ISSUED EVERY — — SECOND WEDNESDAY

SIXPENCE

RADIO

IN AUSTRALIA & NEW ZEALAND

Incorporating "Sea Land and Air"

VOL. I. MAY 16, 1923 No. 4

—Underwood Photo.

MUSIC IN THE AIR.

The above photograph shows Miss Jeanette Vreeland, opera singer, and Bert Acosta just before they entered the 'plane piloted by Lieut. Belvin Maynard. During the flight Miss Vreeland sang several songs into a radio transmitter, in aid of a collection for the American Legion.

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

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

Managing Editor: S. E. TATHAM Associate Editor: M. DIXON

CONTENTS

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Radio Concert Cheers Patient in Hospital

THE above photograph shows a patient in the emergency Hospital at Washington listening to a radio concert while undergoing an operation.

The American doctors recognise that radio music is a remarkable tonic in the case of sick people. The very novelty of being able to listen to the cheerful strains of music while submitting to the gentle operations of the surgeon's knife is calculated to lift the sufferer's mind above his immediate surroundings. Of course music could be heard only when a patient was undergoing an operation by local anæsthetic, but both before and after operations of the most serious nature radio music is proving of immense value in cheering up patients whose state of mind would otherwise be most despondent.

One naturally wonders how long it will be before patients in Australian Hospitals will be able to enjoy radio music the same as their American cousins.

Broadcasting Speeches

A LIMITED vision must be credited to those newspapers and individuals who made light of the suggestion put forward by Dr. Stopford, M.L.A., President of the Balmain Radio Society, that a transmitting set should be installed at Sydney Parliament House to enable members' speeches to be broadcasted to "listeners in" all over the State.

It is only fair to say, however, that the majority of critics cast no doubt on the practicability of doing as Dr. Stopford suggested—rather did they ridicule the idea that anyone wished to hear more of members utterances than they now read in the press. This, it may be allowed, is a debatable point, but if it were true that the speeches of members of Parliament are as uninteresting and devoid of common-sense as some people allege it would be a regrettable state of affairs. Personally we do not subscribe to that belief at all, and we feel confident that in the near future, probably during the life of the present Parliament, debates conducted on the floor of the House will be available to all who possess receiving sets no matter how remotely they may be located.

Candidly speaking, the effect of a broadcasting service, even if it includes parliamentary debates, cannot fail to be of great educational value. No intelligent person disputes the value of newspapers and other forms of literature in broadening people's minds and enabling them to obtain a more intelligent grasp of the leading questions of the day. It can safely be left to the good taste of the community to choose the reading matter it needs just the same as we can rely upon the "listeners in" to hang up their receivers if the programme they are listening to fails to interest or amuse them.

The fact that the broadcasting of parliamentary debates in Australia would be an innovation is no argument against undertaking it. Election campaigns have been conducted by radio in parts of America, and the possibility that a similar thing will happen here in the next couple of years is a very real one. It follows as a natural consequence that if the public are prepared to listen to a medley of voices proclaiming the virtues of their respective owners in an election fight they are not at all likely to object to hearing the words of wisdom which fall from the lips of our legislators on the floor of the House.

It is not blind faith, but a knowledge of its wonderful utility which induces enthusiasts like Dr. Stopford to advocate the more general application of radio telephony to the needs of the general public.

There is little doubt but that when the man in the street gets to know its value as a medium of communication and entertainment he will embrace it with an enthusiasm transcending that which greeted the telephone, gramophone and other inventions of first-hand importance.

Mankind's Debt to Radio

SCARCELY a week passes without some fresh evidence being adduced of the practical value of wireless telegraphy. It may seem a small thing in its way to read of a rescue party being directed to the scene of a shipwreck through the broadcasting of an S.O.S. call, or medical advice being flashed across a thousand miles of ocean to a sick or injured man, but it is points like these that count. Their true significance can only be realised by totalling up the countless human lives that have been saved, and the anxiety and suffering that have been obviated in recent years.

Spurred on by the knowledge that every advancement made in perfecting apparatus for the speedy and efficient transmission and reception of radio messages adds still further to its value to mankind, those engaged in exploiting the possibilities of wireless transmission of sound may be expected to accomplish much useful work as time goes on. No greater incentive to work can be given any man than the knowledge that the whole world stands to benefit by his success, and it is safe to say that no discovery of ancient or modern times holds such possibilities for universal application of a high and useful order as radio telegraphy and telephony. With such a happy combination can it be wondered that all connected with the enterprise view the future through rose-coloured spectacles?

The day of pioneering the science is almost past; it has established its claim to be regarded as an agency of humanitarian and commercial value almost beyond estimation, and the future may be regarded as at its feet.

Radio's Proud Record

Robbing the Sea of its Terrors

Summit of Splendid Service

IT is a well-recognised fact that maritime disasters, of which there is a record from the time that man first attempted to cross the ocean in a frail craft, will continue so long as Nature makes war on man's creations by storms, fogs and other dangers which imperil life at sea. Much has been accomplished in recent years towards ensuring the safety of ocean travel. Larger and stouter vessels have been built, the introduction of various life-saving devices on board ship has been made compulsory, and signal stations have been established at various danger points along the Coast. Despite all these precautions, we are frequently alarmed, and sometimes saddened, by the news that disaster has befallen an ocean-going vessel. It is no evidence of human incompetence to have to make this admission; it simply reveals the operation of a law which is as inevitable as the setting sun, viz., that in many directions man's work must always fall helpless before the onslaughts of Nature.

Radio Spells Safety.

Fortunately, however, while it is not always possible to prevent accidents, a cure can frequently be prescribed. It has been demonstrated on countless occasions during recent years that radio telegraphy is responsible for saving more lives when a shipping disaster occurs than any other agency which can be called on to assist. The number of vessels that are regularly proceeding to and fro along the recognised routes spells almost certain rescue should a disaster occur in the vicinity, provided news of the happening reaches other ships. Radio telegraphy represents the only means of doing this, and it has done it so frequently and with such happy results, that its value is known to all.

Instances Recalled.

Who does not remember the magnificent rescue work carried out by H.M.A.S. *Melbourne* when she responded to the S.O.S. call of the *Helen B. Stirling*. It is beyond question that had the helpless vessel not possessed a wireless outfit she, too, would have been added to the list of ocean mysteries. To mention another meritorious rescue we can turn to the stranding of the *Mindini* on Mellish Reef. A rescue ship was speedily on the scene in response to a wireless call, and the passengers and crew were spared the ordeal of spending several weeks on a shelterless island under conditions which would almost certainly have resulted in the outbreak of disease. Yet another happening of recent date in which wireless telegraphy performed excellent service was the stranding of the *Iron Prince* at Cape Howe. The speed at which messages passed between the ship and the agents through medium of the Sydney Radio Station stands as a tribute alike to the system and the men who operated it.

Mr. John A. Guy, Wireless Operator of the ill-fated steamer "Iron Prince."

Mr. W. C. Hodges, Wireless Operator at Sydney Radio Station, who was on duty when the "Iron Prince" called for assistance.

Wreck of "Iron Prince."

As already mentioned, an excellent performance in the speedy exchange of messages stands to the credit of the operators at Sydney Radio, and on the ill-fated vessel immediately the disaster occurred.

Mr. J. A. Guy, wireless officer on the *Iron Prince*, transmitted news of the vessel's plight at 1.55 a.m. on the morning of April 19. The message was picked up by the operator on duty at Sydney Radio (Mr. W. C. H. Hodges), and within the space of one minute was despatched to Sydney, where it was communicated to Mr. Scott Fell, representing the Sydney agents. Mr. Fell immediately got into direct touch with Pennant Hill by telephone, and in response to his request a message was transmitted to the *Iron Prince*. The answer was received and communicated to Mr. Fell while he held the telephone line—the whole operation occupying approximately sixty seconds. It is no exaggeration to say that the feat is one worthy of the highest commendation, and all concerned have every reason to feel proud of their achievement.

Direction and Position Finding by Wireless

Record of Progress

By GEORGE APPERLEY
(Radio Engineer)

THE real practical application of the Wireless Direction Finder was made during the Great War when its usefulness was abundantly proved. Its value in locating enemy wireless installations ashore and afloat and in guiding aircraft cannot be over-estimated, and the result of the accumulated fund of information which became available as a result of its constant use day and night in actual services has lead to remarkable developments in this branch of wireless telegraphy. It has therefore, very rapidly emerged from the experimental stage to one where its practicability is firmly established.

Hertz in his original researches showed that electromagnetic waves could be reflected in the same way as rays of light by the use of suitable cylindrical parabolic mirrors and also demonstrated that the amount of energy induced in his resonator varied with its orientation in respect to the source of the radiated energy. The problem of directive transmission and reception of electromagnetic waves has since received the attention of many inventors, but until recent years this branch of radio remained more or less undeveloped.

Marconi in his early experiments in 1899 successfully projected a beam of electric radiation in a given direction

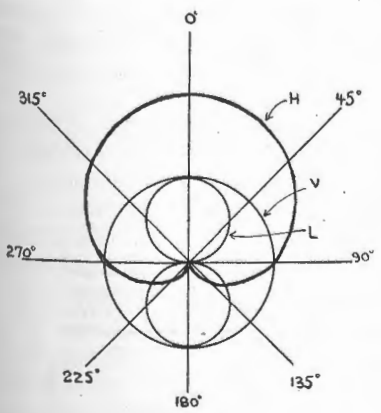


Fig. 1.

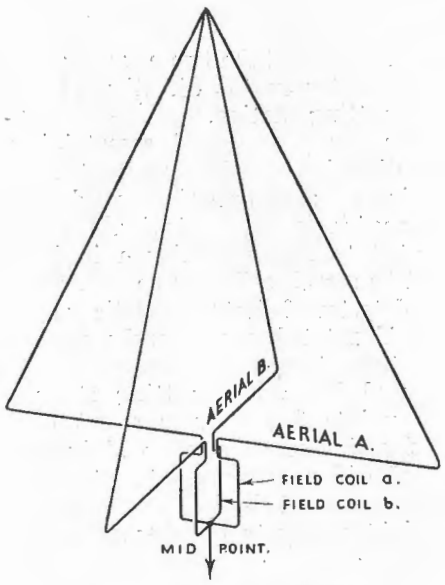


Fig. 2.

over a distance of about two miles by the method originally employed by Hertz whilst subsequently other inventors proposed using spaced vertical wires or screens arranged as reflectors in place of the mirrors. For the reason that waves which can be transmitted by reflectors of this nature are very limited in length, the application of this method took no practical form until quite recently, and although at the present time it is being very usefully and extensively employed for transmission, its field of use is still limited to short distances.

Sloping antennae, revolving screens, and certain forms of rod oscillators were also suggested, but the first really practical solution of the problem was, however, due to Marconi, who, in 1905 employed bent antennae for both directional transmission and reception. Each antennae was constructed in the form of an inverted "L" the horizontal limb being made considerably longer than the vertical portion. He found that the transmission and reception qualities of such antennae were greatest in a direction opposite to that in which the horizontal limb was pointing, although transmission or reception could be effected to a less extent, in other directions. This invention forms the subject matter of Commonwealth Letters Patent No. 5429/06, granted to Marconi's Wireless Telegraph Company Limited of London.

In 1906 Marconi patented in Great Britain a method of employing a stellate receiving aerial consisting of a number of bent antennae arranged radially from a central point for the purpose of locating the direction of any sending station. A receiver was arranged to be connected to each aerial in turn and the one which gave loudest signals indicated that the transmitting station was in a direction opposite to that in which its free end was pointing. During the same year F. Braun devised a method of directional transmission employing three simple antennae in which oscillations were created, having certain definite phase differences by which means it was possible to cause the waves emitted from each antennae to assist one another in certain directions but to neutralise each other in certain other directions. This method

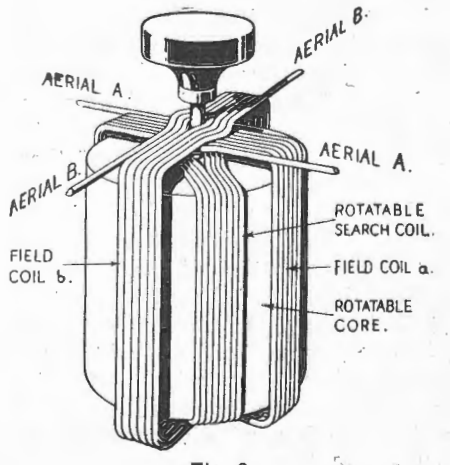


Fig 3.

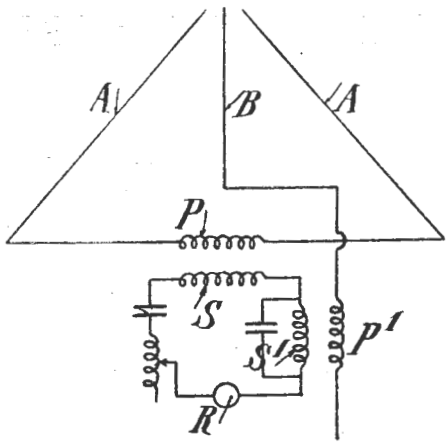


Fig. 4.

was not, however, as simple and practicable as the Marconi bent antennae.

In 1907, E. Bellini and A. Tosi obtained a patent for a very practical system of directive radiotelegraphy employing nearly closed loops. The aerial system was suspended from a suitable mast, and consisted of two wires, the upper ends being insulated and the lower ends connected to the transmitting or receiving instruments. The wires were stretched out to form a triangular loop. It is now well known that an oscillating circuit thus formed is capable of maximum radiation or reception of electro-magnetic waves when their direction of propagation lies in the plane of the loop, and minimum when at right angles to the plane. The radiation or reception qualities for other directions is shown in the figure-of-eight polar diagram L. Fig 1.

As the inventors point out in Commonwealth Patent Specification No. 10060/07 of the invention, loops of this nature would satisfy the requirements of fixed stations, but obviously if transmission or reception is required to be effected in all directions either the aerial loops must be constructed to rotate or a large number of them provided at each station. Both these methods are impracticable or inconvenient. The above Commonwealth Patent Specification of the invention of Bellini and Tosi describes a method of achieving this by employing two triangular loops fixed at right angles to each other as shown in Fig. 2. The bases of the two loops are connected each through a winding marked fild coil a and b.

When the loops are influenced by electromagnetic waves radiated from a transmitting station, oscillating currents will flow in each and through the respective field windings the intensity of each current depending upon the angle between the direction of the transmitting station and the plane of the loop. Each current flow will give rise to a magnetic field in the space limited by the field coils and produce a resultant field the direction of which will depend on the phasing and intensity of the two currents and consequently on the direction of the transmitting station.

For the purpose of ascertaining the direction of the resultant field a third winding termed a search coil is placed inside the field windings and pivoted to rotate as shown in Fig. 3. The search coil may be connected to a detector of electromagnetic waves, and if rotated continuously during the time the aerial loops are influenced by a transmitting station, two points 180 degrees apart can be found where signals will be received with maximum intensity, and another two similarly separated, but at right angles to the former where signals cannot be heard.

Directional transmission may also be carried out with such an arrangement by energising the search coil, the direction of transmission being varied at will by rotating the coil.

The foregoing is the basic feature embodied in the greater number of modern Wireless Direction Finders at present in use. Other methods involving the use of one or more rotating aerial loops supported on suitable frames also find application in particular circumstances, but the sphere of usefulness is limited by the space required, and time occupied in rotating the loops when rapid readings are required.

In 1908 Bellini and Tosi applied for and were granted a patent in Australia, No. 13912/09 for an important improvement in their system whereby transmission or reception can be carried out solely in one direction. Hitherto, waves could be transmitted in any desired direction, but radiation also took place in the diametrically opposite direction, figure-of-eight polar diagram L, Fig. 1. Similarly it was possible to determine the line along which the waves arrived at the receiving station, but not possible to ascertain the direction along that line of the transmitting station. By combining a uniformly radiating aerial system such as a vertical wire with the system of loop aerials shown in Fig. 2, they showed how signals may be transmitted to or received from any one point along a line passing through the vertical axis of the aerial system. The uniform transmitting and receiving qualities of a vertical aerial are shown by the circular polar curve, V Fig. 1, and those of the loop aerials by the figure-of-eight.

The vertical or uniformily radiating or receiving aerial is combined with the loop aerials so as to be substantially in their symmetrical axis and magnetically coupled to the receiving system S, SI, R, as shown in Fig. 4, which is reproduced from the patent specification. When electromagnetic waves act on this arrangement oscillating currents are pro-

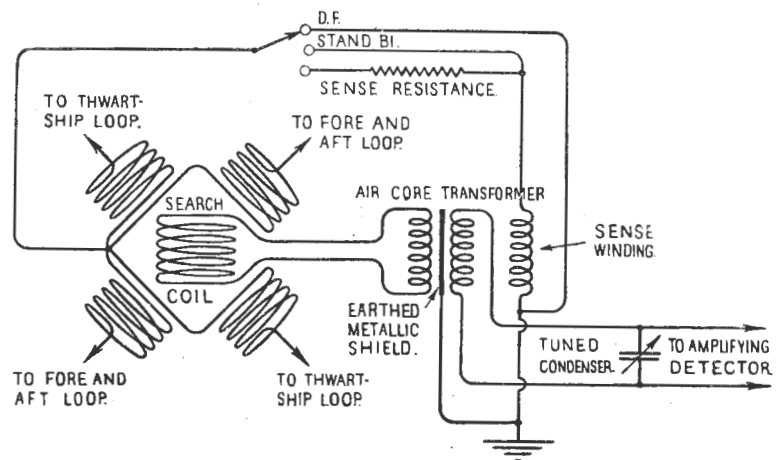


Fig. 5.

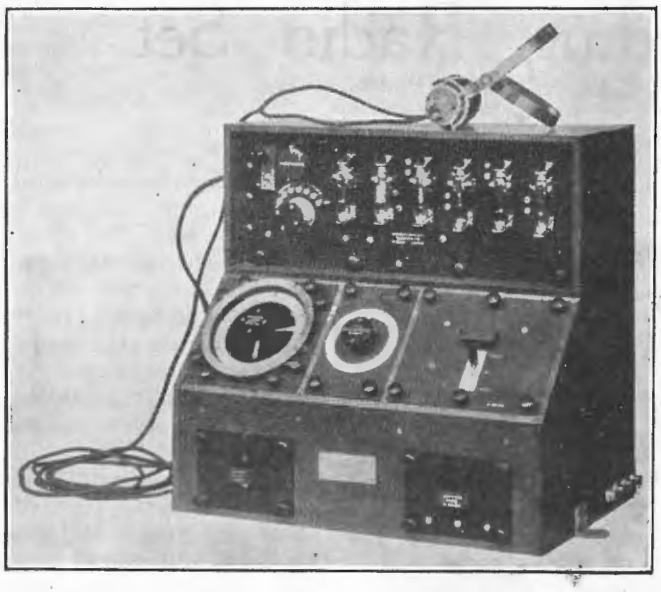


Fig. 6.

duced in each of the two aerials and act simultaneously on the receiver. If these two currents are equal in strength and in phase the signals in the receiver will be a maximum. If now a transmitting station is moved in a circle around the receiving system the intensity and phase of the current in the vertical aerial will remain uniform whilst that in the loop will have two maxima and two minima with a change of phase through 180 degrees. Therefore, if the two currents are brought into phase they add when the transmitter is in the plane of the loop on one side, and when completely out of phase neutralise if the transmitter is in the plane of the loop on the other side. The resultant effect is shown by the "Heart shape" polar diagram H in Fig. 1. If, therefore, the absolute direction of any one transmitting station is known or first ascertained, the absolute direction of any other unknown stations may be readily determined. The method of operation however, presented many practical difficulties owing to the necessity of very accurately tuning the aerials in order that the currents induced in each might bear the correct phase relationship.

This difficulty is readily obviated by a system of tuning invented in 1919 by H. J. Round and G. M. Wright, Commonwealth Letters Patent No. 15463/20 in which closed aerials having themselves no definite natural period are connected to field coils very closely coupled to the search coil. All necessary tuning of the aerials may then be made by varying a capacity associated with the search coil circuit. In order to obtain maximum coupling the search coil is made with as large a diameter as possible so that its windings and those of the field coils are brought so close together. Owing to the fact that the magnetic field produced by the field coils is not uniform, but is more intense in the neighbourhood of the conductors themselves, errors are produced with such an arrangement because when the search coil is rotated the law of coupling between it and each field coil does not follow the theoretically required sine law. In 1920 G. M. Wright devised a method for eliminating these errors employing a search coil wound in two sections displaced on the former by an angle of 45 degrees for which he was granted Commonwealth Letters Patent No. 1707/21.

In modern Direction Finders employing the Bellini-Tosi type of loop aerials, the vertical antenna is dispensed with and the loop aerial system itself earthed at the central point of each field coil as shown in Fig. 2. In the earth connection may be included tuning elements and the system will then possess the uniform receiving qualities of a simple vertical wire. By suitably coupling this circuit to the receiving circuit and introducing means for obtaining the necessary phasing of currents in the loops and earthed circuit the system will be capable of "Heart Shape" reception as previously explained.

Marconi's Wireless Telegraph Co. of London has extensively developed this system and produced a combination of apparatus free from the many defects which previously existed. The aerial loops are aperiodic and closely coupled to the receiving circuit for reasons already explained. Fig. 5 is a simplified diagram of the circuits. When the "D.F-Sense" Switch is in its upper position the search coil only is coupled with the receiver and the system possesses a figure-of-eight polar curve. To prevent any undesired influence on the receiving circuit due to the loops acting as a plain vertical aerial a shielded transformer is employed, the shield being interposed between the primary and secondary windings and connect-

Fig. 7.

ed to earth. This method is due to H. J. Round Commonwealth Letters Patent, No. 15163/20, and prevents any difference of potential occurring due to the capacity to earth of the aerial system. The centrally earthed connection of the field coils also assists in this direction.

When the switch is in its central position the earthed circuit as well as the search coil is coupled to the receiver, but owing to the better receiving qualities of the system as a plain vertical aerial, signals from any direction may be received. This provides a ready means for quickly searching for a station—the only operation necessary being the tuning of the receiver circuit. The third

An Expanding Radio Set

By C. W. MANN

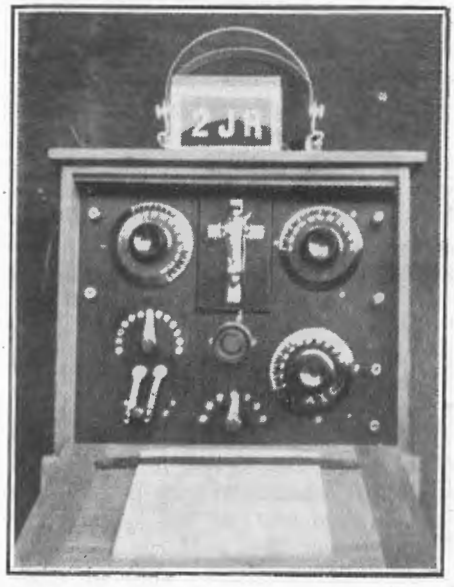
I HAVE chosen the above name as befitting a set which has been built up from very modest proportions. One sometimes wonders why the average man takes up wireless as a hobby, but no doubt there are many reasons. In my own case profession and taste were the guiding forces, and an inspection of the very fine exhibition staged by the Metropolitan Radio Club finally decided my action. I chose an "Expanse" loose coupler and a pair of Brown's 'Phones, and commenced the formidable task of erecting two 35 feet masts from which to drape my aerial. In doing this I gained an experience which may be useful to others, and hence it is passed on. To obviate the swaying of the spreaders which, in my own case, was accentuated by the strong winds prevailing at the time, I erected the aerial I attached a light line of picture cord to each end of the spreader and secured it at the base of the mast. On windy days this can be tightened and will effectively prevent all swaying of the spreader and pole. My aerial consists of four wires 150 feet long, and on account of the excellent results obtained I can recommend this size.

I commenced with a galena crystal, and nearly all my best results have been obtained by using galena with a "catwhisker," consisting of a single strand of flex soldered to a short length of No. 22 bare copper twisted into a spiral. My experiences in crystal work have been very interesting. Out of the many crystals I have collected during geological research work I tested some thirty or forty, and achieved many interesting results. I found that for good all-round work galena was unsurpassed. Molybdenite is a valuable rectifier, giving loud and clear signals when used for short distance reception; but not of great value for distanes over a hundred miles. Bornite alone and with zincite gave good results, cuprite rather poor, while the results from magnetile, iron pyrites and silicon were very good. It would be interesting to secure a classified list of results which have been obtained using a large unmber of crystals, and

Mr. C. W. Mann, and—

I would recommend the classification to some enthusiast.

On my crystal set Melbourne and Adelaide time signals are heard with remarkable clearness, and Awanui is frequently picked up. Brisbane is also heard strongly. On one occasion,while using only the aerial and earth connections with 'phones and detector in series, I heard VIS working VHN (s.s. *Katoomba*). With the loose coupler VIS has been read at a distance of 27 feet from the 'phones. During the period mentioned Mr. Charles Maclurcan (2CM) and Burwood Radio (2IX) were the only amateurs regularly transmitting, and they were heard quite plainly at a distance of over six miles, while occasionally we were given a treat by Amalgamated Wireless Ltd.



—his Set.

The experience in tuning gained on a crystal set has been of very great assistance to me, and the expense of the loose coupler has been fully justified . He is a wise dealer who sells us a crystal set when our ambitious selves long to use Armstrong's Super Circuit.

My first attempts at valve set construction were probably as humorous as those of many other amateurs. The loose coupler, good as it was for crystal work, was not a success as the primary and secondary in a valve circuit. One of my experiences is worth repeating. I completed the wiring of the circuit and placed the valve in the socket and stood by. I soon heard 2IX "testing" and later some music from a phonograph. I then left the set and next morning heard VIS working ships. During the next three weekks I heard nothing. I tightened up the wires, tested every connection, blamed loose coupler, condenser, etc., until nothing remained to adjust or to curse. A new valve solved the trouble. In the old valve the grid and filament touched. I had been blinded to its fault by the fact that signals had once come through normally. The moral is: "Do not always blame the wiring or the circuit." Test every new circuit with at least two separate valves, preferably of different types. After burning out one valve I learnt that it was a fairly safe procedure to invert a voltmeter between the filament prongs of the set before replacing the valve. Always remove the valve when you feel inclined to make any alteration in the wiring, and be careful to insulate the high tension leads with rubber tubing.

I soon discarded my first valve set, and designed and built one which I

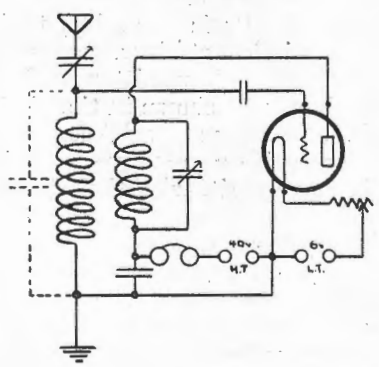
think combines compactness with efficiency. There is much to be said for the set which rambles over one's desk. The leads are plainly seen and a new circuit can be tried easily. There is usually a tendency, however, to loss of efficiency owing to the capacity effects which are created by the wandering leads. Occasionally one sees a set which fills a small room, but it is questionable if the ability to effect a change of circuit connections quickly and easily compensates for loss of efficiency due to the loose ends. I do not hold that a compact and even portable set combines every advantage, but a glance at the photograph will, I think, reveal at least a few advantages of the compact and portable type.

In making my set I kept closely to the old adage: "Plan your work and work to your plan." Get all your material on your bench and then you can have a straight run at the construction. The whole time occupied in making my set—including the cabinet—was six hours. The set measures 12" by 10" by 9", and is mounted on ¼" ebonite with nickel-plated fittings throughout.

It is a good plan to use the rule and compass freely—the results will amply justify it.

To construct such a comparatively small set one would have to use a Varicoupler or variometer. My varicoupler is wound with No. 26 D.S.C. on the primary, and No. 30 D.S.C. on the secondary. Thirteen tappings on the primary control the inductance and a beautifully smooth-working rotor tickles the primary inductance.

The tuning is very critical and fine, but is easily controlled. On wave lengths from 400 metres to 2,500 metres the capacity effect is not great. The secondary is a periodic and gives good results. In the matter of building the variocoupler I think a few words would not be out of place. Of course, the winding and assembling is mainly the same as for any coils. To attach to the panel I first inserted the studs in the panel and attached to each a piece of rubber-covered flax about six or eight inches long. The coupler was then secured in position with a couple of nickel-plated screws , and the loose flex drawn tightly, each to its respective tappings and soldered. Do not use killed spirits; fluxite will do, but a solution of resin in methylated spirits will make a better and more lasting job. The rheostats and condensers were then attached to the panel and the wiring completed. The constructional details are similar to those encountered in making other valve



sets, and offer no difficulties which cannot be solved by the average intelligent amateur as they arise.

The primary coil is 10.3 c.m. in length, allowing 140 turns of No. 26 D.S.C. wire, giving an inductance value of 1,522,582 c.m.'s The primary condenser (c.i.) has a value of .0012 M.F., and this, in conjunction with the inductance, gives a maximum wave length of about 2,500 metres. I have used Radiotron, Myers' Audion QX valves, and others and find that the results obtained with the Q.X. were far superior to those obtained with any other valve. All Australian stations have been copied with ease, and I consider it a greater test to copy VIP or VIN on 600 metres than to read NSS or NPM on higher wave length. I would suggest to the amateur who wants to find the range of his set that he listens in for the time signals which are always sent by VIM at 12 o'c.a.m., VIA at 12.30 a.m. and VIP at 1 a.m. (Sydney time).

Sydney telephony has been heard even away from the 'phones, but this is a minor consideration. Many amateurs insist that the test of a set is the fact that a concert can be heard at the front gate or down the street, while neglecting the fact that clearness and medium signal strength is the end to be attained in telephony. My log shows, among other stations, 2BB, 2CM, 2DK, 2FA, 2IX and 2LA. The set on one occasion had no less than seven head sets attached and signals were loud, in fact, no weakening was noticed at all. I can recommend the circuit and the panel design to any amateurs who want to construct an efficient and compact set. The panel has a couple of features which make for efficiency. The door is made to drop in front and the panel is set back a couple of inches to allow the door to close when the set is not in use. When open the door makes a good writing desk for copying signals into the log. The door at the back is fastened by two dowels and a catch, and can thus be entirely removed to allow one to have a greater freedom of movement when working on the set. There are perhaps many details and explanations which I have left unwritten, but I shall be very pleased to assist any amateur in the construction of his set if he will cammunicate with me, c/o. The Editor of *Radio*.

Waverley Amateur Radio Club

At the usual meeting held on May 3 the question of affiliating with the Radio Association of New South Wales, which had been postponed from a previous meeting, was discussed. Mr. Perry advocated joining up with the Association, while Mr. Burrows emphasised the necessity of coming to a decision one way or the other. Eventually it was decided that while the Club was in sympathy with the Radio Association it could not see its way clear to affiliate at the present stage.

The meeting appointed Mr. A. Burrows as publicity officer to look after the Club's press reports.

Wireless Telephone "Call"

Transmitter and Receiver

HITHERTO one of the greatest obstacles to a more extended use of the wireless telephone has been the necessity for maintaining a continuous watch at the instruments during those periods when communication is expected or desired, means being lacking whereby, as in ordinary telephone practice, a station could be "rung up."

This problem has been solved by the introduction of the Marconi Wireless Bell, recently placed on the market by Amalgamated Wireless (Australasia), Ltd. It is an automatic device operated by a distant transmitter, and performs in a simple and efficient manner the same function as that of a call bell on the ordinary land line system.

It has been designed so that each instrument is insensitive to all signals except those actually intended to operate it, and, in addition, it enables every wireless set with which it is incorporated to call up as many as five different stations on the same wave length, even in congested areas. Furthermore, an additional adjustment enables still other stations on different wave lengths to be called up, these being selected as quickly and efficiently as the first five.

The device is intended for use ir conjunction with any standard type of portable and semi-portable installation, and one of the accompanying illustration shows the apparatus installed in conjunction with a standard set.

The principle is to transmit a signal of definite duration on a specific wavelength, this signal being produced by modulating the outgoing wave at a steady low frequency note. This note is varied by a five point "frequency changing" switch, thus providing the means of calling up any of the first five stations previously referred to, five being in like manner obtainable on each wavelength within the range of the main transmitter, by means of the "frequency changing" switch.

It will thus be seen that by combinations of wavelength and frequency changes an almost infinite number of calls is available, to intergroup wireless stations.

The "Call" Transmitter is fitted in a teak box, as shown in the photograph, and forms a self contained unit, comprising a valve and its oscillatory circuit, with the addition of a fixed resistance to cut down the high tension supply if necessary.

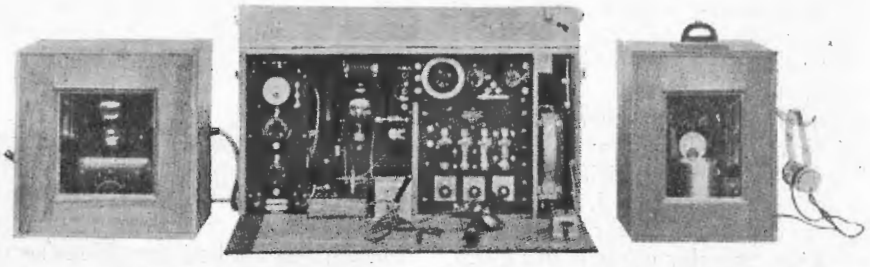
The valve circuit produces low frequency oscillations, the frequency being varied by adjusting in five steps the value of the capacity, which is made up of a series of five condensers, each led to a point on the switch.

ranged as to start moving when the signal commences, i.e., when the handle is actuated, and to complete its travel, thus cutting the circuit, at the end of the allotted period. The magnet then ceases to be energised and the handle reverts to its original position.

The "Call" Receiver, as will be seen from the photograph, is also a self-contained unit.

It consists of two receiving valves with auxiliary circuits and condensers, for amplification and tuning of the incoming call signal; a reaction transformer increases the sensitivity and the signal passes through a galvanometer and two relays to a bell.

In practice, the incoming signal is first received in the usual way by the Main Receiver, the telephone terminals of which are connected to



Portable Wireless Telephone-Telegraph Station, fitted with Marconi Wireless Call Bell. Centre: Instrument Box, Main Transmitter and Receiver. Right: Wireless "Call" Receiver. Left: Wireless Call Transmitter.

This arrangement is connected to the high tension supply of the oscillating valve of the main transmitter and thus the out-going oscillations are modulated at a frequency determined by the control of the low frequency valve.

The call apparatus is set in motion by pulling down the handle seen on the illustration, the handle being held in this position by an electro magnet. The circuit of the latter passes through a dashpot, so ar-

the primary of a variably coupled transformer, the secondary forming the grid circuit of the first valve of the "Call" receiver. This circuit is very accurately tuned by means of the variable condenser to the particular note frequency allocated. The plate circuit of this first valve is inductively coupled to the grid of the second one and also contains a grid condenser and leak together with the secondary of the reaction transformer. Note frequency tun-

ing is accomplished at this stage by another variable condenser.

The anode circuit included a small galvanometer and the windings of a G.P.O. Relay, connected to another dashpot.

Owing to the presence of the grid leak the second valve normally allows the passage of sufficient current to hold over the tongue of the relay against the "dead" stop. The reception of a signal, however, renders the grid so negative as to reduce the current through the valve. This reduced current is no longer sufficient to hold over the tongue of the relay, which consequently passes to the other stop, thus immediately completing the circuit through the dashpot relay. This dashpot is timed in the same manner as the one which controls the duration of the signal at the transmitting end, and once set in motion by the G.P.O. relay, it completes its travel and operates the bell.

It will be seen that only those signals sent by the "Call" transmitter can operate the "Call" receiver and ring the bell.

The telephones are hung on the rest provided on the extreme right of the "Call" receiver, this automatically putting the latter in a stand-by position ready for registering a call.

To effect the call, the Send-Receiver switch of the main set at the transmitting end is placed in the Send position (i.e., to the left) whereupon the valve set starts oscillating. The handle of the "Call" transmitter is then pulled down to its full extent and released. From this point onwards the operation is automatic, as the handle is restored after the required period has expired, this being determined, as explained above, by the transmitter dashpot.

At the receiving end, the call bell is set in motion and continues to ring until the telephones are removed from the rest, whereupon the "Call" receiver will automatically be put out of action and its valves extinguished.

The far-reaching importance of this new development needs little further emphasis, especially in its application to a network of stations. Suffice it to say that by effecting a saving in stand-by charges and materially adding to the convenience of operation, it leads as a natural sequence to a far more practical and extensive use of wireless telephone services.

My QRN Party.

It was nice to keep a-tunin'
With the nabors sittin' round;
They came to hear the music,
But I couldn't get a sound,
'Cept the demons of perdition
That were floating in the air;
It seemed their boss was with 'em,
And they were everywhere.

They made my heart beat faster
When I thought they were so near,
And I cussed the poor broadcaster
Because I couldn't hear.

With their growlin's, squakin's, squealin's,
I could hardly keep my chair,
For, regardless of my feelin's
They taught me how to swear.

I hate to meet my nabors
When I am out alone,
For they are sure to twit me
About my radiofone.
There's little satisfaction
While Satan's 'lowed to roam,
'Till someone takes some action
To keep his imps at home.

When they are on vacations
We are as happy as can be,
For the people of all nations
Can hear sweet melody.
There's nothing I can mention
That keeps me closer home,
And takes so little attention
As my little radiofone.

MANLY (N.S.W.) RADIO CLUB.
Flashlight Photo of the Manly and District Radio Club, showing a section of the audience present at a Lecture delivered by Mr. W. Best, of the Wentworth Radio Club.

The Experimenters' Corner

A Storage Battery for the Dry Cell Valve.

THE Marconi D.E.R. valve is gaining in popularity every day because of its efficient operation from a single dry cell and low current consumption. The only disadvantage is the cost of the renewals of the dry cell and noises produced when it approaches exhaustion. This need trouble experimenters no longer, for the problem can easily be overcome by constructing the small storage battery described below.

Obtain an old positive and negative plate from a discarded accumulator, and cut a strip from each which includes two complete sections holding the paste in place. A hack saw will do to cut the plate, as the material is fairly soft. Now take a piece of lead sheet about 4½in. long and ½ an inch wide, and burn it to the top of the plate. This connection must not be soldered, because of the subsequent electrolysis which will taken place when it comes in contact with the acid of the electrolyte. This is an easy job if tackled as follows: The material required is a small mouth blow-pipe, as used for "dry" analysis purposes in chemical work, and a small quantity of fluxite. Clean the portions where the lug and plate make contact by scraping with a knife, and warm up. Apply a touch of flux and continue until the lead melts and runs together. A fair amount of skill is required to perform this operation successfully; therefore, preliminary experiments should be carried out on some scrap material before tackling the actual job. Stearine from an ordinary household candle will do for a flux. The size of the containing jar depends upon the length of the plates and should be chosen accordingly.

An ebonite top should be fitted with the lugs projecting about one and a half inches, and terminals fitted thereto. A small lead pin about one-eighth inch in diameter should be passed through each lug where it projects from the cover, to provide a support for the plates underneath For the electrolyte use special battery acid with a specific gravity of 1.200.

The capacity of this battery will be in the neighbourhood of 3 amp hours and it can be charged conveniently by using the electrolytic rectifier described in the previous issue of "Radio." Regulate the current tc about 0.5 amperes when charging.

Loud Speaker Suggestions.

No live experimenter is satisfied until he has been able to so amplify the received signals until they are audible all over the room, and further, if possible.

Everyone is not fortunate enough to possess a Magnavox or other type of special loud-speaking apparatus, and so the ordinary head telephones are requisitioned for this purpose.

An excellent substitute is a receiver from a Baldwin Mica Diaphragm head set. After a certain stage of amplification has been reached it will be noticed that the receiver begins to rattle a little and distort the music or speech being received.

The receiver construction is such that the entire magnet system and diaphragm are supported by an aluminium frame work, and are kept clear of the sides and bottom of the case. When the signal energy reaches a certain point, the movement set up is so great that the whole of the magnet system and frame work are set into vibration, with the result that the mica diaphragm rattles. To prevent this disagreeable effect taking place, cut several pieces of felt to the same diameter as the inside of the receiver case, and place sufficient inside until the frame-work barely rests upon the edge of the case when it is inserted therein. This reduces abnormal vibration owing to the damping effect of the felt washers, with the result that interference with the weak impulses transmitted to the diaphragm proper is cut.

Very often this type of receiver will fail to give its usual volume of sound. If this takes place remove it from its case and inspect the small space between the armature and the permanent magneto. At times a small piece of iron filing or other foreign matter works its way into this space and interferes with the freedom of movement of the armature. Cut a piece of paper about a quarter inch wide and several inches long, and work it back and forth along the armature until you are unable to detect any loose matter which would be likely to interfere with the successful operation of the unit.

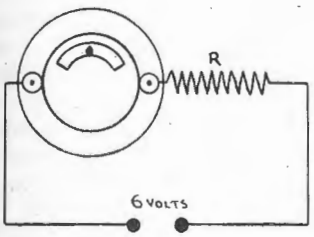
An old gramophone horn should be adapted for this loud speaker, or failing this, the reproducer on the tone arm of an ordinary cabinet type gramophone can be removed—temporarily, of course—and the telephone receiver clamped in its place with several rubber bands.

In general, if you obtain good clear signals in your detective valve circuit with an ordinary headset, the same quality may be expected from the loud speaker, even with two to three stages of audio frequency amplification.

Meters for the C.W. Transmitter.

In the bad old days when spark transmitters were the fashion in experimental circles the only meter, if any, found on the average station was one of the hot wire type for measuring the aerial radiation current. With the advent of the C. W. Transmitters precise measurements of the voltage and current supplied to the valves is essential if they are to be operated intelligently.

The cost of special meters is a considerable item, but if the following suggestion is followed the money



E.C.

saved can be used for purchasing additional tubes or other apparatus.

In all motor accessory shops small dashboard meters can be obtained very cheaply. Obtain one of these which will read to about 10 amperes and remove the shunt from the two terminals at the back. It will now give a full scale deflection, with only a small fraction of the original current. To recalibrate it connect it up in series with a known resistance and a 6-volt storage battery. The value of the resistance must be such that the deflection is confined within the limits of the scale. Suppose the meter gives a deflection of eight divisions when the value of the series' resistance is 150 ohms, this will correspond to a current of 40 milliamperes, and the sensitivity of the meter, therefore is 5 milliamperes per division. Shunts can be fitted to the meter to make it read multiples of this value. For use as a volt meter connect up the battery, and a variable high resistance, as will be described in Mr. Reed's article in our next issue. Adjust this resistance until the meter reads 6 divisions. It will now read directly as a voltmeter. For higher values of voltage additional resistance will have to be used, in proportion to the increase desired. Eureka wire of No. 36 gauge should be used to wind these resistances. Its resistance is, approximately, 15 ohms per yard. If possible, calibrate the meter against some reliable standard.

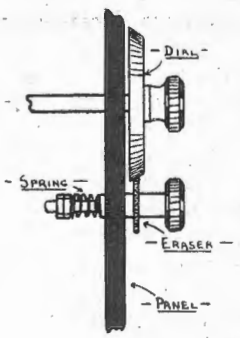
Simple Method of Making Varnished Tubing.

Recently an amateur required some varnished tubing, and being unable to secure any at the moment, tried the following experiment:

He purchased from a nearby store one dozen soda straws. These he placed i na pan of varnish to soak for three hours, after wheih he was careful to see that the varnish dried in an even manner. They were then cut to the proper length with a pocket knife.

A Vernier Adjustment For Dials.

The satisfactory reception of short wave experimental stations requires very accurate tuning, and it is often found that the adjustment obtained by means of the dials on the tuning elements is too coarse. An excellent vernier adjustment is illustrated below. Obtain a switch assembly from which the contact blade must be removed, and in its place a circular typewriter rubber fitted. Drill a hole under the dial for which the vernier



adjustment is required. The exact location of this hole depends upon the size of the rubber, and must be determined by the experimenter himself. When the vernier attachment is fitted to the panel the rubber must bear about one eighth of an inch up the bevel of the dial. The spring "C" allows the tension of the eraser on the dial to be adjusted. The pressure must not be heavy or the adjustment will be too stiff. Fit one of these simple devices to your condenser and variometer dials, and get the best out of your set.

A SERIES OF ARTICLES

written expressly for the raw beginner who is anxious to gain a knowledge of wireless experimenting, simply and quickly, will begin publication in "Radio" at an early date. Watch for them.

Technical Terms
Used in Wireless

Aerial.—A system of conductors insulated from and suspended above the ground, designed to radiate or absorb energy in the form of ether waves.

Alternating Current.—An electrical current flowing in a conductor, which reverses its direction periodically with time, the "periodic time" being the interval between two successive maxima of current in the same direction. A 50-cycle alternating current is therefore one which completely reverses its direction of flow 50 times per second.

Ammeter.—An instrument used for measuring the current flowing through a given circuit. An ammeter should always be connected in series in the circuit.

Ammeter, Hot Wire.—A meter dependent for its indications upon the change of dimensions of an element which is heated by a current through it. In most cases the expansion of the wire is measured by the alteration in the amount of sag. This type of hot wire ammeter is extensively used in radio transmission work.

Ampere.—The standard electrical unit of current, and is that current which flows through the circuit of one Ohm at a pressure of one Volt.

Amplifier.—An instrument designed for the amplification of radio or audio frequency oscillations. In a valve amplifier for radio frequency amplification air core transformers are commonly used as the inter-valve connections, whilst for audio frequency iron core transformers are commonly used.

Amplitude.—The maximum value of current or voltage attained during any half period of an alternating current or voltage is called the amplitude during that half period.

Antenna.—See Aerial.

Atmospherics.—Natural electrical discharges occurring in the ether, which produce disturbances in receiving circuits. They are also known as: "X's," "strays" or "parasitic signals," and sometimes "static." These discharges are propagated through the same medium as radio ether waves and are therefore readily picked up by receivers. At times they are very troublesome, and it is comparatively difficult to tune them out, inasmuch as they have no definite wave length.

Audio Frequencies.—Frequencies corresponding to vibrations which are normally audible to the human ear. These are assumed to lie below 10,000 cycles per second.

Broadcasting.—The radiation of ether waves in all directions used for the purpose of conveying intelligence either by radio telegraphy or telephony from a given central point for the benefit of a large number of receiving stations located within range.

Capacity.—That property of a material system by virtue of which it is capable of storing energy in electro-static form. Capacity is measured by ratio of the quantity of electricity stored to the potential difference at which it is stored. Capacity, as well as Inductance, is a factor which determines the time period and wavelength of a circuit. The unit of capacity is the Farad, but this is too large for practical purposes, thus a sub-unit, the Micro-farad, is used, which is one millionth part of a Farad.

Cascade Amplification.—A method of amplification of radio signals employing several valves joined in cascade or series.

Choke Coil.—A coil possessing great self-induction, which introduces a choking action in an alternating current circuit.

Circuit.—A path in which an electric current flows from the source and returns to it. A circuit may be either open, closed or oscillating.

Coupling.—The action between two circuits enabling energy to be transferred from one to the other. The connection may be by magnetic linkage, electro-static linkage, direct connection, or any combination of these.

Condenser.—A material system possessing electro-static capacity. Two conducting surfaces separated by a dielectric. Condensers are used in radio work for storing electrical energy, and for bringing circuits into a condition of resonance or tuning them.

Counterpoise.—A system of electrical conductors forming one portion of a radiating oscillator, the other portion of which is the aerial. It consists of one or more wires suspended on insulators immediately above the earth and usually directly beneath the aerial.

Continuous Waves.—The term applied to undamped waves radiated from an aerial system in which oscillations are sustained. The continuous waves make possible signalling over longer distances than can be covered by the older form of discontinuous or highly damped waves.

Crystal Detector.—A detector which uses the rectifying properties of the contact between a crystal and a metal surface or between two crystals.

Detector.—A device which translates the high frequency energy into an intermittent direct current suitable for operation of a telephone receiver or indicator.

Direct Current.—An electric current flowing continuously in one direction. Direct current always flows from the positive source to the negative return in a two-wire circuit, and therefore has a readily determinable polarity. Alternating current which is periodically reversing its polarity while flowing through a circuit has no apparent polarity.

Earth.—The connection to the earth which in most systems forms the lower extremity of the aerial system. It usually consists of a system of metal plates or wires or combination of both metallically connected together and more or less deeply buried in the ground.

Electron.—The natural unit of negative electricity. An atom combined with an electron is a negative ion, whilst an atom minus an electron is a positive ion.

Electro-Motive Force.—The force which tends to displace electricity, and is equal to the difference of potential between the points considered. The unit of Electro-Motive Force is the Volt.

(To be Continued.)

Condenser as Waiting Room for Electrons

We all know what a condenser is—two sets of metal plates insulated from one another. But what is it in terms of electrons—those tiny specks of negative electricity which are so useful in vacuum tubes? The answer to this question is given in the following article prepared by John Mills, former professor, author and engineer of the Western Electric Company.

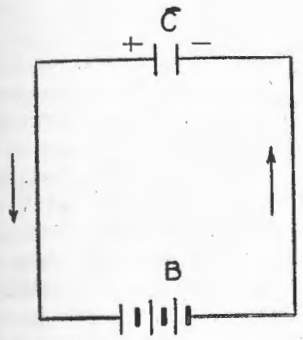


FIG-1

A condenser is merely a gap in an otherwise conducting circuit. It is a gap across which electrons cannot pass so that if there is electro-motive force in the circuit electrons will be very plentiful on one side of the gap and scarce on the other side.

If there are too many electrons waiting beside the gap there must be room for them. For that reason we usually provide waiting rooms for the electrons on each side of the gap. Metal plates or sheets of foil serve nicely for this purpose.

Look at Figure 1. You see a battery and a circuit which would be conducting except for the gap at C. On each side of the gap there is a sheet of metal. The metal sheets may be separated by air or mica, or paraffined paper. The combination of gap, plates and whatever is between, provided it is not conducting, is called a condenser.

WHEN WE CONNECT A BATTERY.

Let us see what happens when we connect a battery to a condenser, as in the figure. The positive terminal of the battery calls electrons from one plate of the condenser, while the negative battery terminal drives electrons away from itself toward the other plate of the condenser. One plate of the condenser, therefore, becomes positive, while the other plate becomes negative.

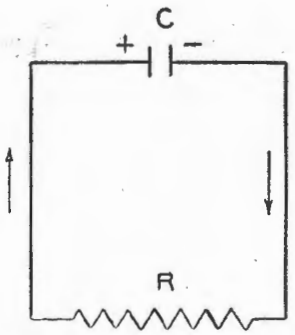


FIG-2

This action of the battery will go on until there are so many electrons in the negative plate of the condenser that they prevent the battery from adding any more electrons to that plate. The positive plate of the battery calls electrons away from the condenser plate, which is making positive, until so many electrons have left the protons that the atoms of the plate are calling for the electrons to stay home just as loudly and effectively as the positive battery-terminal is calling them away.

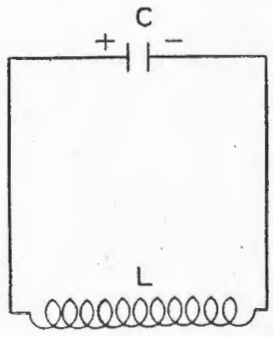


FIG-3

When both these conditions are reached—and they are both reached at the same time—then the battery has to stop driving electrons around the circuit. The battery has not enough electromotive force to drive any more electrons. Why? Because the condenser has now just enough electromotive force with which to oppose the battery.

WHAT IS THE CHARGING CURRENT?

We say that the battery sends a "charging current" around its circuit and "charges the condenser" until it has the same electromotive force. When the battery is first connected to the condenser there is lots of space in the waiting rooms, so there is a great rush or surge of electrons into one plate and away from the other.

Just at this instant the charging current is large, but it decreases rapidly, for the moment the electrons start to pile up on one plate of the condenser and to leave the other, an electromotive force builds up on the condenser. This electromotive force, of course, opposes that of the battery, so that the net electromotive force acting to move electrons round the circuit is no longer that of the battery, but is the difference between the electromotive force of the battery and that of the condenser.

WHY THE CURRENT STOPS.

And so, with each added electron, the electromotive force of the condenser increases until finally it is just equal to that of the battery, and there is no net electromotive force to act.

What would happen if we should then disconnect the battery? The condenser would be left with its extra electrons in the negative plate and with its positive plate lacking the same number of electrons. That is the condenser would be left charged and its electromotive force would be of the same number of volts as the battery.

THE ELECTRONS RUSH HOME.

Now suppose we connect a short wire between the plates of the condenser, as in Figure 2. The electrons rush home from the negative to the positive plate. As fast as they get home the electromotive force decreases. When they are all back the electromotive force has been reduced to zero.

Sometimes we say that "the condenser discharges." The "discharge current" starts with a rush the moment the connecting path is offered between the two plates. The electromotive force of the condenser falls, the discharge current grows smaller and in a very short time the condenser is completely discharged.

That's what happens when there is a short conducting path for the discharge current. If that were all that could happen I doubt if there would be any radio communication to-day, but if we connect a coil of wire between two plates of a charged condenser, as in Figure 3, then something of great interest happens. To understand you must know something more about electron streams in coils.

Erecting an Aerial

Receiving Purposes Only.—One wire of sufficient length, say, 100ft. or over, according to wave length to be received, of 3/20 copper is all that is needed for reception.

Height.—The higher the wire is suspended from earth and surrounding objects the better it will function.

Insulation.—This should be carefully attended to, as if any leakage to earth or objects connected to earth occur, naturally a considerable amount of the signal current shall leak down these instead of passing through the instruments to earth as desired.

Points of Suspension of Aerial.—These points may be either of the following: Masts, buildings, trees, chimney stacks, or any other isolated structure. Where trees and buildings are used the aerial must be swung clear of these by at least ten feet.

Masts.—These may be of steel, iron, galvanized iron piping. The general type of amateur mast is a sectional wooden type.

Mast Erection (Wood).—It is advisable to have the first section of fairly heavy timber, say 6″ by 6″ and of oregon, the second section 4″ by 4″ and the third 3″ by 3″. The length of each section should be about 30 feet. Each lap being 6 feet and the ground pole 3 feet in the ground, this would make a height of 27, 24, 24 = 75 feet. Each lap should have two iron bands shaped so as to accommodate the two different sizes of the poles; these bands should be split so as to take up any slack in the band by tightening up nuts. Band should be 3″ wide and $\frac{3}{8}$″ thick, with a lug on each face for the four stay wires.

Wireless Aid to Injured

How Sufferers are Relieved at Sea

Those fortunate enough to possess wireless receiving sets are frequently able to gather information of interest to the world at large.

The nightly practice of "listening in" often yields results quite unlooked for, and incidentally gives an insight into the valuable link which radio is slowly but surely forging around the world.

One evening, quite recently, an experimenter in a Sydney suburb was sitting with the 'phones glued to his ears when he picked up a message from the s.s. *Wodonga,* which had left Sydney that day bound for Brisbane.

The vessel was asking Sydney Radio Station to be advised of any ships with which she could communicate to obtain medical advice, as an accident had happened to a member of her crew. Sydney Radio immediately broadcasted a message telling of the *Wodonga's* requirements, and asking any ship with a Doctor on board to communicate with her direct. The Huddart Parker steamer *Ulimaroa,* nearing New Zealand, received the call and immediately established communication with the *Wodonga.* An exchange of messages followed in which symptoms of the injured man were explained to the Doctor on the *Ulimaroa,* and he in turn advised the treatment to follow. This was immediately flashed back to the *Wodonga,* and presumably just as speedily carried out.

After the incident had closed, the experimenter who had unwittingly listened to the passing of messages which contained all the elements of a first-class effort at life saving, leaned back in his chair and visualised what he had heard. On the one hand, he saw a vessel steaming north, and, in one of her bunks lay an injured man.

A fall over a doorstep, simple enough in itself, had resulted in an injury which would unquestionably grow worse as time went on, and without proper attention might even prove fatal. An anxious skipper recognised that it was beyond him to render the skilled attention which the man obviously needed—and he had no doctor on board. Rapidly he made up his mind. The wireless officer was instructed to call up Sydney Radio and ask the whereabouts of a ship carrying a doctor. Within a space of time that scarcely extended to minutes the operator received a reply. It came from a ship well over a thousand miles away—the *Ulimaroa* on the last night of her run from Sydney to Wellington (N.Z.). A moment after that vessel received the message from Sydney Radio her operator was in touch with the *Wodonga,* and in the next few minutes with the doctor at his elbow, he gleaned all the information necessary to enable the medical man to prescribe treatment which was flashed back on the instant.

To the sufferer on the *Wodonga* that advice was of great moment, since it gave him a chance of relief which would otherwise have been impossible.

All those on the ship who learned of the incident paid outspoken tributes to the wonderful wireless which had thus added still further to the debt of gratitude it is gradually piling up against mankind.

TRANS-PACIFIC TEST.

The following is a complete list of New South Wales competitors in the Trans-Pacific Test, which has been in operation during the past fortnight:

Messrs. C. D. Maclurcan, W. H. Hudson, J. Spencer Nolan, R. J. Sharpe, S. V. Colville, R. C. Marsden, E. B. Crocker, F. T. S. O'Donnell, E. T. Vears, A. V. Graham, H. A. Warden, C. K. MacDonald, C. S. Mackay, E. R. Mawson, R. H. Fry, C. A. Gorman, R. H. Webster, W. M Allworth, H. A. Stowe, W. J. Rowland, J. H. A. Pike, Waverley Amateur Radio Club, Leichhardt and District Radio Society, Western Suburbs Amateur Wireless Association, Burwood Radio Club (Calibration Tests).

Call Letters

This is the fourth list of call letters of Australian and New Zealand ship and land stations. In subsequent issues of "Radio" further lists will appear, all of which should be preserved so that readers will have a complete list of both local and overseas stations.—Ed.

V X R s.s. *Moorabool*
V X S s.s. *Yarra*
V X T s.s. *Delungra*
V X U s.s. *Dinoga*
V X V s.s. *Dumosa*
V X W s.s. *Dundula*
V X X s.s. *Mackarra*
V X Y s.s. *Macumba*
V Z A s.s. *Camira*
V Z B s.s. *Makambo*
V Z B C s.s. *Komura*
V Z B D s.s. *Koonda*
V Z B F s.s. *Melbourne*
V Z B J s.s. *Hexham*
V Z B K s.s. *Gabo*
V Z B L s.s. *Poolta*
V Z B M s.s. *Era*
V Z B N s.s. *Omana*
V Z B P s.s. *Coolana*
V Z B Q s.s. *Warspray*
V Z B R s.s. *Moreton Bay*
V Z B S s.s. *Largs Bay*
V Z B T s.s. *Koolonga*
V Z B U s.s. *Maindy Lodge*
V Z B W s.s. *Hobsons Bay*
V Z C s.s. *Cantara*
V Z D s.s. *Dilkera*
V Z E King Island Radio
V Z F s.s. *Junee*
V Z G s.s. *Governor Musgrave*
V Z H s.s. *Karuah*
V Z I s.s. *Kadina*
V Z J s.s. *Lammeroo*
V Z K Morobe Radio
V Z L s.s. *Nardoo*
V Z M s.s. *Carina*
V Z N s.s. *Tarcoola*
V Z O Manus Radio
V Z P s.s. *Australpool*
V Z Q s.s. *Australcrag*
V Z R Kaeweing Radio
V Z S s.s. *Australpeak*
V Z T s.s. *Australport*
V Z U s.s. *Urilla*
V Z V s.s. *Calulu*
V Z W s.s. *Australmead*
V Z X Eitape Radio
V Z Y s.s. *Australmount*
V Z Z s.s. *Marrawah*
W G E A s.s. *Easterner*
W H L s.s. *Ventura*
W H M s.s. *Sonoma*
W I S s.s. *E.R. Sterling*
X H O s.s. *Port Nicholson*
X H P s.s. *Port Bowen*
X H Q s.s. *Port Caroline*
X K V s.s. *Clan Macmillan*
X V M s.s. *Canadian Volunteer*
X V N s.s. *Canadian Trooper*
X V P s.s. *Canadian Trader*
X V R s.s. *Canadian Sailor*
X V S s.s. *Canadian Seigneur*
X V U s.s. *Canadian Signaller*
X V Z s.s. *Canadian Miller*
X W D s.s. *Canadian Adventurer*
X W E s.s. *Canadian Gunner*
X W G s.s. *Canadian Aviator*
X W H s.s. *Canadian Sower*
X W I s.s. *Canadian Settler*
X W J s.s. *Canadian Navigator*
X W K s.s. *Canadian Sealer*
X W M s.s. *Canadian Spinner*
X W N s.s. *Canadian Raider*
X W O s.s. *Canadian Rancher*
X W P s.s. *Canadian Planter*
X W Q s.s. *Canadian Importer*
X W R s.s. *Canadian Exporter*
X W T s.s. *Canadian Inventor*
X W U s.s. *Canadian Prospector*
X W V s.s. *Canadian Miner*
X W X s.s. *Canadian Farmer*
X W Y s.s. *Canadian Beaver*
Y G L s.s. *Port Darwin*
Y G M s.s. *Port Denison*
Y J O s.s. *Clan Maclaren*
Y J Q s.s. *Clan Macaulay*
Y T I s.s. *Clan Mackay*
Y U H s.s. *Eastern*
Y U S s.s. *Waimarino*
Y U Z s.s. *Hatarana*
Y W R s.s. *Berrima*
Z B L s.s. *Northumberland*
Z L T s.s. *Port Elliot*
Z L U s.s. *Port Sydney*
Z N Z s.s. *Port Napier*
Z P D s.s. *Port Lyttleton*
Z S U s.s. *Port Stephens*
Z S V s.s. *Port Pirie*
X S W s.s. *Port Melbourne*

Antenna

Generally Termed Aerial

What It Is.—A wire suspended between two points, above the earth electrically not in contact with these points.

What is Meant by Electrically Not in Contact.—Separated by an insulator. An insulator is a substance which does not offer a passage for electricity.

Insulator as used for separating the two points of aerial suspension is generally made of porcelain. These insulators are made in various shapes and sizes, but in all cases provision is made for attaching two wires which pull in opposite directions and are separated by porcelain.

Connection from Aerial to Receiving Apparatus.—When the nearest point of the aerial to the receiving apparatus is being fastened to the insulator do not cut off the remaining wire, twist it around the suspended wire and bring it straight to the receiver terminal marked "A," taking care that no object is left in contact with this wire. To bring it through, say, a window sash, a small hole can be drilled through the sash and a porcelain tube inserted, through which the wire can be taken into the room.

Earth Connection.—This connection should be made from the terminal marked "E" to the nearest water pipe, connection being made by means of a clip, which can be purchased for a few pence for this purpose.

Care should be taken that pipe be scraped clean with knife or file before clamping on clip. This wire does not need insulating or suspending.

If it be remembered that the aerial carries the electro-magnetic waves down through the receiver to earth, it will help to simplify the instruction below.

Stay Wires.—Four stay wires should be attached to one of the bands on each lap, and one on the top mast to a special band carrying aerial pulley and stay lugs. Wire to be used: 7/16 flexible galvanized steel

Movements of Wireless Officers

Mr. F. C. Davies who was relieved on s.s. *Mataram* by Mr. A. H. Jeremy, relieved Mr. C. F. Griffiths as senior operator of s.s. *Changsha* at Sydney on April 27.

Messrs. O. S. Kelly and A. C. Jackson joined s.s. *Changsha* as 2nd and 3rd operators respectively at Sydney on April 27.

Mr. E. M. Stearson signed off s.s. *Montoro* at Sydney on April 26.

Mr. L. G. Graham signed off s.s. *Waimarino* at Newcastle on April 25.

Mr. F. A. Noar signed off s.s. *Waikawa* at Newcastle on April 25.

Mr. N. W. Leeder who was relieved by Mr. A. G. Ross on s.s. *Zealandia* at Fremantle on April 27, is standing by to join s.s. *Gascoyne.*

Mr W. G. McEwan signed on s.s. *Age,* at Sunderland, on February 9.

Mr. G. Hugman relieved Mr. F. S. Stevens on s.s. *Bombala* at Sydney on April 24.

Mr. T. Laidlaw signed off s.s. *Australmead* at Sydney on April 24.

Mr. M. L. Robertson signed off s.s. *Gorgon* at Fremantle on April 23, and proceeded on H.P. leave.

Mr. K. J. Dines signed off s.s. *Moorabool* at Geelong on April 21, and returned to Sydney.

Mr. J. H. Bennett transferred from s.s. *Maori* to s.s. *Mararoa* at Lyttleton on April 13.

Mr. J. A. Guy, who was on s.s. *Iron Prince* when that vessel was wrecked, has now returned to Sydney.

Mr. A. C. Hickey signed off s.s. *Australplain* at Melbourne on April 14, and proceeded on H.P. leave on April 26.

Mr. W. H. George signed off s.s. *Australpool* at Melbourne on April 21 and proceeded on H.P. leave five days later.

Mr. C. J. Lilley signed on s.s. *Dilga* at Melbourne on April 27.

Messrs. J. E. Elmore and W. D. Wedgwood (senior and 3rd operators respectively) signed off s.s. *Parattah* at Sydney on April 30, and proceeded on H.P. leave.

Mr. H. Wormwell relieved Mr R. J. Webb on s.s. *Period* at Melbourne on April 13.

Mr. E. I. Hyde transferred from s.s. *Carina* to s.s. *Alabama* at Melbourne on April 27.

Mr. H. K. Wadsworth transferred from s.s. *Alabama* to s.s. *Carina* at Melbourne on April 26.

Mr. C. F. Griffiths relieved Mr. A. Cuthill as senior operator on s.s. *Montoro,* at Sydney, on May 2. Mr. Cuthill is now on H.P. leave.

Messrs. D. Soraghen and M. C. Wedgwood joined s.s. *Montoro* as second and third operators, respectively, at Sydney, on May 2.

Messrs. W. C. Smith and E. C. Bouel (second and third operators) signed off s.s. *Arafura* on May 2, and Mr. Smith is now on H.P. leave.

Mr. F. L. Scott signed off s.s. *Aramac* at Brisbane on April 27, and proceeded on H.P. leave.

Mr. M. G. Crockett transferred from s.s. *Eriba* to s.s. *Ellaroo,* at Melbourne, on May 1.

HIGH SPEED WIRELESS.

Further wireless facilities for passengers travelling between Europe and America on the giant White Star liner *Majestic* have just been provided.

A short time ago the *Majestic* was fitted with high speed transmitting apparatus, and high speed automatic receiving apparatus has now been added in order to facilitate the handling of the ever increasing number of wireless messages dealt with by this vessel.

Not only is the *Majestic* the largest ship afloat but she is also a favourite with business men. Her wireless traffic exceeds that of any other ship and special facilities are required to deal with telegrams expeditiously.

The high speed transmitting apparatus has proved of great value in despatching the large number of messages which are sent when approaching the United States; and the fitting of automatic receiving gear will be of still further advantage in enabling the ship to maintain its high reputation for the expeditious handling of telegrams.

Weather Reports by Radio

Service for Residents Outback

THE daily weather report, as furnished by the State Weather Bureau, will now be read:—

"A tropical disturbance is developing near Norfolk Island, and this, in conjunction with the high pressure influence, is likely to cause coastal rain during the next few days. The weather inland is fine, but a disturbance is approaching from the west, and good falls may be expected over the drought-stricken parts of the west and north-west during the next 48 hours. Disturbed seas will follow along the coast north of Sydney."

In a short time, perhaps, within the next six months, thousands of homes throughout Australia will be cheered or depressed, as the case may be, by the tidings conveyed to them by medium of their "listening in" sets when the Weather Bureau transmits its nightly forecast.

Anyone with experience of country life in Australia knows that no information is more eagerly sought after by country dwellers than the weather reports and forecasts, which under the present haphazard system of mail services reach them only a couple of times a week. Watch any farmer when he opens the newspaper, and it is any odds that his first glance will be at the weather forecast, which from an experience of what is most sought after, the country editor inserts in a most conspicuous place in the paper. Very frequently it happens that the information contained in that forecast is directly of considerable monetary value to the primary producer, and, indirectly, to the whole State. The farmers' greatest concern is not the operations of Wages Boards and the decisions of Arbitration Judges, but what the weather holds in store for them. When they are able to ascertain this fairly accurately, and at frequent specified intervals they are able to make plans accordingly. The sowing and harvesting of crops, shipping of produce, and numerous other preparations which only the farmer himself knows of are either solely or partially dependent on the weather. Many a time on the coastal rivers a shipment of maize or other grain has been left uncovered on the river bank overnight, awaiting the coming of the steamer the following morning. During the night rain has set in unexpectedly, and all hands had to tumble out of bed and put tarpaulins over the stack to prevent it geting spoiled. Very frequently it happens that much damage is done before protection can be afforded. In addition, a heavy fall of rain during the night has frequently caused rivers to rise suddenly, and produce left on the banks to be washed away. Similarly, too, valuable crops of hay have been damaged by a sudden fall of rain during the night. If the farmer had been apprised the previous day that rain was imminent he could have stacked the hay or carted it into his barn, and so saved the produce of perhaps many months' of labour and anxiety.

On still other occasions, mobs of cattle have been driven miles into other districts for fodder, and a day or two after the drought has broken. Here, too, the knowledge that rain was at hand would have saved the settlers considerable trouble and expense.

In short, radio telephony will prove an even greater boon to country residents than the ordinary telephone service does to the business community of the big cities. City dwellers are wont to wax sarcastic at the expense of the "weather man" when his forecast of a fine day induces them to undertake their usual Sunday outing minus coats and umbrellas, and they receive a thorough soaking for their pains. How much more important is it for primary producers to be furnished with the information which is vital to their existence.

At long last it appears as if the man on the land is coming into his own. The material effect which is certain to follow the inauguration of a wireless telephone service to country districts will be greater than can be foreseen at the present time. Although it will eclipse all other methods of communication in convenience and speed, radio telephony will be an adjunct to, rather than an antagonist of any one of them. The farmer will still look for his weekly or bi-weekly newspaper to keep him in touch with general happenings, and the telephone—where it exists—will still be utilised to ring up the neighbouring town for supplies of goods. But when night closes down and all the world seems to be at rest—as it does seem to be in the country—the farmer will pick up his receivers or adjust his "loud speaker" and the whole family will listen to the mystic voices coming from far-off Sydney or one of the other capital cities. It is in this way that radio will link up the cities with the "great outback."

Radiofun

At considerable expense we have made exclusive arrangements for the publication of "Radio Ralf's" adventures, which is one of our regular features. Hereunder is one of Ralf's adventures, and in subsequent issues of "Radio" his many thrilling experiences will be recorded, which we believe our readers will enjoy.—Ed.

RADIO RALF---

By Jack Wilson

Speaking of Radio.

Listening in has become the greatest indoor sport.

You can't judge a radio fan by the flatness of his ears. He may use a loud speaker.

Tune in with the infinite and forget the coal shortage and Mustapha Kemal.

The poor fish that swallowed Jonah must have suffered a lot of local interference.

If Edison ever sends one of his questionaires to departed spirits there will be great admiration above for the patience of mere mortals who have had to listen to so much similar broadcasting.

When man bought the Radio and added a loud speaker, his wife quickly got a divorce. She couldn't stand the competition.

There's more in the air these days than can be seen.

Jack and Jill went up the hill
And put up their "antenny";
Now every night, with music bright,
They entertain the many.

Radio.

Inland so deep all roaring waves are still;
So far at sea that dock lights long have died,
And there's no sound of any train or mill;
Across the mountains high and deserts wild,
Where arc lights flare, or candles softly glow;
Past harbours where ships lie with canvas furled;
From sunrise to the twilight's afterglow,
Man's puny voice is heard around the world.

Club Notes & News

WIRELESS INSTITUTE OF AUSTRALIA

N.S.W. DIVISION.

THE newly-elected Council of the above Division held its first meeting at the Wentworth Hotel on April 25, those present including Messrs. F. Basil Cooke, Vice-President (in the Chair), Crocker Renshaw, Maclurcan, Gregory, and Mingay.

The first business transacted was the election of a President for the ensuing year, and Mr. C. Maclurcan was unanimously chosen.

Messrs. F. Basil Cooke and Crocker were elected Vice-Presidents, Mr. P. Renshaw Hon. Secretary, and Mr. O. F. Mingay Hon. Treasurer.

By reason of the fact that Messrs. Renshaw and Mingay were then ex-officio members of the Council their resignation as Councillors was accepted, and Major Newman and Mr. S. Colville were elected to the vacancies. A full Council was thus constituted.

The Committee appointed to organise the Wireless and Electrical Exhibition in the Sydney Town Hall reported that it had been decided to postpone the exhibition for a few weeks in order to allow of a more successful result being achieved. There is no intention whatever of abandoning the display, and all concerned may rest assured that it will be held in the near future.

A discussion regarding the appointment of Honorary Radio Inspectors resulted in Mr. Maclurcan being nominated on behalf of the Institute to act as "transmitter station examiner."

QUEENSLAND DIVISION.

The annual general meeting of the above Division was held in the lecture room of the old Fire Brigade building about the middle of April. There was an excellent attendance of members, and keen interest was manifested in the proceedings.

The Annual Report and Treasurer's statement were read and adopted.

The following officers were elected for the ensuing year:—Patron, Professor Hawken; Vice-Patron, Professor Parnell; Honorary Members, Messrs. J. M'Conachie (Deputy Postmaster-General), J. W. Sutton (State Engineer), F. W. Walker (Deputy State Engineer), S. V. Colville founder of the Queensland Division); President, Mr. A. G. Jackson; Vice-Presidents, Messrs. C. W. Isles, A. K. Lawton, P. S. Trackson, S. H. Smith; Hon. Secretary, Mr. W. Finney; Hon. Treasurer, Mr. A. N. Stephens; Hon. Auditor, Mr. H. Maddick; Broadcasting Committee, Messrs. E. C. Littler, J. Milner, A. N. Stephens; Committee, Messrs. A. M'Leod, J. Milner, J. C. Price, and E. C. Littler.

BRIGHTON AND DISTRICT RADIO CLUB.

The first meeting of the Brighton and District Radio Club was held at 18 Willansby Avenue, North Brighton (Vic.) on Thursday, April 19. The attendance, though fair, was not quite up to expectations, but it is expected that the membership will be increased when the club's existence becomes more generally known.

The following office-bearers were elected: President, Mr. T. H. Crago; Hon. Secretary, Mr. W. Kerr; Hon. Treasurer, Mr. P. Thompson. It was decided as a temporary arrangement, and until other club-room provision can be made, to hold meetings at different members' homes every alternate Thursday.

All communications and enquiries concerning the club should be addressed to the Hon. Sec., W. Kerr, 28 Durrant Street, Brighton (Vic.).

MANLY AND DISTRICT RADIO CLUB.

An instructive lecture on "Valves" was delivered by Mr. Best, of the Wentworth Radio Club, at a recent meeting of the above Club.

Mr. Best attended at very short notice but despite this his lecture was most interesting and helpful to those anxious to gain a knowledge of the working of valves. The cordial appreciation which was expressed at the conclusion of the lecture must have convinced Mr. Best that the members of the Manly Club were not slow to recognise his excellent effort.

Amongst the general business transacted was a decision to affiliate with the Radio Association of New South Wales. Mr. Symes, the Club Secretary, was appointed delegate.

It was also decided to support the appointment of four honorary inspectors. A working bee is to be organised in the near future to carry out the task of erecting the aerial poles. The Club has received generous assistance from the Committee of the Literary Institute, many of whom are intensely interested in radio telephony.

At the usual fortnightly meeting held on Monday, May 7, R. C. Marsden, of the Wentworth Radio Club attended and delivered a lecture on the relative merits of crystals and valves. Mr. Marsden displayed a thorough knowledge of his subject and his lecture was most instructive

Direction and Position Finding

(*Continued from page 79.*)

position of the switch connects a non-inductive resistance in series in the earth connection for correctly phasing and balancing the currents in the loop and earth circuits for "Heart Shape" reception.

The Electromotive Force induced in the loops by the impinging waves lags 90 degrees behind that induced in the system acting as a vertical aerial, and since inductance predominates in the former circuit, the resultant current lags 90 degrees behind the induced Electromotive Force. If a suitable value of resistance is selected in the earthed circuit the currents therein can be brought approximately into phase with the Electromotive Force in that circuit, and therefore, 180 degrees out of phase with those in the loop circuits. This provides the phasing conditions for "Heart Shape" reception, and is very simple and stable in operation.

Fig. 6 is an illustration of the complete instrument as supplied for Marine use. It is provided with a supersensitive multi-valve receiver employing high and low freuency amplification. Below the valve amplifier on the left side is the field and search coil or "Radiogoniometer" unit whilst in the centre may be seen the Variable Tuning Condenser, and on the right the "D.F.-Stand-bi-Sense" switch.

Fig. 7 is an illustration of the Direction Finder component showing the field coil winding inside of which rotates the search coil

To eliminate any errors which might arise from stray fields affecting the apparatus each unit is provided with a complete metallic screen.

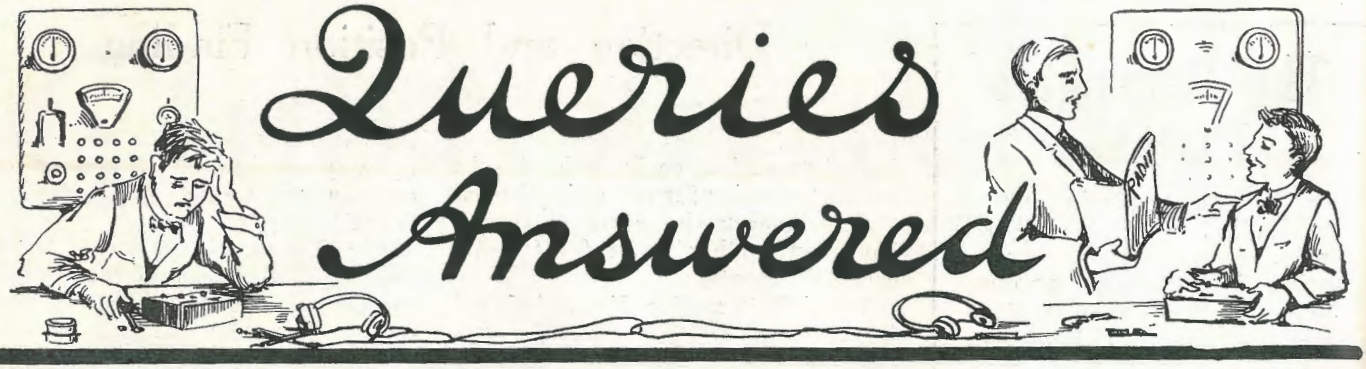
In practice a range of 300 to 400 miles is obtained when working ordinary coast stations and ships, thus an ample margin is provided over the normal requirements of direction finding. The wave range of the instrument is 400-1000 metres.

The Land Pattern Direction Finder is somewhat larger than the Marine type and differs from it in several respects. The circuit is of the improved type, in which the aperiodic aerial system and tight coupled search coil is combined with a loose coupled transformer. A higher degree of high frequency and low frequency amplification is also provided. The system is capable of reception of spark, tonic train, telephony or continuous wave signals.

Long Wave Stations

Those experimenters who have facilities for tuning to long wave stations will no doubt find the following list useful the first column showing the wave length, the second call letters, the third the name of the station, and the fourth column the method of transmission.

Wave Length.	Call.	Name of Station.	Method of Transmission.
2,000	V L A	Awanui (N.Z.)	Spark
2,300	P K C	Sitoebondo	Spark
2,300	P K D	Koepang	Spark
2,300	P K E	Amboina	Spark
2,500	P K X	Malabang	Continuous Wave
3,375	P K F	Balikpapan	Spark
3,375	P K G	Tarakan	Spark
4,800	N P G	San Francisco	Continuous Wave
5,000	J J C	Funabashi (Japan)	Spark
5,000	N P O	Cavite (Manila)	Continuous Wave
8,800	P K X	Malabang	Continuous Wave
9,400	P O Z	Nauen (Germany)	Continuous Wave
9,800	N P L	San Diego	Continuous Wave
11,200	N P M	Pearl Harbour (Honolulu)	Continuous Wave
12,600	P O Z	Nauen	Continuous Wave
14,200	M U U	Carnarvon (Wales)	Continuous Wave
15,200	Y N	Lyons (France)	Continuous Wave
17,750	P C G	Kootwijk-Sambeek (D.I.E.)	Continuous Wave
17,000	N S S	Annapolis (U.S.A.)	Continuous Wave
18,000	P K X	Malabang (D.E. Indies)	Continuous Wave
23,400	L Y	Bordeaux (France)	Continuous Wave



K. H. (Grafton) asks (1) How to find the capacity of a condenser. (2) What would be the gauge of wire and number of turns to cover a wave length from about 100 metres to about 2,000 metres, using a two-circuit set with the diameters of coils as follows: Primary 4½in., secondary 3⅝in.

Answer: (1) The formula for the capacity of a condenser expressed in centimetres (C.G.S. units of capacity) is $C = \frac{(n-1) A \times K}{4 \pi D}$ where n = number of plates.

A=Area of one side of one plate in sq. cms.

K=Specific inductive capacity of the dielectric (Air = 1), and

D = Thickness of dielectric in centimetres.

(NOTE.—One micro farad equals 900,000 cms.) The capacity of two plates 3in. x 2in., separated by a sheet of wax paper (S.I.C. = 2) 5 mils thick would be calculated as follows:

$$C = \frac{3 \times 2 \times (2.54)^2 \times 2}{4 \pi \ 0.005 \times 2.54} = 490 \text{ cms},$$

or 0.00054 micro farads.

(2) You will be unable to cover so great a range with one set of coils. For work between 350 and 2,000 metres wind the primary with 100 turns, 22D.C.C. tapped every 10 turns, and the secondary with one winding of 120 turns of No. 30 D.S.C. Shunt condensers of 0.001 microfarads will be required for both circuits.

N. A. F. (Mt. Mulligan) asks (1) What license is required for a receiver to tune between 400 and 600 metres. (2) Will 220 Volt D.C. overhead power mains, which run both parallel and at right angles to aerial interfere with reception. (3) Would it be possible to utilise these mains for the filament and plate currents of a V 24 valve. (4) Will the aerial (as per sketch enclosed by him) be suitable. (5) Would a regenerative circuit be most efficient, and sketch of same, giving particulars of A.T.I., etc. (6) If (3) be possible would not the waves radiated by the overhead mains be neutralised by the valve being connected to same circuit.

Answer: (1) Application for an experimental license should be made to the Controller of Wireless, Melbourne.

(2) Slight induction may be experienced.

(3) Yes, but the apparatus required to break down the voltage and current and smooth out the commutator ripple would probably cost more than the high and low tension batteries.

4. The aerial is satisfactory for waves above about 400 metres.

(5) Yes. The circuit employed by Mr. Slade, and described in No. 1 issue would be most suitable for you. A primary winding of 50 turns on a 4 inch tube, with taps every 10 turns, and a re-action coil of 50 turns on a 3 inch tube would tune in both 400 and 600 metre sigs with your aerial.

(6) Connection to the mains would be more likely to increase than decrease the induction.

N.W. (Goulburn) asks for details of high frequency transformers of the plug-in-type suitable for 200-450 metre waves.

Answer: An article by Mr. Reed in this issue provides the information you require.

A.L.C. (Leeton) asks (1) Would one valve be sufficient to receive in Leeton music broadcasted from Sydney?

(2) Would a loose coupler be as efficient if instead of using a slider on the primary, taps were taken every ten turns and a variable condenser used in parallel with the inductance.

(3) Would a crystal detector and an amplifying valve be suitable for the reception in Leeton of music from Sydney?

Answer: (1) If you have an efficient aerial system reception of music from experimental stations is possible with one valve.

(2) Greater efficiency will be obtained by the use of a tapped inductance and tuning condenser.

(3) We would recommend you to use your valve and crystal in the special reflex circuit described elsewhere in this issue.

Galena: (Glen Innes) asks How much No. 40 enamelled wire would be required to rewind an ordinary telephone receiver, and what would be the resistance, using proper diaphragm?

Answer: You should use No. 44 S.W.G. Beldenamel wire for this purpose. One ounce will suffice for a 2000 ohm winding. Only about 200 ohms per receiver will be obtained with No. 40 wire.