there be at that station for a practical standard receiver against which results can be compared, and with which ordinary tests and receptions may conveniently and reliably be carried out, and for this purpose the best type of receiver will be that which best combines the essential qualities of practicability and dependability.

This, the two stages of tuned anode undoubtedly does—or at least is capable of doing, and it is the purpose of these notes to show not only why this should be so but how it may be made so. The actual circuit will be described later but first of all it is desirable to deal with the pitfalls so that these may be avoided from the start and success be assured.

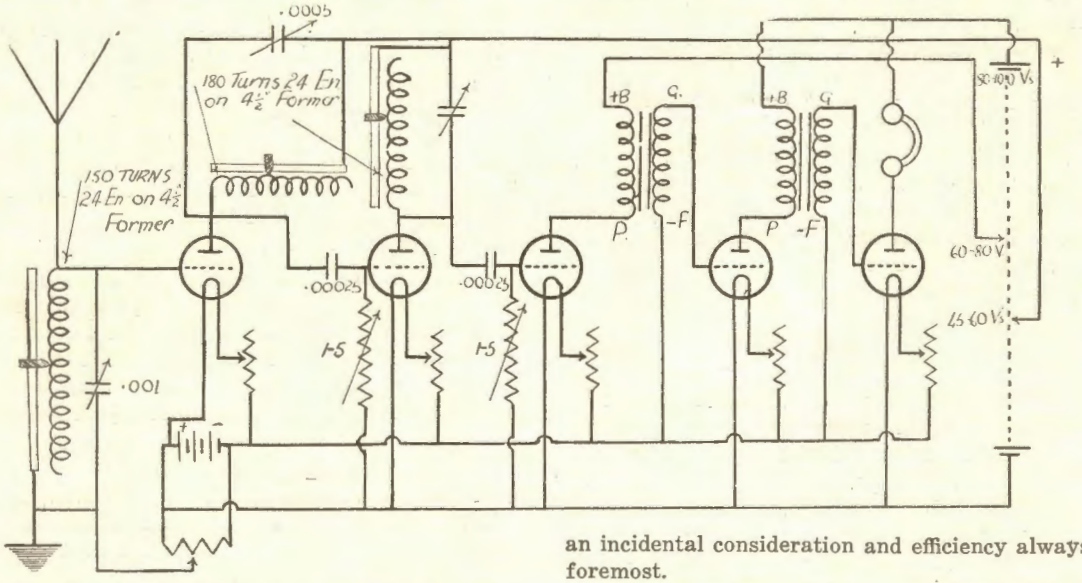
The most far reaching of these lie in capacity effects upon which too much emphasis cannot be laid. The golden rule is, from beginning to end, and throughout the aerial to earth, particularly in the receiver itself, "avoid stray capacity." This will of course be a matter of very careful wiring arrangements and the avoidance of overcrowding of parts and circuits. The capacities and couplings which exist in a valve and its associated circuits are as follows:—

1. Capacity between the plate and grid of the valve and any leads attached thereto.

2. Capacity between grid and filament and leads.

3. Capacity between plate and filament and leads.

2. and 3. are small as far as the valve electrodes are concerned, but begin to become appreciable where the leads come close together. The capacity between plate and grid which, unfortunately, owing to the proximity and comparatively large size of the electrodes concerned is the largest of the capacities within the valve itself. The capacity caused by the electrodes themselves we cannot avoid but we can limit the extra capacity by designing the receiver before constructing it in such a manner that stray capacities and couplings



of any kind shall rigorously be reduced to a minimum. The writer in passing would like to ask: how many S.T. 100 circuits are actually working as they should, viz., doing the work of three and a half valves? Not many, you say. No! Because they are wrongly designed. Arrange your wiring so that all leads, particularly those concerning plate and grid circuits shall be as short as possible and as widely separated as possible both from one another and all other conductors. The use of coil fittings, etc, of minimum self capacity and the use of low resistance wire for all wiring. Coil windings must be not less than 24 gauge.

A Few Don'ts.

Don't use plugs, jacks or switches on the radio frequency side of the receiver. These are all very well for audio frequencies and it may be very neat and convenient to be able to throw valves, etc., in and out of a circuit by mere touch of a switch, but where radio frequencies are concerned such conveniences invariably have to be paid for—often dearly.

If you want to prove what I say, compare your single circuit regenerative circuit (or P1) with that of your friend who has a stage of radio but uses switches to cut it in or out. I have no hesitation in saying that in nine cases out of ten you will beat him with your D.X. results.

Don't attempt to make a tuned plate receiver too small; don't cramp the parts in any way; but allow plenty of room for adequate spacing and proper arrangement of everything. Finally, do not in any way sacrifice efficiency for mere neatness of appearance or convenience. A well designed receiver will look workmanlike, but let this be quite an incidental consideration and efficiency always the foremost.

The operation of the receiver if well designed and wired, will be found quite simple and really no more difficult or tricky than a three coil circuit. The positions of the three sliders can be marked and settings of each condenser noted so that stations once heard can readily be obtained again at will. The primary, and first and second tuned plate coils should be staggered to avoid interaction, viz., primary and secondary tuned plate perpendicular and first tuned plate in an horizontal position. Extension handles can be fitted to the handle of slider contact to come out through the panel or the alteration to the position of slider can be made inside.

It should be noted that the three condensers will cover quite an appreciable band of wave lengths themselves so that to change wave lengths within a small band it is not necessary to keep changing position of sliders, bearing in mind

though that it is better to use a large inductance and a small capacity. The writer has advised coils of 180 turns to enable all the Australian broadcast stations to be tuned in, but if it is desired to tune in the lower wave lengths only, it is advisable to use much smaller coils, but using the same principle of slider or with the H.C. coils.

In conclusion I would like to point out the three extra refinements which readers will notice in the circuit diagram, viz., separate B battery tappings for radio, detector and audio valves. If you do not understand the circuit diagram do not attempt to build this receiver, but study it until you do, and you wil find that you have a Rolls Royce set.

A certain American firm recently made the following offer to an opposition firm; that they would buy all the super heretodyne receivers the opposition could make during the next twelve months if the latter could build a super that would give better results than the former's two stages of H.F. tuned plate detector and two audio,

The super lost, or didn't try—I won't say which!

Following materials are required:

1 bakelite panel, 30 x 9 in.
5 valves.
5 holders.
5 rheostats to suit valves used.
300 ohm potentiometer.
1 .001 condenser, variable.
2 .0005 condensers, variable.
6 wood ends.
3 cardboard formers.
3 sliders (good make).
1½lbs. 24 enamel wire.
2 .00025 fixed condensers.
2 variable grid leaks, 1-5 megohms.
A and B batteries to suit valves used.
8 terminals.

FOREIGN CORRESPONDENTS.

MR. F. CORBEN sends us a list of names of those interested in wireless elsewhere who are desirous of corresponding with local enthusiasts:

The following are musicians, and of course, interested in music:

Miss F. L. Stancliff, 1106 Big Falls Avenue, Akron, Ohio, U.S.A.

Miss L. R. Lanphear, 12 Greenman Avenue, Westerly, R.I., U.S.A.

Miss C. Gilstrap, 49 Hardendorf Avenue, Atlanta, Ga., U.S.A.

Miss L. Fryar, Fryar School of Music, Thirty West Monroe St., Jacksonville, Florida, U.S.A.

Miss V. M. Talbot, 5330 Magnolia Avenue, Chicago, Illinois, U.S.A.

Mr. F. Aillbutt, Box 500, Tacoma, Washington, U.S.A. (A family of six, from age five to twenty-four.)

Mr. H. Baligian, 70 Harris Avenue, Arlington, R.I., U.S.A.

Mr. C. Valeny, c/o Hotel Shawnee, Springfield, Ohio, U.S.A.

Mr. H. Maynard, Portland Chamber of Commerce, Portland, Oregon, U.S.A.

Secretary, Progressive Music and Dramatic Club, Jacksonville, Florida, U.S.A. ((Composed of children between six and eighteen years of age, anxious to correspond with Australian children learning music.)

J. Carlson, Boy Scouts of America, Pine and Ocean Avenue, Long Beach, California, U.S.A. (This Boy Scouts' Club desires to correspond with Australian Boy Scouts—any number.)

Write c/o "The Survey," Technical High School, Bridge and Concord Streets, Brooklyn, New York, U.S.A. (Would appreciate correspondence from any schools in Australia.)

K. Morren, 84 Summer St., Aberdeen, Scotland. (School girl, age 11 years.)

A. McDougall, 86 Mitchell St., East Ham, E.C., Scotland. (School boy, age 13 years.)

See Kam Shan, 8 Caine Rd., Hong Kong, China. (Chinese school boy.)

H. I. Hayashi, 1253 Nuuanu St., Honolulu, Hawai, U.S.A. (Japanese school boy, age 14 years. Writes wonderful hand.)

Brooklyn Technical Radio Club, Technical High School, Bridge and Concord Streets, Brooklyn, New York, U.S.A. (Wishes to correspond with Australian and N.Z. wireless fans.)

Mr. E. H. Blade, 125 East 46th Street, New York City, U.S.A. (Wireless fan.)

V. L. Halstead, 1841 Browning Boulevard, Los Angeles, California, U.S.A. (Boy Scout, interested in stamps, radio, Scout news, etc.)

Mr. Chan Wah Seng, c/o N.V. Straits, Java Trading Co., Singapora, S.S.

Mr. M. Oda. 7 Yanakka-Kamisansakiminami-Cho, Shitaya, Tokyo, Japan.

Mr. S. Hino, 2 Chome, Gyotokn-Machi, Chiba, Prefecture, Japan.

Mr. H. Matsui, Kawaoka-Mura, Kyoto-Ju, Japan.

Mr. Y. Fushimi, 65 Funa-Machi, Yokuya-Ku, Tokio, Japan.

Mr. H. Shimidyu, c/o T. Koike, 4232 Shimono-Cho, Shibukawa-Machi, Gumma-Ken, Japan.

GOOD D.X. WORK.

T. H. Harris, South Strathfield, sends us a very creditable record of 600 metre stations logged on one valve only. The calls were all clearly heard and easily read.

CALL	STATION	(DIRECT) WHERE IN MILES
G B E	NIAGARA	2200 N. E.
V H E	KAROOLA	2000 W.
G D Z V	MAKURA	2000 E.
V Z B W	HOBSON'S BAY	2000 W.
O Z A	PERU (Ship)	2000 N.
S H P	YNGAREN	2000 W.
L F E	VINSTRA	2000 W.
P M Z	TASMAN	2500 N. W.
B E M	BARDIC	2200 W.
G B E	NIAGARA	2000 E.
V Z A	CAMIRA	2000 W.
V Z B S	LARG'S BAY	2500 W.
A V Z	ARNA	2200 W.
O G L A	RHODESIA	2200 W.
V J F	MORINDA	2100 N.
M Y N	TAHITI	2000 E.
V X J	KOORINGAA	2000 W.
V P W	SINGAPORE RADIO	3500 N. W.
G B K J	MARELLA	2000 N.
V K W	CEDUNA	2300 N.
G D Z V	MAKURA	2300 E.
G F Z P	MINDEROO	2400 N. W.
P M C	HOUTMAN	3000 N. W.
V P X	PENANG RADIO	4000 N. W.
C G F	EURELIA	2100 W.
G D K M	WAIOTAPU	2000 E.
M O Y	OSTERLEY	2300 W.
K O B K	WEST KATAN	2500 N.
G F Z P	MINDEROO	2200 W.
K E K B	EAST WIND	2600 E.
V K B	MERRIWA	2000 W.
V P X	PENANG RADIO	4000 N. W.
J P E	PACIFIC MARU	2000 W.
P K B	WELTREVEDEN RADIO	3000 N. W
K U Q M	LAS VEGAS	2800 N. E.

The teacher was trying to impress on the children how important had been the discovery of the law of gravitation.

"Sir Isaac Newton was sitting on the ground and looking at the tree. An apple fell on his head, and from that he discovered gravitation. "Just think, children," she added, "isn't that wonderful?"

The "smart boy" in the class did not seem impressed. "Yes, miss," he piped out. "And if he had been sitting in school looking at his books he wouldn't have discovered anything."—McKendree Review.

* * *

A Chink truck driver recently presented the following bill to the college: 10 goes, 10 comes, at 50 cent a went, 5 dollars.—Penn State Froth.

IT'S THE LITTLE THINGS THAT COUNT

By W. A. STEWART.

IN any receiver, more especially the short wave one, attention to detail is important, and it is small things such as honeycomb coils, sockets, and rheostats, which go a long way towards improving results.

With regard to accessories of any kind, the best is none too good and it is better to wait until you can afford the best rather than to buy a cheap component; it will only be scrapped after a while, which means more outlay, which could be obviated by buying the better article in the first place.

Concerning rheostats it is advisable to see that the correct type is used for the valve in use; for valves of the bright emitter type a rheostat having a resistance of five or six ohms is quite suitable, and can be employed to advantage. Dull emitter valves require a 30 ohm rheostat to give suitable control over the filament. If a 30 ohm rheostat is used on a bright filament valve, it is liable to get hot and if the rheostat is of poor construction it will probably be ruined.

A vernier is a help in getting fine adjustments, and of course it is only really necessary on the detector valve as usually the amplifier valves, are not very critical, and an ordinary rheostat will work quite satisfactorily. It is advisable to have a separate rheostat for each valve as it is then possible to get correct filament values. If two low frequency, or audio amplifying valves are used, one rheostat will suffice for the two valves as the filament control of the amplifying valves is not very critical. Taken all round the Bradleystat is one of the best forms of filament control ever designed, as it gives even filament control for any type of valve.

The best type of valve sockets should be used as bad contacts, give rise to noise in the set. If the valves of the American (radiotron) type are employed the best form of socket is one that makes contact on the side of the valve pin, and not the bottom, as it will usually be found that the bottom of the pin is coated with solder, which quickly corrodes, causing undue noise. Many sockets are now making their appearance with contact on the side of the pin, and these are preferable to the other type. Valves of the English or Continental type usually make good contact in the sockets, but it is often advantageous to spread the legs of the valve a little with a knife blade.

In amateur circles there seems to be a movement towards doing away with valve sockets, and soldering the connections to the valve elements themselves. Some experimenters have gone as far as taking the base off the valve altogether, and soldering all connections to the leads from the valve elements direct. The idea of this is to reduce capacity effects between the valve electrodes, and thus make for greater efficiency on the shorter wave lengths. For this reason valves of the V24 or QX type which have the connections widely separated, are very effective.

Terminals are another source of trouble, and where possible all connections should be soldered. Some manufacturers use what are known as solder lug, which are small metal lugs to which the wire is soldered, and then placed under the terminal, but this is no better than putting the wire itself under although it may look neater. In my opinion there is no need for terminals at all, and in preference it is better to solder flex leads direct to the various parts of the circuit itself, and connect to the batteries direct.

With regard to inductances, honeycomb coils are more adaptable on the longer wave lengths, and I can recommend them for reception above 600 metres. Here again only the best should be used, as a good inductance makes the receiver. I have just tested a set of "D.A.D." coils, which are locally made. They are wound with silk covered wire, and are of the Duo-Lateral type of winding. The self capacity is extremely low, all unwanted "dope" being removed by a special process, which leaves just enough to hold the coil together. These coils are extremely efficient, and although somewhat dearer, are well worth the extra, as the results are there.

Variable condensers need hardly be dealt with again, as I have mentioned them many times before, but for good results, only the best should be used.

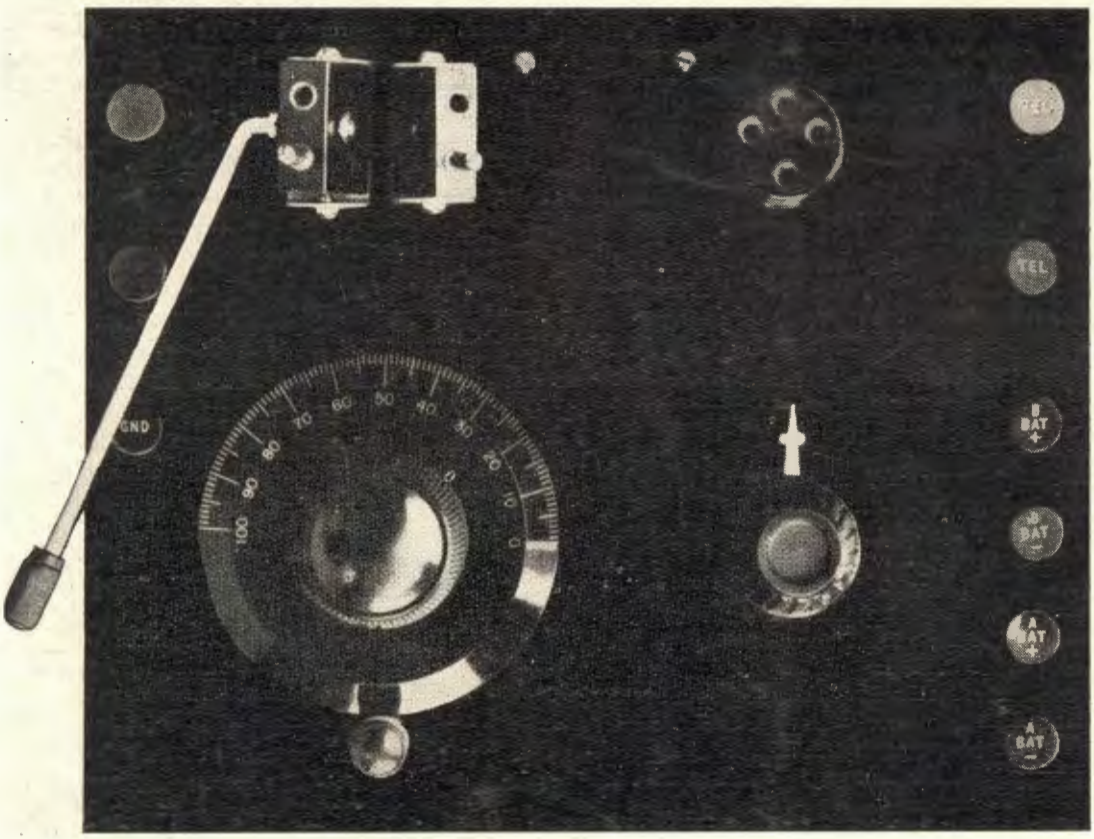
A variable grid leak is also of great use, but once the correct value of the fixed grid leak has been found, it can be forgotten providing of course it is well constructed.

A CHEAP SINGLE VALVE RECEIVER

By "INSULATOR"

I've been to Bathurst over the week-end. When I say Bathurst, I mean that this town had to be the first stop. But it wasn't, as the car on which I travelled stopped at almost every town and between almost every other town, owing to many and varied mishaps with the engine. Cars, I don't understand, at least I didn't, but now after having pulled the inside out of at least this one in particular, I claim to know where such things as gear boxes, coils, clutch plates, etc., are located and also just what is likely to go wrong with all of them. But it wasn't such a bad trip after all, although I expected in indulge in sleeping out more than once.

But Bathurst—oh Bathurst, what a dreadful place you are. I'll take on hand to say that Bathurst has collared all the static possible. Each time a set was connected up our old friend (?) static would let you know he was very much in existence. The voice of Uncle George could be heard alright, but static could be heard much louder and really made it very difficult to get anything at all. I visited Father Templeton, of Stanislaus College, and he advised me that static was "a killer." So did Mr. A. V. Cape, of Dunedoo. Old wireless men will remember A.V.C., the enthusiast. Coming home from the "city of the plains" was quite a task. Howard—he drove



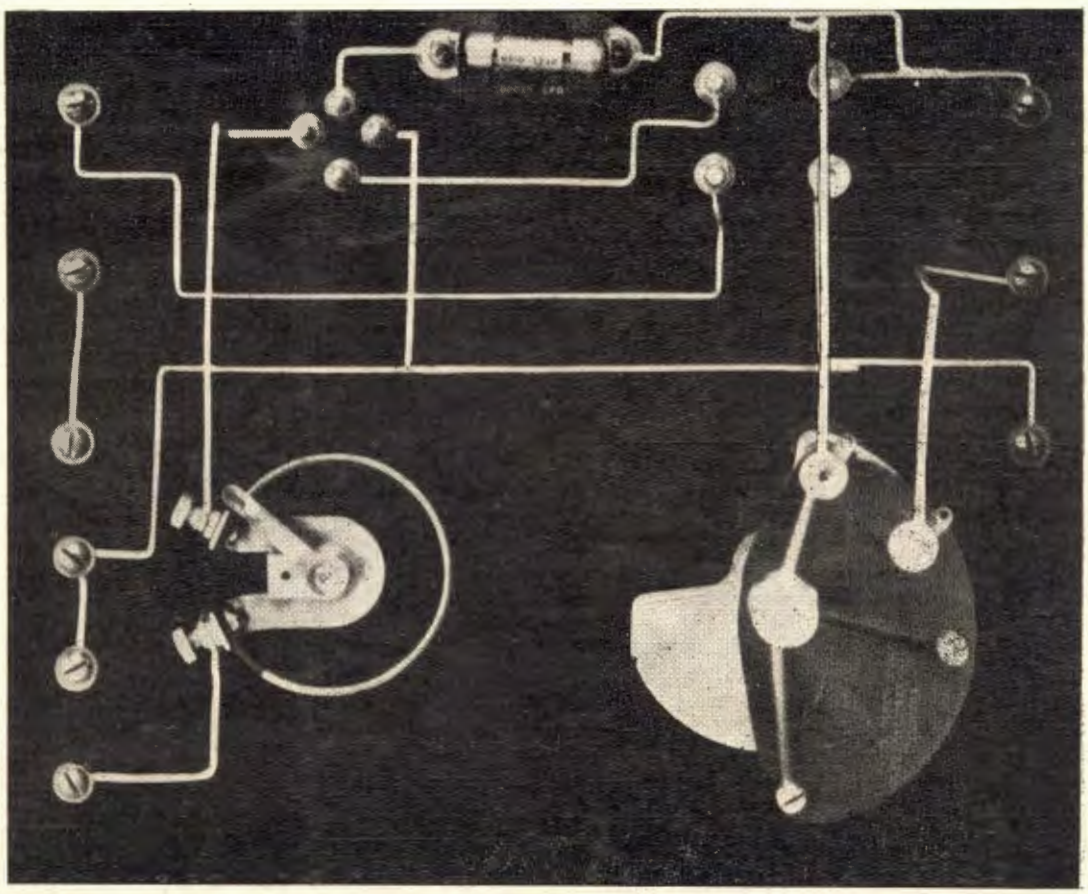
Front View of Panel.

the car—reckoned that if we left at 4 a.m. we should be in Sydney by 9 a.m. We certainly left at 4 a.m. alright, but we didn't see Sydney till 4 p.m. In between times was spent mainly in garages, so to-night I am rather tired and I want you to let me down lightly this week. Will you? Good! The illustrations will show you a nice little cheaply made single valve regenerative receiver. Honeycomb coils are used so that any desired wave length may be obtained by plugging in suitable coils. The circuit again is the P1 and employs only one variable condenser across the primary, the tickler coil being left untuned. This is no disadvantage, however, as the value of re-action is controlled by the proximity of one coil to the other.

Here is what you require:

1 panel, 10 x 8 x 3/16.
1 2-coil holder.
1 .001 or .0005 valiable condenser and dial.
1 English valve socket.
1 grid condenser and leak.
8 terminals.
1 30 ohm rheostat.
1 vernier condenser friction knob.
Panel wire.

In laying out this set I had in mind to cheapen it as low as possible—to be within reach of the average family man who wishes to graduate from the crystal to the valve stage. The parts themselves may be purchased for under £3, so that considering say a dull emitter valve at 27/6 and 3 dry cells at 9/- for an A battery, and one 42 volt B battery at 12/6, this set should fill the bill. Taking into consideration a small cabinet and the necessary honeycomb coils £7/10/- ought to cover the lot. "And who is there with soul so dead" who can't spare £7/10/- for the cause of wireless —a good cause, folks. "Ask the man who owns one."

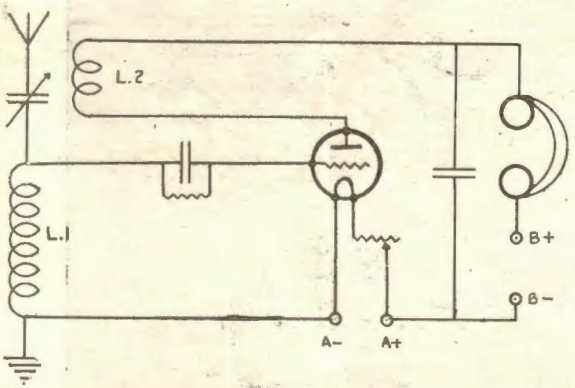


Back View of Panel.

Unlike a crystal set a valve set never grows old. An audio frequency amplifying panel may be added, two in fact, if desired—and nothing goes to waste.

Look again at the illustrations and note the lay out. Take up your panel and design accordingly. Now don't be scared; it really isn't difficult. Place your panel on a table and lay out your parts on top, just where you want them to be. Got the idea? Alright, then mark out with old compasses and centre punch all marks for drilling. Maybe you will experience a wee bit of difficulty in plotting the holes for the sockets. A simple, but perhaps not too reliable method is to do as I do. Measure in your mind's eye just where you intend putting the socket and wet the ends of the pins—lick them really—and place down on panel. When taken away four small wet "blobs" will be seen which should be centre punched. I know you'll laugh but it is quite effective.

Drill all your holes and now assemble the variable condenser. Fit the dial temporarily and mark out just where the friction button is to come. These buttons have a rubber washer extending beyond



the knob. This rubber washer rubs on the edge of the dial thus giving a vernier effect which is particularly good. And a vernier condenser of this class is very cheap and wonderfully effective. Try it and see for yourself. Hold on here for a minute, people. Mrs. Insulator is calling 'Tea-oh!' and I can smell the saos and cheese. Here I am back again and feeling quite refreshed—good old tea. Let's go on. Insert the vernier button and see that it is so placed that when it is turned the whole dial does likewise. It does that O.K.! Right, now assemble your coil holder, valve socket, rheostat and terminals. The whole outfit is beginning to take shape now, as all that remains to be done is the wiring. The back panel view is just the thing to follow, it is quite clear to you, I hope. As a check the circuit diagram is given.

Now you are ready to listen in. Place the valve in the socket — but, ah wait, let me tell you something about this. Pick up your valve and look closely at the four pins at the bottom. See that pin which is slightly away from the other three? That is the pin which is connected to the plate or anode of the valve. Some valves have an A or P alongside of this pin to denote anode or plate. The positive of the B battery flows through this pin to plate, so be careful not to insert it in the socket wrong way about. A glance at the socket will show you that provision is made for this staggered pin, so note when putting your valve into the socket, otherwise if the B battery gets across the filament its a case of "good night" valve. However, connect up ready for listening in, noting carefully that you don't join the B battery to the A battery terminals. Keep the tickler coil away from primary coil and tune with condenser until the desired station is heard. Now bring your tickler nearer to the primary and adjust the vernier button for fine tuning. By bringing the tickler too close the valve will howl so be careful not to do this. If on the other hand persistent howling takes place a grid leak of a different value is necessary. Each valve has its own peculiar characteristics and you will quickly acquire such knowledge.

Coils again are:

Broadcasters (2BL)	35	50
Farmers (2FC)	150	100

Cheerio till next week.

With apathy did the village resident listen to the city visitor's account of the joys and excitement of life in town. "We get everything here that is worth seeing," said the villager. "Why, last week we had the champion brass band here, the week before the greatest trombone player in the country, and this week we are going to have a great production of the drama, 'Lewis the Cross-Eye.' I tell you that is going to be a real show!"

"What did you say the name of the play was?" asked the visitor.

"Here, have a look for yourself," said the other, as he produced a much folded programme, announcing "A grand production of Louis XI."

THIS MAN IS PEEVED.

He built this set and the darn thing wouldn't work. If he had made a set according to instructions given in Wireless Weekly almost every week, he wouldn't have got this way. MAKE SURE OF BEING ON THE SAFE SIDE. Get "Wireless Weekly" every week. Fill in this form and mail it to us with remittance.

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Correspondence

(To the Editor)

Sir,—I hope I am not too late to correct a regrettable error in my report of the recent "Wireless Weekly" amateur efficiency test — I inadvertently wrote 2DN instead of 2ZN. Will you kindly correct this? Since writing there has been a commendable roll up of amateurs in the air, each endeavouring earnestly to retrieve lost laurels. 2JM has improved his musical transmissions wonderfully, and his Sunday lecturettes are quite features—a little less dogmatism and technicality, however, might be replaced by definite structural details of "hook ups" such as the famous "Low Loss," "Reinartz," etc. 2ZN's CW and ICW has improved but am afraid 2GR's Morse will never be good. It is an acknowledged fact that Morse sending is young men's work, and elderly people rarely acquire proficiency. His transmissions are beautifully modulated. 2YI still remains ponderous, overwhelming, and all wave embracing, and whilst on the air all other amateurs might as well close down. The rest of the radiators, although in earnest are simply floundering about with huge generator hums, broken up loose connection signals and over sensitive microphones. Last night the ticking of 2YG's watch could be heard 50 feet from the phones and every other movement in the room equally pronounced, I hope, Sir. you will soon start another test. It affords fine tuning practice, and is exceedingly interesting as well as stimulating.

Yours etc.,

S. A. MACROW.

55a Brown St., Paddington.

(We cannot agree with our correspondent regarding the tuning of 2YI. On our own "low loss" we find him extremely sharp; this in fact applies to most. No doubt the reason why no mention was made by Mr. Macrow of either 2CM and 2DS is his former report was that both these transmitters were working below 120 metres.—Editor.)

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(To the Editor)

Sir,—I am interested in the various theories expressed by several of your correspondents in answer to Mr. P. Boulton's statement that he can hear speech and music from his set without 'phones and loud speaker. The various explanations given by your correspondents of the phenomenon do not at all satisfy me, as my set has exactly the same characteristics and has had it to my interest for some considerable time.

Without going into the details of my set, let me say briefly it is a five valve set constructed by myself, using double circuit, jacks with two audio stages.

There are many individual features incorporated in its design for the purpose of experimenting with any number of valves, from one to five.

I endeavoured to trace the cause as I considered such a feature had possibilities if developed, but I must admit that after many weary hours of search I have been unable to ascertain the cause. My set does it when 'phones or loud speaker are not in the room and I have no loose connections.

Sound in telephone receivers, we know, is the vibration of the diaphragm, the intensity of the sound and its pitch depending upon the number of ampere turns on the magnet bobbins and the sound wave frequency respectively. Sometimes I wonder if our theories of electricity are not too empirical. My own explanation of the occurrence is the aperiodic vibration about their contact points of the two circuit jacks.

If this is so, then is not electricity merely vibration.

I am reminded of the old story of the suggested destruction of the great iron lamp standards of Paris. Their destruction was to be brought about by ascertaining their critical period of vibration and the force necessary to produce it.

It was found that the force could be applied by the little finger and provided the correct period was imparted to it the lamp post would in the fraction of a second crack like a carrot and fall.

Could not electricity then be a vibratory force of high frequency?

I have what I think is evidence in radio work. Has it ever been observed that if a receiving valve is forced close to the point of oscillation that the issuing sound is decidedly metallic?

There was a time when I thought the metallic sound of loud speakers was due to the metallic diaphragm. But since then I have experimented with non-metallic substances and have found the same phenomenon.

The plate which acts as a relay is of metal. Is not the metallic sound due to the actual vibration of the plate? If so then electricity is vibration detectable only by mechanical means. Let me carry this vibration theory a little further.

Place a finger on the aerial or grid circuit. The intensity of sound is decreased. My explanation is that the vibrations are damped by the application of a force not in tune just as we damp the sound emanating from a gong by putting the hand on it.

To the eye, the ear or any of the other three senses, these vibrations are undiscernible just as waves at radio frequency cannot be distinguished by the ear. But the fact that our senses cannot detect a phenomenon is no criterion of non-existence.

A small instantaneous concentrated force has more effect that a much larger force applied through a greater period of time. The nail that is struck with a short sharp blow will penetrate further into wood than if a much larger force were applied to the nail head over a longer period of time.

Think of this analogy in connection with the sensation of shock imparted to our senses when we accidentally come in contact with a live wire at relatively high potential.

The minute and undetectable vibrations of the wire impart to our bodies a sudden blow, the whole force being applied in the fraction of a second. The blow, from my experience, is similar to a knock on back of the head.

So powerful is the sudden application of the vibratory force that at times we are hurled feet away from the place of application, like a stone from a catapult which gets its high velocity from the sudden checking in the propelling force of the catapult. The more quickly this force is checked, the greater will be the velocity of the stone.

The same phenomenon occurs in electricity. The sudden interruption of electric force causes a high surging whose maximum potential is many times greater than that of the interrupted force. Hence the precautionary switchgear and protective devices in cable work so as to prevent an undamped surge from breaking down the insulation of the system and causing disaster.

To me the whole phenomenon of electricity is high frequency vibration of the materials' minutest parts (the atom is much too big to consider in this relation).

The periodicity of the vibrations is critical so far as danger to life is concerned. If it is very high it is harmless.

This characteristic has its analogy. I have seen a man put his finger under a steam hammer which a few moments before had roughly forged a crank shaft in a few blows. The hammer descended from the same height and apparently with the same force time and time again but the man, who had such confidence in the operator, was only conscious of the fact that the hammer just touched his skin and did the finger no injury.

In other words the periodicity or duration of the blow was too short to be effective. So with the high frequency electricity.

That some materials are "non-conductors" is due to their inability to vibrate at a sufficient high frequency to cause the phenomenon of electricity. In other words there is a critical period of vibration which imparts to certain substances the characteristic known as electricity—a magical word, a satisfactory definition of which I have never seen or heard.

Yours etc.,
"FREQUENCY."

Lightning Arresters.

(To the Editor)

Sir,—Mr. Taplin's article in last issue on the above subject arrests attention owing to being based on the bad old superstitions about lightning that apparently still claim credence from the Fire Underwriters and some commercial men. The scientific investigations that Mr. Taplin suggests should be made, have already been made long since

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and are common knowledge to every scientific student. The idea that lightning is a sort of raging lion going about looking for easy paths, and dealing destruction at every stroke never did impress anyone but the timorous public and a few dealers in lightning rods such as are satisfied by Mark Twain in one of his humourous pieces. The view now held is that in every part of the earth and at any given moment there are streams of ionised air rising up in one part, descending on another between the earth and the atmosphere upper strata, known as Heaviside layer. When this ionised air comes into space occupied by dust or vapor particles assembled, either as visible or invisible clouds, they charge it by accumulation to a potential that increases gradually or swiftly until it reaches the disruptive point for the particular material that insulates or isolates it from places of lower potential. More often than not the resulting "flash over" that we call lightning takes place in the direction of the upper air rather than the earth. But when the "flash over" takes place towards earth the mere fact that some of it finds a comparatively easy path of low resistance in for example a wet chimney, as suggested by Mr. Taplin, does not minimise the effect of the stroke. It ought to be obvious to any electrical student that when there is a potential drop of some thousands of volts across a small resistance there must be a generation of terrific heat owing to the enormous current that flows for an infinitesimal time. No lightning rod ever stood up under the stain of a direct flash of lightning and no "lightning arrester" ever did or will arrest lightning that selects it for a path.

How then can a wireless aerial be safe? The answer is that a lightning rod or a stream of warm air ascending from a chimney or an unoccupied house, or an aerial well earthed through a decent tuning coil, or any other conductor extending in unbroken electrical continuity between the upper air and the ground are all extremely efficient leakage paths for atmospheric accumulations of electric ions and function in precisely the same way as a grid leak does in a valve set. You must, in fact, nip your lightning in the bud, before it becomes lightning. There never was a more curious perversion of plain facts than Mr. Taplin's amusing picture of lightning choosing a straight path. A lightning flash is about the most crooked, forked, and zigzagged and tortuous phenomenon ever beheld by bewildered human eyes or recorded on photographic plates or tracked along its course of devastation. If however, we catch it young and teach it to conduct itself properly along the right paths it is quite harmless. A good conductor such as a wireless aerial is like a good bus conductor—it prevents overcrowding by not allowing a crowd to collect. Once a crowd of electrons has collected in force at a given point you have as much hope of arresting it as a burly policeman has of arresting a bull in a china shop. Those of us who listen in and are annoyed at the cackle and sizzle of "atmospherics" or "statics" in our 'phones are perhaps not conscious that we are getting a testimony to the efficacy of our set as a protection from lightning since atmospherics is merely out pet name for the prenatal lightning that our aerial, like an infant Hercules, is strangling in his cot and returning again to mother Earth. The fault with our Fire Underwriters, however, is that they prefer that the humble, ordinary householder should assume the heroic role of Ajax defying the lightning and they insist on us installing "Arrestors" when we would rather the lightning just moved on peaceably. This way of putting it may sound humorous but it is the actual fact. Huge concerns like the electric railways sometimes have to play Ajax with the lightning and defy it with horn gaps, choke coils, electrolytic cells, and other weapons that frequently do more harm than good during a thunder-storm, but the less we who use wireless sets do to impede the free passage of electrical discharges through our sets the better for our own safety and for the pockets of the insurance companies. There is not one authehntic instance of a house having been struck by lightning because of the proximity of a wireless aerial and there is every reason to conclude from electrical theory and from common experience that it would pay the insurance people to reduce rather than increase premiums for those who instal such an excellent protective device. But the only good "lightning arrester" on the market that offers an alternative by-path outside the receiving set must of necessity also act as a "wireless arrester" and quench all signals while doing at the same time rather badly and dangerously, what the properly-earthed receiver does well and safely. No one dreams of "arresters" on tin roofs or electric lighting wires, or those pipes that adorn our sewerage system, yet none of these are half so inocuous as the innocent aerial, so why scare the timid householder away from wireless by branding it as an "extra risk?" Superstition dies hard, and sometimes it is commercially exploited to the detriment of progress.

Yours, etc.,

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Published by A. W. Watt, "Keira," Alfred St., North Sydney, for the proprietors and printers, Publicity Press, Ltd., 12/16 Regent Street, Sydney.