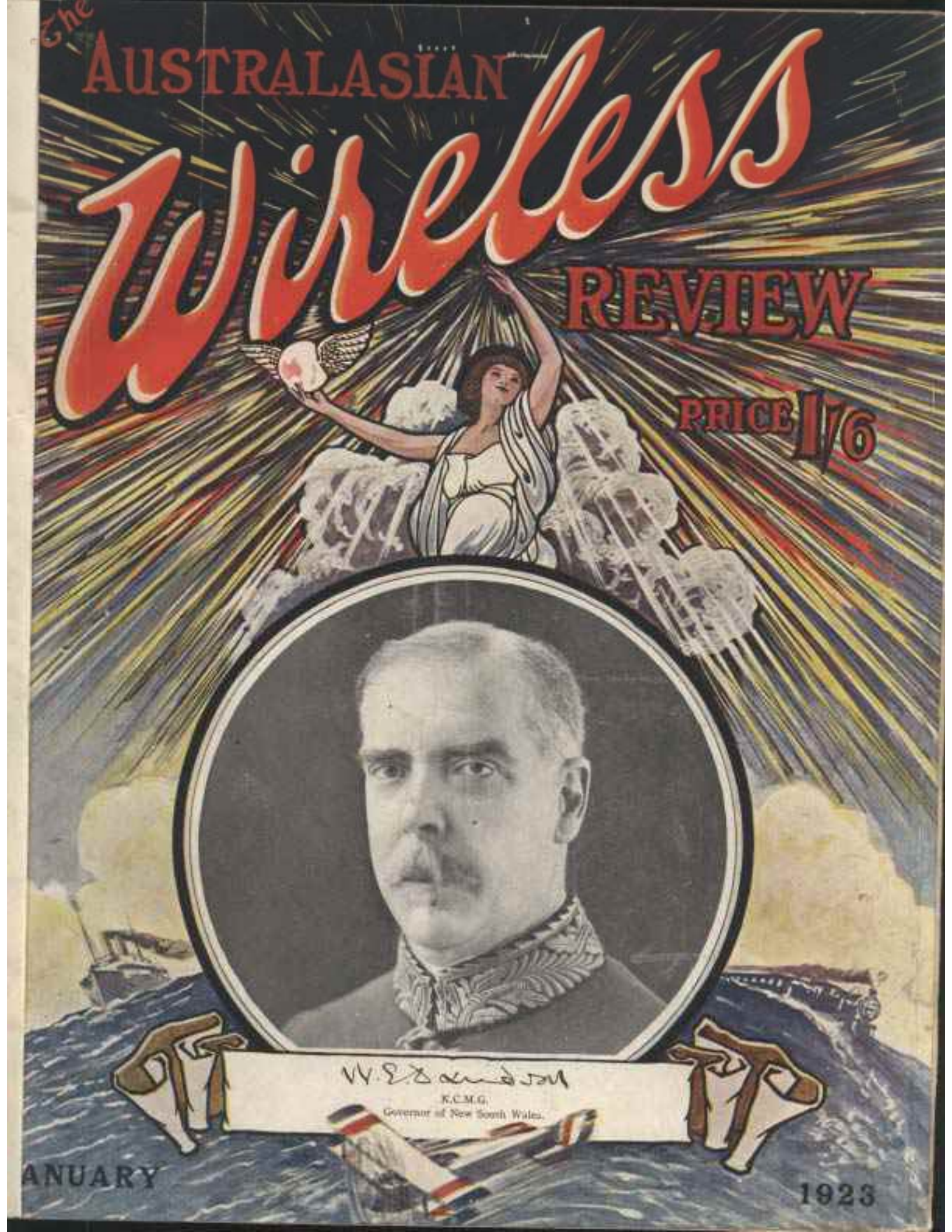
The

AUSTRALASIAN Wireless REVIEW

PRICE 1/6



K.C.M.G.
Governor of New South Wales.

ANUARY

1923

The

AUSTRALASIAN WIRELESS REVIEW

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ILLUSTRATIONS

The "Australasian Wireless Review" is forwarded to any address in Australasia for **10s.** *per annum*

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Editorial

THE SHAH WHO SOLD THE WIND.

THERE is a story of an impecunious Shah of Persia, who sold the wind to a usurer, in order to replenish his impoverished coffers, and thought that it was a huge joke, when the suggestion was made for him to sell the wind. Persia, in those days, was a country wherein the windmill was the only motive power used for all kinds of manufacturing purposes. As soon as the usurer got his Deed, sealed, signed and delivered, conveying to him the wind, for all time, for a certain stated sum of money, he notified all windmill owners that thereafter they would pay to him an annual rental for the use of the wind—his property.

Needless to say, the Persians were soon up in arms over the matter, and the iniquitious deed was destroyed, and the usurer repaid.

The wind, or air, or ether, of Australia, is the birth-right of the Australian people. Persons, firms, or corporations may be granted limited rights to the Australian ether, especially when those rights may be of real benefit to the Australian people, as well as the persons, firms or corporations, who are so fortunate as to obtain those rights. But the matter must begin and end there.

We mean to develop an Australasian Radio Science, we intend to play our part in furthering that science, which is, as yet, in its infancy. To do so, our enterprising business people must be granted every facility to prosecute research and to place at our service, radio apparatus of an ever improving pattern and design. Our amateur wireless enthusiasts must be given the same rights and privileges to receive and transmit radio-telephony and wireless telegraphy, as are enjoyed by others in almost every part of the world outside Australia. Elsewhere, the wonderful new radio science is rendering to the community, the most marvellous service civilisation has ever experienced. The whole tone of society, from the lowest rungs of the ladder to the highest, is being uplifted by broadcasted music by noted artists, songs by the best of singers, stories, lectures and addresses by the ablest of speakers. The sick in the hospitals are having their weary hours of suffering lightened by radio music. Miles out at sea, passenger vessels relieve the tedium of the voyage by radio concert reception. The country school-house, on the borders of civilisation, is receiving its lectures, music and song, from the city centres, and so bringing into the lives of those in the lonely back-country districts, some of the benefits of the city life.

All and sundry may send and receive radio-telephony and telegraphy, in order that the greatest impetus possible may be given to the prosecution of invention and research.

We must have all this, and without further delay.

We must have the benefits of this wonderful new service to mankind, in full swing in Australasia.

Why do we so sadly lag behind in this great march of progress?

We do not intend to indulge in any carping criticism, we desire, rather, to appeal to all concerned to remember that he who serves his country, or his fellow-man, best serves himself.

SERVICE must be the watchword—everything must be subordinated to rendering the Australasian people that need of radio service which is their due.

It is better for all concerned to render that service with the goodwill of the people, than to be forced to render it by the will of the people.

The brake on the wheel must be lifted!

In the light of the knowledge that the development of the radio science brings to us, we conceive that it may be necessary to entirely revise our patent laws, or, at least that sections of them which relates to inventions which depend for their value on the use of the people's ether. An inventor should have the right to obtain some material benefit from his invention. If, however, his invention is useless, until the people, as a whole grant such concessions as may make his invention valuable there must be mutual concessions, and the inventor must be satisfied with receiving a royalty for the use of his invention from all and sundry. In other words, the people must have the full and unrestricted right to the use and benefit of the invention in return for the concession they grant concerning it. Radio apparatus inventions are too valuable to be allowed to rest in the hands of monopolies or combines, or to be assigned to those monopolies or combines by inventors.

We will protect the inventor, but we must protect ourselves also.

Research in the radio science can only be prosecuted at a great cost—that cost can only be re-imbursed by the manufacture and sale of radio apparatus. Competition in the production of the most efficient radio apparatus, is the main factor that will make for the advance of the radio science in Australasia.

Let the powers that be see to it that there is a fair field and no favor!

The Australasian Wireless Review

WE make our bow to the reader. We are here because we believe that we are needed. We want to see the radiophone boom in full swing in Australasia without delay. We believe that a monthly review, devoted to the wireless science can help in fostering that "get together" spirit which will boom radio-telephony along. Loyal co-operation amongst radio enthusiasts is a vital necessity! We would like to have the help of Wireless Institutes and Radio Clubs to make us acquainted with each other. Let us know what you are doing in your districts, for the benefit of all and sundry. Send us photos of your stations, sketches of experiments you may have carried out, and anything and everything which will be helpful to your fellow experimenters. There is a wonderful good fellowship among wireless amateurs. We indulge our hobby for our own enjoyment, but we are never happier than when helping others.

¶ We are at your service. We have come along to help.

¶ We shall search the world's wireless literature and will place before you, from month to month, all those tips and hints which may help you to get a little more out of your set. We will put you in touch with all that is new and practical and likely to assist you in your experimentation and research.

¶ We have got into touch with the world's leading manufacturers so that we can post you on the latest achievements in the manufacture of radio apparatus, and in the development of new circuits, etc.

¶ We want to make you acquainted with the traders in the radio industry in Australasia, whose goods you will be pleased to know about. We shall make a special feature, in each issue, of telling you what you can obtain and where to obtain it. You want to know of the latest and best: the trader wants you to know of it. We shall therefore serve you both.

¶ Our motto, "To Serve."

THE EDITOR.

Facsimile of a message from His Excellency the Governor of New South Wales to the Radio Experimenters of Australasia.

GOVERNMENT HOUSE,
SYDNEY.

Message for the "Australasian Wireless Review".

.....

A monthly wireless Magazine should meet a long felt want in Australia and it has my best wishes for its success.

One of the most vital needs of the Empire today is closer communication between Great Britain and her Dominions. It is also equally necessary that there should be a scheme of communication between the Capital and the remote parts of the State so as to eliminate as far as practicable the isolation of the Interior as it exists today. Wireless would provide the ideal facilities for communication in our far back Settlements. The advantages of direct communication are so obvious. We must avail ourselves of all the improvements in methods of communication and there is no Country in my opinion for which Wireless would form such an important asset as it would for Australia.

Wireless is making tremendous strides throughout the World and will play an important part in the future. Young Australians would do well to devote their attention to the pursuit of this new and wonderful science.

W. S. Davidson

Governor.

23rd November, 1922.

Dame Margaret Davidson, who accompanied
His Excellency the Governor at the
opening of the Radio Exhibition

The First Radio Exhibition in Australia

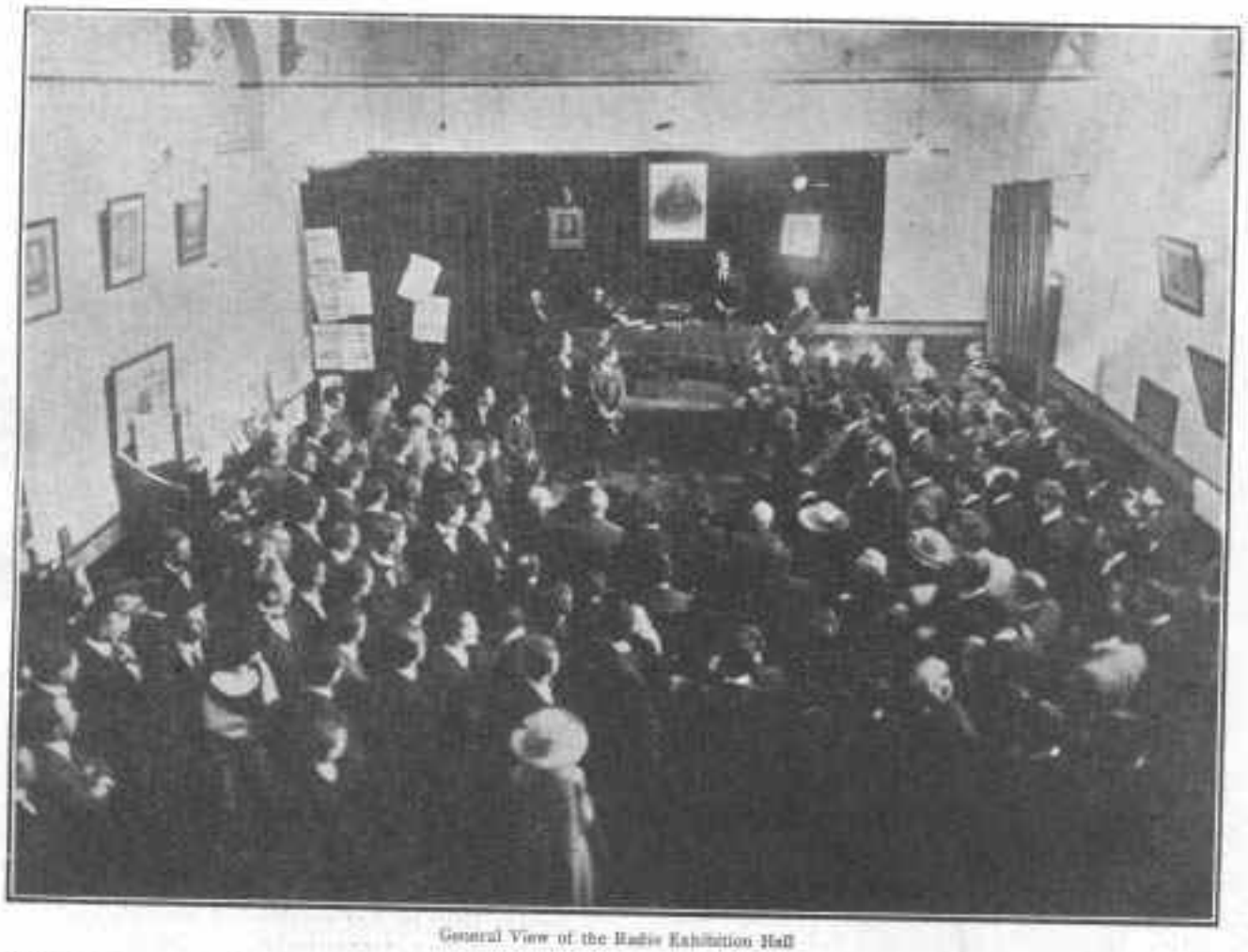
In launching the first monthly radio magazine in Australasia, we deem it fitting to give some prominence to what is bound to prove one of the most important events in the history of our scientific progress, that of holding the First Radio Exhibition.

The Exhibition was held under the auspices of the Sydney Metropolitan Radio Club, and was opened by His Excellency Sir Walter Edward Davidson, K.C.M.G., Governor of New South Wales, at 3 p.m. on Friday, September 22nd. It was an unpretentious affair, but it was a revelation to the general public, by whom it was attended in large numbers. The Club President, Mr. R. C. Marsden, Mr. A. Mitchell, the Secretary, and Mr. O. F. Mingay, received His Excellency, who, in an excellent speech, gave every encouragement to young Australians, to pursue their experiments, and to play their part in the advancement of the radio science.

During the course of the Exhibition, a number of demonstrations of telephony reception were given by the Club President, who, using a receiver and two stage amplifier of his own construction, clearly proved to the visitors that radiophone music could be received in such volume as to fill the hall.

Unpretentious as the First Radio Exhibition was, it marked the commencement of a new era in the scientific life of Australia, for we are about to take our place with the countries of the Old World in having our share in the enjoyment, entertainment and instruction which this wonderful new science has brought to civilisation.

The time is not far distant when every country school-house will have its receiving set, by means of which country children may receive class instruction by able lecturers. We believe that the country school-house will be the centre of attraction in the country districts, where both parents and children will assemble in the evenings to hear band items.



General View of the Radio Exhibition Hall

instrumental and vocal solos, and entertaining lectures and addresses.

In the cities, the radiophone will bring music, song and story into every home, for the humble crystal receiver will be within the reach of all.

The next Radio Exhibition should find us in full enjoyment of all the benefits of radiophone broadcasting, and the many enterprising firms who intend to cater for the requirements of "listeners in," should have some fine exhibits of receiving and transmitting apparatus to place before us for our delectation and instruction.

Our illustrations give a general view of the Exhibition Hall, with the platform in the background, and a number of the photos. of prize winning apparatus, constructed by amateurs, are included.

Australia's Pioneer Broadcaster

There is a warm corner in the heart of every radio fan in the eastern portion of the Mother State for Mr. "Charley" Maclurcan, whose Sunday night radiophone concerts, "broadcasted" from his home at Strathfield, Sydney, N.S.W., are eagerly looked forward to by experimenters, who want to try out their gear on radio telephony. Purely in the interests of the science, and for the benefit of radio experimenters, Mr. Maclurcan has devoted every Sunday night, from 7.30 to 9, for more than a year, to transmitting music, vocal and instrumental items, speech and story, with C. W. and Buzzer practice as an intermezzo.

Mr. Chas. D. Maclurcan,

A World's Record Breaker

An Experimenter who first studied his subject thoroughly and then by perinacity and steadfastness of purpose won laurels for Australia in the foremost science of the world. He should be an inspiration to wireless enthusiasts, prompting them to aid in advancing an Australian Radio Science

Mr. Maclurcan was a keen devotee of wireless as far back as 1910, and, in that year, a photo. of his apparatus appeared in "Modern Electrics." At that time he had an aerial on the top of the Wentworth Hotel, with which he could receive Suva, a distance of 1900 miles. His receiving gear consisted of a loose coupler, loading coil, two silicon detectors, a perikon detector and 3000 ohm 'phones. He had two sending sets; one had a one-inch spark coil, a helix, Leyden jars and spark gap; the other set was of a more pretentious nature, and included a 1½ k.w. rotary converter, run on 240 d.c., converting to a.c. at 50 cycles; an oil cooled transformer, rotary spark gap, glass plate condenser in oil, and a helix.

With the small set, using a current of 12 volts, he sent messages to a ship 64 miles out at sea, and thinks he could have done better if the operator on the ship had been willing to stay out of bed a little longer to carry on the test. Apparently, operators in those days did not enthuse about amateur sending tests. His best sending with the big set reached 300 miles. A little later a fire at the Wentworth Hotel destroyed all his wireless apparatus, but, nothing daunted, he imported a transmitting set from the Clapp Eastham Co., of New York, U.S.A., of ½ k.w. capacity, and he made up a new receiving set, in which he incorporated a De Forest Audion Valve, the first to be used in Australasia. At that time "regeneration" was not known, and the valve was just an ultra-sensitive detector.

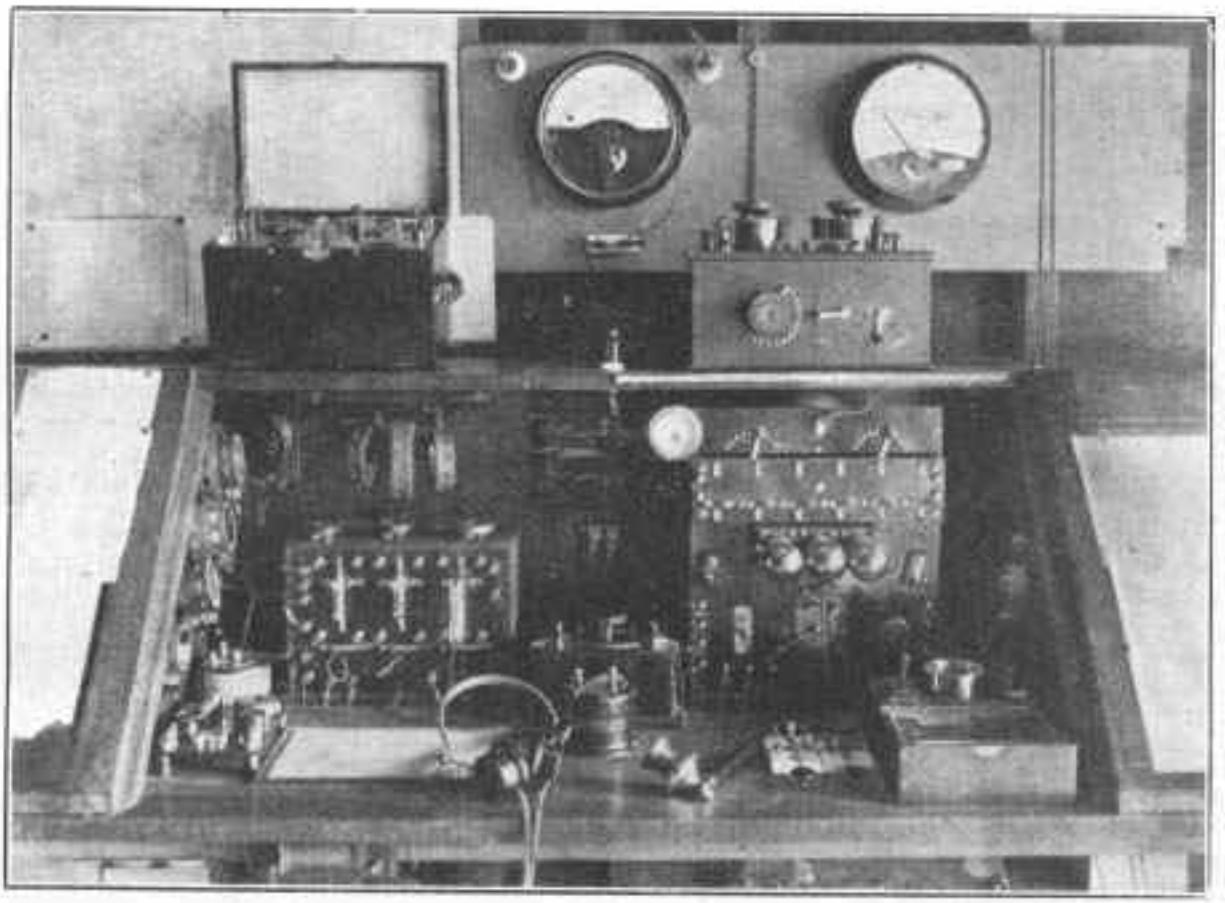
The outbreak of the war put an end to his experiments for the time being, as his gear, in common with all other wireless apparatus, was interned. In 1919 he resumed his experimental activities, and equipped himself with both sending and receiving sets of his own design and construction. With tireless energy and unabated enthusiasm he has introduced improvement after improvement, with the result that he has brought his transmitting set to such a pitch of perfection that he has established world's records for long distance transmission on small current consumption. He has been picked up in New Zealand with one valve, using for transmission less current than it takes to light the tail lamp of a motor car! In the days to come (may they be soon), when the ether is vibrating for the better part of the 24 hours with music, lectures, sermons, song and story, we will have a kindly remembrance for our pioneer "broadcaster," whose generously given services to his fellow experimenters may have laid the foundation for many important radio improvements, which may be invented by the young Australians of this section of our great continent.

Broadcasting in England

THE General Post Office authorities have authorised the use of wavelengths between 350 and 425 metres for broadcasting in England.

Probably for the first time in history a wireless aerial was installed at a place of worship in that country on April 27th. This was done by permission of the Postmaster-General, to the Guild-house, in Eccleston Square, S.W., for the purpose of demonstrations which accompanied a lecture on Wireless Telegraphy and Telephony, given there by A. O. Gibbon, of the Engineer-in-Chief's Office, G.P.O., in aid of the funds for the League of Arts.

Loud-speaking telephones and a new method of amplification being employed, the audience was enabled to hear various items of news, music and spoken verse transmitted from the various stations around London —a typical demonstration of "broadcasting," proposals for which are now approved by the authorities.



Mr. Mackircan's Transmitting and Receiving Sets at Strathfield, Sydney, N.S.W.

Paris Police Plan Extensive Use of Radio

WIRELESS telephony and airplanes gave Paris the quietest May Day in history, enabling police groups to be shifted quickly to points wherever manifestations seemed to be concentrating. As a result, only a few insignificant street fights followed the annual labor reunion in the Federation's Headquarters, with no serious injuries.

Throughout the afternoon three airplanes hovered over the city and its suburbs, in wireless telephone and telegraph communication with the Prefecture of Police and the Place de la Republique, whence police manoeuvres always are directed.

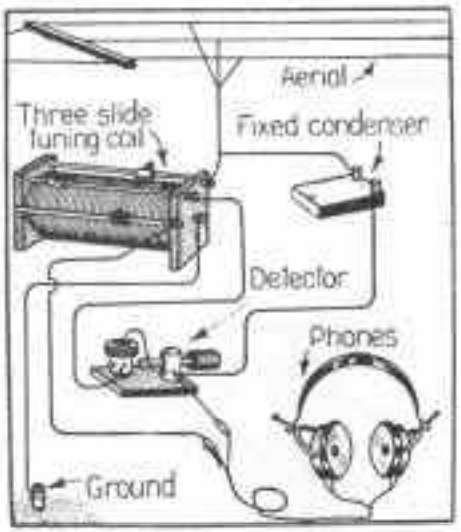
For several weeks Chief of Police Leullier has been experimenting with the use of wireless. To-day he expressed the fullest confidence that in less than a month every station would be equipped with the necessary sending and receiving apparatus, while automobile patrols, similarly equipped would visit the more populous districts day and night. It is estimated that this will enable the city materially to decrease the present police force.

Our Australian Police authorities are going into the question of equipping the police with wireless apparatus.

Tips for Fans

SIMPLE RECEIVING SET.

A SIMPLE tuner to use with a crystal detector to tune to 260 metres. Construct a three slide tuner approximately 3 in. long by 3 in.



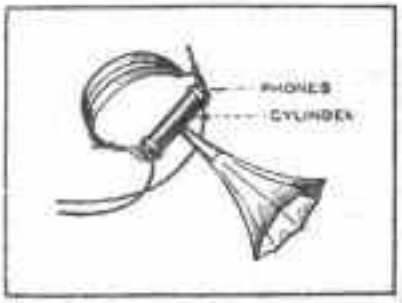
in diameter, wound with No. 24 S.S.C. wire, and connect it as per diagram herewith.

A unique three slide tuner circuit is shown above. This circuit has been found very selective, and is an efficient set for radiophone broadcast reception within a radius of 3 to 5 miles.

* * *

A HOME MADE LOUD SPEAKER.

A SIMPLE method of using a pair of ordinary receivers in conjunction with a gramophone horn is shown in the accompanying illustration. The horn used is a familiar type of gramophone horn, and the cylinder shown is of cardboard or fibre, 7 in.



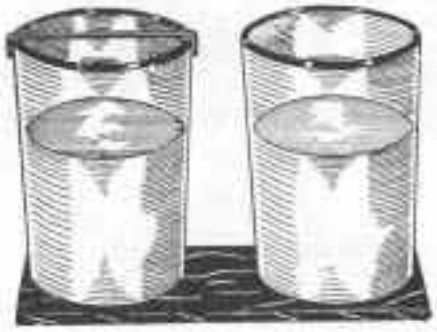
long, and of a diameter suitable for the receivers. A hole is cut in the middle of the tube for attaching the horn. Various methods can be devised for attaching the horn, but the best method is to rivet a short piece of tubing to the cylinder to make a tight-fitting socket. The 'phones are clamped over the ends of the cylinder, as shown.

Some enterprising Australian firm should make up this loud speaker attachment, which could be sold at a price well within the reach of the amateur.

* * *

THE DANCING WIRE.

A CURIOUS little experiment may be carried out with two drinking glasses. Half fill these with water. Now rub a moistened finger round the rim of each and see if they are of similar tone. There will probably be some slight difference, but this can be adjusted by adding more water to one of them. Then secure a piece of thin wire and bend this at the ends so that it can rest across one of the



tumblers. Now start to rub the other glass and almost at once the wire commences to jump about, although it is not actually touched at all. This is due to the fact that sympathetic vibrations arise in one tumbler when the other is touched. A still more vigorous movement on the part of the wire may be induced by striking one of the tumblers rather sharply with a piece of wood.

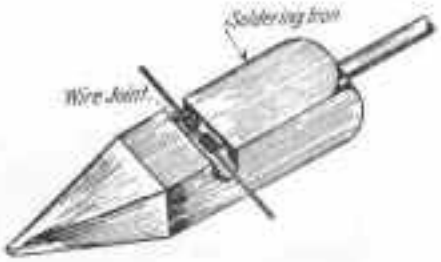
When the glass at the right is rubbed, the wire on the glass at the left will start to dance, due to sympathetic vibrations set up in the second tumbler.

This little experiment will serve to show our friends how the "vibrations" of the ether are communicated from the transmitting station to the receivers.

* * *

SOLDERING IRON KINK.

A GROOVE made in a soldering iron, as shown in the illustration, is much better for soldering wire connections than using the tip of the iron, as the solder is given



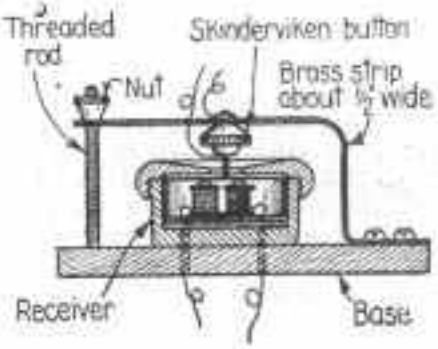
a chance to sweat into the connection. This groove may be filed or ground into the iron. Several different sized grooves located on the different faces permit the soldering of different sized wires more easily.

Did you ever cuss a wire joint as it skidded about over the hot soldering iron? File a groove or two in your iron, tin it thoroughly with sal-ammoniac or resin, and you will be tickled pink with the results.

* * *

SKINDERVIKEN BUTTON QUERIES.

A SUGGESTION for mounting a Skinder viken button to be used for amplifying radio signals. By



turning the nut the pressure between the button and the diaphragm of the receiver may be varied.

The Skinderviken button is a very

small transmitter which works on the principle of varying the resistance of carbon grains when compressed and released. It may be used in any place where an ordinary transmitter would be used, and will give satisfactory results.

Could it be used to amplify radio signals?

You might try using it to increase the volume of signals from a radio set by placing the machine screw, fastened to the diaphragm, in contact with the diaphragm of one of the radio receivers. This should be arranged in such a way that the amount of pressure at the point of contact may be varied to secure best results, a suggestion for which is shown in the accompanying cut. The transmitter button should then be connected to a local battery and to a 4-ohm telephone receiver. If you wish higher amplification, you might try connecting the button with a local battery, and the primary of a telephone transformer; connecting the secondary of the transformer to a 75-ohm telephone receiver (higher resistance than in former case).

A NEW BINDING POST.

IN electrical work it is often seemingly little that makes a great difference in operation, and perfection in details has a great effect on the attainment of results. There is nothing

more aggravating than a poor binding post. The new binding post which we illustrate presents various features of superiority; there is practically nothing about it to wear out; it will receive a wire and hold it firmly without marring it; and as regards its appearance the illustrations speak for themselves. These posts are particularly recommended where perfect connections which will resist vibration are to be made. The contact surfaces between which the wire is gripped are practically the full width of the post, and the opposed faces, gripping the wires, are accurately parallel. These binding posts are highly recommended for testing laboratories and in general wherever really good work is to be done. They are made in various sizes, the largest passing a 150 ampere current. Nothing is more aggravating than binding post troubles. Here we have an evident attempt to get rid of them.

Some radio experimenters have the habit of clamping the wire terminals to wood or other bases simply by curling the wire under a washer held down by a wood screw. Such connections are liable to give rise to an "open circuit" at any time, especially when a long distance record is sought by the radio experimenter. The use of suitable binding posts always pays in the end.

A GREAT PIONEER.

ONE of the greatest pioneers in wireless work was the late Professor David E. Hughes.

Years before Senatore Marconi had begun to experiment in wireless, Hughes struggled along, firm in the belief that wireless communication was possible.

His rough-and-ready apparatus may be seen to-day in the Science Museum at West Kensington. Crude as his instruments are, they are historical relics, for with them Hughes "picked up" signals from a clockwork transmitter up to a distance of 500 yards. In the days of his early experiments, Hughes, like many other great inventors, received but little sympathy or help, and once, in 1880, when he was explaining his experiments before the President and some Fellows of the Royal Society, he was laughed at, and told that "the whole business is absurd."

If Hughes could have seen the effects of the present-day wireless boom he would, perhaps, have felt that his life had indeed not been lived in vain.

* * *

EDISON'S WIRELESS.

THOMAS A. EDISON, the great inventor, has armed himself with a wireless receiving set. But the invention is not new to Mr. Edison.

He has always been experimenting with anything that held possibilities of this sort. As far back as the 'eighties he was engaged in tests for the transmission, without the aid of wires, of the ordinary Morse dot and dash signals.

He had an idea in mind for an apparatus to enable people in a moving train to talk to friends on a land station.

However, he was advised at that time to drop the subject, as it then promised no particular advantage. Fewer people travelled by railroads then, and it was thought that they would not be inclined to spend extra money on sending messages by wireless when they could send one, at a cheaper rate, from the first stop that

the train made. The difference of time saved would not be worth the money.

Edison's wireless was achieved by induction between metal strips placed on the roofs of the train, and a wire stretched between poles in a line running parallel to the railroad.

The Story of the Telephone

Dr. Graham Bell's Great Achievement

WHAT would the world do to-day if the whole telephone system were suddenly destroyed?

Incalculable delays would result! business would be choked, and commerce held up. And yet very few pause to consider how this essential factor of modern life came into being.

Dr. Graham Bell

The first faint cry of the baby telephone was heard, not in a spacious experimental laboratory, but in a poorly furnished garret, nearly fifty years ago.

In Boston there was an electrical shop, and in the attic of that shop, on June 2nd, 1875, two men were working and puzzling over a clumsy piece of electrical mechanism.

They had in mind a telegraph which, instead of merely sending out clicking signals, would transmit musical notes, so that a large number of messages could be sent over a single wire at the same time.

It was no good. For weeks they had been trying, but, despite every effort, they could obtain no results.

Alexander Graham Bell and his assistant, Thomas A. Watson, were the baffled men; but their labors were most unexpectedly to be crowned with success.

Clock-spring reeds, vibrated by electro-magnets, were part of their experimental telegraph set, and when Watson, who was sending, pressed down the key to cause the clock-spring at the sending end of the wire to vibrate, the contact points fused together. Consequently, the spring was held down by electro-magnetic force, and Watson tried to pluck it free, with the simple result that it vibrated over the magnet.

But, though the result was simple, the developments were wonderful indeed. The telephone had spoken!

Bell, in a frenzy of excitement, dashed into the room, for his ear had caught the feeble sound which passed over the wire.

"What did you do then?" he shouted at Watson. "Don't change anything. Let me see."

By accident, the fundamental principle of the modern telephone had been discovered. It happened that the current was flowing continuously through the line and the electro-magnets, and therefore the plucking of the spring had caused a variation in the current intensity, thereby throwing the corresponding clock-spring at the receiving end of the line into vibration. The rest was mere mechanical adjustment.

It is claimed that the Sea Shell Loud Speaker eliminates distortion. A Sea Shell Loud Speaker at the Radio Exhibition.

Wireless Pars from Everywhere

Directional Wireless.

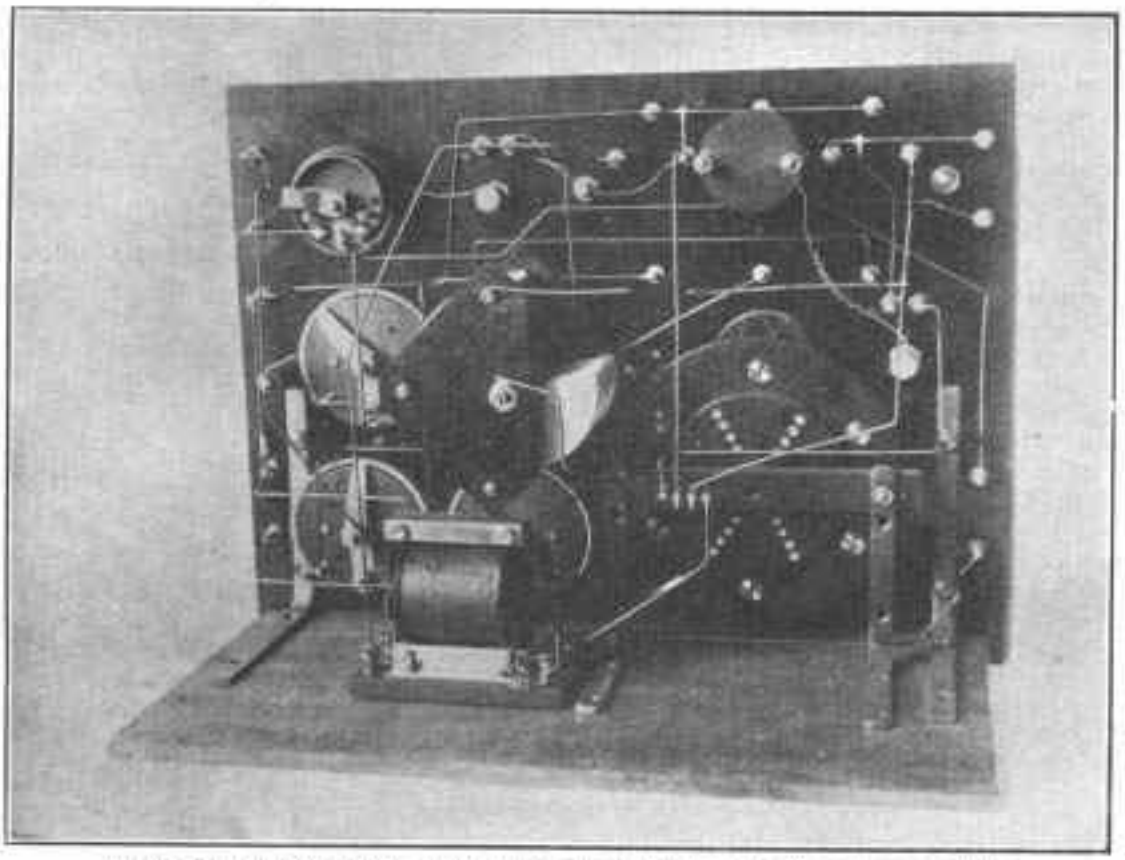
Directional wireless is perhaps the most immediate aim of experimenters. Already some small advance has been made in this direction, and one New York inventor actually claims to have succeeded in limiting transmission to one selected receiving station, though no proof is forthcoming.

"Blow, Blow, Thou Wireless Fuse!"

SINCE Major-General Squier announced his method of operating a wireless set through a lamp, fuse wire manufacturers have reported a remarkable boom in their business. Operation by the new method requires a lot of experimental work—and a lot of fuses.

Railway Radio Telephony.

Experiments with the employment of wireless telephony between moving trains and between a moving train and a fixed point, are being carried out in many countries. One method is to fix antennae on to a coach, and also between two telegraph poles by the side of the line.



Back of panel view of Multi Valve Set made by Mr. A. E. Grigg, 1st Prize winner at Radio Exhibition

Radio and the Alps.

ALL have heard of the work that the famous St. Bernard dogs of the Alpine monasteries have done in rescuing mountaineers. At the Vallot Observatory, on the peak of Mont Blanc, a wireless station has been erected specially equipped to resist the sudden atmospheric changes that usually put ordinary equipment out of gear. Climbing parties are now warned to equip themselves with radio apparatus before setting out on a climb, so that help can be called for from the Observatory.

Wireless in French Ports.

FRANCE has established wireless telegraph posts at Rouen and on pilot boats on the Seine which will be used to transmit messages relating to maritime affairs and the promotion of port services, according to the Department of Commerce. The pilot boats, it is reported by Consul M. B. Kirk, of Rouen, will transmit by wireless the arrival of all vessels coming up the Seine on every tide to the post office, and the post office will instruct the pilot vessels where to place the ships on their arrival.

Moth Radiograms.

MOTHS and a few other insects have a remarkable way of communicating with one another, and it has been proved that a female moth can be caged in a scent and sound-proof box and yet she is able to call her mate without any great difficulty. It has been suggested that the insects use some form of radio to get in touch, and following this suggestion experiments are being carried out by some well-known scientists. Already they consider it possible for the insects to send out small radiations.

Recording Signals.

MESSAGES received by your wireless set when you are not present need not be lost. Signals can now be recorded on a special form of tape machine, or can be made to reproduce themselves on a gramophone record.

* * *

Newspapers and Wireless.

NEARLY two hundred daily newspapers in the United States are now running wireless news supplements, and the number is constantly growing. The great majority of them are published on the Atlantic Coast. Nearly two score newspapers in New England publish such supplements, fifteen in the Southern States and eleven enterprising newspapers on the Pacific Coast.

* * *

An African Station.

A wireless station is to be erected at Ain-el-Hadjar, near Saida, on the railway line from Perreganx to Colomb-Bechan.

The station will be an important link between France and her African colonies.

* * *

The "Father of Wireless!"

PROFESSOR BRANLY, regarded by France as the father of wireless telegraphy, because of his coherer which made possible the practical use of Hertzian waves, is said to have refused 20,000 francs offered him by the French Chamber of Deputies for the purpose of continuing his radio research work. It has lately been reported that Professor Branly would soon discontinue his laboratory work because of lack of funds.

* * *

A Music Hall Innovation.

LISTENING-IN sets are to be installed in the Palm Court of the Palladium Music Hall, London.

Here some 300 people, waiting for the commencement of Mr. Harry Day's revue, "Rockets," will be able to hear, through the loud-speaker apparatus, news and music from all parts of the world.

If the innovation is appreciated, Mr. Gulliver intends to extend it to all his theatres throughout the country. Mr. Henry Day will do the same.

Underground Wireless.

Experiments in wireless transmission underground have recently been made. A receiving set was taken into a cave about a quarter of a mile in any direction from its mouth. Here a 50 feet aerial was suspended, and with a small apparatus signals were received clearly from several high-power transmitting centres.

* * *

French Amateurs.

WIRELESS has its thousands of devotees in France as in England and America.

The post and telegraph authorities in France are preparing a scheme which will enable the ordinary citizen to have a receiving apparatus, by which he can "listen in" at a cost of a few francs a year.

* * *

Broadcasting at Vancouver.

A WIRELESS telephone service has been established at Vancouver for British Columbia. The range will be as far as 2500 miles seawards.

Transmissions will include news, concerts, etc.

The tests have given excellent results, and the service is now in regular operation.

* * *

Private Wireless.

THE opening of auction offices and sale rooms in Coney-street, York, with a private wireless installation for communication between London and York will take place shortly. This new departure is being undertaken by Messrs. Duncan B. Gray and Partners, Mount-street, W., owing to their extensive estate managements in Yorkshire.

* * *

Wireless Telephony in Sweden.

THE telegraph authorities of Sweden are making experiments with a view to linking up the ordinary land line telephone with the wireless telephone, so as to effect "through calls." This system of linking up the land line 'phone with the wireless 'phone has proved very successful in America, especially in connecting up Santa Catalina Island and the mainland.

Marconi's Experiments.

SENATORE MARCONI arrived at New York on June 16th, on his yacht Elettra. He informed Press representatives that his experiments had achieved important results in two directions. Senatore Marconi has succeeded in transmitting messages at 100 words a minute without any blurring of signals. His other experiment was in the direction of eliminating atmospherics. He believes that in the near future "X's" will be eliminated completely when sending and receiving messages. Senatore Marconi also reports hearing the mysterious long-wave signals, and is still puzzled as to their origin.

* * *

Sir Oliver Lodge.

SIR OLIVER LODGE, England's veteran scientist, celebrated his 71st birthday on June 12th by making wireless experiments at his beautiful home in the country near Salisbury.

"I spend a good deal of my time on wireless research now," he told a "Daily Mail" reporter, who offered his congratulations.

"With an assistant, I have been carrying out a number of interesting experiments, but for the moment I am keeping them dark.

"I have been particularly interested lately in what the 'Daily Mail' has been saying in regard to broadcasting. I expected broadcasting would become popular a long time ago, for I then thought, and still think, that there is a wonderful future for it.

* * *

For the Children.

Anent the supposition that fairy stories will be broadcasted at the children's bedtime, someone asks: "Who is going to answer all those questions which make the telling of a fairy story such an exercise in patience and ingenuity?

* * *

Learning the Code.

For those who desire to practise the Morse code, gramophone records are available which dictate the code, the abbreviated figures and punctuation signs.

New Power Amplifier and Loud-Speaking Receiver

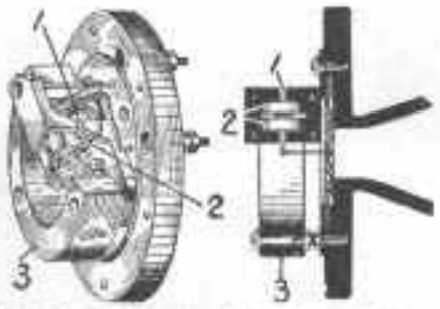
A WELL-KNOWN American telephone manufacturer has recently placed on the market a power amplifier and loud-speaking receiver, which is here described in detail. This has been brought out because of the widespread interest that has been displayed in the receiving of broadcasted news, music and entertainment, by private radiophone operators. It is designed to be used in connection with a regular receiving tuner, and a detector with one or two steps of amplification. The outfit consists of a loud-speaking receiver especially designed for radio work, and a two-stage vacuum tube power amplifier, equipped with three special vacuum tubes, connected as shown in the accompanying diagram.

The makers claim that this set, when used in connection with a well designed vacuum tube receiving set, will reproduce all forms of music and speech with wonderful clarity and quality of tone, sufficient to fill public halls and theatres of medium size.

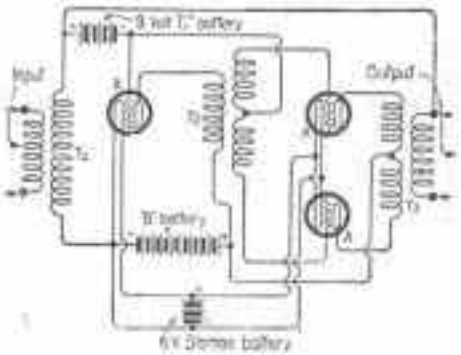
The tubes employed with this set are especially designed for the circuit used. They make use of a special oxide coated filament which insures maximum electron emission with minimum filament temperature. The tubes, when in operation, glow dull red, which feature insures long life and minimum filament power consumption.

The amplifier unit consists of a wooden cabinet, measuring approximately 12½in. x 10in. x 4½in., which carries a panel of insulating material. Upon this panel are mounted a switch, of the push and pull type, to control filament current; a fine point switch to control the volume of sound; sockets for the three special vacuum tubes, and the necessary binding posts for connections.

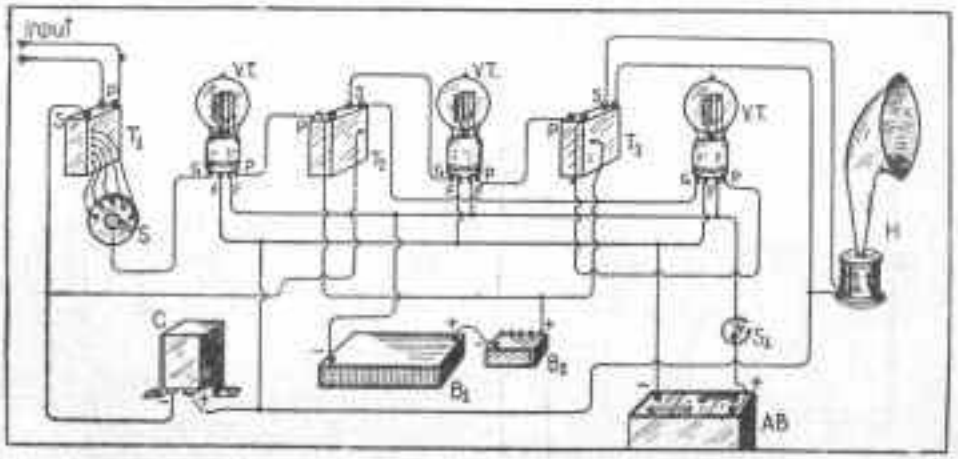
The circuit of the amplifier is unique in that it employs three vacuum tubes for two steps of amplification. As may be seen from the accompanying circuit diagram, the volume of sound is controlled by cutting in more or less of the first amplifying transformer secondary, by means of the five point switch. The second and third tubes are connected in parallel, and each receives its plate voltage through half of the primary of the third transformer. The circuit of these two tubes is of the balanced or "push pull" type so that each tube is required to handle only one-half of the energy delivered to the receiver. This circuit increases the operating margin of the outfit and reduces distortion to a minimum. A "C" battery with a potential of nine volts is used to impress a negative biasing charge on the grid. A



This View of the New Radio Loud-Speaker Here Described Clearly Demonstrates Its Simplicity. No Large Separately Excited Field Magnets Being Necessary. The Moving Armature is Linked by Means of a Delicately Pivoted Lever System to a Corrugated Diaphragm of Iron, or in Some Cases Bakelite.



The Schematic Circuit Here Shown For the Radio Loud-Talker Gives a Clear Idea of the Electrical Circuits Employed For the Three Power Tubes and Special Tapped Transformers, "C" Battery, etc.



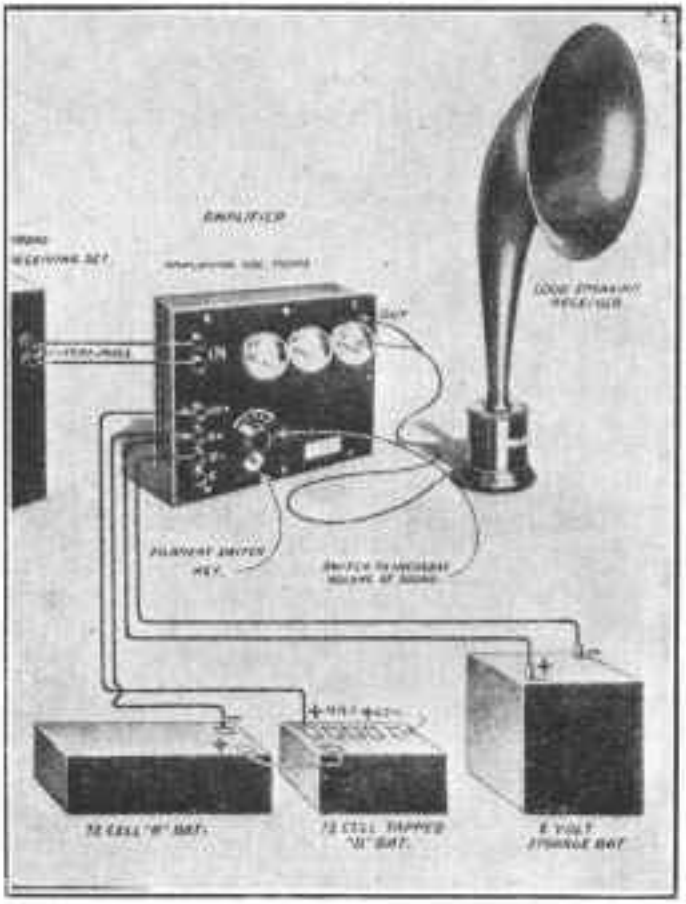
This Diagram Shows the Connections Used With the New Radio Loud-Speaker Illustrated in the Accompanying Photo. The Transformer T2 Has a Tap From the Centre of the Secondary, While the Transformer T3 Has a Tap From the Centre of the Primary Winding. This Power Amplifier Circuit Operates on What is Called the Push-Pull System, and It Gives Very Excellent Results Indeed; Great Stability and Freedom From Howling Being Two of Its Outstanding Features.

plate voltage of 120 volts is used and a filament voltage of six volts.

The loud-speaker itself is of the pivoted armature type, actuated by magnets with a resistance of 325 ohms, and connected by means of a rod to a corrugated diaphragm, made of soft Norwegian iron. This construction may be readily seen from the accompanying cut. The entire receiver is mounted in a metal housing and used with a curved horn especially designed to give adequate volume and pure tone.

The two units, that is, the amplifier cabinet, and the loud-speaking receiver, are especially designed to be used together and to give a maximum volume of sound with a minimum distortion. A special feature is that no storage battery current is consumed in exciting a field magnet.

The "C" Battery mentioned in this article is something new to Australasia, and when applied to the valve grids in the ordinary amplifier it will considerably clarify the signals. An amplifier that "howls" can be cured by a "C" Battery of from 4 to 22 volts.

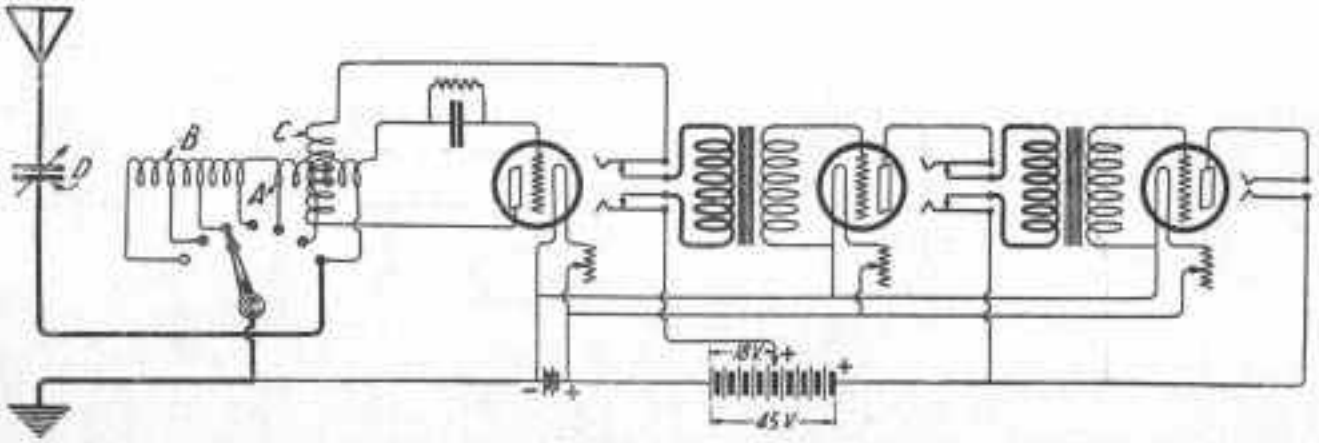


This Photo-Diagram shows the Latest Type of Radio Loud-Speaker which is remarkable for its Clarity of Tone and Freedom from Howling and Frying Noises. The Loud-Speaker shown requires no separately excited field, a Special V.T. Amplifier Cabinet being used with it, however; this Cabinet containing Three Special Power V.T.'s besides the Necessary Transformers and Control Switch

A Home-Made Broadcasting Receiver Set

WE have not had an opportunity of trying out the receiver set, the diagram of which is given below, but it will suggest itself to the experimenter as one well worthy of a test. We will be glad to have a report from anyone who may construct the receiver on the lines laid down.

In addition to extreme simplicity of tuning, the set will respond up to 2000 metres. There is no body capacity effect, which makes the set especially valuable for C.W. and 'phone work. The cost is very moderate when one considers the results obtained through the use of this set, and it can be assembled in a very short time.



Circuit of a Broadcast Receiver using Detector and Two Steps of Audio Frequency Amplification with a Range up to 2,000 Metres

The following is a list of material used: 1 variometer; 1 fixed condenser .0005 mfd.; 1 variable condenser .0005 mfd.; 2 knobs and dials 3 inches for condenser and variometer; 1 UV200 detector tube; 2 UV201 amplifier tubes; 1 pair Baldwin 'phones; 3 'phone jacks, 1 two-circuit, 1 open-circuit, 1 closed-circuit; 3 VT tube sockets; 2 blocks 11 battery; 2 amplifying transformers; 2 rheostats; 200 feet wire 20/38 Lit-zendraht; 1 inductance form, 4 x 4 inches; 1 grid condenser and leak; 10 switch points; 1 inductance switch lever; 1 plug for 'phones; 1 panel 8 x 21 inches. This material will total about £25 for the complete set, but if you are located close to a large broadcasting station, one or both of the amplifiers may be dispensed with if desired, and it will be found that the receiver is still very efficient.

To tune the set simply set the inductance switch on one of the contacts, then turn the condenser slowly until the signal is heard and adjust the tickler dial for maximum signal strength. For 'phone work it will be found better to reverse this method, and, setting the condenser, slowly rotate the tickler dial until the carrier wave is heard, then carefully tune, using both dials until maximum signal is heard. It may be necessary to slightly lower the detector filament to clear the speech after the final tuning is accomplished.

A Simple Set for Broadcast Reception

Start with a Crystal Set and add to it like this!

WITH the increasing use of radio as a means of broadcasting entertainment and information, the average citizen desires to know how he may take advantage of the opportunity now available. Since his knowledge of radio is very limited, it is obvious that a set to meet his needs must be simple in operation, sensitive to do good work, and possess a fair degree of selectivity. As his interest probably will not extend beyond the reception of 'phone stations, the set should be designed primarily to cover only the band of wave-lengths used by such stations.

There are any number of sets designed for the beginner that do very good work, but aside from being costly they are not constructed so that other apparatus can be added to increase their range and efficiency. This is a desirable feature, as the beginner will wish to add to his set as his knowledge and interest increases.

With the above facts in mind, we shall confine ourselves to a set of the single circuit type with crystal detector and so designed that additional apparatus may be used without changing the original set. Such a set which is simple in operation can be constructed at a small cost. It is selective enough to tune in the 'phone stations to exclude undesirable signals.

Figure 1 shows the circuit used. L is a cardboard tube about 3 inches in diameter and of equal length. It should be thoroughly dried in an oven, then given a coat of shellac and again baked. While still warm it is tightly wound with fifty turns of No. 24 D.C.C. magnet wire. A tap is taken from the 20th turn and at every ten turns thereafter, making five taps in all which will require four switch points as the first is connected to the antenna binding post. A convenient way of taking off a tap is to tie a loop of about six inches at the proper turn. S is an assembled switch arm of 1 inch radius. C is a panel mount type of variable condenser of .0005 mfd. capacity. It should be equipped with pointer and 180 degree scale. D is any good type of crystal detector that is of easy and stable adjustment, the dust proof type being the best. P is the headset which should be 2000 or 3000 ohms resistance.

There are six binding posts of the "hole" type. No. 1 is for the antenna, No. 2 for the ground and Nos. 5 and 6 for the 'phones. Nos. 3 and 4 which lead from the detector will be explained later. All the above articles can be obtained from any radio dealer.

The receivers to be efficient and of neat appearance should have the parts mounted on an insulated panel and should be enclosed in a box or cabinet. A suitable panel can be made of 3-16 inch sheet bakelite. A small case, such as is sold in stationery stores for filing letters, makes a fine cabinet. They are equipped with hinged covers and have a handsome appearance. The dimensions are optional with the builder as long as it is large enough to contain all the apparatus. One measuring 5 x 7 x 4 inches in depth outside measurement will do nicely. The panel should be cut to fit inside the box. Figure 2 shows how the instruments are mounted on the panel, and how the complete set looks when viewed from the top. All interior connections which should be soldered must be made before the panel is fastened.

It is desirable that the panel be placed deep enough in the box to allow the cover to close. Two blocks of wood glued to the sides of the box serve as supports for screwing down the panel. The cardboard tube should be fastened to the bottom of the case by screws or other means. Holes or slots are cut in the sides to allow wires to enter. This permits the cover being replaced while the set is in use. If desirable a larger box may be used and by building in a partition a place is provided for 'phones. To make the set portable a handle can be placed on the cover and small catches on the side to fasten the cover.

A little practice will enable the novice to adjust the detector to the highest degree of sensitivity. The tuning is done mostly with the condenser and a little experience will

soon determine the adjustment required to get the correct values of capacity and inductance.

Many factors enter into the distance over which such an instrument will function, but probably the most important is the antenna system. Briefly stated, the better the antenna the greater the range of reception. How elaborate an antenna the beginner will use will largely depend on the neighborhood in which he resides. Using a small indoor antenna the writer has clearly heard music and voices from a 'phone station at a distance of five miles during daylight. With a good antenna several times the distance can be covered. After the beginner realises the possibilities of broadcast reception he will wish to hear more distant stations or to bring in the near ones more loudly. By connecting a jumper wire across binding posts 3 and 4 the crystal detector is shorted and a vacuum tube detector with a control unit may be connected, as shown in Figure 3. This gives a more sensitive and dependable set. Also a variometer may be connected to the posts and a wider band of wave lengths can be covered. The set can also be more sharply tuned by using a variometer. Figure 4 gives the hook-up of such a set.

Placing a variometer in the plate circuit as shown in Figure 5 results in a tuned plate regenerative set. Too much regeneration distorts voice and music, but very good results can be obtained by careful adjustment.

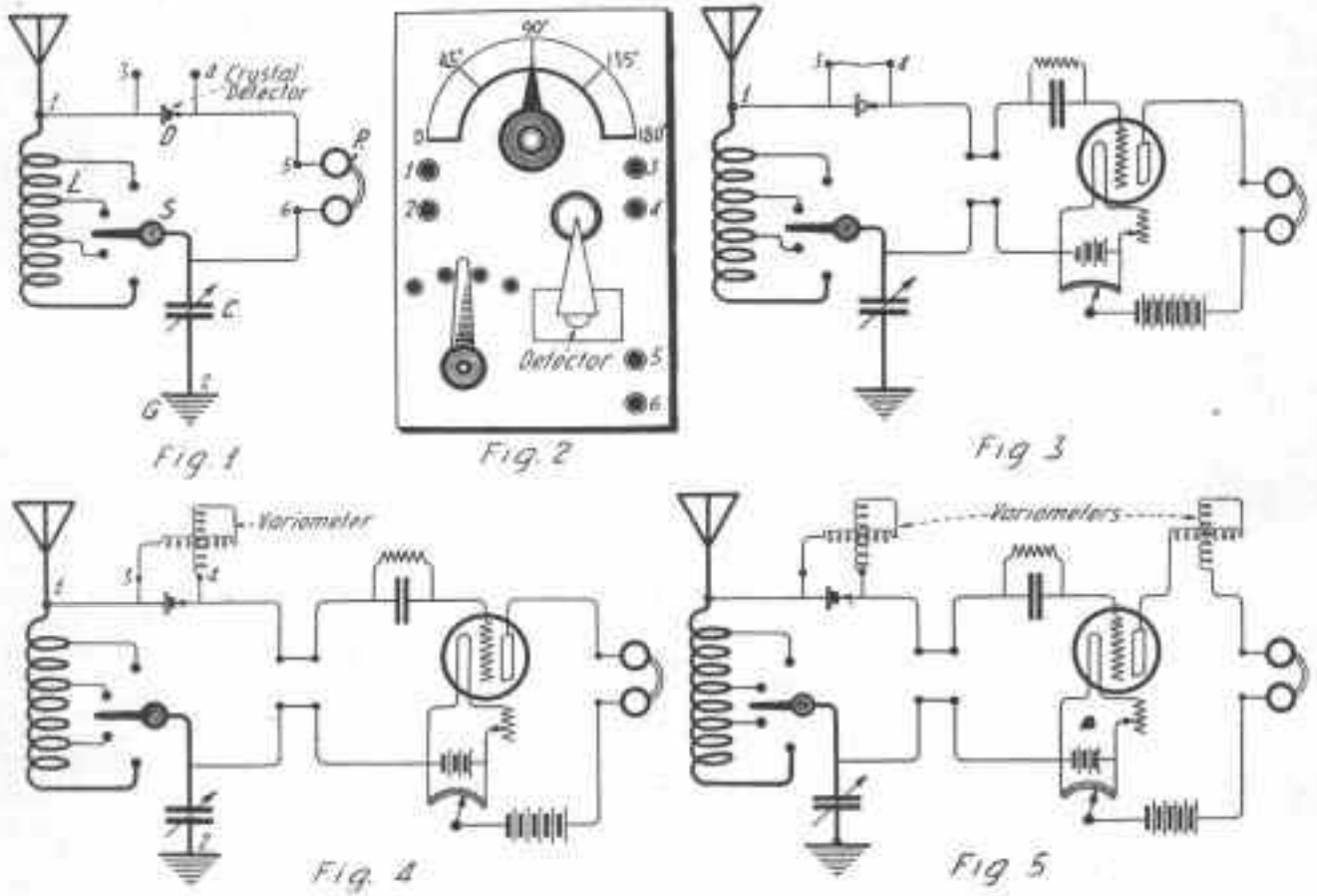


Fig. 1 Fig. 2 Fig 3

Fig. 4 Fig 5

Various Hook-ups of a Simple Broadcast Radiophone Receiving Set

Radio Aids Surgical Patient

THE radio telephone and spinal anaesthesia together took a young girl through two dangerous operations recently at the Samaritan Hospital, in Philadelphia. It was impossible to give the patient ether, so an injection into her spine was used to numb her body from the shoulders down. In order to distract her attention from the operation and give her mind a healthy tonic during the forty-five minutes she spent on the operating table, the head phones of a radio receiving set were placed over her ears, and she listened to the art of great musicians as transmitted by radio. While Dr. Frick excised her appendix and removed several large gall stones, the patient displayed great interest in the broadcast programme, oblivious of the surgeon.

The Construction of a Frame Aerial

MUCH has been done recently, and a great deal more has been said, on the subject of making wireless receptive apparatus extremely portable, and what at one time was really the least mobile part of the equipment is now apparently the most amenable to easy removal.

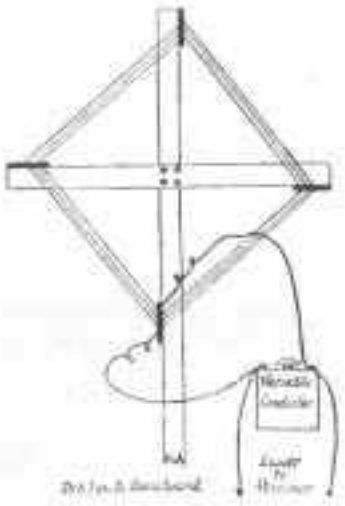


Diagram of Frame Aerial

The aerial, at one time inevitably a contraption of tall masts and strong guys, can now be so inconspicuous as to be carried in a handbag.

Very early in the days of amateur experiments, it was found that an iron bedstead in an attic made quite a good aerial. Then were successfully tried such common things as an open umbrella, wires tucked round inside a hat, wireless antennae in the form of a chest protector, and other freakish devices too numerous to mention. One thing they had in common. They were not nearly so receptive as an outdoor aerial.

It would be a pretty hopeless proposition for a novice to try to tune in signals upon a crystal receiving set with anything so diminutive as an ordinary frame aerial. There is no reason, however, why quite good signals should not be received if the run of a good attic were available, and little skill and ingenuity applied to the problem of stretching wires along under the rafters.

No Earth Wires Needed.

For the amateur who can use an electron valve, or perhaps two or three, the frame aerial has much to commend it. Most of the noises not proper to wireless signalling, called "parasitic" noises (because they come in on the backs of the signal wave) are due to stray currents being led into the receiving apparatus by way of the earth wire. Earth connection is not necessary with a frame aerial and these noises are eliminated to a great extent.

The two ends of the wires wound on the frame are taken to the aerial and earth connection respectively of the detecting set, which otherwise needs very little modification. An ordinary room door, or even a cupboard door, if it can swing round half a circle on its hinges—that is, if on opening it lies flat against the wall in which it is set—will make quite a good frame for the aerial, and will not need a lot of knocking about in fitting the wires to it.

We had better perhaps first describe the make-up of a smaller affair, so that the experimenter may be led on by easy and successful stages.

Enamelled copper wire, not smaller than gauge No. 24, is the best to use, and if the notches into which the wire is laid cannot be made in a piece of ebonite, wood well soaked in hot paraffin wax had better be used.

The spacing of the wires in their adjacent turns is an important matter, as a crowded "loop" is not nearly so efficient as one with the wires properly spaced. As a guide, if the frame is a square of 4 feet sides, the wires should be spaced 1 of an inch apart. If 6-feet sides, 7-16 of an inch; 8-feet sides, 9-16 of an inch; 10-feet sides, ½ of an inch; and 12-feet sides, 15-16 of an inch.

Making the Frame.

Suppose we have decided to try a 4-feet rectangle; two pieces of wood, deal "slate battens" will do, planed up to two inches wide by one inch thick, one piece eight feet long and the other six feet long will be required. Make of these an upright cross and secure where the pieces cross one another with two or more brass screws.

Less wire will be needed than for the construction of an efficient outdoor aerial, as will be seen by the following table, and it must not be forgotten there is one "best" wavelength for any winding, though the frame aerial is sensitive over a fairly

The advantages of a frame aerial will be seen in this picture. No outside wire is necessary, and it can be easily mounted on a desk.

wide range. A variable condenser is essential also, as the frame aerial itself takes the place of the usual tuning inductance and has to be tuned to the waves it is required to receive.

The table in Column I. gives the number of complete turns on a square frame of 4 feet sides. Column II. indicates the length of the wave to which it is most sensitive, and Column III. the range over which the frame aerial is reasonably efficient.

I. Complete turns of wire.	II. Best Wave Length in Metres.	III. Efficient Range in Miles.
2	250	200-350
4	300	250-400
6	350	300-500
10	600	350-1000
20	1200	500-1800

All that is now necessary in order to use the frame aerial is to attach a couple of wires to the ends of those on the frame; put your variable condenser across them, and carry on the wires to the aerial and earth terminals of an ordinary receiving set.

The bottom end of the upright may be shaped to stand in the hole of a large inverted flower-pot, or a block of wood may be used instead.

There is one advantage possessed by a frame aerial which cannot be made too much of, and that is its directional effect. An outdoor aerial is put up pointing out any way, depending upon the convenience for attaching to the house or planting a pole in the garden, and it receives signals from some quarters better than from others.

With a frame aerial reception is best with the plane of the coil pointing in the direction of the station it is desired to receive from; that is, according to our diagram, with the arms of the cross pointing that way.

If at right angles, the received signals dwindle down to zero, and if the frame is rotated upon its upright axis, there are two loudest and two most silent positions as the frame turns round the complete circle.

This property is made use of in direction-finding stations, where two stations separated by a known distance communicate their angular divergence to one another.

The point of intersection of their projected planes indicates the position and the distance away of the station, such as a ship or aeroplane which is signalling. The advantage of such guidance in foggy weather is obvious.

This method was used during the war for "spotting" enemy stations, and it is conceivable that it will be used in peace time for the same purpose, for should an amateur be so misguided as to disturb the ether by badly adjusted valves, or attempt to signal when he hasn't a license, running the offender to earth will be an easy matter.

The Powers and Limitations of Your Receiver

THE wireless "boom" has been so sudden, and so much mystery surrounded radio apparatus previous to it, that the present great desire for knowledge has resulted in a large amount of misunderstanding and, possibly, misinformation.

People want results from their receiving sets which they cannot in fairness expect. There is considerable misunderstanding as to the range in miles over which the various types of receiving sets will prove effective.

We read from time to time in the daily Press accounts of little wonder receiving sets, complete in a watch-case, or thimble, or which will fit into a matchbox. All that, we are told, is necessary for the holder of one of these Tom Thumb pieces of apparatus to hear signals from infinitely great distances, is for him to place his foot against a water-pipe and hold an umbrella over his head.

The midget sets do exist, and some of them operate very effectively. There are also some stations at which reception over hundreds of miles with a frame aerial is accomplished. But the conclusion some people jump to that these two schemes may be combined is, at present, unfortunately very far from being correct.

The small crystal set may be used over comparatively short distances to receive from a transmitting station. It is safe to say that the average maximum distance for such an instrument is from 3 to 5 miles.

When the frame aerial is employed for receiving over long distances, special accurately designed valve amplifiers have to be used.

Another popular belief, which is quite inaccurate, is that a loud speaker attached to a simple crystal receiving set will magnify the sound sufficiently to fill a whole room.

The loud speaker of a wireless set is similar in action to a gramophone. The volume of sound issuing from the machine can be regulated so as to produce loud, medium, or soft tones.

A great vibration of the diaphragm produces a great sound and, in ratio, the smaller the vibration of the diaphragm, the lesser the amount of sound volume.

In wireless the volume of sound produced by a loud-speaking attachment must depend upon the strength of sound received from the transmitting station.

With the ordinary simple receiving set loud speakers cannot be used directly except when the receiver is located within a very close range of the transmitting station.

This distance from the transmitting station may be increased to a certain extent if a valve detector or a valve amplifier in conjunction with the crystal is employed. But no matter what type of receiver is used, if the distance between the receiving and the transmitting station is more than a few miles, an amplifier will be necessary if a loud speaker is to be used with good results.

An amplifier is a piece of apparatus which, as its name implies, is

used to amplify or magnify the strength of the received signals.

Modern amplifiers comprise one or two valves with the requisite connecting equipment and controls. The battery operating the apparatus is generally a 6 volt 40 or 80 "ampere-hour" accumulator and one high tension battery of about 60 volts. For one valve, however, about 20 volts high tension will be found sufficient.

When two valves are used, the amplifier is generally termed a two-stage amplifier. In this case, arrangements are usually made for transferring signals from the first to the second valve, or by using one valve only, as desired. In this way the volume of sound produced can be controlled.

The action of this type of amplifier is quite easily explained. The incoming wireless message passes through the tuning gear of the receiving set into the detector valve or crystal, whichever is being used. Thence it passes into the first amplifier valve.

This amplifier valve adds to the strength of the incoming waves. If the incoming waves are of strong energy, then the action of the amplifier is strong; but if the incoming waves are small, the action of the valves is small. All signals are made louder in direct proportion to the strength of the received signals.

Every variation in aerial current causes a very considerably augmented variation in the plate circuit, and the resultant signal is increased considerably.

When a second stage of amplification is employed, the signals resulting from the first stage are used to control the valve action of the second amplifier, and the energy resulting therefrom is directed from that plate circuit to the telephones or loud speaker.

By means of suitable connecting apparatus several valves can be linked together and so amplify received signals tremendously. This will easily be understood if one imagines four amplifying valves connected together and each valve magnifying the strength of signals, say, five times.

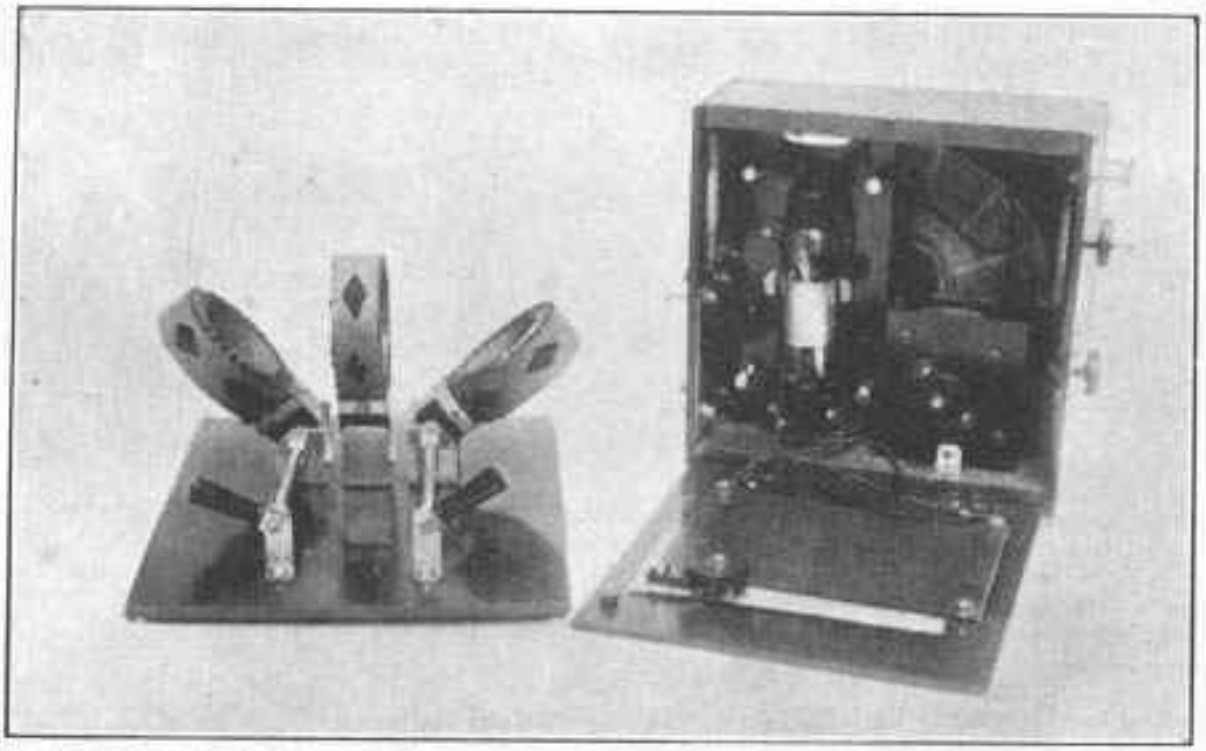
The second valve will magnify the original signal 25 times, the third 125 times, and the fourth 625 times. Theoretically, there is no limit to the number of valves which can be employed for amplification. Practically, however, the use of any number above six will give but indifferent results. The effect sometimes means such a chaos of noises as quite to defeat the object in view.

The following notes may help to give a novice an idea of what he may expect from the various classes of receiving sets:

	Range.
Simple Crystal Receiver.	
With outdoor aerial ..	3 to 5 miles
Two Valve Receiver.	
With outdoor aerial ..	150 miles
with indoor frame aerial	10-12 miles
With outdoor aerial and loud speaker	20 miles
Three-Valve Receiver.	
With outdoor aerial and loud speaker	150 miles
With telephones	250 miles
Using frame aerial and 'phones	50-100 miles

The above distances are, of course, often exceeded, and, in fact, can vary considerably.

Also, the distance over which a message may be received depends on the power of the transmitting station.



Best Single Valve Set (Mr. E. B. Crocker), 1st Prize, and Best Single Piece of Apparatus (Mr. E. E. Wiltshire), at Radio Exhibition

How Speech is Sent by Wireless

TO convey simply, and without the useless use of technical phraseology, the principle underlying the radiation of speech by wireless is by no means a simple matter.

The writer trusts, however, that a perusal of this article will leave the reader with some idea of the manner in which wireless communication by speech is established.

To the amateur with a rudimentary understanding of wireless telegraphy, and to the more advanced student with a theoretical knowledge of the continuous wave system of wireless transmission, the following explanation will be readily understood.

We are all too familiar with ordinary speech to give much attention to the fact that it is just ordinary, every-day wireless telephony. Nature has supplied our bodies with a transmitter and receiver, and the air which surrounds us is the connecting link by which we convey intelligible sounds to each other.

It is not necessary for two persons to clasp hands, or in any other way to be tangibly connected, before information can pass between them.

A Simple Analogy.

Our transmitters, however, have a very limited range. Compared with wired or wireless telephony, the distance over which the human voice can travel, to be understood, is negligible. Our receivers also, which are our ears, have a limited range of sensitivity, there being many sounds, in fact, which we cannot hear at all.

We all know that a small child can walk a certain distance, say half a mile, and then its strength is exhausted. If the child is perched on the shoulders of its father, however, its strength does not enter into our calculations.

The distance it can cover will depend upon the strength of the father. This analogy is a very rough one, but it serves to illustrate the manner in which ordinary land-wire telephony

The Waverley Radio Club. "Listening in"

and wireless speech over long distances is accomplished.

The ordinary wired telephone which is used so extensively to-day is a complete circuit of wire connected up to an electrical source of supply which gives a continuous flow of electricity through the circuit.

The circuit also contains a transmitter and receiver.

So long as the current of electricity remains at a steady rate of flow in the circuit, the receiver is unaffected by it; but when we speak into the transmitter, the diaphragm at the back of the mouthpiece vibrates, and causes variations in the otherwise steady current.

These variations travel round the electrical circuit until they reach the diaphragm of the receiver, which vibrates in a similar manner to that of the transmitter, and conveys the speech to the listener. The voice might be likened to the small child, and the electrical current to the father which carries it.

Continuous Waves.

The analogy, as stated, is only a very crude one, and given principally because of its simplicity. We will now deal with wireless telephony, and use as an analogy something which comes nearer to the actual conditions prevailing in wireless telephony.

If we look at the wax disc of a gramophone record we see that the numerous circular indentations upon it are in reality only one groove which starts at the edge of the record, and by a gradually diminishing circular path travels to the centre of the disc.

If, when the record is first constructed, we start it revolving on our gramophone, the application of the needle will produce no results in the sound box, and therefore we hear nothing. This is because the small groove in the record is uniform, and, like the steady current in the telephone circuit, gives no result.

When the record is prepared, however, the voice of the singer causes vibrations in the instrument which are carried to the disc and imposed upon the soft wax.

The record is then ready for use, because the uniformity of the wax has been varied by the acoustic properties of the voice, and if we now place the record on a machine and set it in motion, the small needle reproduces the variations, and the

The North Sydney Radio Club just in the middle of an argument when the photographer happened along.

original song or speech issues from the instrument.

The vibrations of the human voice are extremely slow compared with the vibrations set up by the continuous waves, and if speech is imposed upon the waves the oscillations are modulated or moulded in a similar manner to the wax, by the acoustic frequencies of the voice.

When we listen to wireless telephony the "carrier waves," which are "carrying" the speech or music to us, are inaudible, because of their rapidly oscillating and uniform character.

When the waves that have been modulated by the speaker or singer at the transmitting station arrive upon the receiving aerial, the regular sequence of the waves is varied and this variation is immediately registered by the detector of the receiving set and converted back into speech.

There is much to be said in favor of wireless telephony when comparing it with wired telephony or even wireless telegraphy.

Wireless versus the Telephone.

It has an undoubted advantage over telephony of the wired order, in so far as the distortion of the voice so frequently encountered on the ordinary telephone, especially when communicating over long distances, is entirely absent when "wireless" is used.

This is due to the fact that the "carrier wave" employed in wireless telephony remains unaltered irrespective of the distance over which it has to travel. The intonation of the voice is therefore unaffected.

In wired telephony, even a slight variation of the current flowing in the telephone circuit will cause irregularities to occur, which may render the speech quite unintelligible to the listener.

Wireless telephony also possesses the great advantage over wireless telegraphy of being immediately understood by all, without the need for tedious lessons in the Morse code.

A few years ago the bridging of vast distances by wireless could only be accomplished by skilled telegraphists who also had to be well versed in the technicalities and theory of the science.

To-day, given the requisite apparatus, it is within the power of all of us to converse across the boundless spaces of the ether. To-morrow—who knows?

Crystals as Detectors

Before Setting up a Valve Set, Gain Experience by Using a Crystal Detector

BEFORE 1914 most wireless amateurs were happy to be in possession of a good crystal detector from which heaps of interesting fun and enlightenment were obtained. To-day, the crystal should not be despised.

As most of you know, when we receive wireless music, song, or speech, the waves reach our aerials in the form of oscillating currents—that is to say, the current surges to and fro.

After tuning in for the wave-length which we require, we are not able to hear anything unless we employ a detector of some kind. The detector, acting as a sort of valve, stops the two-way movement of the current, and converts it into a one-way current which allows the telephone diaphragms to respond, and enables us to hear whatever is being broadcast.

I will not give a list of all minerals which are more or less suitable for use as detectors, but three of the most sensitive are quite cheap, and can be obtained from your wireless dealer:

(1) Zincite pressing against chalco-pyrite. This combination is sometimes known as "perikon."

(2) Galena in contact with the point of a fine, springy wire, or with the point of a black-lead pencil.

(3) Silicon in contact with a point of gold, bronze, brass or steel.

(4) Iron pyrites is the crystal most in favor at the moment, though many swear by galena.

No. 1 has the great advantage of being a very sensitive detector. Moreover, once the two companion crystals have been adjusted and pressed together, they remain in sensitive condition, even though vibration or accidental jarring takes place.

No. 2 is sensitive at certain points, but as the wire or blacklead must rest very lightly indeed on the surface of the crystal, this type of detector is easily knocked out of action by the slightest vibration. Sometimes the act of walking across the floor will destroy the adjustment.

No. 3, silicon, also is sensitive at certain points, and the pressure upon it by the metal point may be rather stronger than is the case with galena. Consequently a silicon detector will remain in adjustment for a longer time than galena.

Another method of using galena has recently been patented in France. A container is partly filled with mercury, and is sealed by an insulated plug. Two terminals pass through the plug, and fixed to their lower ends, inside the container, are two pieces of galena which dip into the mercury.

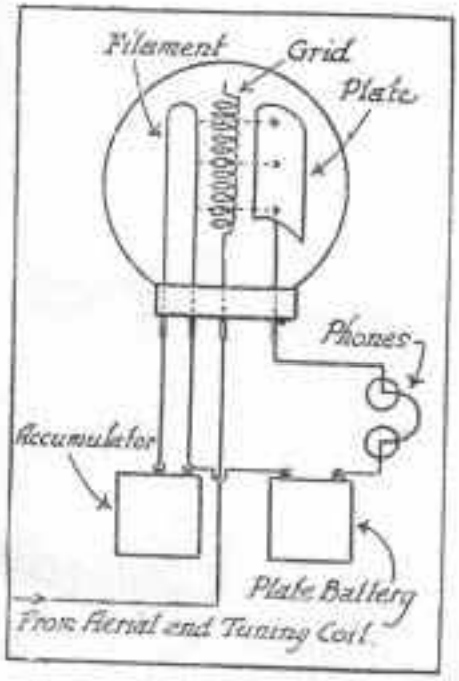
A good crystal detector, in conjunction with efficient tuning coils, however simple, and good telephones, will give excellent results in reception of broadcast concerts, provided you live within about 3 to 5 miles from the broadcast stations. After the initial outlay for the crystal detector no expense is incurred for maintenance, as no batteries are required.

For all round reception a valve detector is much better, and, in fact, is essential if you live far away from the broadcast stations. But, in any case, you will learn quite a lot by using a crystal set first.

Questions about the Valve

What is the Plate For?

THE plate is connected in the circuit so that by remaining positive it attracts the electrons which are thrown off by the heated filament. The electrons are negative. A small current from dry batteries will work the plate.



What is a Valve?

IN outward appearance like an ordinary electric light globe. It lights up from a six-volt accumulator. In addition to the glowing fine wire filament, there is a "grid" and a "plate." Air is extracted from the glass globe, so that the filament, grid and plate are supported in a vacuum, the latter being an essential condition of the valve.

What is the Filament For?

WHEN the valve is alight, electrons are thrown off from the heated filament wire, and pass through the grid to the plate. The whole principle of modern wireless is based on that fact, formerly known as the "Edison Effect."

What Happens When the Grid is Positive?

AS we already know, the grid rapidly changes from positive to negative, in accordance with the wireless wave which is being received. Now, during the fraction of a moment when the grid is positive, the grid will permit only the negative side of the incoming wireless waves to pass through and will stop, or repel, the positive side of the incoming waves. In addition to attracting the electrons, the grid, whilst positive, helps them on their way to the plate.

What is the Plate?

THE plate is a small nickel tube which surrounds the filament and the grid.

What is a Grid?

THE grid is a tiny spiral of hard wire, one end of which is connected to the aerial tuning coil. The grid is situated between the glowing filament and the plate.

Whilst the Grid is Negative, what Happens to the Electrons?

DURING the time that the grid is negative, the grid does not attract the electrons, which are negative also.

How Does the Valve Detect?

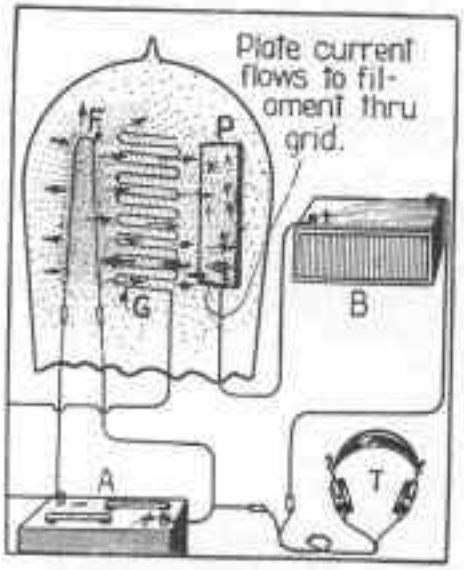
LOOK at the little sketch and you will see the filament, the grid, and the plate, inside the glass globe. In an actual valve, the filament might be a vertical wire passing through the centre of the coiled wire grid. Surrounding the filament and grid would be the nickel tube which we call the plate. Directly the 6-volt accumulator is switched on, the filament becomes almost white hot, and the electrons, or small charges of negative electricity, are thrown off from the filament and fly to the plate, which, being positive, attracts negative. On the way from the filament to the plate the electrons are bound to pass through the coils of the grid, which remains positive and negative alternately.

What is the Grid For?

THE grid is connected to the end of the aerial tuning coil, which is affected by the incoming wireless waves of alternating currents, i.e. they surge to and fro, first positive and then negative. The grid, as part of the aerial circuit, is constantly changing from positive to negative—as frequently as the wireless waves themselves.

To Sum Up—

THE original incoming wireless wave, which was alternately positive and negative, is, by the combined functioning of the filament, grid, and plate, converted into a one way direct current, and thus permits of wireless speech, music, or other signals being heard in the telephone receivers.



A CLEAR EXPOSITION OF VALVE ACTION.

DIAGRAM showing the action taking place in an audion bulb—note that B battery current flows from the plate to the 'phones T, but that the electron flow is from the hot filament F, toward the cold plate P. The varying charges impressed on the grid G, regulate the amount of current passing through the telephone circuit.

Honeycomb Coils

A Simple Method of Winding them

EFFICIENT tuning coils of the basket type can be wound by amateur wireless experimenters in quite a simple manner which will be found equally useful for spark, continuous wave, or telephonic reception in the

Fig. 1.—Honeycomb Coils in Use as Tuner.

following manner. Practically the only expense involved is the initial cost of the wire and a small quantity of white shellac varnish.

The Former.—The necessary former for winding these coils on can be made up by first securing a wooden cylindrical disc measuring about 2 inch in diameter, and 7-8 inch wide, as shown by Fig. 1.

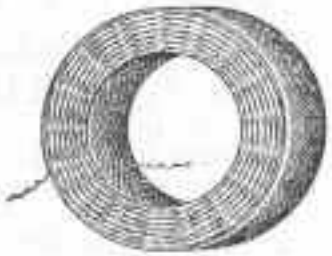


Fig. 2.—Finished Coil wound by method explained in this article.

This disc must be divided and marked off into seventeen equal parts round the periphery. The best method of doing this is to cut a strip of paper the same width as the edge and just sufficiently long to go round the circumference of the disc. The paper strip can then be marked off into seventeen equal parts quite easily whilst flat (see Fig. 2) and then be gummed on to the edge of the disc.

Next procure thirty-four ordinary pins and press two into each division opposite to each other (see Fig. 3.)

Winding.—All that is now necessary is to wind on the wire. No. 32 gauge double or single-silk-covered copper wire is suitable. Of course, a larger gauge wire can be used, but where space is to be considered the smaller gauge is preferable.

To wind the coil, take the bobbin containing the wire and place it upon a suitable support, so that when the wire is pulled it will unwind quite readily. Now take the former in the left hand, the wire in the right hand, and after leaving a sufficient length from the end, say 10 in., commence to wind it on as shown diagrammatically by Fig. 4; that is, commencing with pin No. 1 pass round on the outside, then to the inside across to pin No. 5 on opposite side, round the outside of pin No. 5, then to the inside across to pin No. 9 on the opposite side, round the outside of pin No. 9 to the inside, and so on throughout the whole winding of the coil, going forward to the fifth pin ahead each time on each side alternately. The first layer should lie flush against the edge of the disc. If the pins are numbered the operation will be facilitated.

By this means a coil of any size up to about 1 in. in width and of

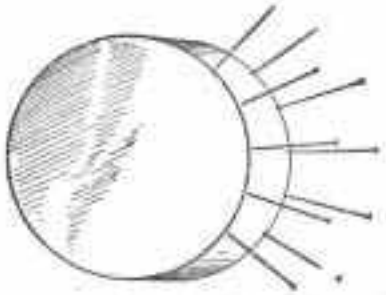


Fig. 3.—Pins Inserted into Disc.

comparatively low self capacity can be wound, according to the wavelength range it is desired to receive. It is a good plan to count the number of turns wound on, and this can be done quite easily by marking an arrow head on the disc opposite pin No. 1, one turn being recorded each time this pin is passed.

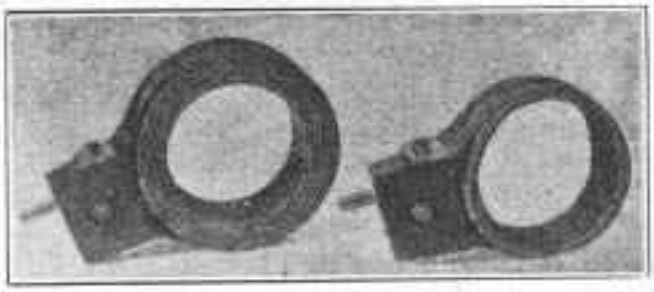


Fig. 4.—Mounted Honeycomb Coils.

As a guide, it may be mentioned that in actual practice it has been found that a number of these coils

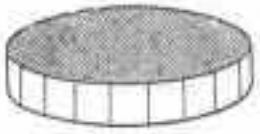


Fig. 4.—Wooden Disc.

having windings ranging from forty turns up to 1200 turns give a wavelength range of from 300 to 25,000 metres with a suitable aerial tuning condenser in the circuit.

When the desired number of turns has been wound on the former the free end of the wire should be temporarily twisted round the last pin and cut after leaving, say, 10in. spare. A small quantity of shellac varnish should then be poured into a flat tin and the whole coil and former laid into it for a few seconds to allow the varnish to soak in. The coil should then be removed and suspended by the wire for a few minutes to drain, after which it must be thoroughly dried either in front of a fire or in a moderately heated oven. When dry the wire will be found to be quite rigid and the pins can be easily withdrawn and the coil removed from the disc. As a precaution it is advisable to bind the coil at intervals of 1 in. with fine thread to prevent the outside ends from slipping. The finished coil will have the appearance shown by Figs. 5 to 7. If desired the two 10 in. ends can be taken to suitable plugs or studs of a tuning switch to facilitate the insertion of the coil in the receiving circuit.

Fig. 5.—Divided Paper Strip.

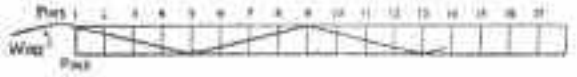
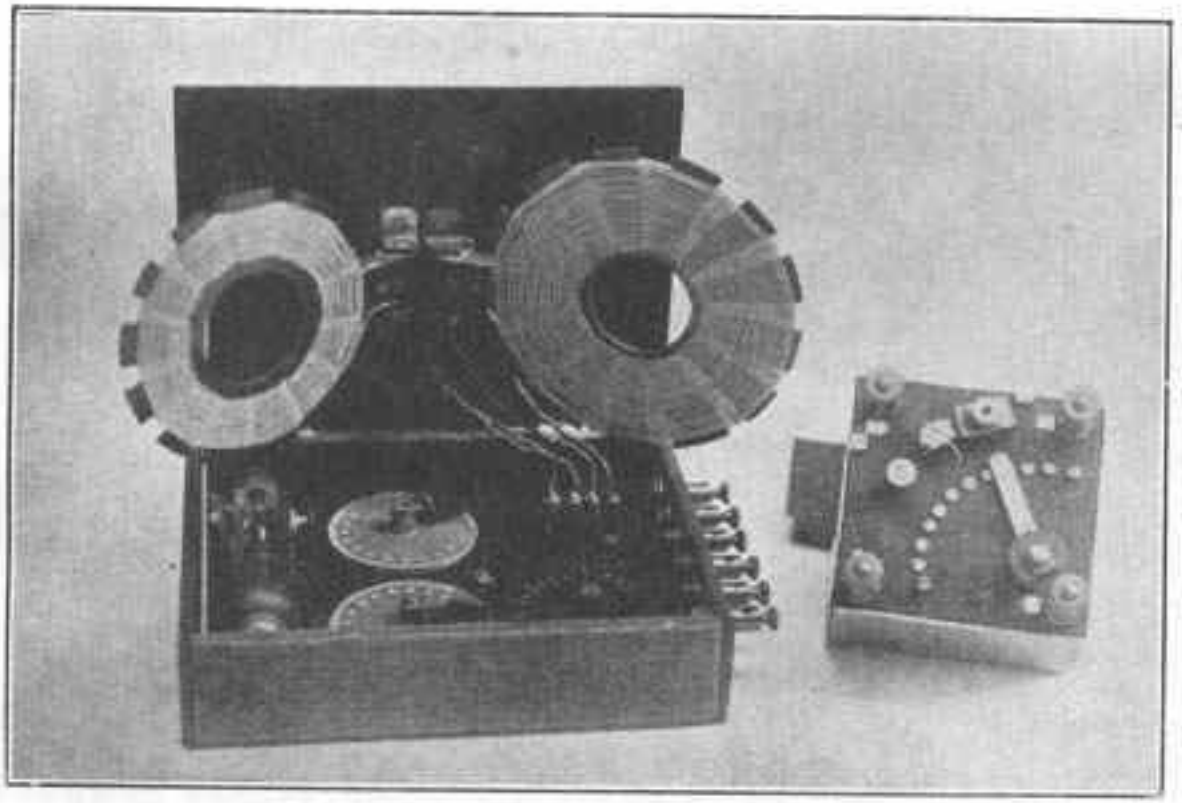


Fig. 6.—Method of Winding.



Smallest Valve Set (Mr. E. B. Crocker); Smallest Crystal Set (Mr R. P. Addison). Prize Winners at Radio Exhibition

IMPORTANT research has been carried on in England in connection with directional transmission on very short wave lengths, and in a paper given before the Institute of Electrical Engineers, London, on Wednesday, May 3rd, C. S. Franklin, an experimental engineer of Marconi's Wireless Telegraph Company, disclosed some hitherto unpublished information on this subject.

Short Wave Directional Wireless

Employing a wave length of only fifteen metres, duplex wireless telephony has been carried on between London and Birmingham, which has been audible only at the specially designed stations carrying on the experiments.

Another result of this research has been the evolution of a "wireless lighthouse," which may mean much for the safety of navigation. A wireless beam, radiated by a revolving transmitter, can be made to indicate to a ship, its exact position with respect to the "wireless lighthouse."

The apparatus concerned was demonstrated with a transmitter using a wave length of only one metre.

All About Batteries

IN these days of wireless progress, when the thermionic valve is being used in increasing numbers by amateurs for the reception of wireless speech and telegraphy, the batteries utilised in conjunction with it are often regarded as being of no importance at all.

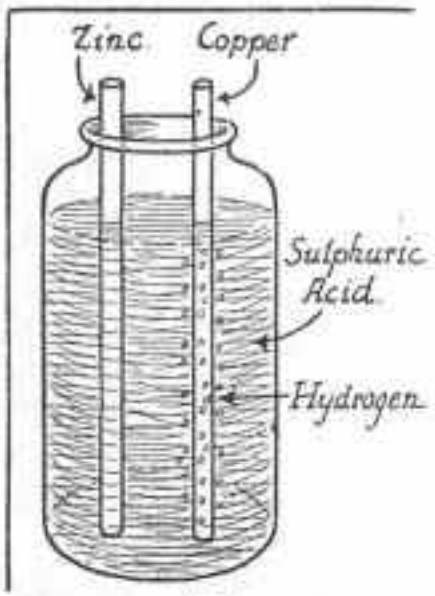


Fig. 1

Little thought is given to the fact that an inefficient battery means inefficient valves, and valves which are inoperative mean a useless wireless set.

At the best, faulty batteries create an enormous amount of trouble, and many hours have been wasted in dismantling perfectly good apparatus in an endeavor to trace a fault which, but for the neglect of the batteries, would never have existed.

When a number of cells are connected together for the purpose of supplying an electric current, they are known as a battery. This naturally invites the query from the novice, "What is a cell?" and this is the point from which we must start.

A "primary cell" is a piece of apparatus which, by means of chemical action between dissimilar metals and certain acids, produces electricity. A primary cell can be constructed from an ordinary jam jar, a sheet or rod of copper, a similar rod or plate of zinc, and a quantity of sulphuric acid.

If we fill the jam jar to within an inch or two of the top with sulphuric acid, and insert our two rods, as in Fig. 1, the acid will attack the zinc, which will commence to dissolve, and in the process produce a substance known as zinc sulphate.

The disintegrating action of the acid upon the copper rod is practically nil; but hydrogen, which is released in the form of bubbles from the acid when it attacks the zinc, is attracted to the copper rod, which gradually becomes covered with globules of the gas.

As the process continues, the potential of the zinc rod in relation to the copper rod gradually increases, the copper collecting more and more bubbles of hydrogen, which is a non-conductor of electricity.

If we now connect a wire between the tops of the two metals, the energy contained by the cell will cause an electric current to flow between the two plates.

If no such connection is made, and the bubbles on the copper are sufficiently numerous they will, despite the fact that many of them reach the top of the liquid and escape into the air, so completely cover the copper rod that any further chemical action between the zinc and copper is impossible owing to the barrier of the hydrogen.

The cell is now "polarised," and, incidentally, of no further use as a producer of electricity. This cell, in the simple manner given, is therefore of little use for electrical work, because of "polarisation."

One method of nullifying the effect of the hydrogen produced on the copper plate is that used in the primary cell of the "Leclanche" type, in which the hydrogen is chemically combined with oxygen to form water directly it is produced.

These cells are extensively used, especially where small voltages are required, such as for ringing an electrical bell, etc. Dry cells are also primary cells, but it is not necessary to enter into a detailed explanation of them here. Suffice it to say that their action is the same as that of the "Leclanche" type, the liquid, i.e., acid, being introduced in the form of a paste.

As the dry cell is much cleaner and smaller than the Leclanche type, it is very popular whenever a "high tension" or plate voltage has to be considered in constructing a valve receiving set.

The "storage cell," or "accumulator," like a primary cell, consists of plates of metal immersed in acid. The chemical action which takes place inside the cell, however, is of a different nature.

In the case of the primary cell, chemical action produced a charge of electricity. With an accumulator it is necessary to have an external source of electric supply to create chemical action. In this instance lead plates are commonly used; one

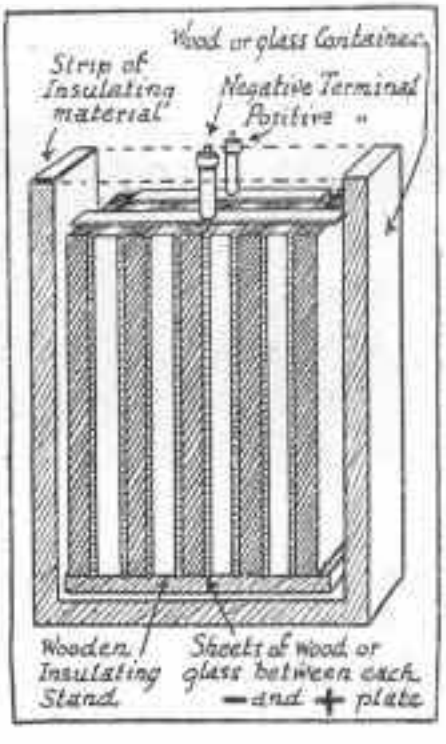


Fig. 2

plate is of pure lead, while the other, which is of lead also, contains several holes, which are filled with a mixture of red-lead and sulphuric acid.

If these two plates are connected to the + and — terminals of a source of electrical supply, the current passing from the submerged part of one plate to the other causes chemical action of a certain nature to take place between the two plates. When the flow of electricity is discontinued, and the two plates are connected together at the top, above the acid level, a current will flow in the connecting wire. This is due to the two plates endeavoring to return to their original condition.

When this eventually happens, no further electricity will flow between them, and the secondary cell is said to be "discharged." This cell, however, can be repeatedly recharged from a source of external electrical supply.

It is apparent that if more than one plate of each type is used, the greater will be the resultant chemical action, and commercial accumulators usually consist of several alternate negative and positive plates, separated by thin sheets of glass or wood, which are introduced into the container holding the acid, as shown in Fig. 2.

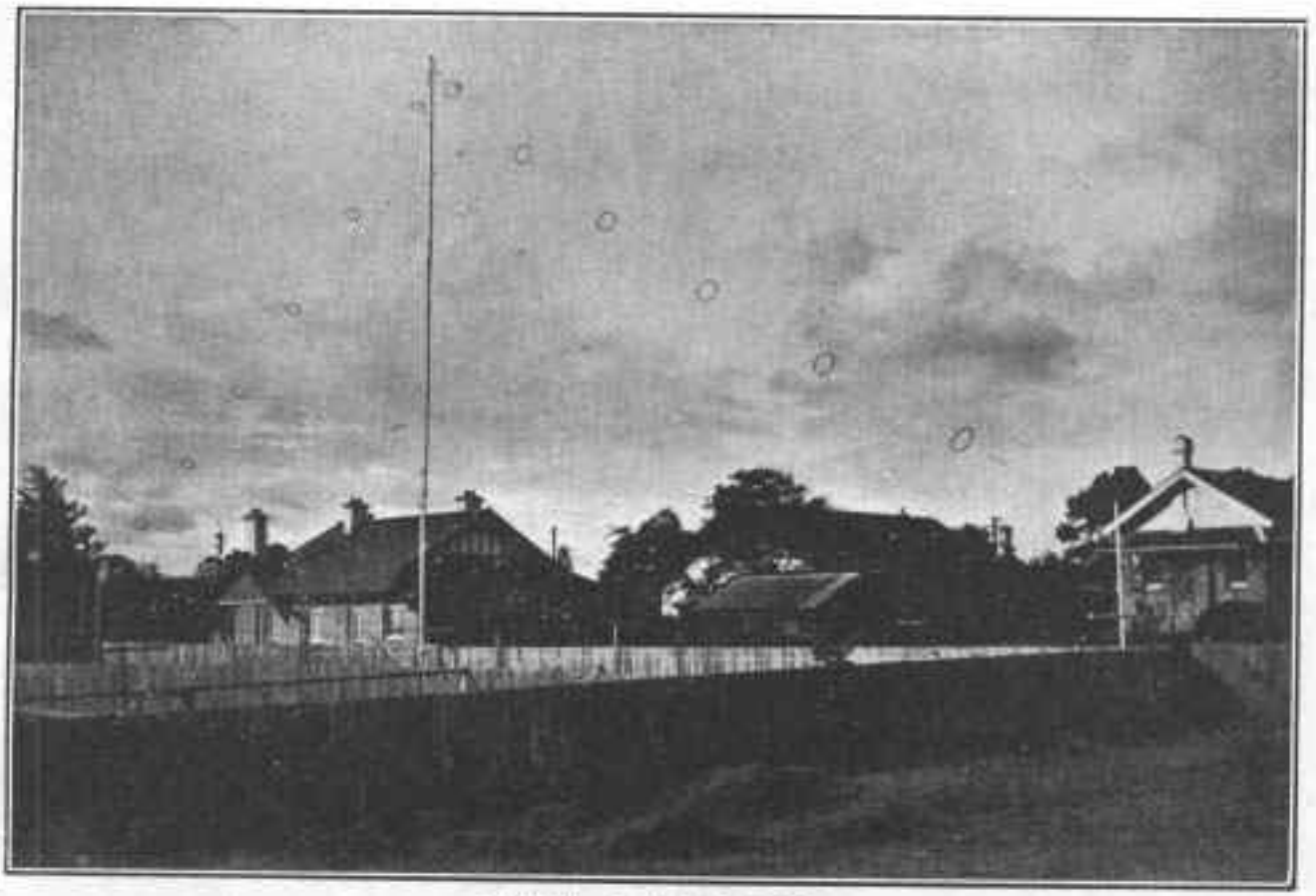
It will be seen that every positive plate has a negative plate on either side of it, and an easy method in which to determine the positive and negative terminals of a cell which bears no indication in this respect, is to refer to the plates. The terminal attached to the larger number of plates will be the negative one.

The expressions "storage cell" and "accumulator" are somewhat misleading, because, as has been seen from the foregoing, the cell does not actually store or accumulate electricity. Electricity starts chemical action in the cell, and when the influence of the electricity is removed, the cell commences to produce electricity in exactly the same manner as a primary cell, i.e., by chemical action.

It is this type of cell which is generally used for supplying the electric current to the filament of valves. The average voltage given by any one cell is 1.5 to 2 volts.

Of course, it is taken for granted that the reader knows that if the two terminals of a storage battery are connected together, the battery would be "short-circuited" and the battery ruined.

In buying a storage battery for a receiving set, it should be borne in mind that the experimenter may want to add an amplifier and perhaps a loud speaker later on. In this case a storage battery or accumulator, as it is more generally called, of at least sixty continuous hours capacity will be required. If an accumulator is said to have an eighty hour capacity it may mean eighty "ignition" hours, which is equivalent to only forty hours continuous capacity, as when being used for ignition purposes it is only in use half the time—half the time "sparking"—half the time inactive.



Mr. Macluroan's Aerial at Strathfield.

About Your Set

THE tuner is an instrument by which we are able to receive signals from a desired station to the best advantage—that is to say, to be "tuned in," to the exclusion, as far as possible, of all other signals.

The detector then converts the electric impulses received into currents which will actuate the diaphragms of the telephones. A valve amplifier inserted between the detector and the telephones may be used to increase the intensity of signals.

Recently, the crystal detector was generally used for reception. This detector consists of a metallic contact touching lightly a small piece of galena, silicon, or carborundum. A test buzzer circuit with dry cell, to indicate the correct sensitive adjustment of the detector, is essential when this type of detector is used.

Among the recent radio developments come the more sensitive valve type of detector which is now in general use. It consists of an exhausted electric bulb which needs a source of filament current, generally supplied by a six-volt accumulator, and a high-tension battery to furnish the plate voltage, which usually consists of a number of small dry cells assembled in a unit.

For detection purposes either a gas content valve (or "soft" valve), or a highly-exhausted valve (or "hard" valve) may be employed.

Many amateurs prefer the less-sensitive hard valves, as they do not require such delicate adjustment as the soft.

Naturally the accumulator needs recharging periodically, and since most electron valves used for reception need a filament current of about one ampere, a six-volt sixty ampere accumulator, for instance, supplying filament current for a two-valve amplifier and a detector, would have to be charged completely after every twenty hours' constant use.

If large size dry cells are used for intermittent operation of valve detectors, it will be as well to use two or three cells in parallel for each valve employed, consisting in turn of four cells connected in series. Eight or twelve dry cells would thus operate a valve receiver.

It has been found possible by using special radio amplifiers, to amplify, or magnify, the received impulses before they reach the detector.

Father does his duty nobly and well.

We have just completed a test of a special radio-frequency transformer, which is arranged to be applicable to 200 to 500 metre wave length, or by disconnecting a brass strap from the centre of the three terminals on each side, this transformer is suitable for 500 to 5000 metre

A coming Australian Radio Scientist

wave lengths, so that practically all the necessary wave lengths are covered. We will publish particulars of this experiment in a later issue.

The term receiver is variously used. Sometimes it means the combined tuner and detector; sometimes it also includes the amplifier; and sometimes it denotes the tuner only.

One or more electric circuits are contained in the tuner, which are so adjusted that they catch impulses of the desired wave length only.

A coil of wire, cylindrical in shape, with one or more sliding contacts, is the simplest form of tuner, of which there are two general types in use—the single and multi-circuit tuners.

The former are the less expensive and more easily operated, though the latter give greater freedom from interference, and are, therefore, preferred by the experienced amateur.

Everyone knows the standard telephone detector—which is essentially the same as the receivers used for radio telphone reception, though their type is distinctive.

Made in the watchcase form, they are attached to bands which pass over the head, and hence derive their name—head receivers.

In order that they may follow and respond to rapid pulsations of current, the diaphragms are very light—while a far greater number of wire turns are round the magnetic pole.

This causes a proportionately greater magnetic field with a feeble current, and the result is an extremely sensitive receiver.

Comparatively high resistance telephones are desirable for valve reception.

The two receivers are generally connected in series, those of fair sensitiveness having 1000 ohms resistance in each receiver, while 1500 to 2000 ohms are found in the better ones.

One or more stages of amplification, each needing an additional electron circuit, will further increase the strength of signals received and thus the range of "picking up."

The same accumulator which operates the detector valve filament will operate the amplifier valve filaments, and, if proper connections are made, an ordinary sixty-volt high-tension battery may be used for the plate in both amplifiers and detectors.

Except in cases where exceptional signal intensity is needed, two stages of audio-frequency amplification will suffice.

Regenerating Systems

THIS is a mystic word to amateurs and thought by many to cover all of the phenomena that are observed in the vacuum tube circuits. The principle of regeneration is simple and distinct—a fact which can hardly be said of all the methods required to produce it.

It is well-known that a vacuum tube detector is more sensitive than a mineral detector because most of the energy supplied to the telephone receivers comes from the detector circuit itself. It is somewhat similar to

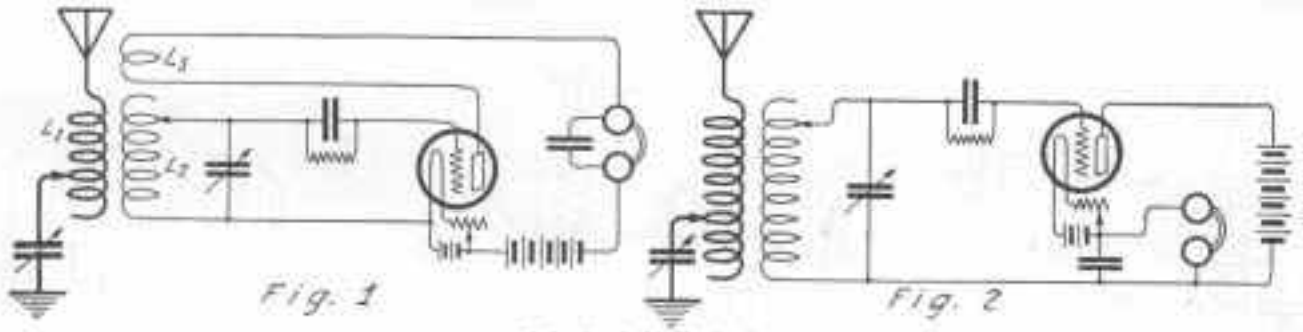


Fig. 1

Fig. 2

Inductive feed-back circuits

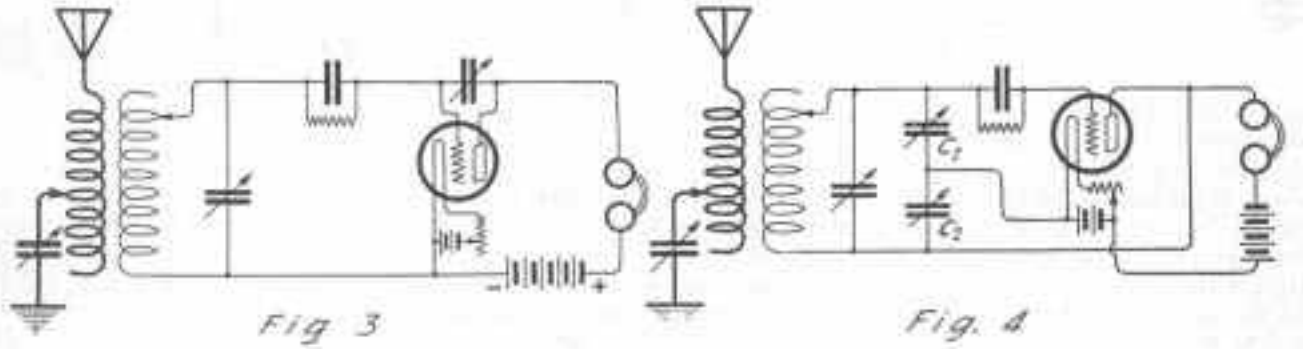


Fig. 3

Fig. 4

money put into the bank which is later withdrawn with the interest that has accumulated. More is withdrawn than put in. This in a similar way, in connection with a receiver using a vacuum tube detector, the output is more than the radio frequency input, with the surplus energy coming from the plate circuit battery. Thus it is the same as getting from 200 per cent. to 1000 per cent. interest on the energy supplied by the antenna—which is the plate circuit battery—doing this kind of business, will become bankrupt after a while, but fortunately the battery is easily restored by putting other dry cells in the plate circuit or re-charging the old ones if storage cells are used.

For many years amateurs were content by getting this amount of interest on their investment of incoming energy, but now with the use of regenerative receivers they want to get compound interest. This is what is done by regeneration. With one of a number of coupling schemes part of the energy from the telephone receiver circuit is sent back through the tubes again, resulting in still larger currents in the plate circuit—the circuit in which the telephone receivers are located—part of which, of course, goes back through the tube again. The plate current then increases until some factor in the circuit limits the output and the action becomes steady. This limiting factor may be the vacuum tube itself, the resistance of the associate circuits or the telephone receivers. The result is that the signal is amplified many times the normal amount and much greater distances are attained.

Inaudible signals without regeneration sometimes become very strong with regenerative circuits.

An additional feature in regenerative receivers is that tuning is very much sharper. The reason for part of this is that the decrement of the receiver is lowered. When a certain transmitting set is heard on a wide range of wave-lengths, it is ordinarily set down as having a broad wave. However, the decrement of the receiving set itself is often to blame, as it is the combined effect of both the sending and receiving decrements that determine the apparent broadness of the wave. Less interference is usually encountered when using regenerative receivers.

The only thing necessary to add to a vacuum tube circuit to produce regeneration is some device that will return some of the energy from the output or plate circuits to the input or grid circuit. This may be done

with either inductive, capacitive or resistance coupling between the grid and plate circuits. It is necessary with any system to provide a fine adjustment of the coupling so that the regeneration is not overdone to cause distorted signals with an unnatural tone.

Two things must be considered: The polarity of the currents so applied back on the grid at each instant must be the same as that due to the incoming signal currents, and the amount of coupling must be less than that necessary to produce stable and continuous oscillations (singing) which would continue after the signal wave had stopped.

One of the best-known methods to obtain regeneration utilises the inductive feed-back circuit. This scheme is shown in Figure 1. The oscillations in the plate circuit for the most part have the same frequency as the group frequency of the transmitting set if the valve is adjusted properly. The coil L3 is in series with the telephone receivers and induces a current in either the antenna or secondary circuits as may be desired. Another variation of this system is to omit the grid condenser and to adjust the valve so that no rectification takes place in the first tube. In this case high frequency currents are induced back. Another valve is then used to detect these oscillations that has a grid condenser in its circuit.

Another method of inductive feedback is shown in Figure 2. Here the telephone receivers are so connected that they form part of both plate and grid circuits, acting as an impedance coupling or a one-to-one transformer. This method of securing regeneration does not permit any control by the operator, and unless additional features are added other methods are better suited to amateur needs.

A capacitive coupling method is shown in Figure 3, where a variable condenser is connected across the grid and the plate of the valve. The size of this condenser depends largely upon the range of wave-lengths desired. A condenser having a maximum capacitance of .004 mfd. will be suitable for a receiver up to 2600 meters wave-length. It should have a very low minimum capacity or else provision must be made to disconnect both sides from the circuit when regeneration is not required. This condenser will affect the wave-length—especially on short-wave receivers—so that retuning is necessary each time the coupling is varied. This effect brings it into disfavor with many experimenters for short-wave receivers.

Another type of capacitive coupling is shown in Figure 4. In this circuit two condensers are connected in series across the plate and grid of the valve and the midpoint between them is connected to the filament. Sometimes both condenser are mounted on the same shaft and operated by one knob. In this case the capacity of one condenser may be increased while the capacity of the other is decreased at the same rate. The plates of these condensers are preferably designed so that the capacity across the pair remains as nearly constant as possible with whatever adjustment each individual condenser has. In this way the regeneration adjustment does not detune the circuit as much. The minimum wave-length, however, is increased since the effect is the same as if a single fixed condenser is placed across the tuning condenser in the secondary circuit.

Condenser C1 may be fixed and the coupling controlled by varying the bridging condenser across the plate circuit. When the latter condenser is at its maximum capacity the regeneration is at a minimum. It may have a maximum capacity of .001 to .002 M.F. for wave-lengths up to 3500 metres.

It is generally conceded that for short-wave receivers the tuned plate system of regeneration is best suited to the needs of the average experimenter. This system is shown by a representative circuit in figure 5. The variable inductance is used to tune the plate circuit to the frequency of the incoming waves.

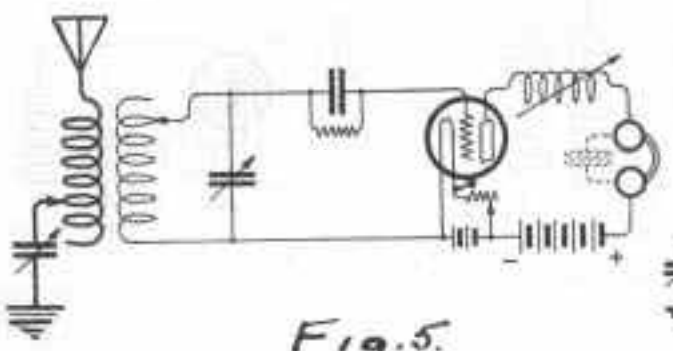


Fig. 5.

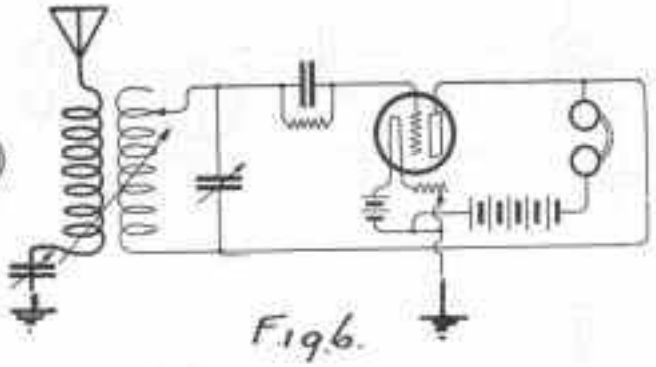
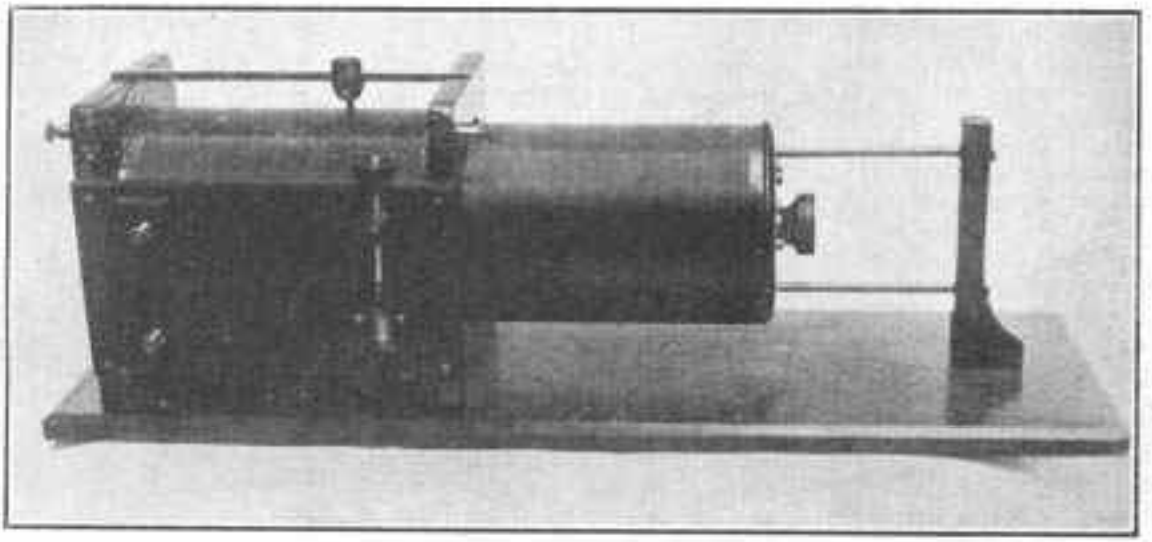


Fig. 6.

Ordinarily, the capacitance of the receiver cord will act as a condenser shunting the high impedence telephone receivers, or often a small fixed or variable condenser is added at that place. The inductance is preferably of the variometer type. Tuning the plate circuit to the incoming waves is in itself instrumental in increasing the strength of the signals barring any regenerative effects.

When a potential is applied to the grid by an incoming wave, the plate current suddenly increases or decreases as in the case of any vacuum tube circuit. This change in plate current will induce a potential across the inductance L which will oppose the potential of the plate battery. This will have the effect of momentarily changing the potential on the

grid since the grid is located in the electrostatic field between the plate and filament within the tube. This variation of grid potential acts to produce regeneration in the same way as with other systems. In building this circuit the inductances should be somewhat larger than the secondary of the tuner—if tuning is aided in the secondary circuit with the aid of a variable condenser across the tuner—since the capacity in the plate circuit is smaller. One of the first methods of regeneration used is the ultraudion system shown in Figure 6. Its main feature is that it can be used without the aid of any auxiliary equipment in the circuit. Ordinarily, it is best adapted for long-wave receivers only. A further advantage is that the circuit may be readily changed back to a non-regenerative circuit if desired. As shown by the diagram the wire that usually connects from the secondary of the receiving tuner to the filament is connected instead to the plate. In many sets best results are obtained with one side of the filament grounded. Its action is not unlike that of the capacitive coupling of Figure 4.



Mr. J. Watson. Best Crystal Set, 1st Prize, Radio Exhibition

GENUINE RADIO SLEUTH.

WILLIAM J. BURNS, Chief of the Department of Justice, Bureau of Investigation, told a story recently in which radio took the part of Sherlock Holmes. A dapper young man appeared one day before the sales manager of a large radio manufacturing plant, and explained that he wanted to purchase a very fine receiving set for a local high school. He was greeted cordially and the best of the house's sets were demonstrated. Ordering an expensive set, he managed somehow to secure delivery without payment, and then disappeared. The set also vanished from the place it had been shipped to originally much to the chagrin of the manufacturers, who decided to advertise their loss through radio itself, being able to give a very accurate description of the young man, who had a noticeable scar on his cheek.

Chapter two opens in an apartment where a genial and fine appearing young man, with a scar on his cheek, is entertaining his friends with a new receiving set. Suddenly the instrument begins to tell of the manufacturer's loss and give a detailed description of the thief—unmistakably the host! The consternation of the guests may be imagined. The next morning a very worried mother paid for the instrument which her son had wanted so badly, he had evolved the above scheme for getting it, whereupon the manufacturer dropped the matter.

* * *

A SIX MILLION MARKET.

A MARKET for 6,000,000 radio receiving sets in five years is seen by the Copper and Brass Research Association, which set this modest figure after a short investigation. The Association is composed of manufacturers of copper and brass, who realise that radio apparatus consumes annually many tons of their metals. In reaching the figure of six million sets, the Association took as a basis the fact that there are approximately that number of phonographs now in use, and that the cost of the average receiving set is about equal to that of the average phonograph. Radio experts, however, point out that the six million phonographs were sold over a period of some fifteen years, while at present there are about 1,500,000 radio receiving sets in use, 85 per cent. of which were purchased within the past year. This seems to indicate that radio is destined to far surpass the phonograph, until there is one in every home.

An Efficient Honeycomb Coil Receiver

A VERY efficient honeycomb coil receiver with detector and two stages of audio frequency amplicastages of audio frequency amplification has been constructed by Major W. H. Newman, whose station is at Artarmon, on the North Shore line, Sydney, New South Wales.

This honeycomb coil set is most compactly built, being contained in a polished cedar cabinet 6¼ inches deep by 9 inches high by 13 inches long, with a front panel of 5/16ths English ebonite. The only external accessories are the "A" battery and 'phones, so that the whole outfit is easily portable.

Contained inside the cabinet are three V. 24 valves, one as detector, and two as audio frequency amplifiers. These valves are mounted on a separate panel, parallel to the front panel, and on a shelf between the two panels are the two audio frequency transformers. The "B" battery, which consists of 12 pocket flashlight cells, giving 54 volts in all, is also placed in the cabinet, the current being controlled from a switch mounted on the front panel.

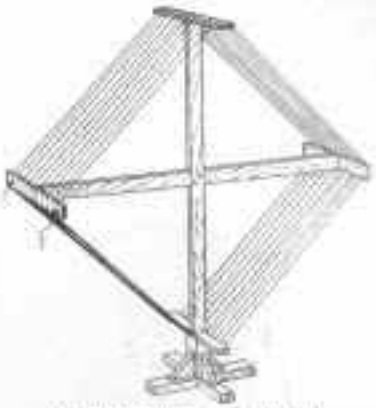
Owing to the sharp tuning qualities of this set, local interference can be easily eliminated. The circuit is a particularly good one for all-round work, and is given below.

The primary and secondary condensers are of .001 Mfd. capacity, while the capacity of the grid condenser, which is also variable, is .0005 Mfd. In tuning for telephony the tickler coil is closely coupled to the secondary, and tuning is done with the primary coil and the secondary condenser.

The set is usually worked on an inverted "L" type four-wire aerial, of 7/20 stranded copper wire, spaced 3 feet apart and 150 feet in length, with an average height of 50 feet. No difficulty has been found in working the whole of the Australasian commercial stations, and under favorable conditions the large American C.W. stations are read.

Recently a demonstration of the possibilities of wireless telephony as applied to railway working was given on this set to the Railway Commissioners at their office at Bridge Street, Sydney. In this case a loop aerial was used, consisting of ten turns of 20 gauge enamelled copper wire wound on a frame 4 feet 6 inches square. Music and speech transmitted by Garden Island Wireless Station, Amalgamated Wireless, Mr. Maclurcan and Burwood Radio Club were received with surprising loudness.

For making a loop aerial similar to the one illustrated two pieces of wood 7-8th by 1½ inches, by 4 feet 6 inches, four pieces 7-8ths by 1½ inches by 19 inches, 120 feet of No. 20 gauge enamelled copper wire, 12 screws and 2 binding posts are necessary. A base or support of some kind has also to be constructed to permit the loop to revolve around its



Major Newman's Loop Aerial

vertical axis, because this type of aerial is highly directive and must be turned so that its horizontal axis points in the direction of the transmitting station.

The frame is assembled as shown, and ten full turns of wire are wound on, the turns being spaced ¾in. apart. The ends are connected to the binding posts, from which wires are run to the aerial and ground posts of the receiving set.

In actual use it was found that better results were obtained when the loop aerial was connected only with the aerial binding post of the receiving set, and a regular ground connection made with the ground terminal of the set.

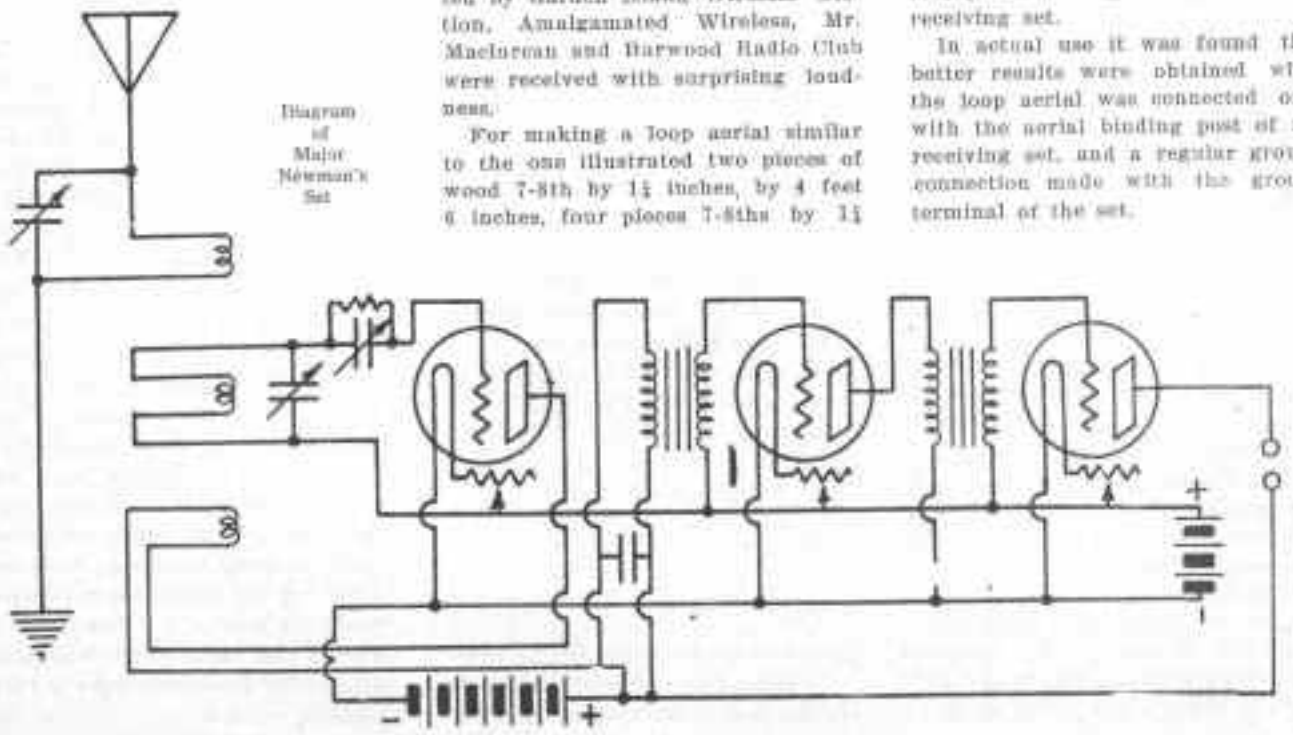


Diagram of Major Newman's Set

People who are Waiting to Talk "Wireless" with You

The first stage in "Radio Fever" is to wonder just how you should start, and how you can get the best value for the money you are prepared to expend. We take the opportunity to introduce you to the people who will advise you on wireless matters and show you over their radio goods.

MR. MALCOLM PERRY is the manager of the Experimental Wireless Sales Department, Australectric Ltd., 97 Clarence Street, Sydney, N.S.W. He was Honorary Secretary of the New South Wales Wireless Institute, from March, 1911, until March, 1920, and then filled the office of Treasurer until this year (1922).

Mr. Malcolm Perry

It is worthy of note that the New South Wales Wireless Institute was the first institution of its kind in the British Empire.

Its first President was Mr. Frank Leverrier, K.C., and Mr. W. H. Hanman was the first Secretary. The Institute was launched on its career on March 14, 1910.

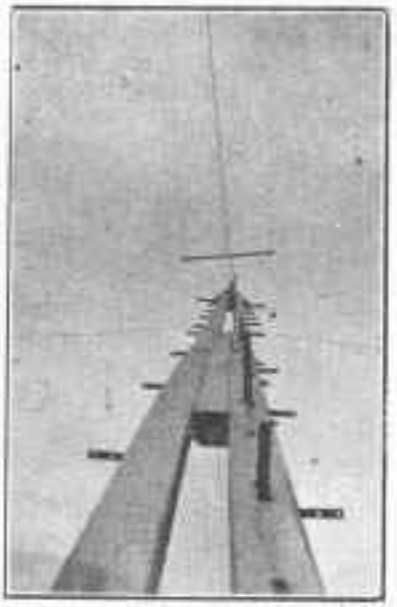
Mr. Perry commenced wireless experiments in 1905, and was one of the first men in Australia to take up the science seriously.

In that year he gave a demonstration at the Sydney Grammar School, with a four-inch spark coil and a Marconi Coherer, transmitting a distance of EIGHTY FEET. That is NOT a mistake—eighty FEET, not MILES! Still, that was a very wonderful performance in those days, and the Headmaster carefully closed the door between the room where the transmitting took place, and that in which the coherer was working, **in order that the ether waves should not pass through the open doorway!** The aerial used for transmitting was of the spirally wound loop type—the precursor of the type of loop aerial mostly used in these days. His first outside aerial was one 20 feet high and 18 feet long. This was erected in 1907. At that time, he had to do his own transmitting, and receiving as well. He first started up his spark coil transmitter, and then chased off, about three hundred yards, to a friend's place where he had arranged his receiving apparatus!

A little later, this difficulty was overcome, as H.M.S. Powerful, was fitted up with wireless, one of the first vessels to be equipped on the Australian Station.

Lower end of Mr. Perry's Aerial, 25ft. high

In August, 1910 he erected a wireless aerial 150 feet long and 115 feet high! News of the De Forest Audion Valve began to filter through to Australia about 1914, but owing to the war, amateurs did not get much chance of trying it out until 1919. Mr. Perry's first valve set included an Audiotron, with which he did some very good work. He is still an experimenter—has a lot of loose parts around which he hooks up to try out some new circuit or kink—after the experiment is over, he pulls everything adrift, and waits around for the next worth-while development. This is the real experimenter's spirit—no fancy panels, or compact box sets, for that type of radio fan!



Looking up Mr. Perry's Aerial at the 25ft. end

We publish a photo. of his aerial, which is somewhat of a curiosity. In looking at it, you should throw your head back and look up at the ceiling—and hold the photo. at arm's length above your head, the plane of the photo. parallel to that of the ceiling—then you will be looking up the mast just as the camera "saw" it. Note the "two-leg" construction and the climbing irons on the sides. The present aerial is 75 feet high at one end and 25 feet high at the other.

Mr. Perry has a little story, for private ears only, of a battle he had with the elements, in the early days, the result of which was that the track of his high mast was found 500 feet away, and a nine-inch ebonite insulator was so beautifully copper-plated with fused aerial wire that a bell could be rung across it quite easily!

MR. FRANK E. O'SULLIVAN, Electrical Engineer and Supplier of Radio parts and apparatus, of 296 Pitt Street, Sydney, New South Wales, is a son of the late Hon. E. W. O'Sullivan, M.L.A., Minister for Works in the See Government in 1905.

Mr. Frank E. O'Sullivan

He was originally intended for a journalistic career, but decided to be an electrical engineer. He entered the Railway Department as an apprentice, and took up studies at the Sydney Technical College to render himself proficient both in theory and practice. To-day he is the head of a large thriving establishment, carrying a large stock of everything electrical, and employs some 20 hands. One of his big jobs was the electrical installation of the Commonwealth Bank, which included lighting, electric lifts, the largest electric cooking plant in Australia, secret service telephonet system, electric bath heaters, electric furnace for destroying notes, tele-autograph for transmitting handwriting, electric tell-tale system for indicating the progress of night-watchmen through the building, etc.

That Mr. O'Sullivan should turn his attention to wireless, came as a matter of course, and he has probed the mysteries of the radio science with characteristic thoroughness.

He is specially catering for the amateur who intends to build his own set, and has a full stock of valves and all necessary parts.

* * *

MR. S. HARDY is in charge of the Wireless Department at Messrs. Anthony Hordern & Sons, Pitt Street, Sydney, N.S.W.

If some kind friend is thinking of making you a present of a radiophone receiving set for Christmas, there will be a good range of radio apparatus to choose from, as a consignment is expected to come to hand shortly. In the meantime, if you are needing valves, crystal detectors, switches, condensers or condenser parts, or any of those things a radio experimenter is always in need of, a visit to Mr. Hardy may help you to get hold of just what you require.

* * *

MR. J. CLARKE is the Sales Manager of the Western Electric Company, Ltd., 182 Castlereagh St., Sydney, New South Wales. The Company's main factory is just outside Chicago, where 28,000 hands are employed. At a test made recently the Company's Superintendent at New York spoke over the land lines, and at the Chicago end the telephone line was joined to valve amplifiers, then on to the Company's loud speaker horn. He addressed the whole staff of the factory, over 28,000 in number, and everyone heard perfectly. Western electric phones and valves are well-known commodities, and a large stock of crystal sets, valve receiver sets, and valve amplifier loud speakers will be available for your inspection by the time this article appears.

* * *

MISS WALLACE, whose radio supply store is in the Royal Arcade, Pitt Street, Sydney, New South Wales, took the Electrical Engineering Course at the Sydney Technical College and secured her diploma.

She then went into business as a contractor, installing lighting systems and power motors, and created some diversion at times by scaling the ladder in her dungarees and working side by side with her men. She pleads guilty to "speeding up the gang," as the Americans term it, on occasions when work had to be rushed through, by setting a team on one side of a job and taking a team herself on the other side, but admits quite frankly that she could not outpace the men's team, and says, with a twinkle in her eye, that she was never very far behind either.

Miss F. V. Wallace

A Lady Electrical Engineer whose initiative and resource have brought her prominently before Sydney's Radio public.

MISS WALLACE started dealing in Radio goods in September, 1921, and has acquired a large measure of popularity amongst the radio fans of Sydney and district. Both her valve and crystal sets are well worth inspection, and her stock of radio parts includes everything dear to the heart of the wireless experimenter.

MR. W. M. B. VEITCH is the Australian representative and Technical Expert of the Magnavox Company, 228 Pitt Street, Sydney, N.S.W. He joined the New Zealand Government Post Office Service in 1910, and is the son of Mr. R. D. Veitch, who holds the position of Telegraph Engineer in the N.Z. Service equivalent to that of State Engineer in Australia.

He had four years' wireless service in New Zealand, at The Bluff, Wellington, Chatham Islands, and Awanui. After passing a series of examinations, he was promoted to the Professional Division of the Engineering Branch, and engaged in laboratory work. At the same time he held the position of Radio Inspector,

Mr. W. M. B. Veitch

examining candidates for the Commercial Wireless Certificate. He joined the Magnavox Company twelve months ago and came on to Sydney as their technical expert. He will not only talk the wonders of the "Magnavox" Loud Speaker to you, but is at all times pleased to give amateurs the benefit of his advice and assistance in any little radio difficulty they may encounter.

* * *

MR. C. STEVENSON, proprietor of the Electric Utilities Supply Co., 605 George Street, Sydney, New South Wales, has been handling radio supplies for about six years. He is a consistent experimenter, and tries out everything new. His valve receiver is a practical, attractively finished piece of apparatus, and he is making a specialty of the Myers Valve. It

Mr. C. Stevenson

is claimed that it has five times the amplification of the ordinary tube. One peculiar feature it possesses is that it will oscillate anywhere from 2 to 200 volts on the plate. Long life is assured the valve by its being gas free and having a special filament.

Mr. Stevenson's stock covers everything likely to be required by amateurs making up their own sets.

* * *

MR. W. G. KEOGH is in charge of the Wireless Department at Messrs. Grace Bros., George Street

Mr. W. G. Keogh

West, Sydney, New South Wales. During the war he was in the Flying Corps, running a "Sopwith Pup" and operating a Mark III. wireless outfit. He recently made a tour of the United States, and got into touch with the leading radio apparatus manufacturers there. Whilst in California he took part in a test made in a forest just outside Oaklands, which, for some unaccountable reason, is impermeable to the ether waves. The party was equipped with the most sensitive receivers, but could not get a signal. The head of this testing party was Mr. S. F. Bronsky, whose radio station is situated in Oaklands, Cal., U.S.A.

* * *

MR. RAYMOND H. SHAW is the Radio Department Manager for Electricity House, 387 George Street, Sydney, New South Wales.

Mr. Raymond H. Shaw

Starting as a signaller in the Senior Cadets, he studied for his Commercial Wireless Certificate, and became a ship's operator on the Helen B. Stirling, a sailing vessel of the schooner type, which went down in a hurricane off the north of New Zealand in January of this year. No, he was NOT on board at the time. He was for some time in charge of the radio factory of Mr. McIntosh, who was in the radio apparatus business in the Royal Arcade, Pitt Street. Starting in a comparatively small way, Electricity House has found it necessary to increase their construction staff considerably and to instal up-to-date plant and machinery. Everything in radio is obtainable at Electricity House.

People Waiting to Talk "Wireless" with You—(continued)

MESSRS. A. L. MOORE and S. V. Colville are in business as Radio Apparatus Manufacturers and Suppliers of all Radio Sundries, at 10 Rowe Street, Sydney, New South Wales.

Mr. Moore's entry into the radio world dates back very many years. He started off with the usual crystal set with a loose coupler. Later, he installed a transmitting set, and carried out many interesting experiments. When the valve arrived he was among the first to try it out, and has moved on, from stage to stage, experimenting with all kinds of circuits, and has now a three-stage amplifier set, with honeycomb coils covering a range of from 150 to 25,000 metres. He holds the Commercial Wireless Certificate.

Mr. Colville founded the Queensland Wireless Institute at Brisbane, and became its Secretary and Organiser. He commenced experimenting in wireless in 1912, and in that year had a spark transmitter and a receiver embodying the coherer.

He afterwards took up the crystal

Mr. A. L. Moore

detector and followed with a valve set in due course. The next step was to instal a valve transmitter at the Institute's rooms, with which he covered 80 miles with two V.24 valves. Transmitting is his particular forte, and the firm is turning out a very compact transmitting set. They stock the Radiotron Valves from

Mr. S. V. Colville

the U.V. 200 to the 50 Watt power tube, as well as all other types.

"Everything in Radio" is the firm's motto.

* * *

MR. R. C. MARSDEN, President of the Metropolitan Radio Club, and Club's Delegate to the New South Wales Branch of the Radio Association of Australia, is a British Army Reservist, being a Staff Captain of the Royal Garrison Artillery, and a Lieutenant in the Flying Corps. He commenced his wireless career under Father Shaw at the well-known station at Randwick, Sydney, N.S.W., which was then the Maritime Wireless Station. He had his own wireless plant at what is now known as "Cairn," Potts Point, Sydney, using an aerial 80 feet high and 80 feet long—quite a big aerial in those days, and not a bad one in these—his gear included a spark coil and the usual accessories for transmission and a crystal receiver. In 1911 he went Home, to take up a course in electrical and mechanical engineering at the Liverpool University.

During the war he was with his regiment in France (the Royal Garrison Artillery), and took a prominent part in the development of the underground aerial communication system which we did not hear much about until the war was over. In conjunction with that system he used his first valve set. On his return to Australia he immediately applied for an amateur's permit, and was the third on the list of applicants for a post-war license. His training has prompted him to devote himself more to the practical side of radio research than to the theoretical aspect, and he has constructed some very fine apparatus, which we have no hesitation in saying is equal to that produced in any part of the world to-day. His present set is a three-valve panel, one detector, and two stages of audio-frequency, using an Oscillandion Valve—which has been in use since 1916—and two V. 24 valves as amplifiers with Federal Transformers. Aluminium shielding is used between the transformers to obviate inter-action. At present he is devoting his spare moments to research on the elimination of "static," and although he has not met with a great deal of success

Mr. R. C. Marsden

up to the present, he is deeply imbued with the true experimenter's ever-present optimism, and intends to carry on until he meets with some measure of achievement. His Call Sign is 2.J.M.

MR. O. F. MINGAY, a member of the Wireless Institute of Australia, is the manager of the Radio Apparatus and Telephone Department for The Burgin Electric Co., Ltd., 252 Kent Street, Sydney, N.S.W.

He was in the Government Telephone Engineering Department for fourteen years, and served nearly five years in the A.I.F., in connection with the Signal Service and Wireless and General Communications. His war service enabled him to obtain a wide experience in wireless matters. At the front he used the well-known Mark III. set, power amplifiers, loop sets and found that the valve mainly used was of the French "R" type.

Whilst on service he was a military wireless instructor, and after the war had the good fortune to be able to spend six months with the G.P.O. engineering staff in London, and gained valuable knowledge on radio matters. After he returned to Australia he organised the Military Radio Association, of which he was secretary. A few months ago, he relinquished Government service to take up his present position with the Burgin Co. Ltd., who are handling the Mullard "Ora" Valves, Ilemler and De Forest products, as well as a full line of sundries.

Radio or Audio Frequency Amplification?

By O. F. Mingay, Member of the Wireless Institute of Australia

A VACUUM tube, of the three electrode order, acts as an amplifier of radio signals, due to the controlling influence of variations of the grid potential on the plate energy. This amplification takes place when the tube is detecting, regenerating or acting as a self-heterodyne, but, notwithstanding the fact that a single valve amplifies, further amplification may be desired, as some signals may still be too weak to be properly translated.

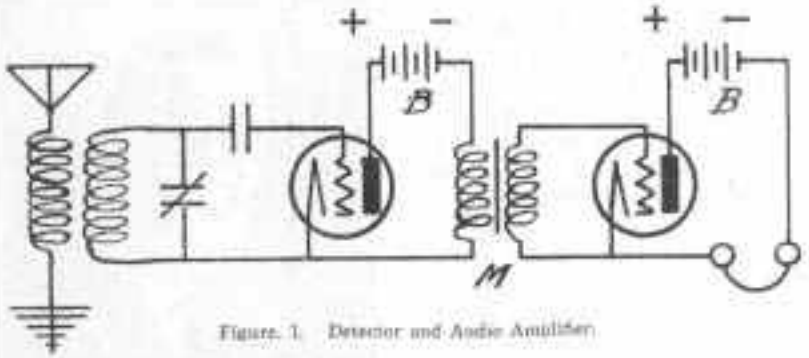


Figure. 1. Detector and Audio Amplifier.

Two kinds of amplification are available, radio or high-frequency and audio or low-frequency, and the difference between them must be carefully noted. In a radio-frequency amplifier the signals are amplified before they are detected, while in the audio-frequency amplifier they are first detected and then amplified.

Which kind of amplification to use is determined by the class of service desired. If you are interested in hearing long distance weak signals, radio-frequency amplification is necessary. If loud signals from local stations are wanted, the audio-frequency amplifier must be installed.

Again, if the operator wants to hear distant stations loudly both kinds of amplifier must be employed.

The question may be asked, "What is the difference?" and as both types amplify the signals, "Why cannot the audio-frequency amplifier be used to hear distant and weak signals?" Audio-frequency can, of course, be applied, but it must be remembered that what your detector valve does not detect, audio-frequency cannot amplify, as will be shown. A very weak signal may cause variations in the plate current of the detector tube, but the pulsations may be so weak that there is no effect either on a pair of phones or on the primary of an amplifying transformer.

In that case the amplitude of the original oscillations must be increased to a value sufficient to affect a detector tube. That is exactly what the radio-frequency amplifier does!

The Audio-Frequency Amplifier.

In a case where reception is quite successful with only a detector tube, but louder signals are desired, the manner of adding one stage of audio-frequency is shown in Figure 1. "M" is a small iron core transformer, the ratio of the primary winding to the secondary being about 1 to 3. The electrical characteristics of the primary winding should be the same as those of a pair of phone receivers. The first tube is adjusted to function as a detector, that is, it is working on the bend of the grid voltage-plate current curve. The second tube, however, is operated on the straight part of the curve, and a glance at Figure 2 will show why this is done.

It has to be remembered that whatever is detected by the first tube must be faithfully reproduced by the second tube, but with increased amplitude. If reference is made to the straight part of the curve between points "C" and "D" in Figure 2, it will be seen that such faithful reproduction is achieved when the valve is so adjusted. The incoming variations actuating the grid are repeated in the plate circuit, without distortion, but with considerably more volume—this is the very action we need, in fact, as will become evident by experience, any difference of potential applied to the grid will be reproduced in this manner.

In the audio-frequency amplifier the audio-frequency component of the

detector plate current is amplified, the variations in both tube circuits are identical, but differ in the amplitude.

The purpose of the transformer is to raise the voltage slightly, as it is the voltage which affects the grid and not so much the current.

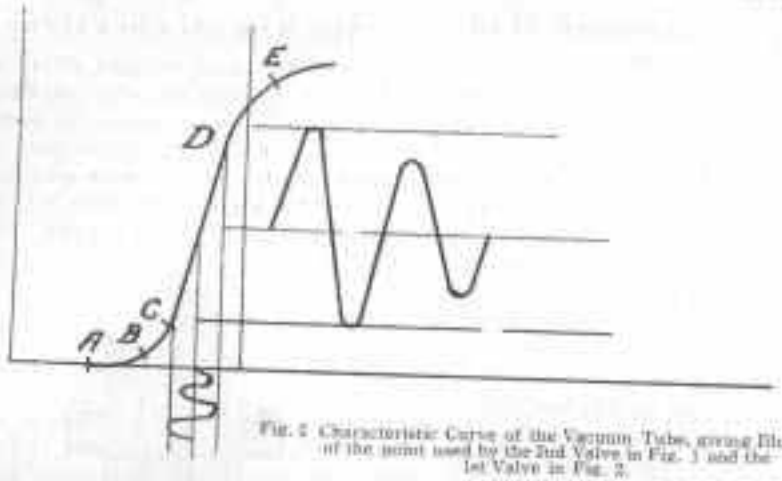


Fig. 2. Characteristic Curve of the Vacuum Tube, giving Illustration of the point used by the 2nd Valve in Fig. 1 and the 1st Valve in Fig. 2.

A choke coil can be used instead of a transformer, but the latter gives better results.

The Radio-Frequency Amplifier.

How the radio-frequency amplifier differs from the audio-frequency amplifier will now be explained. If you refer to Figure 2 you will readily grasp the following:—Here M.1 is the tuning unit, a pair of honeycomb coils with two condensers.

M.2 is practically the same thing. The first tube is adjusted for amplification—i.e., straight line operation between points "C" and "D" in Figure 2, while the second is for detection, to be adjusted about point "B" on the curve in Figure 2. The tuning units are all set for some definite wave-length, and the following action takes place:—The radio-frequency waves are conducted to the first tube, and, without detection, are repeated, with increased amplitude, in the plate circuit. These amplified oscillations affect the primary of the second tuner, in this case the transformer, exactly as if they were received direct from the aerial. They are then transferred to the secondary by induction and undergo the process of detection or rectification. Any number of steps of radio-frequency amplification may be used, but, in practice, a separate transformer is not used in each step, as special transformers are available having windings of such resistance that the tuning of them is purposely broad—that is, that they can cover a fairly large band of wave-lengths. High value resistances have been used for the purpose of radio-frequency amplification, as have single variometers. This is a phase of wireless which is still in the throes of development, and it offers a fine field of research to the experimenter. Radio-frequency makes possible successful reception on small or loop aerials, and with the latter "static" is reduced to a minimum.

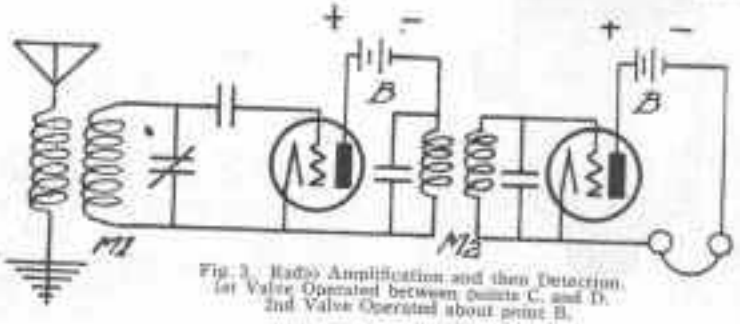


Fig. 3. Radio Amplification and then Detection. 1st Valve Operated between points C. and D. 2nd Valve Operated about point B.

Care of Amplifiers.

With audio-frequency amplifiers great care must be taken in the placing of the various parts. If the transformers are set too close together, the amplifier will howl unmercifully, and all sorts of noises, growls, and cries will be heard. The connections should be as short as possible, and carried by a direct line from point to point. Wires should cross each other at right angles. All connections should be soldered.

Make sure that the valve holder springs are clean and bright.

Be sure that your "B" battery is in good order, and that your "A" battery is showing full voltage. Separate "B" batteries in each stage of amplification will tend to reduce the tendency to howl. Excessive "B" battery voltage may burn out your transformers. Shielding the amplifier with metal has been tried in U.S.A. with good results.

DON'T meddle with the electric light mains when erecting your receiver. You will only blow a fuse, and perhaps treat yourself to an unpleasant shock.

Leave your receiver alone when there is thunder about. A ground switch in your aerial circuit is well worth while. It may save your set from utter destruction.

HINTS.

Look after your accumulators. Don't "drain" them utterly. Have them charged regularly, whether they want it or not.

Use clean rain water for them if you can't get distilled water. Don't add acid to water. It's bad for your health.

Keep your high-tension batteries well ventilated or they will begin to "sweat," and, consequently, deteriorate.

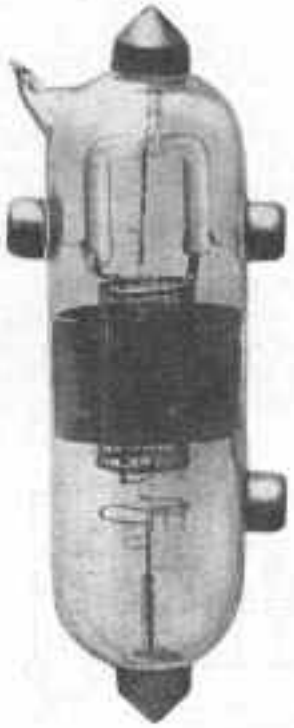
Hang the 'phones on a wall when you have done with them. This allows the moisture on the diaphragms to dry. Never tap the diaphragms with a pencil. Once they get bent they are useless.

Apparatus and Appliances

What You Can Obtain and Where You Can Obtain It

THE MARCONI FOUR-ELECTRODE VALVE.

REGARDING the four-electrode Marconi valve, illustrated above, an English writer says:—"There is another form of oscillation valve which appears to possess many eminently superior points over the three-electrode valve, and that is the four-electrode valve. This is an arrangement whereby an additional grid is



inserted in the tube near to the anode, and is so arranged that the filament directs negative charges upon both plates. When used in a suitable circuit, the amplification obtained with this type of valve is remarkable, one single valve having its circuits suitably coupled producing as good results as the ordinary three-valve amplifier employing the three-electrode valve."

In using the term "both plates" the second grid is regarded by the writer quoted above as a plate—in fact, the second grid is a plate in the form of a grid, and it is coupled up in the same manner as a plate in the ordinary valve.

The plate proper is coupled direct to the negative leg of the filament.

BROWN'S TELEPHONE HEAD SETS.

IN S. G. Brown's 'phones the receiving coils are wound on the pole pieces of a permanent magnet as usual, but the ordinary diaphragm is replaced by an iron reed tuned to a suitable note, to which an aluminium diaphragm is screwed. The diaphragm is spun into a special fitment. The type "A" receivers are provided with a milled head adjusting screw at the back of the receiver case for setting the reed to the position of maximum sensitiveness. The terminals are marked + and — in order to connect up with the correct polarity. Brown's 'phones are largely used by the Air Force and the Defence Department. The headband is of aluminium, and the whole headpiece weighs only 10 ounces.

* * *

"EVER READY" "B" BATTERIES.

A REALLY dependable dry cell "B" Battery comes as a boon and a blessing to radio enthusiasts. The Ever Ready Co., Hoffnung Chambers, Pitt Street, Sydney, New South Wales, have just put upon the market an Australian "B" battery. The battery is in two sizes, 30 volt and 40 volt. Each type has seven taps, in addition to the positive terminal. The construction is in accord with the latest radio engineering practice, in that the cells are carefully insulated from each other by specially prepared waxed board, and the whole is run into one solid block with paraffin wax, ensuring immunity from deterioration by dampness. An ammeter across the terminals will show 9 to 10 amps, whilst a similar test on some other makes of dry cells will only show 2½ to 3 amps. The Ever Ready cell has, therefore, 6½ to 7 more ampere hours capacity than the cells mentioned above. The firm has under consideration the manufacture of a "C" Battery in 1½ volt steps for those experimenting with the Armstrong Super-Renegerative Circuit.

The 40-volt "B" Battery is on sale at the radio goods dealers.

* * *

THE MARCONI V.24 VALVE.

THIS valve may be used either as as a detector or as an amplifier, and gives excellent service in either capacity. It has the advantages of great stability and extreme sensitiveness. The plate potential is only 24 volts, and the filament 6 volts.

Marconi valves are obtainable at The Australectric Ltd., 97 Clarence Street, Sydney, New South Wales.

* * *

CHARGING YOUR "A" BATTERY.

MOST of us have had the experience of the set suddenly going "dead" on us. When this occurs, we usually look for some connection adrift, and after fossicking about for a time, the brilliant idea strikes us to put a volt meter across the battery terminals. We find that the accumulator has run down! The next job is to get it charged. We may have to carry this heavy and awkward, but highly necessary, part of our equipment to some near or distant charging station. It may be charged at the right rate, and for a sufficiently long period, or it may not.

If we were on d.c. current we might charge it through a lamp re-

sistance, or a bank of lamps. Most of us have the a.c. as the house lighting current. A.C. is no good to charge accumulators, as we all know. The writer got over this difficulty by installing a "Tungar" rectifier. This battery charger steps down the 240 a.c. to 12 volts at 3 amps or 6 volts at 5 amps, charging rate, without any adjustment, automatically adapting itself to whichever size of accumulator is put in circuit.

It is a thermionic valve rectifier, having a valve on the Fleming valve, two electrode principle. It is the sweetest thing imaginable to overcome battery charging troubles, and is a perfectly dependable device, that can be left in circuit overnight, leaving your battery available for service at any hour of the day for testing or other purposes of your set. One of its best features is that the battery cannot discharge itself if the alternating current supply should fail. As soon as the interruption was over and the current switched on again, the "Tungar" would resume its charging of the cell. The "Tungar" Rectifier is handled by the Australian General Electric Co., Ltd., Wentworth Avenue, Sydney, N.S.W.

The company should make the "Tungar" a complete outfit for the radio experimenter by adding a tap to charge "B" batteries of the accumulator type. This could be readily done and at no great cost.

* * *

THE STAR "A" BATTERY.

A GLANCE at the battery will convey some idea of the rugged construction of the "A" Battery being manufactured by the Star Batteries Co., Ltd., of 43-45 Wentworth Avenue, Sydney, New South Wales.

Its very appearance denotes that it is built for service, and a glance at its interior construction more than confirms one's first impression that it is a thoroughly practical article.

The plates consist of two grids burned together, so that, when pasted, the paste "biscuits" are dovetailed into the grids, making it impossible for them to come out—a feature that experienced users of accumulators will appreciate, especially when the old square grid type of batteries are called to mind, which would not stand much shaking about without dropping some of their "biscuits" and so setting up a short circuit within the cell.

The firm is also putting up a "B" Battery in 12 volt sections. Those of us who have had the annoyance of inferior "B" batteries will welcome a "B" battery that can be kept up to concert pitch by an occasional charging. "Hitch your waggon to a star" is the slogan adopted by Star Batteries, Ltd., and it is good advice to the Radio Experimenter.

* * *

AN IDEAL STUDYING LAMP.

IN reading up the theory of wireless it is wise to obviate eye-strain. An electric reading lamp which throws a soft glow on the reading

matter, whilst leaving the eyes comfortably shaded, is being put on the market by Mr. Frank N. O'Sullivan, of 296 Pitt Street, Sydney, New South Wales.

* * *

THE STROMBERG-CARLSON RADIO HEAD SETS.

THE Stromberg-Carlson Co., of Rochester, N.Y., U.S.A., and Canada, who enjoy a world-wide reputation for high-grade telephone appliances, are represented in Australia by Messrs. L. P. R. Bean & Co., of 229 Castlereagh Street, Sydney, New South Wales.

If you want a Radio Head Set that will exhibit sound engineering principles, correct design, high-grade workmanship, durable finish, extreme sensitiveness, and superior tonal qualities, you will be wise to investigate the Stromberg-Carlson.

It is claimed that the tendency of the insulation to break down has been effectually overcome in this firm's Radio Head Set by winding the magnet wire in even layers, separating each layer by insulation, and by impregnating the whole in moisture-proof and high insulation material.

By this means a solid mass is made of the windings, so that jar and vibration will not cause deterioration.

One important point to radio experimenters is that any high voltage inductive kicks through the windings cannot damage them.

The loss of efficiency due to loosening of the operating parts is overcome by the pole pieces being directly welded to the permanent magnet.

The set is one of the comfortable-to-wear type and the price is a very reasonable one for such a high-grade article.

Messrs. Bean & Co. carry large stocks of all of the Stromberg-Carlson Telephone Manufacturing Co.'s goods, including telephone jacks and special radio transmitting microphones.

* * *

A NEW AUDIO-FREQUENCY TRANSFORMER.

"IT looks good, and is good," is the way one is prompted to describe a new audio-frequency transformer, now being manufactured by Electricity House, 287 George Street, Sydney, New South Wales.

It is of the closed core variety, the core being of transformer iron specially manufactured for the purpose. It is somewhat larger than other types of radio-transformers, but the extra size is due to the fact that more space has been taken up in carefully insulating the primary and secondary windings from one another, and in insulating adjacent layers. The plate is of bakelite and the metal work is nicely finished in nickel. Electricity House is gaining quite a reputation for turning out a workmanlike job, and this radio-frequency transformer is yet another feather in their cap. A geared stand or panel type honeycomb coil holder, with efficient honeycomb coils for all wave lengths from 200 to 25,000 metres, are other items which this enterpris-

ing firm is manufacturing, and both holders and coils are more than pleasing both in appearance and performance. "Everything in Radio and Everything Electrical" is the firm's motto, and a visit to the establishment, which is packed with goods from floor to ceiling, will convince the sceptic so far as to acknowledge, at any rate, that if Electricity House has not got "everything" they have nearly everything.

* * *

AN IDEAL CRYSTAL RECEIVER.

THERE is a never-failing fascination in exploring the ether via a crystal detector. The interest of the experimenter in trying our different crystals never wanes. The Col-Mo Duplicate Crystal Detector is just the ideal piece of apparatus for crystal experiments. For radio-concert reception the amateur will want to get the very best out of his crystal set, and the Col-Mo will enable him to do so. It has two crystal holders of an improved pattern and a change-over switch brings into the circuit whichever crystal it is desired to test. It has a tapped inductance, with broad and fine tappings, and it is also fitted with a buzzer for testing purposes. The whole is mounted on a bakelite panel and the finish is of the very best.

The Col-Mo is the design of the Colville-Moore Wireless Supplies, 19 Rowe Street (near Hotel Australia), Sydney, New South Wales, who are handling all lines of radio goods, including an "Amplihorn," a device which can be attached to the ordinary headphones, to enable a number of people to listen in at the same time. The "Amplihorn" is correctly designed to give distortion-free results, and is a very cheap attachment for the purpose it serves.

* * *

W. HARRY WILES, of 60 Goulburn-street, Sydney, N.S.W., has made a name in the electrical trade, which has been built up by enterprise and square dealing. Mr. Wiles commenced experimenting in wireless many years ago, and is keen on seeing to-day's radio service at the command of Australians everywhere. He has a large stock of double and single headsets, loose couplers, honeycomb coil holders, vario-meters, vario-couplers, filament resistances, valve holders, condensers and condenser plates, terminals, spindles, switches and switch points, condenser dials and knobs, crystal detectors, insulators, grid leaks and condensers, in fact, every requirement of the experimenter is catered for.

* * *

BOOKS ON WIRELESS.

WIRELESS Press Inc. of U.S.A. have their branch at 97 Clarence Street, Sydney, New South Wales. The radio experimenter who desires to secure really practical books on wireless should write for the firm's catalogue, which includes the title of just the particular book you need on any subject pertaining to the radio science. "The Wireless Experimenter's Manual"; Bangay's "The Oscillation Valve"; "The Radio Experimenter's Handbook" are books which will suit the beginner, and are written in a clear, non-technical style. The publications handled by the Wireless Press Co. cover aviation, electricity and radio in all its branches.

Radio Club Activities

North Sydney Radio Club.

AT its last meeting, the North Sydney Radio Club elected its officers for the ensuing year. The President is Mr. J. O'Brien; Vice-president, Mr. Raymond McIntosh; Honorary Vice-president, Mr. H. Buick; Secretary, Mr. R. H. Evans; Treasurer, Mr. E. Kruckow; Committee, Messrs. O'Brien, McIntosh, Evans, Planner and McClure; Auditor, Mr. H. M. Planner.

The new officers are keen and enthusiastic, and intend to make the coming year one of advance and progress for the Club.

The working programme will be of such a nature that meetings will be eagerly looked forward to by members. North Sydneyites should join up and become initiated into the mysteries of radio, so as to be ready to take advantage of the broadcasted concerts, &c., which are to commence at an early date. It is pleasing to learn that the North Sydney Radio Club will be one of the first to devote one evening a week to broadcasting, for the benefit of their fellow-experimenters.

Leichhardt and District Radio Society.

THERE was a very pleasant little function at the Club Rooms, 2 Annesley-street, Leichhardt, recently, when Mr. Thompson presented a very fine crystal receiving set to the Club. Needless to say, the members present expressed their thanks in no uncertain measure on receiving such a very welcome addition to their apparatus. We congratulate Mr Thompson on the spirit in which he has come forward to aid the Club and to help on that work of experimentation which will make for a radio science which we shall be proud to call Australian.

Waverley Amateur Wireless Club.

THE Waverley Amateur Wireless Club is one of the most active radio clubs in New South Wales. It possesses a temporary transmitting set using three V.24 valves as oscillators, with 250 volts on the plates. This potential is obtained with a step-up transformer, which has a second tap by which 700 volts can be had.

Another special tap on the transformer provides the current for lighting up the filaments. An electrolytic rectifier is used. It is the intention of the Club to instal a radiophone of 50 or 100 Watts capacity, and when that is accomplished the three V.24 valves will be used in the receiving apparatus, which at present consists of an audiron valve with a loose coupler by way of inductance. One thousand eight hundred metres is the range of the coupler, and honeycomb coils are added for the longer wave lengths. Some very fine work has been done with the receiving set.

The Club has been requested to organise in connection with the American Amateur Trans-Pacific Radio tests, and a committee has been formed to go into the matter. It is proposed to instal a radio-frequency transformer-coupled receiving set with as many valves as possible for the purposes of the trans-Pacific tests, and anyone who can assist in any way will be warmly received by the Club.

Western Suburbs' Radio Association.

THE Western Suburbs Wireless Association has elected its officers for the coming year. President, Mr. R. S. Burman; Vice-president, Mr. G. R. Challenger; Secretary, Mr. W. H. Martin; Treasurer, Mr. S. St. Hill; Committee, Messrs. H. Browne and Lucas; Technical Committee, Messrs. Challenger, R. S. Burman and Lucas; Trustee, Mr. Challenger. The Association members have been divided into two sections, one to deal with transmitting, the other to devote its attention to the receiving apparatus.

At a recent meeting, some long-wave duo-lateral coils were tested, and American stations were brought in clearly. The Association can serve fellow experimenters if they will send us a short article describing these long-wave duo-lateral coils, the number of turns for each, the size and kind of wire used, and what coils were used in combination for primary, secondary and lickler, in the tests carried out.

To the Radio Clubs.

THE one thing needed, to give a fillip to the launching of the radio boom in Australia is a nightly service of radio-telephone and telegraphy. Most of you have transmitting sets, and those Clubs which do not yet possess one, are contemplating the installation of a transmitting set. You desire to increase your Club membership and to bring the radio service to the people of Australia at the earliest possible moment. If you will arrange amongst yourselves to give a nightly concert and practice service, each club taking one night, you will not only render the service so urgently needed, but it will help to train your members in the mysteries of transmission at the same time?

What about the Sydney Clubs setting the ball rolling—next week? You can arrange the matter at one short meeting of delegates from all the clubs of the district, so why not start right away?

We would like to be able to congratulate you on adopting this suggestion in our next issue. May we?

RADIO AID TO AUSTRALIAN BUSHMEN.

PLANS have been formed at Melbourne, to furnish bushmen with wireless telephone instruments, enabling them to summon medical aid, which it is proposed to send by aeroplane from commercial flying centres.

By this means it is hoped to save a large number of the lives that are lost every year owing to the weary journeys by camel and horse which the bushmen in the "Never Never" land have to undertake before doctors can be reached.

According to the Melbourne "Herald," there are more than 1000 people scattered over the Oodnadata Alice Springs section, an area equal to that of Great Britain, without means of obtaining immediate medical aid.

Radio Fans Everywhere

THE Great Amateur Radio Association of the United States, with its **hundreds of thousands of members,** owes its success to the fact that it had the backing of a widely circulated journal, which insistently demanded that every facility should be granted the Amateur Wireless Experimenter to tread the highways and byways of radio research.

That journal forced upon the attention of the "powers that be" that the free use of the ether was the birthright of every American citizen!

THE AUSTRALASIAN WIRELESS REVIEW is going into every city, town, hamlet or village in Australasia through a well-known publications distribution agency.

We want you to help us make THE AUSTRALASIAN WIRELESS REVIEW a power in the land, so that we can impress upon the attention of the powers that be in Australasia that we must have the same privileges that are enjoyed by experimenters in other countries. We intend to make THE AUSTRALASIAN WIRELESS REVIEW the biggest and brightest and most informing wireless magazine in the world. We want to give you, at an early date, a review at least twice the size as at present at the same price.

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