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VOL. II.

APRIL 30, 1924

No. 29



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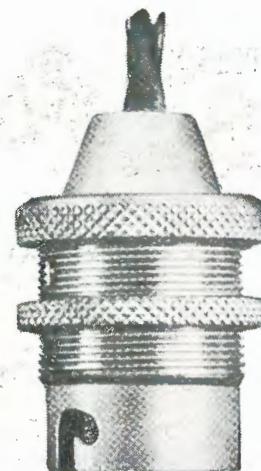
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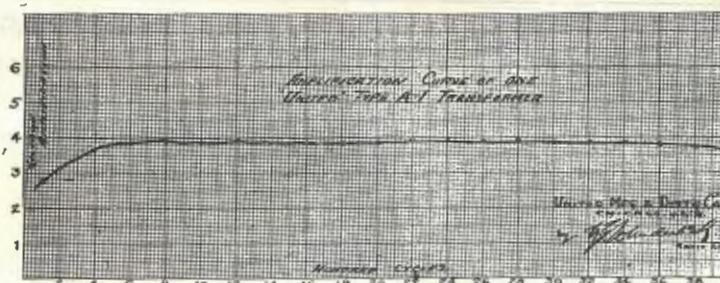
UNITED.....

UNITED AUDIO
Type A-1 Ratio 5 to 1



Transformers

UNITED AUDIO
Type A-2 Ratio $3\frac{1}{2}$ to 1



A UNITED TRANSFORMER CHARACTER CHART.

Transformers, in order to give perfect audio amplification must have a characteristic curve as near to a straight line as possible.

United Audio Transformers have just such a curve as can be seen from the above chart.

A perfect audio transformer necessitates the best of core and winding design and construction.

In the United the best of core iron is used. A proper air gap is another reason for their perfect performance, and the winding construction and impedance further combine to make it the absolute best.

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Try them and convince yourself. Results speak louder than advertisements.

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28 CLARENCE STREET, SYDNEY and at 592 BOURKE STREET, MELBOURNE.



For Ladies Only

WITH memories of friends' "autograph books" running through our heads, we hasten to assure our male readers that we have not entitled this issue's Radiotorial as we have for the unworthy purpose of unduly arousing their curiosity.

BY way of an innovation—and the more we think about it the more we wonder why we never did it before—we are going to address our remarks this fortnight to the fair members of the family circle, and, although they are intended for them, there is not the slightest reason in the world why the stronger sex should not read them, too. The same applies, by the way, to the ladies with regard to future editorials when matters will be discussed which it would at first appear are of interest only to fathers, brothers and sons.

AND now, ladies, we will have our little talk.

IN these times men, little alone women, have not much leisure for reading or indulging in other methods of keeping abreast with the world's progress, so that it is not at all unlikely that they do not know enough about wireless telephony, telegraphy and broadcasting as it is necessary that they should.

KNOWLEDGE of many subjects, particularly radio, frequently inspires interest and this interest, if it is of the genuine, healthy variety, inevitably develops into active participation.

WHY not investigate the matter for yourself?

"OH, but it's so technical," you say, "I would never be able to understand and grasp the meaning of such things as 'rheostat,' 'audio-frequency,' 'cage aerial,' 'primary coil,' 'rotor,' and all the hundred and one other names that designate the various apparatus and their use."

IT is not necessary that you should.

LEARNING about the various departments of radio is like learning about anything else. Like Romulus and Remus, nobody expects you to build your Rome in a day.

TAKE the question of broadcasting, for instance. We will suppose that you have bought a listening-in set. More than likely you have spent several shillings on books that may more or less tell you all about wireless. But lo and behold! when your set comes home and you unpack it—what do you find?

A HANDSOME wooden cabinet faced on one side by a bakelite panel. Attached to this are at the most, per-

haps, three knobs. Simply adjust these till you hear the music or speech come over the ear-phones or loud speaker and you are "listening-in." What could be simpler? What is the use of all your hastily acquired wireless knowledge? All the hundred and two adjustments, the assembling and the fifty other tedious but necessary things have been done for you. It remains but to sit back and enjoy benefits conferred.

BY purchasing your receiver from a reputable firm you have no need to worry—you cannot make a mistake—and it will be as easy to manipulate as it is to knit a woollen scarf.

"WELL, suppose I do buy my listening-in set," you say, "what am I going to get out of it—is it worth while for a woman to have one of these instruments?"
"IS it worth while?"

WOULD you like opened before you a world far stranger than any book, more enthralling than any moving picture—"The Sheik" not excepted? Would you like to forget the drudgery of the day in this new magic? If you are a housewife, would you like to do your mending and your dusting to the strains of the world's best bands, history's most divine operas and to the sounds of voices that have moved kings to tears? If those things mean a lot to you, would you like to know immediately the price of eggs, milk, butter, vegetables rise and fall? Would you know what Society is wearing, eating, thinking, saying, doing?

ARE little Willie and Sybil a little difficult to put to bed these long evenings? Would you like to have something that would tell them stories till their little heads drooped quietly and silently off to sleep while you were engaged in entertaining your friends? Would you like to hear of the latest dress-length materials, their price and where they may be had without even reading the newspaper advertisements or having to undergo the stress and strife of "Friday night" shopping sorties? Would you care to listen while experts tell of the proper care and attention required by children?

IN a word, would you be instructed or amused in any manner which you might desire by experts for whom the world has been combed, by the mere turning of a knob?

WE think you would.

Highlights of Radio Broadcasting

Tapping the Ether

By ALFRED N. GOLDSMITH, B.S., Phd., Fellow I.R.E.,
Chief Broadcast Engineer, Radio Corporation of America

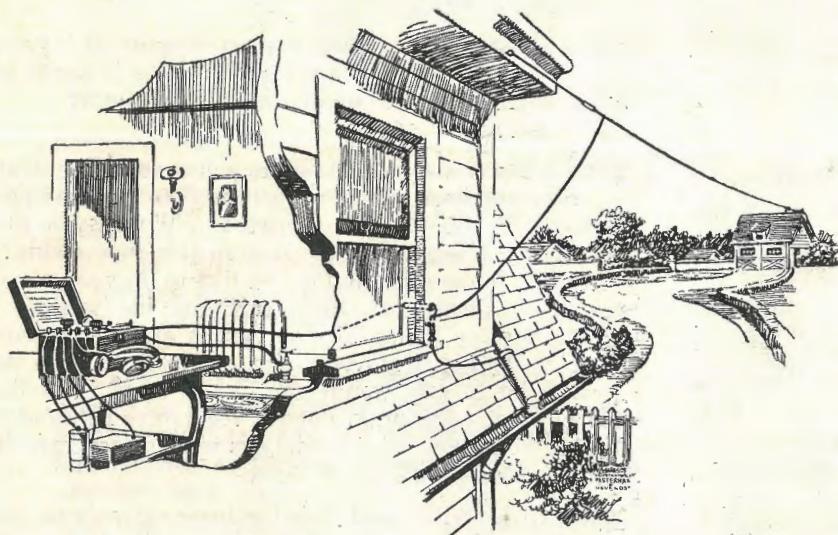
(Special to "Radio.")

BEING blind is rightly considered to be a most serious handicap. And yet all mankind is stone blind to a very real sort of physical light, namely the radio wave. Scientists and engineers have repeatedly proven beyond question that the electro-magnetic waves which carry broadcast communication are really identical, except in frequency, with the ordinary light which is so easily perceived by the human eye. But, while the radio waves are light waves,

gressively changes through blue, green, yellow, orange and red. When the frequency of the light waves becomes still lower, they become invisible to the human eye, and when frequencies of a million or so a second are reached, the invisible light waves are known as radio waves and are capable of carrying messages in well-known fashion. So that we are quite justified in speaking of radio waves as "black light" or "invisible light," from the physical standpoint.

waves to any marked extent. It can be correctly stated that most houses are transparent to radio waves, which makes it possible in many cases to receive messages with entirely indoor arrangements. But metallic objects do absorb some of the energy of the waves, and it is for this reason that we use aerial wires in tapping the ether for radio messages.

The best sort of aerial wire is the highest and longest system which can be conveniently used and which will enable receiving the desired frequencies or wave-lengths. For the usual broadcasting waves and receiving sets, the aerial wires cannot generally be more than about fifty feet high and one hundred and fifty feet long. Beyond this, it is difficult to use the ordinary receiver conveniently with such aerial wires. The more free and open the aerial wires, as a general rule, the louder the signals when using a non-regenerative receiver (such as a crystal receiver or a radio-tron receiver without any "feed-back coupling"). The aerial wires for such sets should be swung away from building, metal lathe in walls, telegraph, telephone or power wires, water or drain pipes, gutters, metal roofs, or other metal objects. If a regenerative receiver is used, it is not nearly so important to take precautions to have an antenna which is away from other absorbing objects. The regenerative receiver has a feed-back or "tickler" control of intensity which, by proper handling, will make up to a considerable extent for the shortcomings of the aerial wire system, or "antenna" as it is generally called. A good ground connection direct to a permanently moist soil is generally necessary for proper operation with a non-regenerative receiver, but the goodness of the ground is not so important with the regenerative receiver. Sometimes, instead of an



A Country Installation with Outdoor Antenna.

the human eye does not respond to them at all. Otherwise men standing near a broadcast station would see a brilliant glow surrounding the aerial wires of the station and marking the transmission of the programme from the station.

The frequency of a light wave of the ordinary variety determines its colours. Thus, if the frequency is high, the light is called "violet," and produces a definite sensation of "violetness." As the frequency becomes lower, the colour of the light pro-

Since the eye cannot see these waves, it becomes necessary to find a substitute "electrical eye" which will enable these waves to produce effects which can be perceived by the human senses. Since the radio waves sweep through most substances as though there were no obstacle intervening, it is necessary to find some material which will trap the radio waves or make them deliver a part of their energy to the receiving set. The wooden or concrete walls of a house, or the human body, do not stop radio

actual ground connection, a "counterpoise" ground is used. This is merely a wire or two insulated from the ground and stretched under the antenna. It is connected to the ground binding post of the receiving set in place of the usual ground connection. Its effectiveness in some cases is regularly "discovered" by radio enthusiasts.

The first illustration of this article shows a typical high-grade receiver installation for country use. With ordinary sets in the country, a good-sized antenna is useful and unobjectionable. Dependence in rural locations has to be placed on signals coming from a distance, and it is therefore necessary to have a sensitive receiver and an antenna of good dimensions, particularly if regeneration is not depended on to a great extent. The lightning arrester is shown in the drawing. A word on lightning arresters will be of interest to radio users. When the lightning arrester is installed on an outdoor antenna in accordance with the accompanying directions, all insurance requirements are met and the receiving set is not regarded at all as a hazard. Actually the lightning risk in radio reception on an outdoor antenna is so extravagantly small that the writer is somewhat at a loss as to how to express it. Possibly it is about as great as the chance of being able to pay for an elaborate meal in a restaurant by means of the pearls which one might expect to find in the oysters.

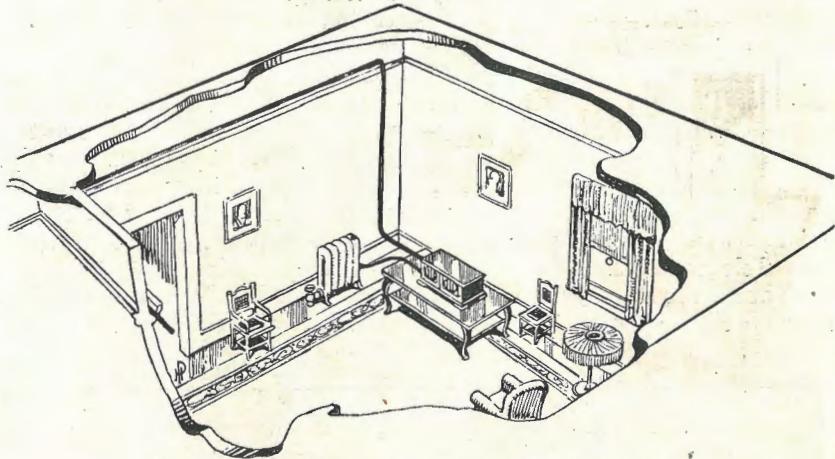
In the city, and particularly if the local stations are principally desired, the indoor antenna is very satisfactory. Such an antenna may be made of number 28 or 30 silk or cotton covered copper wire, held in place by small hooks or thumb tacks or other unobtrusive fasteners. The second drawing shows a suitable installation. Lightning arresters are naturally not required at all, nor are antenna switches. For five- or ten-mile reception, the arrangement is ideally simple and handsome. It works much better in some locations than others, depending on the type of building in which the set is installed. If there is a great deal of steel in the building, or if the wires of the antenna run too near steel girders or electric light wires in the walls, the reception may not be satisfactory, particularly if the broadcast sta-

tions are at some distance. But in general, good results will be thus obtained, and it is a very simple and cheap matter to try out such an indoor antenna to see if the desired results are obtained. Where it gives satisfaction, it enables the listener to dispense with the sometimes more inconvenient outdoor antenna arrangements which, however, give louder signals. It is well to be content with reasonably loud signals, particularly in crowded neighbourhoods. Only a trial can determine whether the indoor antenna will give the desired results in any given location.

Another type of aerial wire system for trapping radio waves is the loop or coil system. It is generally a flat spiral of square outline, several feet on a side. Its terminals are connected to a tuning condenser, and to the "ground" and "antenna" binding posts of a suitable receiving set. The coil system has its advantages and its drawbacks for reception. One disadvantage is that much less energy is trapped than by a long wire antenna, and therefore the receiving set must be much more sensitive than

ity. By this last is meant the possibility of picking a desired station or getting rid of an undesired station, not by receiver tuning, but by rotation of the loop. The loop receives most powerfully when the waves come from the direction in which the loop points; and, in a well-designed set, the loop hardly received at all in a direction at right angles to the loop. Consequently, an undesired station can be much reduced or even cut out entirely by properly turning the loop and, of course, also tuning the receiver to the desired station.

The coil aerial therefore represents not merely an "electrical eye," but even an "electrical telescope" or "transit" since it indicates the direction of the incoming waves as well as their existence. It is systematically used for this purpose in the United States Navy's "radio compass" stations which give ships their position at sea in bad weather, and in the loop receivers on board ship which get special signals from the "radio light houses" of the Department of Commerce, for the same important purpose.



City Installation with Concealed Indoor Antenna.

the ordinary receivers for outdoor antennas in order to get the same strength of signal. This requires that a number of additional tubes and their circuit equipment shall be included in the receiver. Very careful receiver circuit design and construction is required to get good loud speaker operation on distant stations using a coil antenna, particularly if high selectivity is needed. On the other hand, the loop aerial has the advantages of compactness, portability, sightliness (when properly arranged), and of directional selectiv-

The True Spirit

AN Auckland (N.Z.) amateur is so keen on the "magic spark" that besides listening-in at his home to American and Australian broadcasting stations nightly, he has had his motor-car equipped with a cage antenna. He may be seen any evening in the locality driving his automobile with the 'phones clamped to his ears and listening to anything that he may pick up.

H.M.S. "Hood's" Wonderful Wireless

Eight Radio
Rooms

World-Wide Range
Thirteen Receiving Sets

Nine
Aerials

ONE might suppose that anything connected with His Majesty's Ship "Hood," of the British Special Service Squadron, would be on a par with all else that goes to make her the greatest and finest battleship afloat, but what imagination might lead one to think before one had been given information concerning her wireless installations, would be as a mere drop in the bucket when compared with the actual facts.

THE "Hood" to-day represents the very last in Capital ships. It is only necessary to add that her wireless equipments are the same.

HIS Majesty's Ship *Hood*, the largest battleship in the world and now in Australasian waters, is fitted with the most elaborate and up-to-date wireless equipment of any radio station afloat.

The personnel of the wireless staff numbers 49 and comprises Lieut.-Commander P. W. Bowyer-Smyth, R.N., Fleet Wireless Officer; a Warrant Telegraphist, a Chief Petty Officer Telegraphist, four Petty Officer Telegraphists; twelve Leading Telegraphists, twenty Telegraphists and ten Boy Telegraphists.

There are seven wireless rooms and another special one situated on the

bridge of the *Hood*. This room contains numerous keys and switching arrangements so connected that the instruments, both receiving and transmitting, in any of the seven wireless cabins can be controlled from the special room on the bridge.

Every wireless room is connected with the others by the means of buzzers which give internal communication to different parts of the ship.

Altogether, there are nine aerials on the *Hood*. It may be of interest to state that the main one consists of five miles of wire!

In addition to various and many special sections of wireless equipment,

including Direction Finders, etc., this giant of the British Fleet possesses eight transmitting sets and thirteen receiving sets!

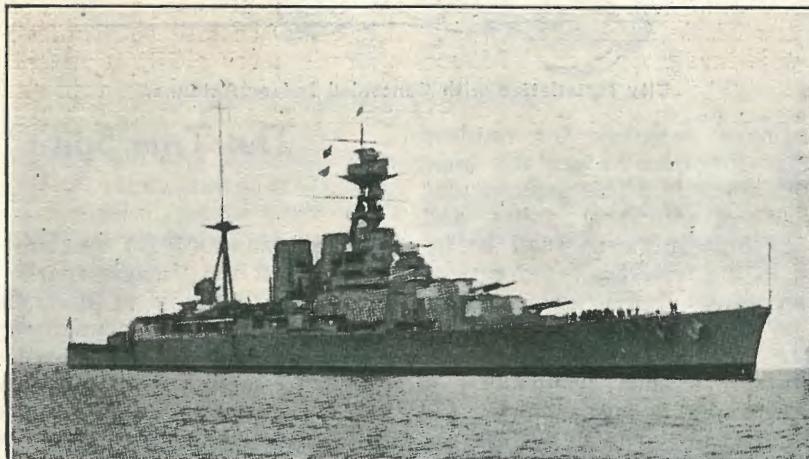
The eight transmitters, we understand, include a 25 k.w. Poulsen Arc set and a 25 k.w. Spark set, and from these, range right down to a 100 watt valve transmitter. The transmitting equipment includes a special telephony set.

When at sea, the last of the Capital ships is never out of touch with land, and the high-power transmitting installation has maintained communication with coastal radio stations over a distance of 6,000 miles.

The thirteen receiving sets aboard range in wave-length from 100 to over 25,000 metres and the *Hood* can therefore tune to signals from any wireless station in the world.

All receivers can be used simultaneously. It may seem to the reader that this is a bold statement—receiving different signals on thirteen different receiving sets with the use of only nine aerials—but this is done, however, by connecting two receivers to the one aerial, thus allowing of two-fold reception.

Not one of the thirteen receiving sets of the *Hood* or any other vessel of the Special Service Squadron has regenerative receivers that cause the aerials to oscillate, while the receptive range of the Vice-Admiral's ship—



H.M.S. "Hood."

and most of the others for that matter—is world-wide.

Lieut.-Commander P. W. Bowyer-Smyth, R.N. Fleet Wireless Officer aboard H.M.S. *Hood*, controls the working of all the other radio stations of the ships of the Special Service Squadron.

Vice-Admiral F. L. Field, C.B., C.M.G., is also a big man in radio circles. In November, 1919, he was appointed a member of the committee to advise the British Government on Imperial Wireless Telegraph Communication. He is a very keen believer in wireless in its relation to the closer linking up of the British Empire and the expansion of trade.

Captain J. K. im Thurn, of H.M.S. *Hood*, is also a wireless expert. He has his own specially-designed receiving set aboard with him and in his spare moments he is a confirmed radio enthusiast.

The Editor of *Radio* in conversation with several of the operators found them to be typical wireless men. They are very reserved about their work, but that, of course, is a tradition of the "Silent Service."

In trying to "draw" these silent gentlemen they were asked what was their opinion of Australian Coastal Wireless Stations. Then did the flood-gates of their baffling silence open!

"The Australian Coastal Wireless Stations," they said, "have methods of operation and the handling of traffic that are equal to stations in any other parts of the world!"

They were also very pleased with the manner in which Adelaide, Melbourne, Sydney, Brisbane and other coast stations handled traffic to and fro from the ships, and they could not say enough in praise of the coastal wireless operators.

In conclusion, it might be added that the Editor of *Radio* when at his experimental station heard most of the ships of the Special Service Squadron working while at sea and rarely has he heard such excellent wireless work combined with such rapidity and general efficiency.



Captain A. G. D. West, in the foreground, is the Chief Engineer of the British Broadcasting Company, while at his side is Mr. G. Leslie Morrow. At the moment this picture was taken they were receiving music and speech in London from the American broadcasting station KDKA at Pittsburg.

"Radio" is the only paper dealing effectively with Australian Broadcasting activities. It is bright and up to date.

An annual subscription at 10/- will bring it regularly to your home each fortnight. Send that Sub. to-day.

"KGO, Oakland, California"

GREAT interest continues to be evinced by Australian radio experimenters in the reception of the General Electric Company's Broadcasting Station KGO, Oakland, California, United States of America, and this issue we publish two further letters.

As may be seen, the well-known experimenter, Mr. A. E. Wright, of Scarborough, on the South Coast of N.S.W., is still more than holding his own, and this time, has furnished us with a detailed report of reception of

We here append copies of two of the letters we have received. In passing, it might be pointed out that those experimenters who have logged KGO when writing to *Radio* and acquainting us of the fact should let us have every possible detail, not only for the preservation of the mere news interest but so that it may be established beyond dispute that they actually *have* listened-in to the Californian station. We have a tender recollection of a few weeks ago when an American station was supposed (vide daily

At 5.15 p.m., Carrier and at times faint music; 5.35 p.m., someone spoke, then orchestral music; 5.39 p.m., "KGO Oakland, California" (then orchestra); 5.44 p.m., "KGO, Oakland, California" (then orchestra).

(Announcement.)

5.50 p.m.: "Pacific Coast Station KGO, Oakland, California. There will be 10 minutes' interval then KGO will continue music from St. Francis Hotel Orchestra, San Francisco. Henri Hoburgo (or Oburge), conductor.

At 6.3 p.m., Orchestra; 6.10 p.m., "KGO, Oakland, California" (then music); 6.14 p.m., "KGO, Oakland, California" (then music).

(Announcement.)

6.19 p.m.: "Pacific Coast Station KGO, Oakland, California. There will be an intermission of ten minutes after which KGO, Oakland, California, will continue the broadcasting of music supplied by the St. Francis Hotel Orchestra, Henri Hoburgo, conductor."

At 6.34 p.m., Orchestra; 6.37 p.m., "KGO, Oakland, California"; 6.42 p.m., "KGO, Oakland, California"; 6.45 p.m., at this time he announced another interval; 6.54 p.m., orchestra; 6.57 p.m., "KGO, Oakland, California."

(Announcement.)

7.3 p.m.: "Pacific Coast Station KGO Oakland, California, General Electric Company. This concludes music from St. Francis Hotel Orchestra, San Francisco, Henri Hoburgo conducting. KGO, Oakland, California, signing off at 1.2 and a-half Pacific Coast time. Good morning."

I managed to get a J.P. to be present and to verify this last report. (Two valves.)

Yours, etc.,

(Signed) A. E. WRIGHT.

Windsor,

N.S.W.

April 14, 1924.

Dear Sir,—

In the last issue of *Radio*, I read with interest the article, "Wake up, Experimenters," and am pleased to hear of the success of Mr. A. E. Wright, but must say that he does not hold a monopoly on KGO, as I also have got a line on that station.

Using a four-valve set of my own construction, one Stage Radio "Tuned Anode," Detector, and two stages of Audio, the signals have come in very strong, and by plugging in an extra stage of Audio and a Loud Speaker, I am able to hear the music all over my house and I must say that it is very fine music, too. The voice of the announcer is always clear and distinct, the words "KGO, Oakland,

(Continued on page 72.)

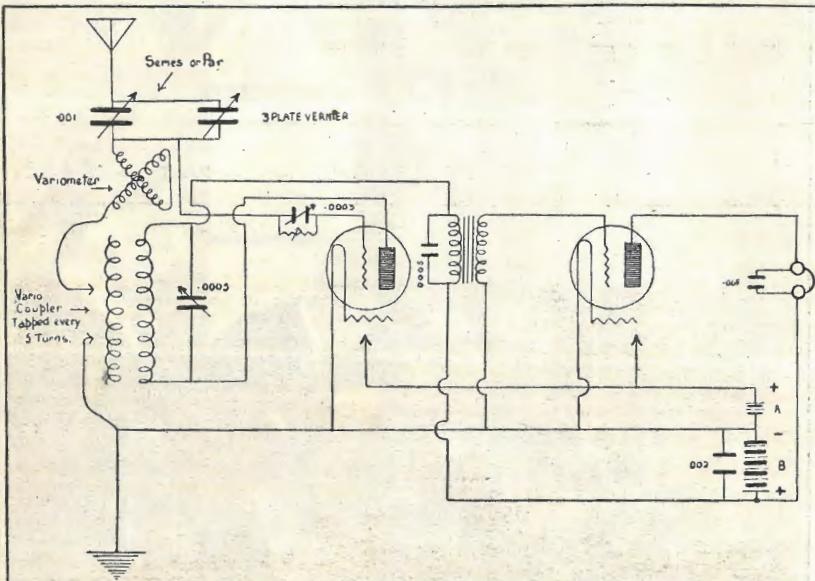


Diagram of the Receiving Circuit used by Mr. A. E. Wright.

the Yankee station. As can be seen, on the night of April 13 last he was practically in continuous touch with the American studio for a time extending over two hours!

Evidently the article entitled "Wake up, Experimenters!" has had the desired effect, for, in addition to Mr. Wright's letter, we have received a communication undoubtedly proving trans-Pacific reception from Mr. J. G. Onus, of Windsor, New South Wales.

His is indeed a splendid performance and if he continues as he has begun—and we have no doubt that he will!—he may shortly be able to rightly consider himself one of THE experimenters. Good luck to you, Mr. Onus!

press) to have been heard at several points in Australia and afterwards proved to be the musical items broadcasted from a prominent New South Wales country town.

We don't want anything to happen like that in *Radio*!

LETTERS TO THE EDITOR.

Scarborough,
South Coast.

April 13, 1924.

Dear Sir,—

KGO again to-night, 13th instant. My battery almost flat and with a very powerful regenerative set operating somewhere close, *probably unlicensed*, I managed to get the following:—

Wireless Telegraphy's Triumph

The Saving of the "Honolulu Maru"

WHAT might have been the fate of the Japanese steamer "Honolulu Maru" had she not been equipped with wireless apparatus is fearful to contemplate. For many hours the vessel had been struggling against blinding rain squalls off the South Coast of N.S.W., and bad though conditions were, they were made very much worse when portion of the heavy cargo shifted and a list of a terrific angle developed. The "Honolulu Maru's" destination was Sydney, but as the slow hours dragged on the possibility of ever completing the voyage seemed to become more and more remote, and but for the Magic Spark which insured the sending of succour, there is a strong possibility that a brave ship and many brave men would have gone to their doom in the watery depths.

EARLY on the morning of April 4, the Deputy Director of Navigation at Sydney received a wireless message calling for urgent assistance from the Japanese steamer *Honolulu Maru* bound from Melbourne to Sydney. Despatched at 12.43 a.m., it read: "Honolulu Maru. My ship has heeled too much. Dangerous. We need assistance. Position is latitude 36 degrees 36 minutes South. Longitude 151 degrees 20 minutes East." At the time the message was sent the ship was between 60 and 70 miles from the N.S.W. coast and practically due East of the Bega river mouth.

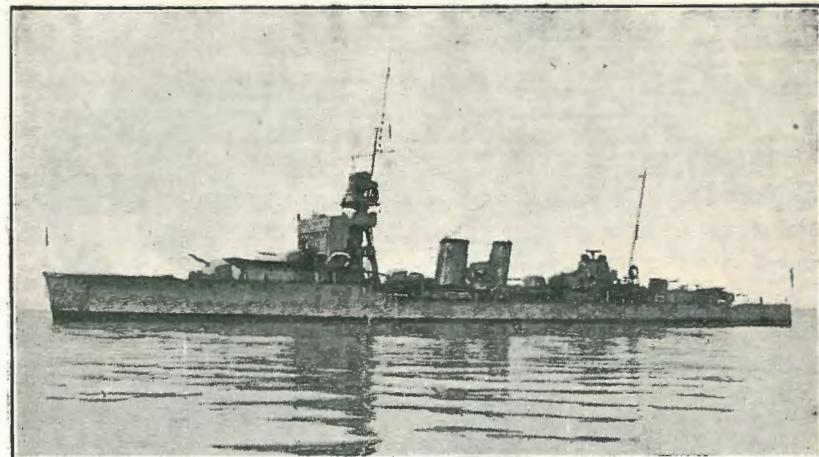
Both the *Persic* and the *Canberra* picked up the call for help, while the British light cruiser *Dauntless*, which was proceeding from Hobart to Sydney in advance of the Special Service Squadron in order to enter dry dock, also logged the Japanese boat and immediately proceeded to the scene of the incident. She was later joined and relieved by H.M.S. *Dragon*.

Upon receipt of the message the *Canberra*, which was Sydney-bound, turned south, and with a fine burst of speed eventually reached the distressed steamer and stood by, finding that the *Dauntless* had got there before her at 8.30.

The first wireless land station to hear the S.O.S. was Pennant Hills which communicated the news of the distressed vessel's plight to her Sydney agents who promptly despatched

a tug to the *Honolulu Maru's* help. Later, another tug, the *Heroic*, followed.

eningly and seeming as if every moment would be her last, the Japanese ship was making slow but definite



H.M.S. "Dauntless."

When the first word of disaster was received by stations the Japanese boat was listing to port at an angle of over 30 degrees, and at 7.50 a.m. this had increased to 40 degrees, but with the news that the *Dauntless* was speeding towards him the captain decided not to forsake his ship. Expected to reach the *Honolulu Maru* at 7 a.m. the battleship, however, experienced difficulty in reaching the scene of the distress signals and it was not until 8.30 that she stood by.

All this time, although rolling sick-

progress and at 11.30 on Friday morning she was 68 miles south-east by south of Jervis Bay and her list had eased to 30 degrees.

At an unearthly hour on the Sunday morning, towed by the tugs *Champion* and *Heroic*, a battered semblance of the *Honolulu Maru* shuddered into Jervis Bay. Later, again in company with the tugs and the battleship standing by she entered Sydney Harbour—safe at last!

And so ends the story of one more triumph for Wireless Telegraphy.

World-Wide Wireless

Radio Jottings from Everywhere

"Danger! Do Not Touch!"

SOME folks entertain some weird ideas with regard to wireless—as the following true story will show. A householder in one of our Northern suburbs across the Harbour had the aerial to her wireless telephony receiving set installed on the roof, but unfortunately, soon afterwards, one end of a wire fell on to the lawn. The agitated lady immediately rang up

coming in contact with the wire! To cap it all, she concluded with the remark that she had tried to drag the wire out of harm's way with a rubber garden hose but up to that time had been unsuccessful! As somebody said some time, somewhere: "That do beat all!"

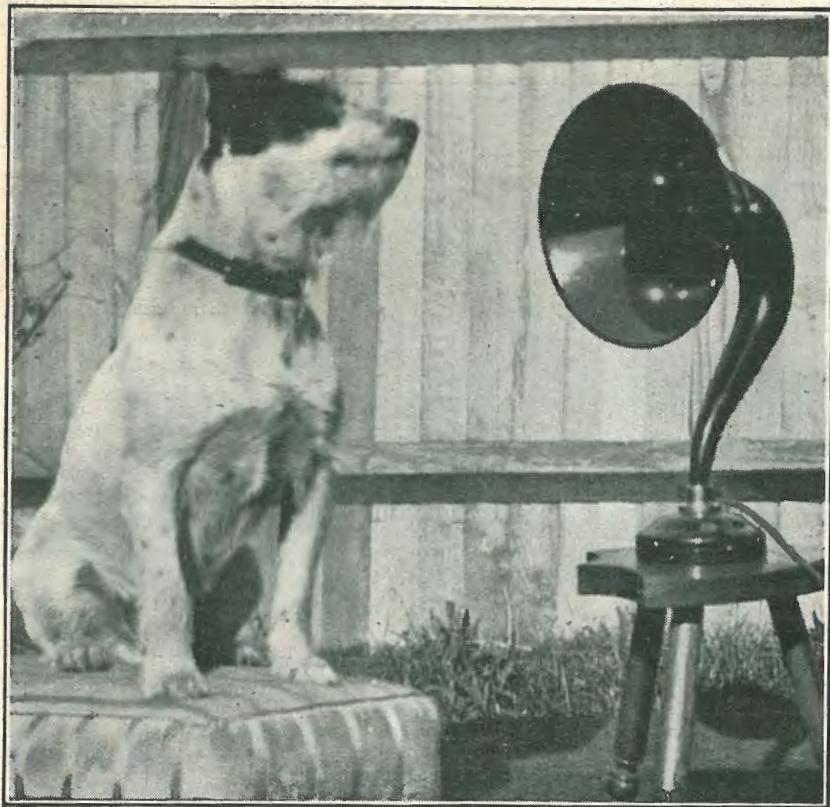
In "The Islands"

THE need for better communication facilities between the Islands in

latest link is the erection of a type F. station by Amalgamated Wireless (Australasia) Ltd., to the order of Messrs. Burns Philp & Co., at Tarawa in the Gilbert Group. The distance to Ocean Island radio station is approximately 240 miles, and advices state that it is giving excellent results.

Argentine Station Opened

THE new wireless station which has been built at Monte Grande for the International Trans-radio Wireless Telegraph Company, Argentine, for the purpose of placing the Argentine in direct wireless communication with North America, Europe, and the far-East, was officially opened by the transmission of an inaugural message from the President of the Argentine to King George V. Direct services will be carried out between Monte Grande, New York, Paris and Berlin. It is intended to extend this direct service to England as soon as possible, but as Great Britain does not possess a wireless station sufficiently powerful to communicate with South America, this service cannot be brought into operation until a suitable station is available in this country. The transmitting station at Monte Grande, 12 miles from Buenos Aires, covers an area of 1,200 acres. There are ten steel towers 500 metres apart, each tower being 690 feet high. The power of the station is 800 K.W. The receiving centre is at Villa Eliza, 25 miles from Buenos Aires and the same distance from the transmitting station. The telegraph office, from which the transmitting station is automatically controlled and to which the receiving station is connected with telegraph lines and an automatic linking device as is the case in the Marconi system in England, is situated in the centre of the commercial quarter of Buenos Aires.



"His Master's Voice."

(With apologies to the well-known gramophone company.)

the company who had fitted up the aerial and stated that she had locked her children in the house for fear that they might be electrocuted by

the Pacific has long been apparent, but during the past year several wireless stations have been installed and others are under consideration. The

NOW THEN, EXPERIMENTERS!

"Pymble,"
Victoria.

The Editor,
"Radio."

Dear Sir,

I am forwarding a list of the New South Wales experimenters that I have had the pleasure to bring in with quite good strength, even the 'phone stations, on one Radiotron detector tube:-

2CM, 2GR, 2Y1, 2ZN, 2UW, 2YG, 2FA, 2RA, 2LO, 2ZG, 2J1, 21J, 2JM, 2VM, 2HM, 2YD, 2SO, 2O1, 2GQ (4F1).

I am sure this will encourage the real experimenters to keep to "DX" (long distance) work.

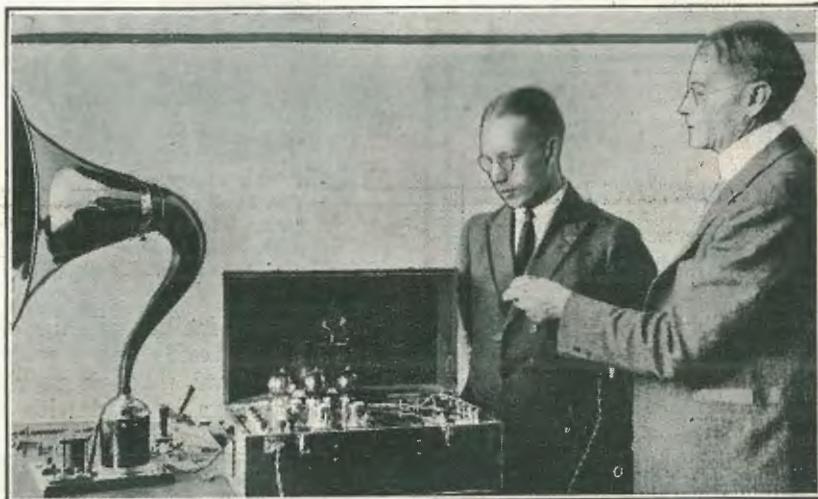
Yours faithfully,
(Sgd.) G. STEANE.

In the Polar Regions

AN interesting illustration of the value of wireless as a means of enabling a ship, in whatever part of the world she may be, to communicate with land, is provided by the fact that two Norwegian vessels, one in the Arctic and the other in the Antarctic, have been in telegraphic touch with their own country. The Norwegian flag was, until recently, represented further north and further south than that of any other country, by the *Maud* and the *Sir James Clark Ross*. The *Maud*, Captain Amundsen's vessel, which is attempting to drift across the North Polar basin, is now lying off the New Siberian Islands. She is equipped with a Marconi valve transmitter set, and by this means is in communication with the Spitzbergen radio station, more than a thousand miles away. The *Sir*

James Clark Ross lately returned from a whaling expedition in the Ross Sea. Her wireless apparatus also includes a Marconi valve transmitter, which enabled her to communicate with the Awarua radio station, New Zealand—seventeen hundred miles to the northward. At 3 p.m. on January 22 when the *Sir James Clark Ross* was in latitude 78 degrees 30 minutes south, a message was handed in at the Christiania telegraph office to be forwarded to the vessel. This was sent via England, Australia and Awarua radio. The reply by the same route, was received in Christiania at 5 a.m. on January 24.

AS previously stated in *Radio*, the New Zealand Government is linking up the Cook Islands by wireless and establishing stations at Aitutaki and Mangaia. The plant is now in Wellington and will go forward by the *Mangauni* to Rarotonga, where it will be overhauled by the Superintendent who will proceed immediately to the two islands in company with the Overseer of Public Works to install it. This outfit will assist enormously in reducing running costs and expenditure, as shippers at the Islands will be kept in constant touch with the steamers as they pass through the group and will, of course, be advised early of their time of arrival.



The Statement in the Newspapers that Human Heart Beats have been Broadcasted has caused considerable public interest in Australia. The Feat has been made possible by the invention of the Microphone-Stethoscope, a brain-child of Professor R. B. Abbott, who recently, on the occasion of the sitting of the American Congress of Internal Medicine, Broadcasted Pulsations of the Heart which were heard by Listeners-in at a distance of 500 miles. The Photograph shows the Professor using his instrument on a student at the Purdue University.

Why wait for the Regulations to Change?

We can supply you with a "BURGINPHONE" SEALED RECEIVER NOW.

We will also guarantee to alter it to conform to any NEW REGULATIONS if such are in force within 6 months from purchase.

"BURGINPHONE" WIRELESS RECEIVERS comply with Government Regulations, and are thoroughly efficient.
THEIR RECORD:—Reception of American Broadcasting.

Send for Illustrated Catalogue and Price List, or Call and have a Demonstration.

BURGIN ELECTRIC COY.

Showrooms and Sales Dept.:—

WIRELESS ENGINEERS AND SUPPLIERS,

1st FLOOR, CALLAGHAN HOUSE, 391 George Street, SYDNEY.

Townsville (Q.) Radio Station

A few particulars about the Townsville Wireless Station may prove of interest to our readers.

During August, 1920, a type 1.25 K.W. spark transmitter was installed, but since the greater audibility of the Arc has become established, it was and is only now used as a standby. During the time between the grounding of the ship *Mindini* and her subsequent abandonment on Mellish Reef last year, this set, driven by a Gardner engine, maintained continuous daylight communication with the *Mindini* and other ships that went to her assistance.

DAVID JONES' RADIO SECTION

DIRECTED BY

MR. F. BASIL COOKE, F.R.A.S.

Consequent upon the demand for high-class Wireless equipment David Jones' have installed a special section for the sale of these goods. This presents an opportunity for all interested in wireless to avail themselves of ideal buying conditions. Licenses will be issued upon payment of the required fee.

David Jones' have made a special feature of providing all wireless accessories, including the following :

"Radio Corporation" Radio Transformers ranging from 200 to 5000 metres. Price ... 45/-

Hydrometers, very convenient for keeping accumulator in good order. Price 6/6.

Voltmeters, ensure "B" Battery efficiency. Prices, 7/6, 9/6, 17/6.

"A" Battery Lighting Switch, 4/6.

"Framingham" Series Parallel Switch. Price 5/6

"Weston" Ammeters for transmitters. We hold a very large stock of these meters, ranging in prices from 50/- to ... 107/6

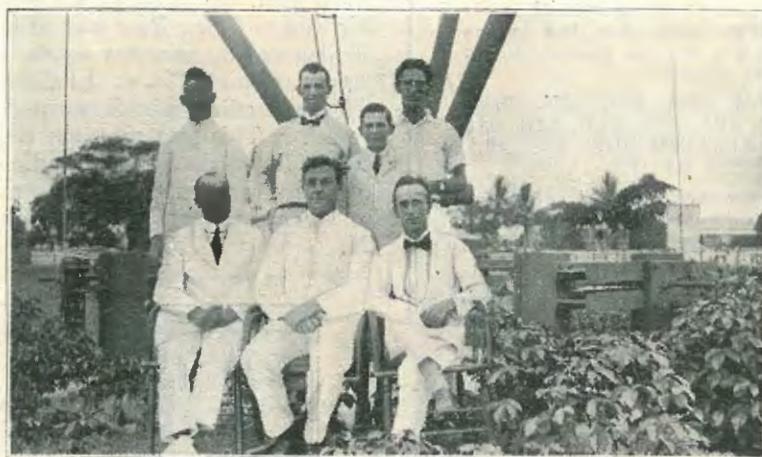
DAVID JONES'

Radio Section

252 YORK ST., SYDNEY

In November, 1922, a 2 K.W. valve transmitter superseded the Arc set, and has been used continuously ever since with conspicuous success. It

On December 21, 1923, Rabaul installed a duplicate of the Townsville station's valve transmitter and unless conditions are particularly bad, no



The Staff of the Townsville (Q.) Commercial Radio Station. Standing (from left to right): H. I. Moore, D. McIntosh, F. Timmins (messenger), P. E. L. Dunne. Sitting: W. Jessop (Senior Mechanician), J. J. W. Lamb (Officer in Charge), C. J. Lennon.

provides great facilities in the handling of heavy traffic and signals received at Rabaul through very bad atmospherics can be read with ease.

difficulty in handling traffic is now experienced.

Recently, tests between Rabaul and



A corner of the Operating Room of the Townsville Radio Station used for Short Wave and Land Line work. All Short Wave Reception is done on the model "L" receiver. For receiving on Long Wave a Marconi type "55" Multi-valve Amplifier is used, giving a maximum of Six stages of High-Frequency Amplification. For C.W. reception a separate Oscillator is used.

During the last Christmas and New Year rush, no delay was experienced and traffic was handled at land-line speed.

Townsville were carried out. Vocal and musical items were transmitted and received at both ends, and the results pleased all concerned.

BOOK REVIEWS

New Wireless Magazine

By the courtesy of the publishers, The Mail Newspapers, Ltd., we have received a copy of the first number of *The South Australian Wireless (Monthly) and Radio Magazine*. Its aims are to champion the rights of the Australian experimenters and to co-operate with the broadcasting companies and radio dealers. A 24-page magazine, it is published monthly and sold at the low cost of sixpence and, judging by the copy we have been privileged to read, a very high standard is to be maintained. The contents are bright, "newsy," interesting and up-to-date and such as will appeal to all, from the veriest wireless novice to the finished expert. Other sections cater for the person who is passively interested in radio right up to the confirmed listener-in with his own receiving set. *Radio* looks forward to further numbers with interest, and takes this opportunity of welcoming one more contemporary to the ranks of the Australian radio press.

Concert items from a broadcasting station were recently given in a tunnel under the Hudson (U.S.A.) River. To issue from the loud speaker in the form of sound, the waves had to travel through 500 miles of air, 70 feet of water, 30 feet of mud and the heavy steel casting of the tunnel.

Miss Jeanette Ethelstone

LISTENERS-IN will remember with pleasure a little incident that occurred recently upon the broadcasting of a programme from 2FC (Farmers' Broadcasting Studio, Sydney). A young lady vocalist was billed to sing that old favourite, "Kathleen Mavourneen," but at the psychologi-



The Lady Herself.

cal moment of beginning, suddenly found herself bereft of voice through a temporary throat trouble. Bravely she attempted again, but could not proceed so thereupon, Miss Jeanette Ethelstone, who was present, came to the rescue and sang the song with great success, although she had never previously attempted it.

RADIO TO SAVE MINERS' LIVES.

Working on the assumption that a wireless receiving set can be successfully operated at 1,000 feet underground, power has been invested in the international officers of the United Mine Workers of America, says a Reuter message, to investigate the radio as a means of life-saving in mining disasters.

Exhibition Mooted

ONE of the first projects of the newly-formed Auckland (N.Z.) Radio Association it is hoped to carry out will be a wireless exhibition after the style of the one so successfully held in Sydney last year. Several local radio experts are now on a visit to the Mother State, gleaning particulars of "how it is done." It has already been decided to offer a number of valuable prizes for the best-made amateur wireless set.

Amalgamated Wireless v. Commonwealth Wireless Branch

A cricket match was recently played at Melbourne between Amalgamated Wireless (Australasia) Ltd. and the Commonwealth Wireless Branch, the latter winning by 107 runs. Principal scorers for Amalgamated Wireless were:—McDonald, 31; Duncan, 24; Daly, 23, and Higgins, 16. Total, 125. Bowling: Clements, 5 wkts. for 16; Webster, 2 wkts. for 18. Principal scores made by the Commonwealth Wireless Branch team were: McGann, 42; Clements, 32; Jones, 31, and O'Kelly, 25. Total, 232. Bowling: McDonald, 2 wkts. for 24; Halfpenny, 2 wkts. for 46, and Duncan, 2 wkts. for 46.

STROMBERG-CARLSON

SUPER No. 2-A Radio Headset SENSITIVE

£2/5/-.

Why buy a cheap inferior set when you can obtain a high efficiency No. 2-A at half the cost of an equal set? It is built by Telephone Manufacturers of 30 years' standing. DURABLE, COMFORTABLE, ACCURATELY REPRODUCES VOICE and MUSIC. Permanent adjustment, unaffected, by climatic and temperature changes. Also RADIO PLUGS and JACKS; MICROPHONES, all types.

Ask your dealer or write us direct.

Aust. L.P.R. BEAN & CO. LTD., 229 Castlereagh St., Sydney Reps.

Interstate:—BRISBANE: S. H. Smith, Radio House. ADELAIDE: Chas. Atkins & Co. PERTH: T. Muir & Co., 99 William Street. MELBOURNE: Homecrafts, 211 Swanston Street.

Wireless Institute of Australia

NEW-SOUTH WALES DIVISION.

Councillors Elected by Ballot.

THE annual general meeting of the above branch was held in the Royal Society's Hall, 5 Elizabeth Street, Sydney, on Thursday, April 17, 1924, at 7.45 p.m. Mr. F. Basil Cooke, Vice-President, occupied the chair. Owing to the great progress which has been made during the past year and the absence of the President, Mr. Stowe proposed and Mr. Crocker seconded that the presentation of the Presidential Address be postponed until the next general meeting in order that it might be printed and circulated amongst members and might also be read by Mr. C. D. MacLurcan in person. This was agreed to. Dr. S. P. Woolnough and Mr. W. A. Watt were appointed scrutineers for the ballot for councillors and at the close of the meeting the following were declared elected:—Messrs. MacLurcan, Renshaw, Cooke, Colville, Newman, Stowe and Marsden. The Treasurer then presented the balance sheet which was adopted. This disclosed a very satisfactory state of affairs in every way and the outlook for the future is a bright one on all sides. Mr. Perry proposed a vote of thanks to the Council and officers of the Institute for their untiring efforts during the past year. He enlarged upon the critical times which they had passed through during the past year and drew attention to the good work which had been done by the Institute. Mr. Marsden seconded this and Mr. Basil Cooke responded.

The next meeting of this Division will take place at the Royal Society's Hall, 5 Elizabeth Street, Sydney, at 7.45 p.m. on Thursday, May 15, 1924, when Dr. S. P. Woolnough, D.Sc. will deliver a lecture on "Waves, Electrical and Otherwise."

Radio "Two-Up"

WHEN the Scientific Novelties Exhibition opened at King's College, London, a few months ago, it is certain that some of the "side-shows" were such as had never been seen

WIRELESS TESTS HELD.

Particulars concerning experimental wireless transmission and reception trials between Australia and America which have been held lately unfortunately reached *Radio* too late to be included in the last number, so as the tests conclude tonight, we have been unable to give our readers the suitable notice we would have preferred.

The arrangements have been the result of negotiations entered into between the Victorian Division of the Wireless Institute of Australia and Mr. Frederick of the *Radio Journal*, Los Angeles, California, whereby during this period, Australian transmitters were to try and get over to America and receivers to listen for the Yankee experimenters.

To-night Australians will transmit from 6 p.m. to midnight.

Those experimenters who have succeeded in logging or transmitting to our trans-Pacific cousins are requested to kindly forward all particulars to The Editor, *Radio*, 97 Clarence Street, Sydney.

anywhere else in the world before. Professor Ernest Wilson was the man principally responsible and one of his less spectacular "stunts" was that of the production of thunderstorms by the aid of 80,000 volts of electricity! "High tension discharges" was his

airy explanation, but the marvel that amused the most people was the spinning of pennies in a plate by wireless. An electrical magnetic field was created and all the pennies could do was spin like tops till the current was shut off. Nor were they the only things that answered to influence. A small doll was placed within the magic circle and it, too, commenced to waltz with great vim and industry. By way of giving the on-lookers an additional thrill, the Professor explained that everyone and everything else in the room would have to follow the doll's example if the electrical circle were enlarged. That was the point when the onlookers suddenly lost interest and passed on to the next room to see another marvel!

"Wonders Will—"

ENGLISH and American wireless experts are now unanimous in the opinion that before the end of the present year radio concerts will be heard equally well on either side of the Atlantic.

The American Auxiliary Language Association holds that the day is not far distant when a universal language will be adopted and international communication become simple.

President Coolidge, on a recent occasion, pressed a button at the seat of the Capitol, sending out a telegraphic wave which caused the siren to blow on the s.s. *President Harrison*, then in Frisco Bay. The journey made by the electrical impulse included 3,100 miles of space, five control stations, and took one fiftieth of a second to complete.

One of the United States' greatest wireless authorities, Lee de Forest, states that speaking pictures, the process of synchronising voice with action on the films, are now perfected.

In a railway tube 80 feet below the Hudson River, U.S.A., on January 5, tests conclusively proved that radio waves can penetrate steel, iron, water and mud. Miners equipped with small portable sets will, in future, work with less danger.

MAKE SURE

of Receiving "Radio" regularly by placing a standing order with your news agent, or sending 10/- for one year's subscription to:

THE WIRELESS PRESS, 97 CLARENCE STREET, SYDNEY.

Mr. J. Malone's Visit to Brisbane

UPON his recent visit to Brisbane a very warm reception was tendered Mr. J. Malone, Chief Manager Telegraphs and Wireless, by the experimenters of Brisbane at Vaughan's Cafe. The Deputy Postmaster-General, Mr. J. McConochie, presided, and in proposing the toast of "Our Guest," said that, though he could not speak as an expert, he fully realised the unbounded possibilities of wireless development, of which, as yet, only the fringe had been touched. In supporting the toast, Prof. T. Parnell, of the Queensland University, emphasised the importance of education in wireless matters. The annoyance caused by oscillating aerials could be removed if all users of valve receivers thoroughly understood their apparatus. The Professor advocated greater freedom in the granting of licenses. He pointed out that some of the world's experts were recruited from the ranks of amateur experimenters.

TRANS-PACIFIC TESTS.

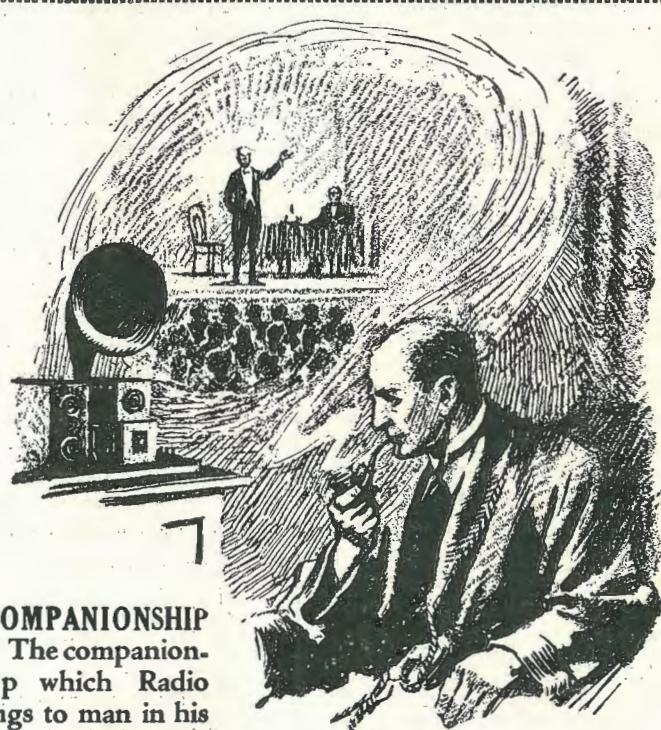
LOOKING EXTREMELY WELL AND SUN-TANED AFTER THEIR TWO EVENTFUL VOYAGES, MR. CHARLES D. MACLURCAN AND JACK DAVIS ARRIVED BACK IN SYDNEY FROM SAN FRANCISCO ON APRIL 19. AS IS WELL KNOWN, THE TWO EXPERIMENTERS RECENTLY LEFT AUSTRALIA TO CARRY OUT TRANS-PACIFIC LOW POWER, SHORT WAVE WIRELESS TESTS WHILE ABOARD THE R.M.S. "TAHITI" AND IN A BRIEF INTERVIEW MR. MACLURCAN TOLD "RADIO" THAT THE TESTS HAD TURNED OUT A PRONOUNCED SUCCESS.

IN OUR NEXT ISSUE, A DETAILED AND EXCLUSIVE REPORT CONCERNING THEIR ACTIVITIES AND THE RESULTS SECURED BY THE TWO WIRELESS EXPERTS WILL BE PUBLISHED.

READERS ARE ADVISED TO ORDER THEIR COPY OF "RADIO" IN ADVANCE, AS IT IS ANTICIPATED THAT THE DEMAND FOR THIS NUMBER WILL BE BIG.

"With the development of wireless," said Mr. Malone, in responding, "the ether has become a commercial highway, and in such a case the commercial man must have precedence over the experimenter." As to the request for greater freedom in the granting of licenses, he pointed out that in Victoria, where wireless had assumed greater importance as a com-

mercial factor than in Queensland, it was complained that the freedom was already too great. It had become difficult to regulate in the interests of the manufacturers of wireless apparatus, and the broadcasting companies on the one hand and the experimenters on the other. It was the desire of the Department to encourage the experimenter, and, at the same time, to protect commercial broadcasting.



COMPARISONSHIP
The companionship which Radio brings to man in his home—and what a wealth of companions Radio introduces into our homes—companions of song, solo and orchestral music, besides fun and news. No need to feel lonely or to miss the best in Radio if you rely on

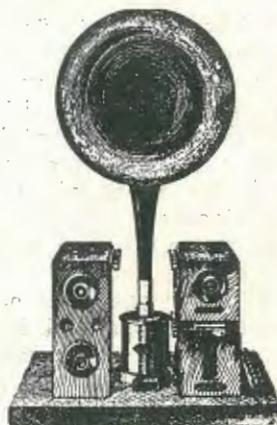
Western Electric RADIOPHONES

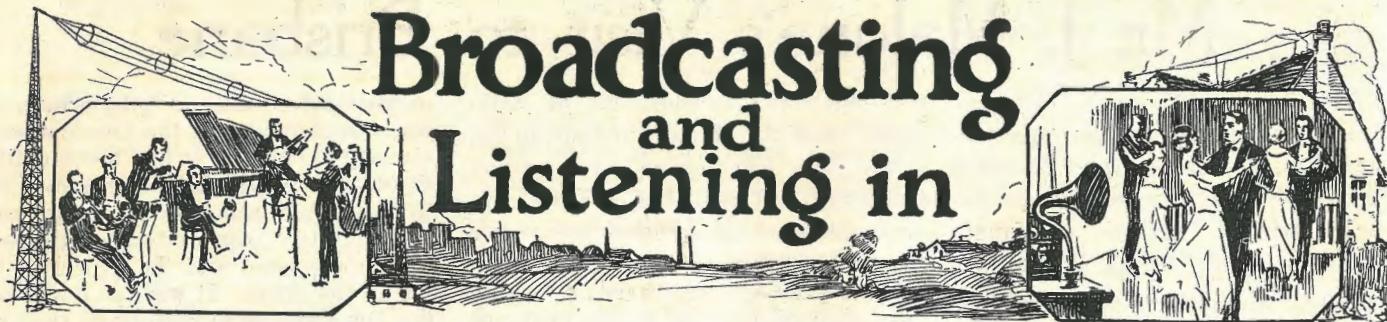
to bring to you from the air all that this new companionship means. Western Electric Radio apparatus is known for its reliability—which means to you the best results possible

For descriptive literature, help and advice on Radio, call, write, or 'phone

Western Electric Company
(Australia) Ltd.

192-194 Castlereagh Street, Sydney.
Telephones—City 336 and 356.





ON a recent voyage made by the P. and O. boat *Barrabool* between England and Australia, wireless music broadcasted from Sydney was heard when the vessel was 900 miles off Cape Leeuwin, which means that the New South Wales station transmitted and was successfully picked up over a distance of nearly 3,000 miles.

* * *

HOWEVER the above feat, excellent as it undoubtedly was, has been put quite in the shade by a far greater one, as the following will show. A wireless operator aboard an overseas trading ship bound for the Commonwealth took with him a three-valve receiving set and coils suitable for picking up the London broadcasting station 2LO. With the exception of occasional breaks of static he was able to hear the English station right down the West Coast of Africa. When the ship left Capetown, where the reception had been excellent, the music began to get fainter and fainter, but it could still be heard when seven thousand miles of water lay between the ship and London, and even when another thousand miles had been laid behind the propellers, 2LO's carrier wave could still be heard.

* * *

IT would be difficult to find a more enthusiastic believer in broadcasting than Dr. J. H. Ritson, of the London branch of the British and Foreign Bible Society. By this means he recently addressed a congregation which it is estimated numbered 250,000 listeners. "That the innovation was a success," he says, "was demonstrated by the pile of letters I received. One was from a woman who wrote that she had heard my address on the Sunday evening in a public house, of all places. She had left her four children at home and had gone to get a drink. When she

heard the loud speaker apparatus in the public house delivering my message, however, she left her beer untouched and hurried home to her children. My words, she said, recalled her childhood days and she assured me she would never touch liquor again. That is how preachers could

2 FC

BROADCASTING TIMES.

Sydney Mean Time.

P.M.

| | |
|--------------|---|
| 12.55: | Tune in to the Music of the Chimes. |
| 1: | "Sydney Morning Herald" News and Cable Service. |
| 1.25: | Coastal Farmers' Market Reports. |
| 1.30: | Stock Exchange Intelligence. |
| 1.32: | Weather Report. |
| 1.35: | Midday "Evening News" News and Cable Service. |
| 1.45: | Close down. |
| 2: | Chimes. |
| 3.5 to 3.45: | Musical Programme. |
| 3.47: | Afternoon Weather News. |
| 3.50: | "Evening News" News and Cable Service. |
| 4: | Close down. |
| 6.30: | Chimes. |
| 6.33: | Children's Time — Lamplighter Stories. |
| 7: | Dalgety's Market Reports. |
| 7.5: | Fruit and Vegetable Market Reports. |
| 7.7: | Closing Stock Exchange Intelligence. |
| 7.10: | Late "Evening News" News and Cable Service. |
| 7.15: | Close down. |
| 7.55: | Tune in to the Music of the Chimes. |

8.00 Entertainment.
to See List hereunder.

EVENING ENTERTAINMENT.

| | |
|------------|---|
| Mondays: | Popular Concert. |
| Tuesday: | Theatrical items. |
| Wednesday: | Dance Programme by Farmer's Novelty Jazz Orchestra. |
| Thursday: | Music Lovers' Night. |
| Friday: | Popular Concert and Amateur Theatricals. |
| Saturday: | Choral and Popular numbers. |

reach the people who do not go to church in Australia. Once wireless broadcasting becomes more common there is no reason why the masses of the people should not be reached."

SIMULTANEOUSLY with the development and popularity of wireless broadcasting in England and America there has arisen an enormous demand for loud speakers. One of the most popular types is the "Amplion" made by the Alfred Graham Company of London. Recent advices from England state that this firm is at present overwhelmed with orders, coming as they do from every country in Europe where broadcasting is in operation. Preparations are afoot to ensure a factory output of 10,000 "Amplions" a week.

* * *

FOR the purposes of judging the possibilities of wireless broadcasting as an educational factor, a test will be held at Bourke (N.S.W.) on May 9 and 10 next. The decision has been made by the Minister for Education, Mr. Bruntell, after a sub-committee's recommendation concerning the use of radio broadcasting for schools. Business houses and private individuals will be allowed to enter the test, while one of the conditions provides that all communications must be made through a loud speaker and audible to an ordinary class-room of 50 children.

* * *

THE first stages in the building of the plant for the Broadcasting Company of Australia was entered into a few days ago. It is to be erected at Braybrook (Vic.) where an area of four acres has been obtained near the Ballarat Road. The work of hoisting the steel lattice aerial mast was carried out by Amalgamated Wireless (Australasia) Ltd. The mast is 200 feet high and thus 16 feet taller than that of the commercial station situated in the Domain.

Radio Service

ESTABLISHED in 1913, Amalgamated Wireless (Australasia) Limited has made wonderful strides in building up an Australian organisation devoted to adapting the science of wireless to the needs of Australian progress.

In 1914 the number of employees in the Wireless industry was under a hundred, and the wages paid amounted to £12,000 per annum. To-day Amalgamated Wireless (Australasia) Limited, with its all-Australian staff, is carrying on public service at 300 wireless stations ashore and afloat. It gives continuous employment to more than 800 people, who receive in salaries and wages the sum of £150,000 per annum.

In addition, the Company disburses in respect of raw material, goods, and general expenses, the sum of £200,000 per annum.

The construction and erection of Broadcasting Stations and the manufacture of all types of Receivers for broadcast reception is a specialised branch of the Company's business. It also maintains a well-equipped plant for the production of Electronic Valves.



Pioneers of the Wireless Industry in Australia





Technical Section

Some Theoretical and Practical Considerations in Condenser Design

(By P. B. C. Holdsworth.)

IT is a comparatively simple matter for any experimenter to construct a variable condenser, but only careful attention to the finer points of design and good workmanship can produce one capable of calibration and from which a true reading may be calculated for all settings and frequencies through a simple formula. Also, while it is true that such a condenser is usually only produced in laboratories, yet if the factors controlling design are followed as closely as possible, a far more efficient instrument will be produced than if the various component parts are merely assembled without any thought of their mutual effect in the completed article. It is, therefore, proposed to outline the chief points to be watched in design and to describe some of the alternative constructional methods in use.

GENERAL TYPE.

The general type of condenser dealt with will be that having an air dielectric and capable of fine or vernier adjustment. The air dielectric type has been selected because, except for special purposes, it is the most generally useful. Air has much to recommend its use as a dielectric for it is free from all dielectric absorption and any loss from this cause is eliminated, and consequently the capacity does not change with frequency as is the case with solid or liquid dielectrics. Also its perfection as a dielectric is such that in a perfect instrument there is no phase difference, or rather the current and E.M.F. are exactly 90° out of phase, and hence there will be no equivalent resistance loss. Vernier

control, or at least some method of very fine control, is a necessity with the present sharply tuned methods of C.W. and radiophone working and this will be described later.

SPECIAL TYPES.

There are three main types in use, two are to be found in general use, while the third is not so common but is useful for decremeters. These three types differ only in the shape of their plates. The one in most general use has semi-circular plates, though the fixed plates may be semi-circular in all cases, for since the capacity varies as the area of plates opposed, it is sufficient to have one set only of special shape. With the semi-circular plates the capacity varies as the angle of rotation or to express it as an equation:— $C = a\theta$. This is, however, true for only one position of pointer and plates, so that the equation is modified to $C = a\theta + b$. Where "a" is the variation of capacity per scale division, "θ" is angle of rotation in scale divisions, and "b" is difference between $a\theta$ as calculated and as actually measured at a certain setting, say 30°. This last constant may be either positive, zero, or negative, depending on the relative position of the pointer and the moveable plates. If it is required to use the above type in a wave-meter reading directly in wavelength, it will be found that since the capacity varies as the angle of rotation, and the wave-length as the square root of the capacity, the scale divisions cannot be uniform. In order to overcome this a special shape of plate is resorted to, the form being such that the capacity will vary as the square of the angle of rotation or

$C = a\theta^2$. Since this form is frequently met with, and is very useful, the equation for the bounding curve will be given. This, it will be seen, is easily obtained. Since C is proportional to the area, we can say $C = A$. Now if $C = a\theta^2$ and the equivalent in polar co-ordinates $A = \frac{1}{2} r^2\theta$ are

differentiated, the equation $r = \sqrt[4]{4a\theta}$ is obtained, where r = radius, θ = the angle of rotation. In determining the outline of the curve, "a" being a constant may be ignored. Having obtained the outline it will be found that no allowance has been made for the semi-circular portion which mechanical considerations require to be removed, so that the equation must be modified into $r = \sqrt[4]{4a\theta + R^2}$ to allow for this. Here R = the radius of the removed portion. This is the second type mentioned. The third type is that in which the capacity varies by a fixed percentage for each degree of rotation. This type is not often used except in decremeters so it is not proposed to describe it in detail, and only the equations for calculation of capacity, and for the bounding curve will be given. These are as follow:— $C = C_0 \Sigma a^\theta$ and

$r = \sqrt{2C_0 \Sigma a^\theta + R^2}$. Where C_0 = Capacity when $\theta = 0$. Σ = Base Napierian logarithms. "a" percent change of capacity per division. r = Radius of polar co-ordinates. R = radius of semi-circular removed portion.

PLATES.

The plates may be made of any good conductor, brass, aluminium and copper being the metals most used. All give satisfactory results. Plates

should not be too thin, however, or their resistance may be an appreciable factor, and they are liable to buckle, and so vary the distance between the two sets, or even "short" the condenser. One set must be rigidly fixed, and the other capable of inter-leaving with it. The most usual method of obtaining this requirement is to space the plates with washers and to rigidly clamp the fixed ones between two insulating end plates, which carry a spindle on which moveable plates have been spaced and clamped. However, the more insulating material used in these plates the greater will be the loss due to dielectric absorption. Attempts have been made to overcome this loss, and one method is to use metal end-plates and have only the spindle bearings insulated from the end plates by a small insulating bush but this was not entirely satisfactory, and the U.S. Bureau of Standards designed a condenser in which the metal case is in electrical connection with the moveable plates, and the fixed are placed inside it and insulated from it by pillars of quartz, the plates being separated by a number of washers. If these are not perfectly free from oil

and dirt when assembled, losses due to resistance will occur. One method adopted to overcome this was soldering the plates into accurately milled supports. In any case, the spacing washers should be sheathed in solder to reduce the resistance to a minimum.

BEARINGS.

Bearings should have a large surface area and the spindle should fit closely to prevent any lateral movement. Collars on the spindle, fitting closely against the end plates will eliminate any end-play. The bearings must be so aligned that the two sets of plates will remain parallel for all settings on the condenser scale.

CONNECTIONS.

The connections with the fixed plates are simply made, but those of the moveable one require some little consideration. If the bearings are well made, and are a good fit, connection may be taken from these, though due to wear, dust, etc., this is a good, but not perfect method. Another way is to solder a pig-tail lead or a watch spring type of connection on to the

spindle and on to a binding post on the case. These methods are satisfactory if the leads are not too long, though if the pig-tail is comparatively long, it will only effect very accurate measurements and likewise contracting and expanding of the spring with rotation is almost negligible. Spring bearings which bear either laterally or longitudinally on an extension of the spindle are not advisable; as one causes uneven wear of the bearings and with the other setting the condenser if there is any play at all causes the plates to move against the spring which as soon as the hand is removed, forces them back into their former position and falsifies the setting.

SCALES AND CONTROL.

Scales are of two kinds, one in which the semi-circle is divided into 180° and a second in which it is only divided into 100 parts, the latter is perhaps the better of the two, especially with the decremeter type of condenser. In some cases the scale is engraved on the panel with simply a pointer attached to the spindle. In

(Continued on page 72.)

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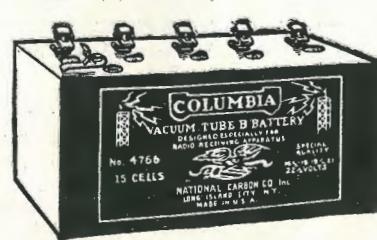
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Revised List of Call Letters of Australian and New Zealand Ships

| | | | | | |
|------|-------------|-----|-------------|------|-------------------|
| CGC | ST. GEORGE | VHQ | FIONA | VML | WHANGAPE |
| CGF | EURELIA | VHR | FLORA | VMN | KATOA |
| CGG | EUDUNDA | VHS | LADY LOCH | VMO | WAIPORI |
| CGH | BOORAL | VHT | TINTENBAR | VMP | WANAKA |
| CGO | EUGOWRA | VHU | MATARAM | VMZ | MARAROA |
| CGQ | KURUMBA | VHV | YANKALLILLA | VNW | WONGANELLA |
| CGR | BILOLA | VHW | WYANDRA | VXA | OONAH |
| CGS | KOWARRA | VHX | VICTORIA | VXB | BAMBRA |
| CGT | MELUSIA | VHY | ULIMAROA | VXC | PERIOD |
| CGU | IRON CROWN | VHZ | BALDINA | VXE | DILGA |
| CGV | WYOLA | VIK | TIME | VXF | ASHRIDGE |
| CGW | MACEDON | VIQ | BUNINYONG | VXG | ENOGGERA |
| ENL | WAIRUNA | VJA | RIVERINA | VXH | KOOYONG |
| ESC | MALAYAN | VJB | WESTRALIA | VXI | IRON MONARCH |
| EYV | KAITOKE | VJC | ZEALANDIA | VXJ | KOORINGA |
| GBE | NIAGARA | VJD | BINGERA | VXK | IRON PRINCE |
| GBFV | ARAFURA | VJE | COOMA | VXL | MOIRA |
| GBJD | WAIKOUAITI | VJF | MORINDA | VXM | BARWON |
| GBKJ | MARELLA | VJG | WYREEMA | VXN | OOMA |
| GBMP | WINGATUI | VJH | LOONGANA | VXO | CORIO |
| GBNM | WAITEMATA | VJI | SUVA | VXQ | RONA |
| GBPY | BOORARA | VJJ | ARAMAC | VXR | MOORABOOL |
| GBTL | GASCOYNE | VJK | GILGAI | VXS | YARRA |
| GBVT | KAIMANAWA | VJL | WERRBEE | VXX | MACKARRA |
| GCDK | KAWATIRI | VJM | ALABAMA | VXY | MACUMBA |
| GCDY | KAIWARA | VJP | BULLA | VZA | CAMIRA |
| GCNY | WAIKAWA | VJR | BOONAH | VZB | MAKAMBO |
| GDBQ | WAIHEMO | VJS | BAKARA | VZC | CANTARA |
| GDJC | MONTORO | VJU | ECHUNGA | VZD | DILKERA |
| GDKM | WAIOTAPU | VJW | DONGARRA | VZF | JUNEE |
| GDLF | COOEE | VKA | BARUNGA | VZG | GOVERNOR MUSGRAVE |
| GDZS | KUROW | VKB | MERRIWA | VZH | KARUAH. |
| GDZV | MAKURA | VKC | MILLUNA | VZI | KADINA |
| GDZX | MAORI | VKD | ALDINGA | VZJ | LAMMEROO |
| GFMP | OROWAITI | VKE | AROONA | VZM | CARINA |
| GFYB | MAUNGANUI | VKF | AEON | VZN | TARCOOLA |
| GFYM | TOFUA | VKG | WEAR | VZT | IRON AGE |
| GFYN | WAHINE | VKH | SAROS | VZU | URILLA |
| GFYP | WAIHORA | VKI | MALLINA | VZV | CALULU |
| GFYQ | WAITOMO | VKJ | CHRONOS | VZZ | MARRAWAH |
| GFZM | CHARON | VKK | CENTURY | VZBC | KOMURA |
| GFZP | MINDEROO | VKL | MONARO | VZBD | KOONDA |
| GJBR | GORGON | VKM | WOOLGAR | VZBF | MELBOURNE |
| GJFR | HAURAKI | VKU | PARATTAH | VZBG | ECHUCA |
| GJLW | NAURU CHIEF | VKV | ARAWATTA | VZBJ | HEXHAM |
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| VHH | EROMANGA | VLX | TUTANEKAI | VZDK | JERVIS BAY |
| VHI | IRON BARON | VMA | ARAHURA | VZDL | ESPERANCE BAY |
| VHK | WODONGA | VMB | KARORI | VZDN | ELLAROO |
| VHL | DIMBOOLA | VMC | KAURI | VZDT | IRON KNOB |
| VHM | KANGAROO | VMD | KOROMIKO | XJW | KAIKORAI |
| VHN | KATOOMBA | VME | RAKANOA | YUH | EASTERN |
| VHO | CANBERRA | VMH | TERAWHITI | YUS | WAIMARINO |
| VHP | NAIRANA | VMI | REWA | | |

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- 2HS Fagan, R. J., Sunny Ridge, Mandurama.
- 2HM Marshall, H. A., Allingham Street, Armidale.
- 2LF Ginger, L. V., 93 Middle Head Road, Mosman.
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- 2XA James, H. K., 12 Rosemount Avenue, Summer Hill.
- 2YL Lendrum, A., 220 Doncaster Avenue, Kensington.
- 2YM Scott, J. L., 80 Hunter Street, Sydney.
- 2YN Thomas, C. P., 343 Sussex Street, Sydney.

VICTORIA.

- 3AB Weatherston, W. S., 23 Melby Avenue, E. St. Kilda.
- 3AU Milligan, S. H., 117 Autumn Street, Geelong.
- 3BK Cumming, W. H., 57 Kooyong Road, Armadale.
- 3CA Dorward, W. H., 4 Orlando Street, Hampton.
- 3II Miles, G. T., Highfield Road, E. Camberwell.
- 3KF Harkin, D. J., 68 Hardiman Street, Kensington.
- 3NN Brown, H. R., Yanac.
- 3PJ Smyth, B. L., 10 Keera Street, Geelong West.
- 3SK Short, O., 10 Redan Street, St. Kilda.
- 3TK Kinsella, T. W., Mayo Park, Lubeck.
- 3WT Tresidder, W. L., 13 Nettle Street, Bendigo.
- 3YA Geelong Wireless Club, Guild Hall, Myers Street, Geelong.

QUEENSLAND.

- 4EG Gold, E. E., Lindsay Street, Toowoomba.

SOUTH AUSTRALIA.

- 5AQ Br. Joseph, Sacred Heart College, Glenelg.
- 5BN Bald Motor and Elect. Works (E. A. Cooper), 31 Pulteney Street, Adelaide.
- 5CN Sagar, E. N., Railway Terrace, Largs Bay.

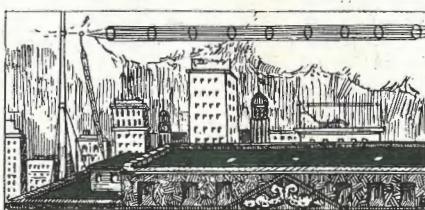
TASMANIA.

- 7AR Johnson, C. F., 33 Hill Street, West Hobart.
- 7FP Philbin, F. T., Box 29, Queenstown (Orr Street).
- 7OM O'May, R. D., "Elvera," Esplanade, Bellerive.

Wireless Institute of Australia

SOUTH AUSTRALIAN DIVISION.

THE monthly general meeting of the South Australian division of the Wireless Institute of Australia was held at the University of Adelaide on April 2. In reply to the division's letters asking their opinion regarding the regulations controlling regeneration, the Victorian branch stated that they were unanimously in favour of them. On the other hand, in a reply received from the N.S.W. division



it was made known that they desired to have the restrictions removed and it was asked that the South Australian body support them with a view of approaching the Controller to obtain some modification of the regulation.

Three new members were admitted. It was decided to donate £2/2/- to the F. L. Moore Relief Fund.

A committee was formed to arrange for a social and dance which will again be held this year.

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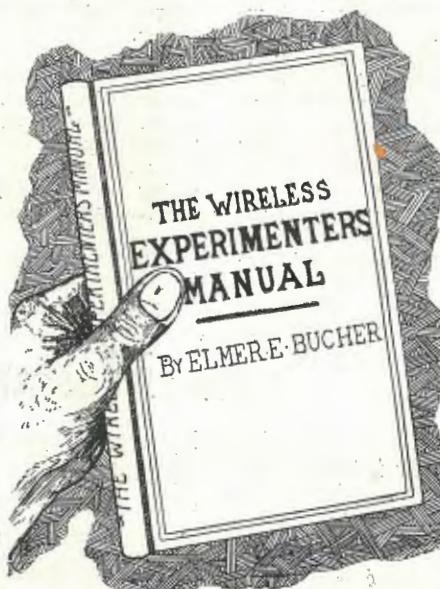
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Queries Answered



A.W.C. (Beaumaris), Q.: What is a good non-regenerative circuit using a crystal as detector and a valve as amplifier with variable coupler and variable condenser?

A.: Use the reflex circuit described in issues *Radio* Nos. 13 and 22, or else connect the valve as an audio-amplifier in place of a 'phone in a simple crystal circuit.

A.J.D.T. (Kuridala, N.Q.) referring to queries by F.C.H., *Radio* No. 25, Q.: Would a DER valve be satisfactory as a detector and U.V.199 or U.V.201A as amplifiers?

A.: Use DER or U.V.199 for the detector, and U.V.201A for the amplifier for best results.

Q.: Using these valves would Edison Primary Batteries and five cells for the filament consume 3 amps for 16 hours? How long approximately should the battery last?

A.: If you use Edison batteries to operate 3U.V.199 valves they will have to supply 0.18 amperes. Five cells in series will give a voltage of about 3.5 and if their capacity is 500 ampere hours, they will operate the three valves at the above-mentioned current for approximately 2,780 hours. Operating for four hours per night this battery will last for nearly two years without requiring to be re-charged. There is practically no local action in an Edison Primary cell, and if the electrolyte is kept well protected by a thin layer of the special oil provided it will last until the elements are consumed. We would recommend a smaller cell, such as the 150 ampere hour size, as it will be worked nearer to its normal rating and will be cheaper to renew.

Q.: Should they be connected in series, or parallel and would five cells be sufficient to operate the three valves?

A.: Connect all cells in series. Each cell has a working E.M.F. of 0.7 volts.

Q.: What is the cost of one of these cells?

A.: Write to Thomas A. Edison, Ltd., 364 Kent Street, Sydney, for prices and particulars.

W.A.B. (Illawarra). Q.: Can a dry cell be used on the filament of a "Myers" valve?

A.: Yes, but the current consumption will be high.

Q.: What make of valves use dry cells instead of accumulators?

A.: U.V.199 DER, U.V.201A, W.D.11 and W.D.12.

Q.: How can circuit submitted be made to receive continuous waves?

A.: You must use a separate heterodyne.

T. W. (Lindfield): The table published in issue *Radio* No. 15 refers to coils used in the secondary circuit. Use a coil one size smaller for the reaction. Regarding the primary coil, this will have to be determined by experiment owing to the various shapes and capacities of experimental antennæ.

J. K. R. (Barcaldine). Q.: What is the approximate range of circuit Fig. 3 published in *Radio* No. 6 under the heading of "Continuous Wave Transmission."

A.: No estimate of range can be given, owing to the many factors involved such as local and intervening conditions.

"Sparks" (Riverview, Sydney), Q.: What is the best valve to use in a one-valve set?

A.: Any make of valve can be used with very little difference.

Q.: What is the number of turns of a honeycomb coil for primary and secondary for various wave-lengths.

A.: See table in *Radio* No. 15, also answer to T.W. above.

Q.: What is the wave-length of Melbourne's broadcasting station?

A.: No stations are officially operating in Melbourne yet.

Q.: What is the wave-length of KGO?

A.: Approximately, 310 metres.

(Please note.—All queries must be signed by your full name. Answers will be published under initials only or nom-de-plume, if required.)

T. R. A. (Auburn, N.S.W.): Considering the number of experimenters who are securing satisfactory operation with radio frequency amplifiers, the best plan would be for you to get in touch with one of them and profit by his experience. Without a personal inspection of your apparatus we cannot state what is the cause of your trouble. So much depends upon the skill of the operator in adjusting the apparatus that estimates of range, etc., cannot be given.

C. C. J. (Kensington Park, S.A.): You should have one rotor as the primary and the other as the reaction, with the secondary wound on the stator. To ensure sufficient coupling between the windings, wind one-third of the secondary as close to the primary end as possible and two-thirds similarly close to the other. If you intend using the set for portable country work, why not use a double coil outfit which will greatly simplify the construction and operation?

New Mosman Radio Body

ON Thursday, March 27, a number of gentlemen keenly interested in the science of wireless, met at the residence of Mr. N. D. Hale, 100 Muston Street, Mosman, to discuss the possibilities of establishing some form of research and experiment in wireless telegraphy and telephony.

Many interesting points were dealt with and it was eventually decided that the body be called the Mosman Radio Research and Experimental

Laboratories, wherein it is anticipated a great deal of very interesting and scientific work will be carried out. Considerable advantage is claimed in that the laboratories will be kept free from all formalities and that the number of members will be limited.

The laboratories will be divided into four sections, namely:—The Northern, Southern, East and Central, and Western Sectional Laboratories,

and will work separately or conjointly as required. Laboratories headquarters will be located at 100 Muston Street.

The names of the gentlemen interested are: Messrs. J. Henderson, M. S. Nunn, H. Naylor, C. A. Holmes, and N. D. Hale. It was decided to commence work immediately, every Thursday evening being fixed for joint experiment.

**MARCH.**

Mr. J. H. Surplice signed off s.s. *Saros*, at Port Pirie, 21st.

Mr. S. Hamilton signed on s.s. *Enoggera*, at Sydney, 31st.

Mr. G. Pow relieved Mr. H. A. de Dassel on s.s. *Karoola*, at Sydney, 31st.

Messrs. F. N. Toohey and E. D. Nicoll signed off s.s. *Cooee* as 3rd Operators at Sydney, 31st.

APRIL.

Messrs. V. J. Foreman and M. Sherwood King signed on s.s. *Taiyuan* as 2nd and 3rd operators respectively, at Sydney, 1st.

Mr. R. C. Christie signed off s.s. *Makura* as 3rd operator, at Sydney, 1st, and signed on s.s. *Aramac*, at Brisbane, 4th.

Mr. A. W. Stewart signed off s.s. *Makura* as 2nd operator, at Sydney, 1st, and proceeded on Home Port leave.

Mr. F. N. Toohey relieved Mr. V. J. Foreman as 3rd operator on s.s. *Marella*, at Sydney, 1st.

Mr. J. H. Surplice signed off s.s. *Waio-tapu*, at Newcastle, 4th and relieved Mr. A. J. Sawyer on s.s. *Omara*, at Newcastle, 4th. Mr. Sawyer terminated service.

Mr. G. Gray signed on s.s. *Camira*, at Sydney, 4th.

Mr. J. K. Skinner signed off s.s. *Kooyong*, at Melbourne, 1st.

Mr. J. McManus relieved Mr. J. K. Skinner on s.s. *Kooyong*, at Melbourne, 1st.

Mr. J. Park relieved Mr. V. E. Stanley on s.s. *Time*, at Sydney, 4th.

Mr. V. E. Stanley relieved Mr. G. I. Duffy on s.s. *Melbourne*, at Sydney, 5th. Mr. Duffy terminated service.

Mr. B. Boni relieved Mr. A. E. Lawrence on s.s. *Canberra*, at Sydney, 4th.

Mr. A. E. Lawrence relieved Mr. B. Boni as senior operator on s.s. *Eastern*, at Sydney, 4th.

Messrs. H. A. Sticpwich and F. Barclay signed off s.s. *Bulla* as 3rd operators, at Sydney, 4th.

Mr. H. A. Sticpwich signed on s.s. *Waio-tapu*, at Newcastle, 5th.

Messrs. B. I. Rose and H. J. Crocker signed on s.s. *Bulla* as 3rd operators, at Sydney, 4th.

Mr. G. I. Flynn signed off s.s. *Woolgar*, at Melbourne, 1st, and signed on s.s. *Hronos*, at Melbourne, same date.

Mr. J. F. McGinley relieved Mr. J. R. Hain, at Sydney, 7th, as 2nd operator on s.s. *Jervis Bay*.

Messrs. G. Steame and E. D. Nicoll signed on s.s. *Cooee* as 3rd operators, at Sydney, 7th.

Mr. J. H. Pullan relieved Mr. F. G. Lewis on s.s. *Ashridge*, at Melbourne, 4th.

Mr. F. G. Lewis relieved Mr. J. H. Pullan on s.s. *Aeon*, at Melbourne, 4th.

Messrs. N. R. Hain and G. Colton signed on s.s. *Eastern* as 2nd and 3rd operators respectively, at Sydney, 8th.

Messrs. E. W. Coldwell and J. W. Jacobs signed on s.s. *Makura* as 2nd and 3rd operators respectively, at Sydney, 8th.

Mr. L. A. Paul relieved Mr. N. M. Leeder on s.s. *Lammeroo*, at Sydney, 10th.

Mr. N. M. Leeder relieved Mr. T. Bannister on s.s. *Mataram*, at Sydney, 10th. Mr. Bannister proceeded on Home Port leave.

Mr. E. F. Hayes signed on s.s. *Kadina*, at Sydney, 8th, and relieved Mr. C. H. A. Kidman on s.s. *Wyreema*, at Sydney, 10th.

**GERALDTON RADIO CLUB.**

A MEETING of wireless enthusiasts has been held in the Parish Hall, there being an attendance of 49. After discussion, it was decided that the club should be known as the Geraldton District Radio Club. The rules and constitution of the West Australian Institute with minor alterations were adopted. The following are the officers of the club:—President, Rev. E. Vine; Vice-presidents, Messrs. Payne and Burrows; Secretary and Treasurer, Mr. C. Lucas; Assistant Secretary, Mr. W. Thomas; Trustees,

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Mr. Godfrey Isaacs tells it:—A schoolmaster one day asked his class what electricity was.

The inevitable small boy raised his hand.

When asked to elucidate the s.b. replied: "Please, sir, I've forgotten."

"Dear me," said the master, "it's a terrible tragedy. Only two people know. One is the Almighty, Who won't tell us. The other is this small boy, who has forgotten."

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Messrs. Monery and Wigg; Committee, Messrs. E. J. Williams, J. Currie and Leibnow; Technical Advisers and Instructors, Messrs. Tymms, Wigg, Leibnow, Goodlands and Cos. At the next meeting, a preliminary lecture will be given by one of the instructors on the subject of elementary electricity. Members are fortunate in having five practical professional men as tutors. It is intended to secure an exclusive club room, which will be constantly available to members for practice and experimental purposes, and a set, mast, aerials, etc., will also be erected. The annual fee for adults is 21/-, and for cadets 10/-.

Condenser Design*(Continued from page 67.)*

others the dial carrying the scale is itself attached to the spindle and rotated with it. In any case, the dial or pointer must be rigidly fixed to the spindle, and it is a good design not to have stops for zero and 180°, as these may tend to displace it if the condenser is swung too quickly. Fine control may be secured in several ways. One is to have a second condenser of very small capacity connected in parallel. This, however, increases the losses due to connection resistances and to dielectric absorption. A second method is to have two or three plates integral with the main condenser, but variable by means of a separate spindle. This is satisfactory but it introduces some difficulties in construction. A third method is to have the condenser controlled through a reduction gear of cogs, or belt and pulley. The drawback to these two ways are slackness due to back-lash in the former, and slip in the latter. Another process, which is simple yet effective, is to have a handle of some four or five inches long rigidly fixed at right angles to the spindle. By this means, provided the condenser has not too many plates, sufficiently fine control may be obtained. The added advantage is that the mistuning, due to body capacity, which is found to occur when the hand is removed after tuning unshielded condensers, is rendered negligible. The above embodies the chief points which require consideration when constructing a variable condenser and it is

hoped that their perusal may help some experimenter to produce a more efficient instrument at his next venture.

KGO, California*(Continued from page 56.)*

"California" coming in very strong and clear.

I am pleased to hear that this station is increasing power to 5,000 watts, as this should mean regular nightly reception of their programme.

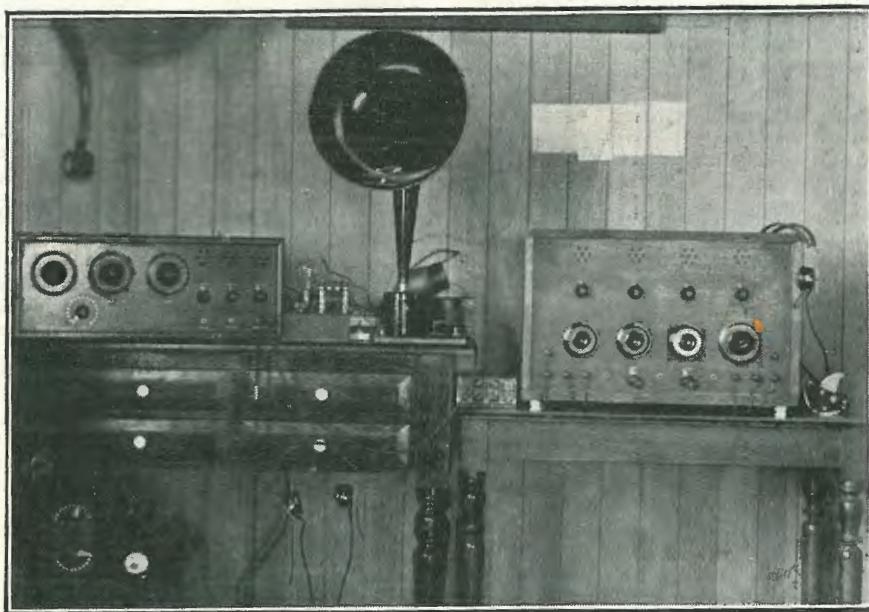
I am enclosing subscription fee to Radio.

Yours, etc.,

(Signed) J. G. ONUS.

Wireless in South Australia

The Millswood Auto and Radio Company Limited, Millswood, S.A., have installed a $\frac{1}{2}$ K.W. transmitting set and have received excellent reports from amateurs who have "logged" it. It is the intention of the firm to carry out tests with this circuit until such time as the projected big broadcasting station is put into operation. Mr. L. A. Harper states that his firm intends to go in for the manufacture of wireless receivers on a large scale. Wireless in the Southern State is becoming very active and a great deal of interest in it is evident both among the amateurs and the general public.



The Radio Outfit belonging to the well-known Toowoomba (N.S.W.) experimenter, Mr. E. Gold. Mr. Gold was of considerable assistance to 2CM in reporting signals received on the occasion of the Trans-Pacific Tests held last year.

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There is only One School in Australia where a Student can receive Sound Instruction in Wireless Telegraphy, and for the benefit of our readers a few of the Advantages offered by this School are detailed:—

1. The Instructors are all Highly Qualified Men, combining 20 years' Practical Experience on Sea and Land.
2. The School's Equipment is of the Very Latest, and includes Complete Commercial Installations.
3. Priority of Appointment to the Students of the School is given in all vacancies occurring on board ships of the Australian Mercantile Marine.

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therefore

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The same is true as regards New System T.M.C. Headphones, Handphones, and Loud-speakers.

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Our Loud-Speakers are foremost in design, pattern and efficiency; for clarity of voice production, freedom from distortion and low cost of maintenance, they cannot be equalled.

They are clear, mellow toned, resonant and sonorous, acoustically perfect, fairly priced and unreservedly guaranteed. Their sound-producing elements respond easily to the many tones of the human voice and all musical instruments. The apparatus can be connected to your own Wireless Set, of whatever design and construction.

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NEW SYSTEM T.M.C. "DE LUXE" HEADPHONES.

These Headphones are extraordinarily sensitive; they remarkably enhance the clearness and range of the Radio-Receiver. You judge a Radio-Receiver by what you hear. If your receiving set is not equipped with New System "De Luxe" Headphones, you are not doing justice either to yourself or your receiver (2,000 and 4,000 ohms).

ONLY 40/- PER PAIR. Postage extra.

N.S.T. AND T.M.C. DOUBLE HANDPHONES— FOR THE LADIES.

The advantages inherent in these Double Handphones will be readily apparent. Using them, ladies do not disarrange their hair; they are more easily adjusted than Headphones, and in many other respects are a boon to lady "Listeners-in."

They are light, artistically fashioned, and mounted on polished ebonite handle, with flex. Resistance, 4000 ohms.

PRICE, £2/15/-. Postage extra.

T.M.C. 3-VALVE LOUD-SPEAKING RECEIVING SET.

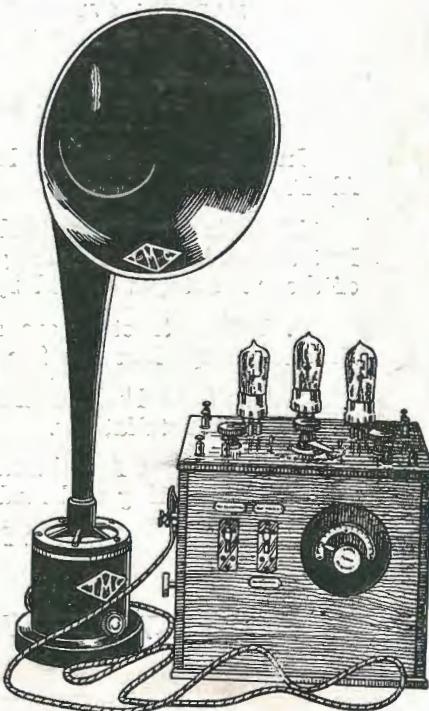
DESCRIPTION:

This model stands alone in high-class receivers with its high efficiency, distinctive appearance and unique features, chief of which is the Loud-Speaker device which is contained in the receiver cabinet. Special terminals are provided for an extra Loud-Speaker and two pairs of Head Telephones without alteration of connecting wires. This set has been designed to comply with the Government Regulations for sealed wave-lengths. It may be adjusted by the manufacturers to receive any one or all the Broadcast stations within reasonable distance. The cabinet is built of well-seasoned, highly finished walnut. All fittings and terminals are of polished brass and lacquered, except at points of electrical contact. Overall dimensions, 10½in. x 10in. x 7½in.

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With built-in Loud-Speaker, which does not include extra Loud-Speaker, and accessories. Carriage extra.

No Loud-Speaker need be purchased with this Set, and no extra amplifiers are necessary. It is a complete receiving set, suitable for Broadcast reception up to 400 miles.



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